LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS

ADMINISTRATIVE RECORD

CHRONOLOGICAL INDEX

Volume 1 of 3

2006

Bate Stamp Numbers
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Prepared for

Department of the Army
Longhorn Army Ammunition Plant

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

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2006

A. Title: Minutes – Monthly Managers Meeting
Author(s): Shaw
Recipient: All Parties
Date: January 17, 2006
Bate Stamp: 00039802

B. Title: Letter – Draft Final Modeling Report-Derivation of Soil and Groundwater Concentration Protective of Surface Water
Author(s): Chris Villarreal
Recipient: Rose Zeiler
Date: January 26, 2006
Bate Stamp: 00039805

C. Title: Report – Final Addendum 4 LHAAP-12 Well Abandonment and Installation
Author(s): Shaw
Recipient: All Stakeholders
Date: January 2006
Bate Stamp: 00039808

D. Title: Report - 2006 Decision Documentation for LHAAP-03, LHAAP-06 and LHAAP-23
Author(s): Shaw
Recipient: All Stakeholders
Date: January 2006
Bate Stamp: 00039845

E. Title: Report – Final Installation-Wide Work Plan
Author(s): Shaw
Recipient: All Stakeholders
Date: January 2006
Bate Stamp: 00039900

F. Title: Letter – LHAAP Final Installation-Wide Work Plan
Author(s): Chris Villarreal
Recipient: Rose Zeiler
Date: February 2, 2006
Bate Stamp: 00040361

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2006

G. Title: Minutes – Comment Resolution Meeting, Installation-Wide Ecological Risk Assessment
Author(s): Shaw
Recipient: All Parties
Date: February 9, 2006
Bate Stamp: 00040363

H. Title: Letter – Draft Final Addendum 2 Additional Investigation at Pistol Range
Author(s): Chris Villarreal
Recipient: Rose Zeiler
Date: February 15, 2006
Bate Stamp: 00040380

I. Title: Letter – Decision Documentation Report for LHAAP-03, LHAAP-06 and LHAAP-23
Author(s): Chris Villarreal
Recipient: Rose Zeiler
Date: February 16, 2006
Bate Stamp: 00040385

J. Title: Minutes – Monthly Managers Meeting
Author(s): Shaw
Recipient: All Parties
Date: February 16, 2006
Bate Stamp: 00040390

K. Title: Minutes – Quarterly Restoration Advisory Board (RAB) Meeting
Author(s): Shaw
Recipient: All Parties
Date: March 14, 2006
Bate Stamp: 00040394

L. Title: Minutes on the Conference Call to Discuss Perchlorate and T&E Species Related to Ecological Risk Assessment Approach - LHAAP
Author(s): Shaw
Recipient: All Stakeholders
Date: March 20, 2006
Bate Stamp: 00040399

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M. Title: Memo – Draft Final Addendum 5 Soil Sampling for Chromium Speciation in Soil to Final Installation-Wide Work Plan
Author(s): Vickie Reat
Recipient: Alan Etheredge
Date: March 27, 2006
Bate Stamp: 00040403

N. Title: Report – Final Addendum 2 Additional Investigation at Pistol Range to Final Installation-Wide Work Plan
Author(s): Shaw
Recipient: All Stakeholders
Date: March 30, 2006
Bate Stamp: 00040404

O. Title: Minutes – Minutes on the Conference Call to Discuss Follow-Up Issues to the February 2006 Eco Risk Meeting
Author(s): Shaw
Recipient: All Parties
Date: March 30, 2006
Bate Stamp: 00040437

P. Title: Minutes – Monthly Managers Meeting
Author(s): Shaw
Recipient: All Parties
Date: April 25, 2006
Bate Stamp: 00040446

Q. Title: Letter – LHAAP Decision Documentation Report for LHAAP-03, LHAAP-06 and LHAAP-23
Author(s): Fay Duke
Recipient: Rose Zeiler
Date: May 1, 2006
Bate Stamp: 00040451

R. Title: Minutes – Monthly Mangers Meeting
Author(s): Shaw
Recipient: All Parties
Date: May 10, 2006
Bate Stamp: 00040453

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

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S. Title: Letter - EPA Comments on Numerous LHAAP Documents
Author(s): Chris Villarreal
Recipient: Rose Zeiler
Date: May 17, 2006
Bate Stamp: 00040456

T. Title: Letter – LHAAP Final Addendum 2 Additional Investigation at Pistol Range to Final Installation-Wide Work Plan
Author(s): Fay Duke
Recipient: Rose Zeiler
Date: May 18, 2006
Bate Stamp: 00040459

U. Title: Letter – LHAAP Draft Final Addendum 1 Soil Sampling at LHAAP-04 to Final Installation-Wide Work Plan
Author(s): Fay Duke
Recipient: Rose Zeiler
Date: May 23, 2006
Bate Stamp: 00040460

V. Title: Memo - Selection of Final Chemicals of Potential Ecological Concern (COPEC) for Further Evaluation in the Baseline Ecological Risk Assessment
Author(s): Shaw
Recipient: All Stakeholders
Date: June 6, 2006
Bate Stamp: 00040462

W. Title: Minutes – Monthly Managers Meeting
Author(s): Shaw
Recipient: All Parties
Date: June 27, 2006
Bate Stamp: 00040473

X. Title: Report – Final Addendum 1 Soil Sampling at LHAAP-04 Former Pilot Wastewater Treatment Plant
Author(s): Shaw
Recipient: All Stakeholders
Date: June 2006
Bate Stamp: 00040479

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Y. Title: Report – Final Addendum 4 Soil Sampling at LHAAP-07 and LHAAP-51
Author(s): Shaw
Recipient: All Stakeholders
Date: June 2006
Bate Stamp: 00040502

Shaw® Shaw Environmental, Inc.

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

Location of Meeting: TCEQ Office, Austin, TX

Date of Meeting: **January 17, 2006, 1:00 – 4:00 PM**

Meeting Participants:

BRAC:	Rose M. Zeiler (RMZ)
USACE-Tulsa:	Cliff Murray (CM), Rick Smith (RPS)
USFWS:	Barry Forsythe (BF), Paul Bruckwicki (PB)
Shaw Environmental:	Praveen Srivastav (PS), Dave Cobb (DPC), Frank Eidson (FE)
USEPA Region 6:	Chris Villarreal (CV)
TCEQ:	Alan Etheredge (AE), Tom Erny (TE), Michael Nelson

An agenda and document status tables were distributed prior to the meeting.

Rose Zeiler opened the meeting with a welcome note. A round of introductions ensued for the benefit of Michael Nelson, Alan Etheredge's supervisor.

RMZ first addressed the open action items from the last monthly managers' meeting held on December 13, 2005. Shaw provided the integrated schedule and notification of the field work beginning on January 3, 2006 at LHAAP-12. The modeling repot and the data gaps investigation report are still in review and Shaw has not provided the white paper on ecological risk assessment.

Defense Environmental Restoration Program (DERP) PBC Update (DPC)
Groundwater Treatment Plant Update. The GWTP is being operated by CES as a subcontractor to Shaw. Two employees of CES are being hired by Shaw effective February 1, 2006. Van Vangala from the Shaw Houston office is the lead engineer overseeing the GWTP operation. The plant is operating two days per week. Shaw is revising the sampling program for the GWTP, monitoring wells, and sumps. The revised plan will be presented to the Army and to the regulators for their review.

Ecological Risk Assessment Status. Shaw has submitted responses to the regulatory comments on the Draft Final Step 3 report to the Army. The responses will be submitted to the regulators on January 18, 2006 after Army's review. February 9 seemed to suit everyone for a meeting on the comment responses. CV will find out if the date is suitable to Susan Roddy.

BF is traveling on that day but may be able to dial in. The responses will be e-mailed and also placed on the portal.

Document Status/Environmental Sites. DPC distributed a modified document status table. PMP and installation-wide work plan have been finalized. They have been loaded on the portal. LHAAP-04 draft work plan addendum has been submitted to the Army. Draft Feasibility Study for LHAAP-17 will be submitted in approximately 2 weeks. CV indicated that he would like an opportunity to review the work plan addenda. The Decision Documentation has been in regulatory review for several months. It was agreed that Shaw will submit the decision documentation for three PBC sites (LHAAP-03, 06, and 23) in a separate binder to expedite the review. The PBC contract is now funded except for a few sites on which the Army is trying to resolve certain issues and remedial action operation/long term monitoring (RAO/LTM) tasks. AE requested that Shaw include documents expected in next 30 days on the document status table.

Paul Bruckwicki, Vicki Reat, Susan Roddy, and Barry Forsythe need access to the Shaw portal. CV will let Shaw know if he wants additional individuals to have access to the portal.

Administrative Record. Shaw is putting procedures in place to manage the Administrative Record. PS is to be copied on all e-mails or hard copy correspondence meant for the Administrative Record.

To a question from CV, DPC replied that Pistol Range is one site where Shaw is planning a removal action in Spring 2006.

Defense Environmental Restoration Program (DERP) TERC Update (PS)
Shaw is preparing a response to regulatory comments on the Draft Final ROD for LHAAP-12. The draft LUC/RD has been submitted to the Army for review. Shaw has submitted a response to the Army's comments on the Draft Proposed Plan for LHAAP-32. CV informed that Dr. Roger Lee is reviewing the modeling report and his comments are expected soon. Chuck Stone of TCEQ is also reviewing the report and his comments are also expected soon.

LHAAP-48 Residential Risk. FE presented results of a residential risk screening for LHAAP-48 that indicated that the site does not represent risk to the potential residential user. The method was different from the traditional full risk assessment but was less labor intensive and gave results comparable to a full risk assessment. CV indicated that EPA would prefer to see a traditional risk assessment completed rather than the method presented by Shaw. CV and AE indicated that ecological risk will have to be addressed for LHAAP-48 because the possibility of a release triggers Tier 1 ecological screening. Another option will be to check the SLERA conducted by Jacobs.

A discussion ensued on the industrial versus residential risk assessments for LHAAP sites. RMZ asked CV as to how the decision was made to conduct risk assessment for an industrial maintenance worker for Longhorn and not screen to unrestricted use. Was it anticipated that the entire installation will have LUCs? CV indicated that it was decided during the RI that an industrial use scenario is consistent with the exposure for a wild life refuge manager. EPA had recommended in the past that residential risk assessment be conducted for certain sites that had

already been closed out under industrial use and had to undergo 5-year reviews. The 5-year review requirement may be dropped if there is no residential risk. RMZ pointed out that the RODs for Sites 27 and 54 do not include LUCs nor Five year reviews, but specify industrial use. AE informed that the old risk reduction rules allow closing out sites with no industrial level risk if deed recordation and 5-year reviews are conducted. EPA's expectation is that the Army would implement LUCs at these sites, possibly under an installation-wide LUC program. The RODs may be modified by an Explanation of Significant Difference. RMZ indicated that the Army will work with USFWS to address this issue, and that the Production Area and other industrial area sites may not be screened beyond industrial use. The Army will also consider an installation-wide LUC document that will encompass sites closed out under No Action RODs. Sites LHAAP-27 and 54 will be evaluated to determine if a residential risk assessment is required after the MMRP work is complete.

LHAAP-12 ROD. AE mentioned that the remedial action goals (RAO) should be more specific. He had provided possible RAOs in his comments on the ROD. CV indicated that the TCE at the site is exceeding MCL. The Army either needs to meet the ARAR or waive it. The Army has evaluated criteria for waiving ARARs and it does not seem to be a viable option. Establishment of a plume management zone is also not an option because that concept falls under the TRRP while LHAAP is under the old rules. The Army would like to use the MNA loosely because of the objections from the Army's attorney. CV suggested that the Army show a decreasing trend in TCE concentration based on data or modeling. He indicated that a call can be set up with the EPA attorney to discuss possibilities.

DERP Corps of Engineers Update

Groundwater Perimeter Wells (CM). No update, still trying to resolve issues.

MMRP. The burn at LHAAP-54 (Ground Signal Test Area) was successful, no update on when the removal will start.

Permit. No update except that USFWS comments and Army responses have been staffed through BRAC D and legal, but a letter has not been finalized. CV indicated that the EPA received some inquiry about the land use issues at LHAAP. EPA informed the inquirer that EPA is not involved land use determination of LHAAP. PB indicated that Mark Williams (Refuge Manager) is concerned about the physical hazards. RMZ replied that the Army is addressing that issue. PB asked if the Army or Shaw has been contacted by Penn Virginia (oil company drilling at LHAAP) for use of GWTP discharge water for drilling. RMZ stated that Pan Virginia will not be permitted to use the water.

Demolition. No update. The Army is planning Phase III demolition for the powerhouse near the Fire Station. The procurement may be handled by Tulsa Corps.

LHAAP-12 and 16 Sampling. CM handed out hard copies of a report containing analytical data collected by USACE from sites LHAAP-12 and 16 from 2004-2005. He distributed CDs of the data to other meeting participants.
Meeting Adjourn.

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

January 26, 2006

Rose M. Zeiler, Ph. D.
Project Manager
Box 3, Building 1440
Fort Chaffee, Arkansas 72905

Re: Longhorn Army Ammunition Plant (LHAAP)
Draft Final Modeling Report - Derivation of Soil and Groundwater Concentrations Protective of Surface Water and Sediment

Dear Ms. Zeiler:

Enclosed please find comments provided by Roger W. Lee (Hydrologist) of the US Geological Survey on the *Draft Final Modeling Report Derivation of Soil and Groundwater Concentrations Protective of Surface Water and Sediment* (Shaw Environmental, Inc., May 2005). If you have any questions, please feel free to give me a call at 214-665-6758.

Sincerely,

Chris G. Villarreal
Remedial Project Manager

Enclosure (1)

cc: Cliff Murray, U.S. Army Corps of Engineers

Alen Etheredge, Texas Commission on Environmental Quality

Barry Forsythe, U.S. Fish and Wildlife Service

Praveen Srivartav, Shaw Environmental, Inc.

USGS
science for a changing world

DATE: January 26, 2006
TO: Chris Villarreal, RPM, USEPA
FROM: Roger W. Lee, Hydrologist, US Geological Survey
SUBJECT: Technical review of "Draft Final Modeling Report Derivation of Soil and Groundwater Concentrations Protective of Surface Water and Sediment Longhorn Army Ammunition Plant Karnack, Texas

I have read the subject report and find it to be well organized and thorough in predicting fate and transport of COCs from source areas on site to points of entry to Caddo Lake. However, there should be actual data available of surface water and ground water contamination to validate modeling predictions. These data are not considered nor provided in this document. The report provides sufficient information to evaluate models, but has left out a good bit of the chemistry and geochemistry of the site. Fate of COCs like chlorinated solvents rely on anaerobic biodegradation terms in the models as part of their chemical processing in the aquifers. However, no evidence of geochemistry of ground water is presented to support anaerobic conditions. If conditions are aerobic as they can be in shallow aquifers, no biodegradation of TCE would be observed and fate and transport modeling should not use a biodegradation term in the in model. This could affect predictions of TCE transport to streams. I have listed below specific comments in the text that the authors should address.

1. Section 3.0--Title should be "Modeling considerations for COCs at Select LHAAP Sites".
2. Table 3-1—TCA isomers are considered only at LHAAP-67. Is this their only occurrence on the site?
3. Page 4-1, 1st paragraph—How was the decreasing trend for perchlorate determined? Please provide evidence and data to show this conclusion can be supported.
4. Page 4-10, 3rd paragraph—What analytical methods were used to establish initial contaminant concentrations in the soil?
5. Page 4-12, 3rd paragraph—Does this model code require boundary conditions or establish a hydrologic steady state? You might state how this differs from hydrologic models coupled with transport.
6. Page 4-14—There should be included here a table of half-lives used with references.
7. Page 5-2, 4th paragraph and elsewhere—Does the ground-water geochemistry show a low enough redox potential and low dissolved oxygen to support biodegradation of TCE? Without that specific data, it is difficult to support that the system is anaerobic and subject to reductive dechlorination. If aerobic conditions prevail, TCE should not have a biodegradation term in the fate and transport computations.

8. Appendix B, page 2-2—The half lives for TCE and VC should be reconsidered. TCE should not have a half life term if the system is aerobic. I could not fine 3.4 years as a half life for VC in the Howard reference. They were 2 years and 8 years at a maximum for VC.
9. Appendix B, page 2-3, 2nd paragraph—Koc is not applicable to perchlorate, but there is some sorption (Kd) for perchlorate, albeit small because of its relatively high aqueous solubility. The sorption process is different for perchlorate and relatively negligible but not because it is inorganic as stated.

00039808
Shaw Environmental & Infrastructure, Inc.
3010 Briarpark Drive, Suite 4N
Houston, Texas 77042
713.996.4400
Fax: 713.996.4401

Shaw® Shaw Environmental & Infrastructure, Inc.

January 12, 2006

Mr. Cliff Murray
U.S. Army Corps of Engineers – Tulsa District
1645 South 101st - East Avenue
Tulsa, Oklahoma 74128-4629

RE: **Task Order No. 109**
Total Environmental Restoration Contract (TERC)
Contract No. DACA56-94-D-0020
Environmental Investigation and Remediation at
Longhorn Army Ammunition Plant, Karnack, Texas
Final Addendum 4 LHAAP-12 Well Abandonment and Installation, Final Work Plan, Groundwater Data Gaps Investigation, Groups 2 and 4, Longhorn Army Ammunition Plant, Karnack, Texas

Dear Mr. Murray:

Shaw Environmental, Inc. is pleased to submit the attached Final Addendum 4 LHAAP-12 Well Abandonment and Installation to the Final Work Plan Groundwater Data Gaps Investigation Groups 2 and 4. We are also sending copies of the document directly to individuals on the attached project document distribution list.

Please contact me if you have any questions or require additional information.

Sincerely,

Praveen Srivastav, Ph.D., P.G.
Project Manager

Longhorn Distribution List

Member	Agency	Address	Phone No. e-mail address	No. of Copies
Cliff Murray Tulsa District	U.S. Army Corp of Engineers	US Army Corp of Engineers 1645 South 101st – East Avenue Tulsa, Oklahoma 74128-4529	Office: 918-669-7573 **Electronic file**	2
Dr. Rose Zeiler	BRAC; Longhorn Site Manager	Building 1440 Fort Chaffee Fourth Avenue Fort Chaffee, AR 72905	Office: 479-484-2516 rose.zeiler@monroe.army.mil	1
Jeff Armstrong	Army Environmental Center	Commander USAEC SFIM-AEC-ERA (Attn: Jeff Armstrong) Beal Road Bldg E-4880 APG, MD 21010-5401	Office: 410-436-1516 jeffrey.armstrong@us.army.mil	1
Chris Villarreal	US Environmental Protection Agency	US Environmental Protection Agency Superfund Division (6SF-AT)n 1445 Ross Avenue Dallas, TX 75202-2733	Office: 214-665-6758 villarreal.chris@epamail.epa.gov	2
Allen Etheredge	Texas Commission of Environmental Quality	Texas Commission on Environmental Quality Superfund Investigation (MC-143) 12100 Park 35 Circle, Bldg D Austin, TX 78753	Office: 512-239-2444 AETHERED@tceq.state.tx.us	2 - most 4-eco
Tom Erny	Texas Commission of Environmental Quality	Texas Commission on Environmental Quality 2916 Teague Drive Tyler, TX 75701	Office: 903-535-5142 terny@tnrcc.state.tx.us	1
Paul Bruckwicki	US Fish and Wildlife Service	US Fish and Wildlife Service PO Box 230 Karnack, TX 75661 *OR* Caddo Lake NWR Hwy 134 & Spur 449 Karnack, TX 75661	Office: 903-679-4536 Cell: 903-407-0852 paul_bruckwicki@fws.gov	1
Barry Forsythe	US Fish & Wildlife Service EPA Liason (6SF-LT)	US Fish & Wildlife Service EPA Liason (6SF-LT) 1445 Ross Avenue, Suite 1200 Dallas, TX 75202	Office: 214-665-8467 forsythe.barry@epa.gov	1

Total external distribution for routine draft final (non eco) reports = 11

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

January 12, 2006

DAIM-BD-H-LO

Mr. Alan Etheredge
Texas Commission on Environmental Quality
Superfund Investigation (MC-143)
12100 Park 35 Circle, Bldg D
Austin, TX 78753

Re: Final Addendum 4 LHAAP-12 Well Abandonment and Installation,
Final Work Plan, Groundwater Data Gaps Investigation, Groups 2 and 4,
Longhorn Army Ammunition Plant, Karnack, Texas, January 2006

Dear Mr. Etheredge,

The above-referenced document is transmitted to you for your file.

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

Enclosure: Final Addendum 4 LHAAP-12 Well Abandonment and Installation,
Final Work Plan, Groundwater Data Gaps Investigation, Groups 2 and 4, January 2006
Copies furnished:
Chris Villarreal, USEPA Region 6, Dallas, TX
Paul Bruckwicki, Caddo Lake NWR, TX
Cliff Murray, COE-Tulsa District, OK
Richard P. Smith, COE – Tulsa District, OK

00039811

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

January 12, 2006

DAIM-BD-H-LO

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

Re: Final Addendum 4 LHAAP-12 Well Abandonment and Installation, Final Work Plan, Groundwater Data Gaps Investigation, Groups 2 and 4, Longhorn Army Ammunition Plant, Karnack, Texas, January 2006

Dear Mr. Villarreal,

The above-referenced document is transmitted to you for your file.

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

Enclosure: Final Addendum 4 LHAAP-12 Well Abandonment and Installation, Final Work Plan, Groundwater Data Gaps Investigation, Groups 2 and 4, January 2006
Copies furnished:
Alan Etheredge, TCEQ, Austin, TX
Paul Bruckwicki, Caddo Lake NWR, TX
Cliff Murray, COE-Tulsa District, OK
Richard P. Smith, COE – Tulsa District, OK

FINAL

ADDENDUM 4
LHAAP-12 WELL ABANDONMENT AND INSTALLATION

FINAL WORK PLAN
GROUNDWATER DATA GAPS INVESTIGATION
GROUPS 2 AND 4
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.
3010 Briarpark Drive, Suite 4N
Houston, Texas 77042

Contract Number DACA56-94-D-0020
Task Order No. 0109

January 2006

FINAL
ADDENDUM 4
LHAAP-12 WELL ABANDONMENT AND INSTALLATION
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
JANUARY 12, 2006

PRAVEEN SRIVASTAV
Name of Texas Professional Geoscientist

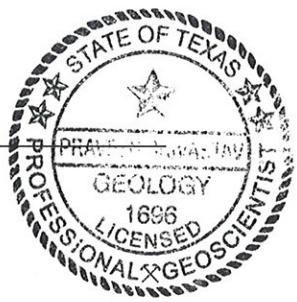
1696
License Number

SHAW ENVIRONMENTAL, INC.
Company

3010 BRIARPARK DRIVE, SUITE 4N, HOUSTON, TX 77042
Address

I certify with my signature below, that the written descriptions and graphical depictions of geology and hydrogeology contained within this report were prepared under my supervision, and accurately reflect existing knowledge about the geology and hydrogeology of the referenced site.

Signature



1/12/06
Date Signed

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Appendix A Texas Well Plugging and Abandonment Regulations
Appendix B Standard Operating Procedure, Groundwater Sampling Using Low-Flow Method

Acronyms and Abbreviations

IRA	interim remedial action
IT/OHM	IT Corporation/OHM Remediation Services Inc.
LHAAP	Longhorn Army Ammunition Plant
pH	potential of hydrogen
PVC	polyvinyl chloride
Shaw	Shaw Environmental, Inc.
SOP	standard operating procedure
TAC	Texas Administrative Code
TERC	Total Environmental Restoration Contract
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound

1.0 Introduction

The U.S. Army Corps of Engineers (USACE), Tulsa District, contracted Shaw Environmental, Inc. (Shaw), under Total Environmental Restoration Contract (TERC) Number DACA56-94-D-0020, Task Order 0109, to perform well abandonment and installation work at Site 12 (LHAAP-12), Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas. The work is being performed as part of the groundwater data gaps investigation for Groups 2 and 4. LHAAP-12 is an inactive landfill known as Landfill 12. This plan is being published under separate cover as Addendum 4 of the *Final Work Plan, Groundwater Data Gaps Investigation, Groups 2 and 4, Longhorn Army Ammunition Plant, Karnack, Texas* (Final Work Plan) (Shaw, 2004).

LHAAP is located in central-east Texas in the northeastern corner of Harrison County. The facility originally occupied 8,493 acres between State Highway 43 in 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 east. Caddo Lake is a large freshwater lake that bounds LHAAP to the north and east. The eastern fence of LHAAP is 3.5 miles from the Texas-Louisiana state border.

1.1 Project Objectives

The objective of the activities described in this addendum is to abandon 12 monitoring wells constructed with stainless steel well casing and screen that may be affecting the groundwater by leaching metals, specifically chromium, into the groundwater. Sampling event results show an increase in chromium concentrations in the groundwater in these wells over time. Two replacement wells will be installed in the vicinity of the wells to be abandoned in order to continue groundwater monitoring for volatile organic compounds (VOCs). In addition, two compliance monitoring wells will be installed in optimal positions near the closest surface water bodies to confirm that surface water is not being affected by migration of contaminants from Landfill 12.

1.2 Site Description

Landfill 12 was established in 1963 and was used for the disposal of industrial solid wastes, possibly containing small quantities of hazardous constituents generated at LHAAP. From 1978 until its closure in April 1994, the landfill was used continuously for the disposal of non-hazardous industrial solid waste. The construction of a landfill cap over the site was completed in 1998 as part of an Interim Remedial Action (IRA). The IRA is consistent with U.S. Environmental Protection Agency presumptive remedy guidance.

2.0 Site Activities at LHAAP-12

Field activities at LHAAP-12 will be documented on activity-specific forms such as the purging and sampling form, the hard-bound project log book, or the daily field activity report form in accordance with Shaw's standard operating procedures (SOPs). Safety protocols and requirements including daily tailgate safety meetings will be in accordance with the Site Safety Health Plan (Shaw, 2004).

2.1 Well Abandonment

Wells will be abandoned in accordance with Texas State regulatory requirements. The applicable regulatory requirements are found in Texas Administrative Code (TAC) specifically 16 TAC Section 76.1004, "Technical Requirements – Standards for Capping and Plugging of Wells and Plugging Wells that Penetrate Undesirable Water or Constituent Zones". The wells to be abandoned at LHAAP-12 and their estimated total depth are listed in **Table 2-1**.

Table 2-1
LHAAP-12 Monitoring Wells to Be Abandoned

Well Identification	Total Depth (feet)	Zone	Casing ID * (inches)	Water Level Below Top of Casing (feet)
12WW08	27.93	Shallow	4"	24.15
12WW09	20.04	Shallow	4"	dry
12WW10	29.96	Shallow	4"	22.96
12WW11	70.42	Intermediate	4"	24
12WW12	27.61	Shallow	4"	23.09
12WW13	67.31	Intermediate	4"	2.51
12WW14	38.54	Intermediate	4"	13.40
12WW15	19.00	Shallow	4"	14.48
12WW16	22.10	Shallow	4"	dry
12WW17	24.10	Shallow	4"	23.78
12WW18	30.48	Shallow	4"	24.82
12WW19	66.08	Intermediate	4"	25.31

Note:

* *Each well has stainless steel casing*

Well abandonment activities will consist of removing casing, screen, and well completion materials such as grout and filter pack sand. If the attempt to pull well casing from the borehole does not result in freeing the casing, the well can be abandoned in place in accordance with State of Texas regulatory requirements. The borehole will be tremied with bentonite pellets or granules to 2 feet below surface followed by a section of cement placed from 2 feet below surface to the land surface to ensure that undesirable water is isolated, that formations are appropriately sealed, and that the surface is properly restored. Existing surface completions will be removed. Abandonment activities and the filing of plugging reports will be in accordance with state requirements. A copy of the Texas requirements is attached in **Appendix A**.

2.2 Well Installation

Four new shallow monitoring wells will be installed at LHAAP-12 (see **Figure 1**). Two replacement wells (12WW20, 12WW21) will be installed in the vicinity of the 12 wells that are to be abandoned in order to continue groundwater monitoring for contaminants of concern. One well (12WW20) is to be installed next to shallow well 12WW12 to continue to monitor the trichloroethylene concentrations in the shallow zone. A second well (12WW21) will be installed farther downgradient from 12WW20 between existing monitoring wells 12WW08 and 12WW16.

Two compliance wells are to be installed. One compliance well (12WW22) is to be installed to the north of the Landfill 12 near the northern tributary of Central Creek. This well will monitor contaminant migration from the landfill to the north. The second compliance well (12WW23) will be installed to the northeast of the landfill boundary to monitor contaminant migration toward Harrison Bayou.

Monitoring wells will be installed using a hollow-stem auger. Soil samples for lithologic logging will be retrieved using split-spoon or continuous sampler.

2.2.1 Well Construction

Wells will be constructed with 4-inch diameter polyvinyl chloride (PVC) casing and screens. The monitoring wells will be installed through the annulus of hollow-stem augers. The PVC well screen for each well will be 0.01-inch slotted and 10 feet long. A threaded PVC bottom cap will be secured to the bottom of the screen interval. Solid PVC casing will be installed from the top of the screen interval to approximately 3 feet above surface grade. A filter pack consisting of clean silica sand (20-40 size) will be placed in the auger-well annulus from approximately 0.5 feet below the well bottom to approximately 2 feet above the screen interval. A 3-foot-thick bentonite seal will be placed above the sand filter pack and will be hydrated with potable water. The annular space from the top of the bentonite seal to the surface will be filled with a bentonite-cement grout.

The drilling equipment will be decontaminated prior to arrival at the site and prior to being used at each well. Details on decontamination of drilling equipment are provided in TERC SOP No. 1118 (IT Corporation/OHM Remediation Services Inc. [IT/OHM], 2000). Split-spoon or continuous samplers will be washed after each sample using a detergent/water solution and double rinsed with tap water in clean buckets. The decontamination wastewater will be placed in 55-gallon drums and disposed at the on-site groundwater treatment plant.

Aboveground surface completions will be constructed for each monitoring well. The surface completions will consist of a 5-foot-long, 6-inch-square protective steel casing with a hinged, lockable lid set a minimum of 2 feet into a 4-foot-square by 6-inch-thick concrete pad. Concrete-filled steel bollards will be installed at the inside corners of the concrete pad. Further guidance on monitoring well installation is provided in TERC SOP No. 1120. Monitoring wells will be logged using the logging forms or similar as provided in TERC SOP No. 1134 (IT/OHM, 2000).

The monitoring wells and surface completions will be installed in general accordance with USACE and State of Texas requirements by a drilling subcontractor licensed in the State of Texas. At the end of field work, a State of Texas well report will be submitted to the Texas Department of Licensing and Regulations for construction of each well.

2.2.2 Well Development

The four newly installed monitoring and compliance wells will be developed to remove drilling fines and to enhance hydraulic communication between the well and the groundwater zone. The wells will be developed no sooner than 48 hours after installation. Well development will be performed by pumping and gentle surging of the screened interval using a rubber-lined surge block. A minimum of five well borehole volumes of water will be pumped (includes the diameter of the well borehole and assumes a 30 percent filter pack porosity.) The volume of groundwater removed from each well will be calculated from the static water level measurement referenced from the top-of-casing. An electronic interface probe will be used to measure the water levels. Water quality parameters (temperature, pH, conductivity, and turbidity) of the development discharge water will be monitored. Development will continue until the water quality parameters have stabilized to within 10 percent and the water is visually clear.

A Shaw hydrogeologist will supervise well development and document the development process and measurements in a Well Development Record specific to each well. Down hole development equipment will be decontaminated prior to and following use at each well location by cleaning in a detergent/water solution and double rinsing with tap water in clean buckets. The development and decontamination wastewater will be placed in 55-gallon drums and disposed at the on-site groundwater treatment plant. The management of investigation-derived wastes is described in **Section 2.2.6**.

2.2.3 Surveying

A State of Texas-licensed professional land surveyor will survey the locations and elevations of the newly installed monitoring wells. The horizontal coordinates (northing and easting) of the wells will be surveyed to the nearest foot and will be based on the North American Datum of 1983. The vertical elevations of the top of the wells (top-of-casing) will be surveyed to the nearest 0.01 foot. The ground surface elevation at each well location will be surveyed to the nearest 0.1 foot.

2.2.4 Groundwater Sampling

Water samples will be collected at the four new well locations using the low-flow method (**Appendix B**). The objective of this method is to collect representative samples of the groundwater in the formation adjacent to the well screen, eliminating the mixing of stagnant water above and below the well screen. Ideally, the flow rate of water discharge from the down hole bladder pump should be equal to or less than the flow rate of groundwater entering the well from the water-bearing zone. After water quality parameters have stabilized and are within acceptable ranges, samples can be collected at the same low flow rate. In the event this method cannot be used due to inadequate recharge, the well can be prepared for sampling by purging three to five well casing volumes of groundwater using a submersible pump. Additional information about sampling procedures and groundwater sampling and purging forms is in the SOP manual (IT/OHM, 2000). Groundwater sampling and purging forms will be completed for each monitoring well sampled.

2.2.5 Analytical Requirements

Groundwater samples collected from the four newly installed wells will be analyzed for VOCs. The following table details the sample methods to be used and the analytical holding limits.

Table 2-2
Analytical Method, Container, Preservative, and Holding Time

Parameter	U.S. Environmental Protection Agency Method	Container	Preservative	Maximum Holding Time
Volatile Organic Compounds	8260B	3 x 40 mL glass vials with Teflon-lined septum	Cool to 4 degrees C HCl	14 days

Notes:
C centigrade
HCl hydrochloric acid preservative
mL milliliter

2.2.6 Investigation-Derived Waste Management

Drill cuttings will be placed in 55-gallon drums or designated roll-off boxes for storage until analytical disposal sampling is completed. A composite sample of the drill cuttings will be collected following completion of the drilling activities. The composite sample will consist of equal parts of five samples collected at evenly spaced locations within the roll-off and analyzed for constituents and properties according to the selected disposal facility. Following characterization, drill cuttings will be disposed on site if determined to be non-hazardous. The cuttings will be transported to a permitted landfill if they are determined to be hazardous. Development and decontamination water will be placed in 55-gallon drums for transport and disposal at the on-site groundwater treatment plant.

3.0 References

IT Corporation/OHM Remediation Services Corp., 2000, *Standard Operating Procedures Manual, USACE – Tulsa District, Total Environmental Restoration Contract, Contract No. DACA56-94-D-0020*, Houston, Texas.

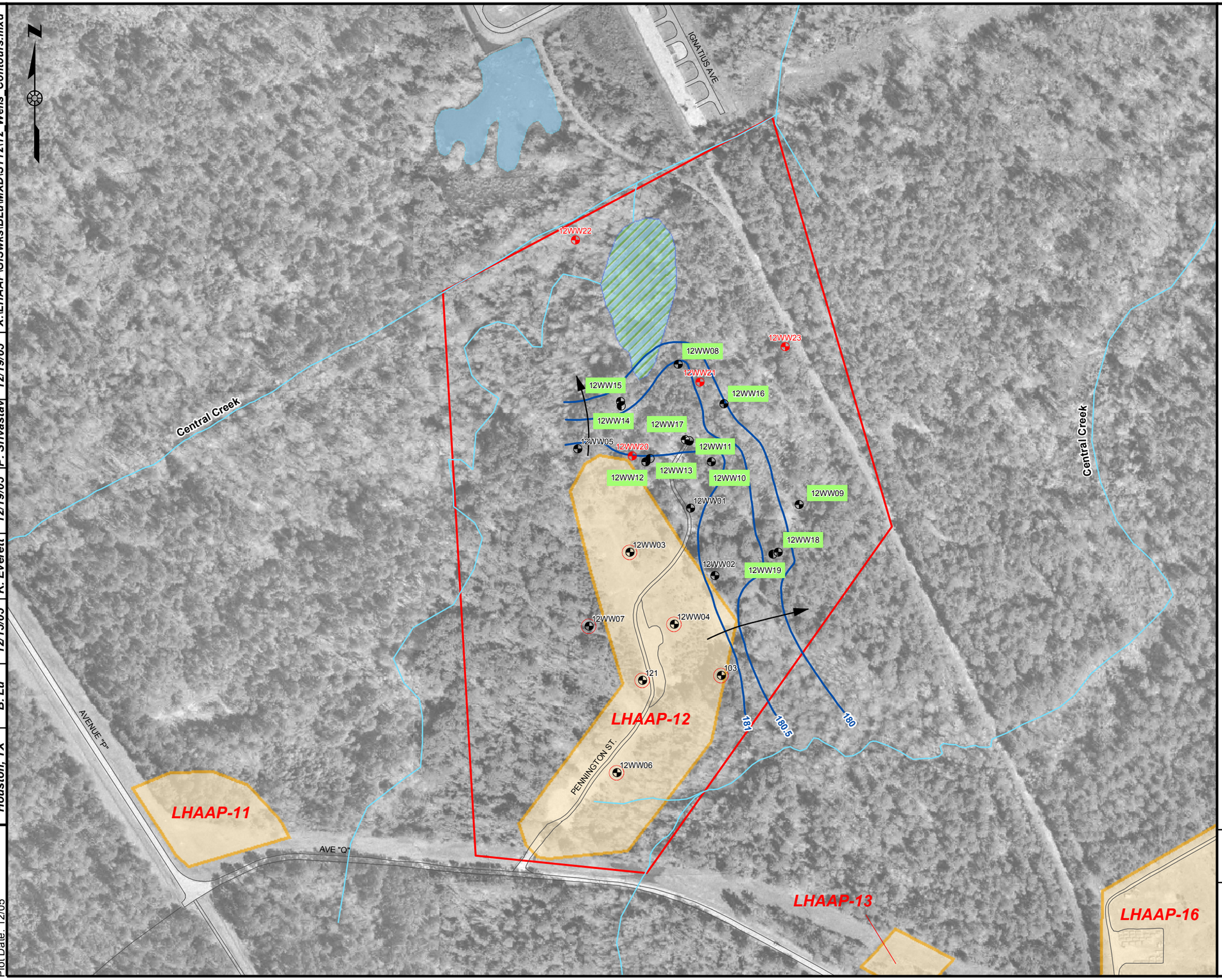
Shaw Environmental, Inc., 2004, *Final Work Plan, Groundwater Data Gaps Investigation, Groups 2 and 4, Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas*, Houston, Texas, February.

Figures

00039824

FILE PATH	X:\LHAAP\GIS\wks\BLu\MXD\ST12\12_Wells_Contours.mxd
APPROVED BY	P. Srivastav 12/19/05
CHECKED BY	K. Everett 12/19/05
DRAWN BY	B. Lu 12/15/05
OFFICE	Houston, TX

Plot Date: 12/05



Legend

- Shallow Monitoring Well
- Intermediate Monitoring Well
- Deep Monitoring Well
- Existing Abandoned Well
- Proposed Monitoring Well
- Groundwater Elevation Contour
- Stream
- Road
- Wetland
- Pond
- Site
- Parcel Boundary
- Groundwater Flow Direction
- 12WW09 Well to be Abandoned

Note:

Groundwater elevation reported in feet above mean sea level.

0 150 300 600 Feet

Shaw®

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

FIGURE 1
LHAAP-12
GROUNDWATER MONITORING
WELL LOCATION MAP
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Appendix A

Texas Well Plugging and Abandonment Regulations

00039826

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TITLE 16 ECONOMIC REGULATION

PART 4 TEXAS DEPARTMENT OF LICENSING AND REGULATION

CHAPTER 76 WATER WELL DRILLERS AND WATER WELL PUMP INSTALLERS

RULE §76.1004 **Technical Requirements--Standards for Capping and Plugging of Wells and Plugging Wells that Penetrate Undesirable Water or Constituent Zones**

(a) All wells which are required to be plugged or capped under Texas Occupations Code Chapters 1901 and 1902 or this Chapter shall be plugged and capped in accordance with the following specifications:

(1) all removable casing shall be removed from the well;

(2) any existing surface completion shall be removed;

(3) the entire well pressure filled via a tremie pipe with cement from bottom up to the land surface ;

(4) In lieu of the procedure in paragraph (3) of this section, the well shall be pressure filled via a tremie tube with clean bentonite grout of a minimum 9.1 pounds per gallon weight followed by a cement plug extending from land surface to a depth of not less than two (2) feet, or if the well to be plugged has one hundred 100 feet or less of standing water the entire well may be filled with a solid column of 3/8 inch or larger granular sodium bentonite hydrated at frequent intervals while strictly adhering to the manufacturers' recommended rate and method of application. If a bentonite grout is used, the entire well from not less than two (2) feet below land surface may be filled with the bentonite grout. The top two (2) feet above any bentonite grout or granular sodium bentonite shall be filled with cement as an atmospheric barrier.

(5) Undesirable water or constituents shall be isolated from the fresh water zone(s) with cement plugs and the remainder of the wellbore filled with neat cement or clean bentonite grout of a minimum 9.1 weight followed by a cement plug extending from land surface to a depth of not less than two (2) feet.

(b) Large hand dug and bored wells 36-inches or greater in diameter to one hundred (100) feet in depth may be plugged by back filling with compacted clay or caliche to surface. All removable debris shall be removed from the well. If the well contains standing water, it shall be chlorinated by adding chlorine bleach at a rate of one (1) gallon of bleach for every five hundred (500) gallons of standing water. Leave mounded to compensate for settling.

(c) Wells which do not encounter groundwater (dry holes) may be plugged by backfilling with drill cuttings from total depth to within two (2) feet of the surface; where a two (2) feet cement plug shall be poured.

(d) Drillers may petition the Department, in writing, for a variance from the methods stated in subsection (a) of this section. The variance should state in detail, an alternative method proposed and all conditions applicable to the well that would make the alternative method preferable to those methods stated in subsection (a) of this section.

(e) A non-deteriorated well which contains casing in good condition and is beneficial to the landowner can be capped with a covering capable of preventing surface pollutants from entering the well and sustaining weight of at least four hundred (400) pounds and constructed in such a way that the covering cannot be easily removed by hand.

Source Note: The provisions of this §76.1004 adopted to be effective November 8, 2001, 26 TexReg 8814; amended to be effective December 1, 2003, 28 TexReg 10468

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Appendix B

Standard Operating Procedure, Groundwater Sampling Using Low-Flow Method

STANDARD OPERATING PROJECT PROCEDURE

Longhorn Army Ammunition Plant, Karnack, Texas

Subject: GROUNDWATER SAMPLING USING LOW-FLOW METHOD

1.0 PURPOSE AND SUMMARY

This Standard Operating Project Procedure (SOPP) establishes guidelines and procedures for use by field personnel in sampling monitoring well groundwater.

A consistently implemented groundwater sampling procedure will help ensure data comparability between different sampling events and between sites. One of the following methods shall be used to collect groundwater samples. The method to be used shall depend upon the site conditions or requirements of the work plan. The low-flow method shall be used unless other methods are applicable and approved due to special circumstances.

(a) Low-flow purge and sample using a submersible pump.
The method involves purging the well at low-flow rates until water quality parameters stabilize and are within acceptable ranges, and collecting the sample at the same low flow rates. This method should be used by default unless the site conditions or the work plan require using a different method. A bladder pump is preferred for low flow sampling, however, other pumps (e.g., peristaltic pump) may be acceptable depending upon the objective of the sampling.

(b) Volume purge and sample using a bailer.
The method involves purging a fixed number of well volumes using a bailer. Purging is continued until at least 3 well volumes are purged and the parameters have stabilized. This method shall be used in lieu of the low-flow method, only if warranted by the site conditions (e.g., bent well casing). A bailer may also be used for collecting sample from a well that goes dry even at the slowest pumping rate during low-flow purging. In such a case, the well is pumped dry and sample is collected with a bailer as soon as sufficient quantity of water has accumulated in the well. This method shall be used only if specified in the work plan or approved by a task manager or the technical lead.

The low-flow purge and sample method shall be used as a default method for collecting groundwater samples for chemical analysis. The use of method (b) will be restricted only to special circumstances, either if specified in the work plan or if warranted by site conditions. If site conditions warrant the use of method (b), prior approval from the technical lead is required and the approving person must be identified in the sample collection log.

1.1 Low-Flow Purge and Sample

Introduction. The low-flow (minimum drawdown, micropurging) sampling method is based upon the premise that a pump located within the screened interval of a well and pumping at a rate corresponding to the hydraulic conductivity of the formation, will rapidly establish a

horizontal laminar flow of groundwater and withdraw fresh formation water without significant mixing or dewatering of the stagnant casing water in the well (U.S. Army Corps of Engineers, 1995). The low flow method aims to minimize well water turbidity which may be caused by resuspension of well sediments or additional development of the formation during high speed pumping.

Establishment of a low flow regime will be ensured by carefully monitoring the drawdown because excessive drawdown indicates that the pump is withdrawing stagnant casing water. The maximum drawdown allowed will be 0.3 feet (4 inches). During purging, the flow rate will typically be maintained within the range of 0.1-0.5 liter/minute (L/min). The flow rate will be decreased further if the drawdown exceeds 0.3 feet. Flow rates up to 1 L/min may be used in purging some high yielding residuum aquifers, if the drawdown remains within the allowable limit of 0.3 feet. However, the flow rate in all cases must be slowed down to 0.1 to 0.3 L/min during sampling to prevent turbulence and aeration of water.

If excessive drawdown is noted using the lowest possible pump rate, then the low-flow method is not applicable. In such a case, the well will be pumped dry once and sample will be collected with a bailer or pump, as soon as adequate quantity of water for samples is available.

2.0 RESPONSIBILITY MATRIX

2.1 Site Manager

The Site Manager or Field Team Leader, is responsible for ensuring that field activities are completed to meet the project objectives, that they are conducted in accordance with the project plans and requirements, and that all activities are performed according to the respective procedures. The Site Manager is responsible for ensuring that all site personnel are trained in the procedures, that the procedures are adhered to, and that all activities are documented.

2.2 Field Team

All members of the field team (samplers, technicians, field geologists, engineers, etc.) are responsible for understanding and implementing this field procedure as well as ensuring that all team members also perform work in accordance with this procedure.

3.0 DEFINITIONS

Bailer. A bailer is an enclosed cylindrical tube containing a floating ball check-valve at the bottom. Lowering the bailer into water causes the ball to float allowing water to enter the cylinder. Raising the bailer through the water causes the ball to settle, creating a seal to trap the water so that it can be brought to the surface.

Bladder Pump. A bladder pump is an enclosed cylindrical tube containing a flexible membrane bladder. Well water enters the bladder through a one-way check-valve at the bottom. Gas is forced into the annular space (positive displacement) surrounding the bladder

through a gas supply line. The gas displaces the well water through a one-way check-value at the top. The water is brought to the surface through a water discharge line. The gas (air or nitrogen) is provided by compressors or compressed gas cylinders.

Purging. The process of evacuation of the static water in the monitoring well to allow formation water to flow into the well. The aim of purging a well before sampling is to obtain a sample that is representative of the groundwater in the soil or rock formation. Purging can be accomplished either by utilizing low-flow purge or volume purge methods. In the low-flow purge method, water is pumped at a slow rate to establish a horizontal laminar flow to draw water from the formation without drawing in the stagnant casing water. Volume purge involves evacuating 3-5 well volumes of water to ensure that all stagnant water has been removed from the well.

Water Quality Parameters. Chemical and physical properties of groundwater measured during purging and sampling to ensure that a representative groundwater sample has been collected and to document the ambient subsurface conditions at the time of sampling. The parameters normally measured include pH, Eh, temperature, dissolved oxygen, conductivity, and turbidity. The measurements are made at specified intervals and documented in appropriate sample collection logs completed in the field.

4.0 PROCEDURE

4.1 Required Records And Forms

1. Groundwater Sampling Log (Attachment 1.0)
2. Chain-of-Custody Form
3. Sampling and Analysis Plan
4. Material Safety Data Sheets (MSDS)
5. Bound Logbook or Field Activity Daily Log (FADL).

4.2 Required Materials, Equipment, Or Supplies

The following supplies are required for low-flow purge and sample method. Other supplies as needed in addition or in-lieu of those listed below are specified in respective sections.

1. Personal protective equipment (PPE) as required by the site-specific health and safety plan
2. Calculator
3. Decontamination solutions; nonphosphate detergent, (Liquinox® or equivalent) rinse water, isopropanol, 10% nitric acid solution, deionized water
4. Compressor, air
5. Container, 1-gal clear glass
6. Controller Box
7. Cooler with ice and packing materials
8. Cylinder, graduated, 2-liter
9. Drum, 55-gallon

10. Filters, high capacity, in-line sample filter, 0.45 micron, if filtered samples are required
11. Filtration units, (disposable) and hand-operated vacuum pump (if needed in-lieu of in-line filtration), if filtered samples are required
12. Flow-through cell or equivalent
13. Gasoline
14. Gloves, nitrile or latex
15. Keys for locking well caps
16. Labels, sample bottles
17. Paper towels
18. Pens, waterproof
19. Pump, bladder
20. Radio, two-way, hand-held or cellular phone
21. Safety glasses with side shields
22. Sample containers
23. Sheeting, polyethylene
24. Steel tape, weighted
25. Stop watch
26. Thermometer
27. Photoionization Detector (PID)
28. Trash bags, large plastic
29. Trash can, 32-gallon plastic
30. Tubing, Teflon®-lined polyethylene discharge bundled with polyethylene air tube
31. Water Level Indicator.

4.3 General Requirements

Decontamination

1. All field sampling equipment (pump, bailer, water discharge tubing, support cables, water level indicator, flow-through cells, etc) likely to come in contact with the sampled groundwater shall be decontaminated before and after each use or between wells. The pump shall be initially dissembled and decontaminated.

2. The water discharge tubing shall then be attached and the pump used to twice circulate the detergent solution followed by potable water, followed by a deionized water rinse as the last step. Only Teflon® or Teflon®-lined tubing shall be reused after decontamination. Polyethylene or tygon tubing shall be discarded after each use and shall not be decontaminated for reuse. Only the outside of the air tube shall be decontaminated and no fluids should enter this tube.

Other Requirements

3. Provide shade for the spooled tube when a sampling event occurs during summer months in full sun. Otherwise, the tube may act as an effective heater, warming the groundwater sample and creating a potential for volatilization.

4. The portable generator/compressors shall be placed downwind from the well being sampled.

5. Store field parameter measurement "instruments" in shade during transportation and at the sampling site. The instruments may give inaccurate readings if left under full sun.

6. To the extent possible, groundwater sampling shall be conducted so as to sample upgradient, presumably "clean" wells first.

7. All personnel involved in sampling shall wear appropriate health and safety clothing and gear, including clean nitrile gloves, in accordance with the site-specific health and safety plan.

8. In order to minimize turbidity in the well, pump and tubing assemblages should be lowered into the well as slowly as possible to minimize turbidity.

4.4 Specific Requirements for Low-Flow Sampling

Follow steps given below:

1. Measure the static water level and the total well depth with an electric water level indicator.

2. Based on the well design information, subsurface geology, and the measured water level, determine the location of the pump intake using the guidelines given below:

   a. If a zone with a relatively high hydraulic conductivity (K) is present in the screened interval, place the pump intake within this zone. A high K zone may be a sandy or gravel unit within an overall clayey unit or a fracture zone within the bedrock. If the high K zone is near the bottom of the screen, the pump intake should be as much above the well bottom as possible.

   b. If a high K zone is not present and the screen is completely submerged, place the pump intake near the middle or slightly above the middle of the screen.

   c. If a high K zone is not present and if the water level is below the top of the screen, place the pump near the middle of the water column. The pump intake should be as much above the well bottom as possible.

3. Connect the safety cable, discharge tube, and air tube to the bladder pump. The discharge tube will be Teflon®-lined polyethylene and its length will be appropriate for the well being sampled. For example, a 100-foot long tube may not be used in sampling a 30-foot deep well, instead a 50-foot length will be used.

Using an appropriate length of tube will minimize the amount of decontamination fluids generated and lessen the opportunity for chemical and physical changes in the water due to contact with the spooled tube.

4. Gently lower the pump to the appropriate sampling depth so as to minimize mixing of stagnant casing water with the screen water and resuspension of bottom sediments. Secure the pump at the desired depth by clamping the support cable to the 4-inch non-locking well cap.

5. Lower an electric water level indicator (with an audio and visual alarm) again into the well, measure and record the water level. The water level may be temporarily elevated because of the insertion of the pump into the well. Wait for a few minutes until the water level returns to the static level.

6. Make proper connections for the pump. Attach air supply line to the controller. Connect the pump discharge tube to a "T" insert with a valve. Connect two sections of Teflon®-lined tube to the two remaining ends of the "T." Connect one tube to the flow through cell and place the discharge from the flow cell into the purge water container. The third tube from the "T" will be used for sample collection.

7. Calibrate water quality meters and place probes into the flow through cell.

8. Measure the water level in the well. Secure the water level probe 0.3 foot (4 inches) below the water level and keep the instrument on.

9. Start the pump at the lowest setting. Gradually increase the flow rate.

10. Constantly monitor the drawdown as the flow rate is increased. If the drawdown exceeds 0.3 foot, indicated by visual or audio alarms on the water level indicator, decrease the flow rate appropriately.

11. Monitor the pump flow rate in mL/min using a stop watch and a graduated measuring cylinder. The target flow rate is 100 to 500 mL/min (0.1 to 0.5 L/min), which may be increased in the case of a rapid recharging well to 1 L/min (residuum well) or greater (bedrock well), with the maximum drawdown limitation of 0.3 foot.

12. Measure water quality indicator parameters every 3 to 5 minutes. The parameters and their tolerance limits are provided in **Table 1** and discussed further in a subsequent section. The measurements shall be recorded on the groundwater sampling form. All measurements shall be recorded in units shown on the form. If measurements are made in different units, these units must be clearly shown on the form.

13. Once water quality indicator parameters stabilize (four consecutive readings within acceptable variability), turn the valve at the "T" junction so that the water is diverted from the flow cell to the tube designated for sample collection. Collect samples at 100 to 500 mL/min purging rate.

A bailer should be used for sampling in the case where a well is extremely slow to recharge (i.e., the recovery rate is below the minimum possible pump rate) and has to be pumped dry. Follow the procedures given below under these circumstances.

14. If the recharge rate of a well fails to sustain the lowest possible flow rate of the pump, causing an excessive drawdown, purge the well dry once. Remove the pump from the well and allow the well to recover until adequate water for samples is available.

15. Use a bailer to collect samples as soon as adequate water is available in the well. Collect samples for different parameters as the water becomes available, in the order specified in Section 4.8. The recovery time may vary from a couple of hours to 12 hours. A minimum amount of time should be allowed between the drying of the well and sample collection. If a well is left unsampled for over 12 hours, the process should be repeated by purging the well dry again.

4.5 Specific Requirements for Volume Purge and Sampling Using a Bailer

The following procedures shall be applicable while using a bailer for purging and sampling a well. A bailer shall be used for purging only under special circumstances. For example, the well casing may be bent and may not allow insertion of a pump beyond the bend. However, prior approval from the technical lead shall be obtained and documented on the sample collection form before using this method.

1. Prepare and decontaminate equipment as per general procedures.

2. Measure the static water level and the total well depth with an electric water level indicator.

3. Use Teflon® bailers, if the bailers are to be decontaminated between wells and reused, or disposable bailers.

4. Use disposable twine with the bailer. Do not decontaminate and reuse plastic twine. Only Teflon®-covered steel cable may be decontaminated and reused at another well.

5. To start purging, gently lower and raise the bailer in the water column.

6. Record water quality parameters at least twice for each well volume evacuated.

7. Purge until at least 3 well volumes have been evacuated and the well parameters have stabilized or the well is bailed dry. Proceed with sample collection once parameter stabilization and low turbidity values (**Table 1**) have been achieved. If the well is bailed dry, wait until adequate water is available in the well and proceed with sample collection.

8. Collect the samples in the analyte order provided in a subsequent section.

9. If collecting a filtered sample, use a disposable filtration unit with a hand-operated vacuum pump. Alternatively, send an unpreserved (no nitric acid added) sample to the laboratory. The sample will be filtered in the laboratory before analysis.

10. Record all pertinent information on the groundwater sampling form, identifying the sampling method used (i.e., volume purge and sample with a bailer) in the "Comments" field. Any fields in the form not applicable to the method used shall be marked "NA."

4.6 Disposal of Purge Water

The water purged from the well is considered investigation-derived waste (IDW). All purge water shall be containerized and handled according to the work plan.

4.7 Specific Requirements for Water Quality Parameter Measurements

Water quality parameters to be monitored during the purge process shall include pH, temperature, conductivity, redox potential (Eh), dissolved oxygen (DO), and turbidity. Measurements shall be made at intervals required by the specific method used. If using a pump, a flow-through cell will be used to measure field parameters every 3 to 5 minutes. If using a bailer for purging, field parameters shall be measured at least twice per well volume evacuated.

The goal of the purging process is to obtain a groundwater sample that is representative of the surrounding aquifer. Field parameters are the simplest indicators for determining when the formation water is being removed. The normal ranges of field parameters observed are indicated in **Table 1**. Stabilization of parameters is required before analytical samples may be collected, irrespective of the method used. Field parameter stabilization is defined as four consecutive readings within the criteria presented in **Table 1**.

Professional judgment should be used in evaluating field measurements. For example, if DO readings are in the 5 to 7 milligrams per liter (mg/L) range, then 10 percent is a reasonable fluctuation. But if DO is in the 0.5 to 1 mg/L range, then fluctuations within 10 percent are perhaps overly stringent and 20-50 percent variations may be allowed. The same is true for conductivity and the 10-mV goal for redox. If after 3 well volumes have been purged, all but one or two parameters have stabilized, but are relatively close to their respective target bounds, then this may be an adequate indication that formation water is being removed and sample may be

collected. Rationale for samples collected when field parameters are outside of the target fluctuations will be documented on the sample collection logs.

Turbidity measurements should be treated differently for different situations. When the analytical program specifies metals (total or unfiltered) for laboratory analysis, then the target turbidity shall be less than 10 NTU, and consecutive turbidity readings less than 10 NTU will be considered equivalent. When metals are not an analytical parameter, then turbidity is not as great a concern, and the target shall be less than 20 NTU. However, in both cases, these goals may not be attainable due to silty or clayey sections of the aquifer matrix. If each parameter has stabilized, but turbidity is still above the target NTU value, then purging shall continue in an effort to attain the target NTU. Decisions to continue purging will be based on how far out of compliance the values are (e.g., 15 versus 100 NTU), and will be made by the technical lead on a case-by-case basis.

During purging , the field parameter values shall be periodically compared to the normal parameter ranges **(Table 1)**. Parameters outside the normal range may indicate a problem with instrument calibration or a faulty well construction. The accuracy of certain instruments tends to drift with time and such instruments may require frequent calibration. An example of a faulty well construction is the presence of cement grout in the screen interval due to a poor bentonite seal. The cement grout causes the pH of the groundwater to be abnormally high (11-13 range). If the parameters are observed to be outside the normal range, the instruments shall be recalibrated and the measurement repeated. If the parameters are still outside the normal range for 4 consecutive readings during purging, the well construction may be faulty and the task manager or technical lead must be contacted for further direction. No samples shall be collected from a well with questionable construction until further direction.

4.8 Sample Collection

Regardless of the purging technique used, samples shall be collected at flow rates in the range 0.1-0.5 L/min or poured gently to avoid aeration, bubble formation, or turbulent filling of sample bottles.

Samples shall be collected in the following order of target analytes, if adequate amount of water is available in the well:

- Volatile organic compounds (VOC)
- Semivolatile organic compounds (SVOC)
- Turbidity
- Major water quality cations and anions
- Carbonate/biocarbonate
- Total suspended solids
- Total dissolved solids
- Kjeldahl nitrogen

- Total metals
- Dissolved metals
- Total petroleum hydrocarbons
- Cyanide
- Ammonia, nitrogen.

Samples for any target analytes not listed above shall be collected in the order of decreasing volatility within the framework of this list. If the amount of water available in the well is low, minimum volume requirements provided in **Table 2** should be implemented or certain target analytes may be omitted, upon approval from the task manager and project chemist.

Filtered Samples. Filtered groundwater samples are normally not needed if a successful low-flow sampling program is implemented. However, if specified in the work plan, filtered groundwater samples will be collected according to the following procedures:

1. If using a flow cell, connect an inline, disposable 0.45 µm filter to the discharge flow tube attached to the "T" junction upstream from the flow cell. If a flow cell is not being used, connect the filter to the discharge tube of the pump. Collect the water discharging from the filter in the sample container.

2. If the low rate is too slow to allow filtration through an in-line filter or if samples are collected by a bailer, an alternative filtration method may be required. A disposable filtration unit and a hand-operated vacuum pump will be used to filter the sample in the field.

3. If filtration can not be accomplished in the field, an unpreserved sample (no nitric acid added) cooled to 4°C shall be shipped to the laboratory along with the preserved sample for unfiltered analysis. The unpreserved sample shall be filtered upon receipt and the filtrate preserved with nitric acid. The data from the laboratory filtered sample will be reported as "dissolved metals."

4.9 Records

For each monitoring well purged, the sampler shall complete a groundwater sampling form **(Attachment 1)**. This form prompts the technician to identify and record information such as: site ID, well ID, sample number, depth of well, depth to water, and well diameter. The sampler can then use the information on the form to perform a well casing volume calculation. The form also includes spaces to record the field parameters that are measured during purging and any comments and observations. This form also prompts the sampler to record the sample number, collection date, and time, sample containers, and associated QC sample information.

All well purging and sampling data and information shall be recorded in the bound logbook or Field Activity Data Log (FADL) for the site sampled. The entries shall be recorded chronologically and the time of the entry recorded first. All continuation

pages shall be sequentially numbered and the last page recorded for the day shall be signed and dated by the recording technician.

5.0 CROSS REFERENCE

U.S. Environmental Protection Agency (USEPA), 1986, *Resource Conservation and Recovery Act (RCRA) Groundwater Monitoring Technical Enforcement Guidance Document,* OSWER-9950.1, September.

U.S. Army Corps of Engineers (USACE), 1994, *Requirements for the Preparation of Sampling and Analysis Plans*, EM 200-1-3, September.

U.S. Environmental Protection Agency (USEPA), 1996, *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*, Region 4, May.

U.S. Environmental Protection Agency (USEPA), 1995, *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures, Groundwater Issue*, EPA/540/S-95/504, December.

6.0 TABLES

Table 1 - Water Quality Indicator Parameters
Table 2 - Water Sample Volume Requirements

7.0 ATTACHMENTS

Attachment 1 - Groundwater Sampling Form

Table 1

Water Quality Indicator Parameters

Measurement	Normal Range	Acceptable Variability[a]
PH	4.6 to 8.5	± 0.1
Temperature (°C)	10 to 18	± 10%
Specific Conductivity (µS/cm)	10 to 8,000	± 3%
Redox (mV)	+400 to -300	± 10
Dissolved oxygen (mg/L)	<10	± 10%
Turbidity (NTU)	variable	± 10%[b]

[a] Acceptable variability for four consecutive readings.
[b] Values of less than 10 NTU are considered to be equivalent.

°C - Degrees Celsius.
µS/cm - MicroSiemens per centimeter.
mV - Millivolt.
mg/L - Milligrams per liter.
NTU - Nephelometric turbidity unit.

Table 2

Water Sample Volume Requirements

Analysis	Standard Volume (mL)	Minimum Volume (mL)*	Minimum Volume Option*
Volatile organics	120	40	X
Semivolatile organics	1000	1000	
Pesticides/PCBs	1000	1000	
Herbicides	1000	1000	
Metals – Total	500	125	X
Metals – Dissolved	500	125	X
Mercury – Total Mercury – Dissolved	Included with metals (100)	Included with metals (100)	
Cyanide	500	125	X
Anions	250	100	X
Nitrate-nitrite	100	50	X
Total suspended solids and total dissolved solids (TSS and TDS)	500	200	X
Total organic carbon (TOC) RCRA 4/well	4 x 25	4 x 25	
Total organic halides (TOX) RCRA 4/well	4 x 100	4 x 100	
Total petroleum hydrocarbon (TPH)	1000	1000	X
Gasoline range organics (GRO)	80	40	X
Diesel range organics (DRO)	1000	1000	

*Quantitation limits (detection levels) may be affected when operating with minimum sample volumes. If volumes are lowered below the minimum sample volumes, quantitation limits will be raised.

Attachment 1

00039843

GROUNDWATER SAMPLING FORM

Sheet 1 of ___

Operable Unit/Site ID:_____ Sampling location ID:_____
Project Name/#:_____ Sample ID:_____
Weather:_____ Collection Time/Date:_____

Pump Installation

Pump installation crew:_____ Installation date/beginning time:_____
PID/FID reading (well head/background):_____ Installation date/completion time:_____
Casing diameter (inches):_____ Screen Interval (ft. BTOC): _____ to _____
Total well Depth (ft. BTOC):_____ Pump intake depth (ft BTOC): _____
Initial (pre-installation) DTW/time:_____ Post-installation DTW/time:_____
Final (after pump priming) DTW/time:_____ Max. sustainable pump rate (mL/min):_____
Free product (circle): LNAPL / DNAPL Appearance of product:_____
Volume of water removed during priming (mL):_____ Discharge tube diameter (3/8" or 1/4"):_____
Discharge tube length (ft.):_____ Inlet reducer used (Y/N):_____

Pneumatic Controller Tuning:

Initial air pressure = H (ft.) X 0.43 = _____ psi

	Initial	2	3	4	5	6	7	8	Final
Pressure (psi)									
Refill Setting									
Discharge Setting									
Flow rate (mL/min)									

Purging

Purging/sampling crew:_____ PID/FID reading (well head/background):_____
Purge date/beginning time:_____ Purge date/completion time:_____
Initial (pre-purging) DTW (ft. BTOC):_____ Final (post-purging) DTW (ft. BTOC):_____
Calculated tubing + pump volume: NA No. of tubing + pump volumes purged:_____

Pneumatic Controller Tuning:

Initial air pressure = H (ft.) X 0.43 = _____ psi

	Initial	2	3	4	5	6	7	8	Final
Pressure (psi)									
Refill Setting									
Discharge Setting									
Flow rate (mL/min)									

Water Quality Parameter Measurements

Time	DTW (ft. BTOC)	Purge Rate (mL/min)	Cumulative Volume Purged (L)	Temp. (degree C)	Electrical Conductivity (uMhos/cm)	pH	Eh (mv)	DO (mg/L)	Turbidity (NTU)

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GROUNDWATER SAMPLING FORM

Sheet ___ of ___

Water Quality Parameter Measurements (continued)

Time	DTW (ft. BTOC)	Purge Rate (mL/min)	Cumulative Volume Purged (L)	Temp. (degree C) ±10%	Electrical Conductivity (uMhos/cm) ±3%	pH ±0.1	Eh (mv) ±10	DO (mg/L) ±10%	Turbidity (NTU) ±10%

10 - est 20 ml

Sampling

Sampling beginning time:_____ Sampling completion time:_____

Water Quality Parameter Measurements

Time	DTW (ft. BTOC)	Purge Rate (mL/min)	Cumulative Volume Purged (L)	Temp. (degree C)	Electrical Conductivity (uMhos/cm)	pH	Eh (mv)	DO (mg/L)	Turbidity (NTU)

Sample Information

Sample ID:_____ Sample collection date/time:_____

Duplicate sample collected (Y/N):_____ Duplicate sample ID:_____

Split sample collected (Y/N):_____ Split sample ID:_____

COC No(s):_____

Requested Analysis	Method	Containers	Requested Analysis	Method	Containers

Comments:

Abbreviations: BTOC - Below top of casing; DTW - Depth to water; H - head above pump intake; mL - milliliter; L - Liter

00039845

Shaw® Shaw Environmental, Inc.

Date: *January 23, 2006*

Project No.: *117591.009A800*
117591.009A810
117591.009A820

TRANSMITTAL LETTER:

To: Mr. Cliff Murray

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

Re: Draft Installation-Wide Work Plan
Contract No. W912QR-04-D-0027/DS02

For: Review ____ As Requested ____ Approval ____ Corrections ____ Submittal X Other ____

Item No.:	*No. of Copies*	*Date:*	*Document Title*
1	1	January 2006	**Decision Documentation LHAAP-03, LHAAP-06, and LHAAP-23** Longhorn Army Ammunition Plant - Karnack, Texas

Cliff – Enclosed is a copy of Shaw's Decision Documentation LHAAP-03, LHAAP-06, and LHAAP-23 for your use.

Copies have also been sent to people on the distribution list below.

Please call if any questions or comments.

Sincerely:

David P. Cobb

CC: See attached page

100 Technology Center Drive Stoughton, MA 02072 *Phone: (617) 589-8000/Fax: (617) 589-2160*

Distribution List:
Ms. Rose Zeiler – BRAC-LHAAP
Mr. Alan Etheredge–TCEQ Austin
Mr. Chris Villarreal – EPA Dallas

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

January 24, 2006

DAIM-BD-H-LO

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

Re: Decision Documentation, LHAAP-03, LHAAP-06, and LHAAP-23
Longhorn Army Ammunition Plant, Karnack, Texas, January 2006

Dear Mr. Villarreal,

The above-referenced document is transmitted to you for your file. Please review the documentation and provide a concurrence letter by February 23, 2006.

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

Enclosure: Decision Documentation, LHAAP-03, LHAAP-06, and LHAAP-23, January 2006
Copies furnished:
Alan Etheredge, TCEQ, Austin, TX
Cliff Murray, COE-Tulsa District, OK

00039848

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

January 24, 2006

DAIM-BD-H-LO

Mr. Alan Etheredge
Texas Commission on Environmental Quality
Superfund Investigation (MC-143)
12100 Park 35 Circle, Bldg D
Austin, TX 78753

Re: Decision Documentation, LHAAP-03, LHAAP-06, and LHAAP-23
Longhorn Army Ammunition Plant, Karnack, Texas, January 2006

Dear Mr. Etheredge,

The above-referenced document is transmitted to you for your file. Please review the documentation and provide a concurrence letter by February 23, 2006.

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

Enclosure: Decision Documentation, LHAAP-03, LHAAP-06, and LHAAP-23,
Copies furnished:
Chris Villarreal, USEPA Region 6, Dallas, TX
Cliff Murray, COE-Tulsa District, OK

00039849

DECISION DOCUMENTATION
FOR LHAAP-03, LHAAP-06, AND LHAAP-23
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Prepared for
U.S. Army Corps of Engineers
Tulsa District
1645 South 101st East Avenue
Tulsa, Oklahoma

Prepared by
Shaw Environmental, Inc.
3010 Briarpark, Suite 4N
Houston, Texas 77042

TERC Contract No. DACA56-94-D-0020, Project No. 845714
Task Order No. 0109

January 2006

Table 1
Decision Documentation for Sites Requiring No Further Action
Longhorn Army Ammunition Plant, Karnack, Texas

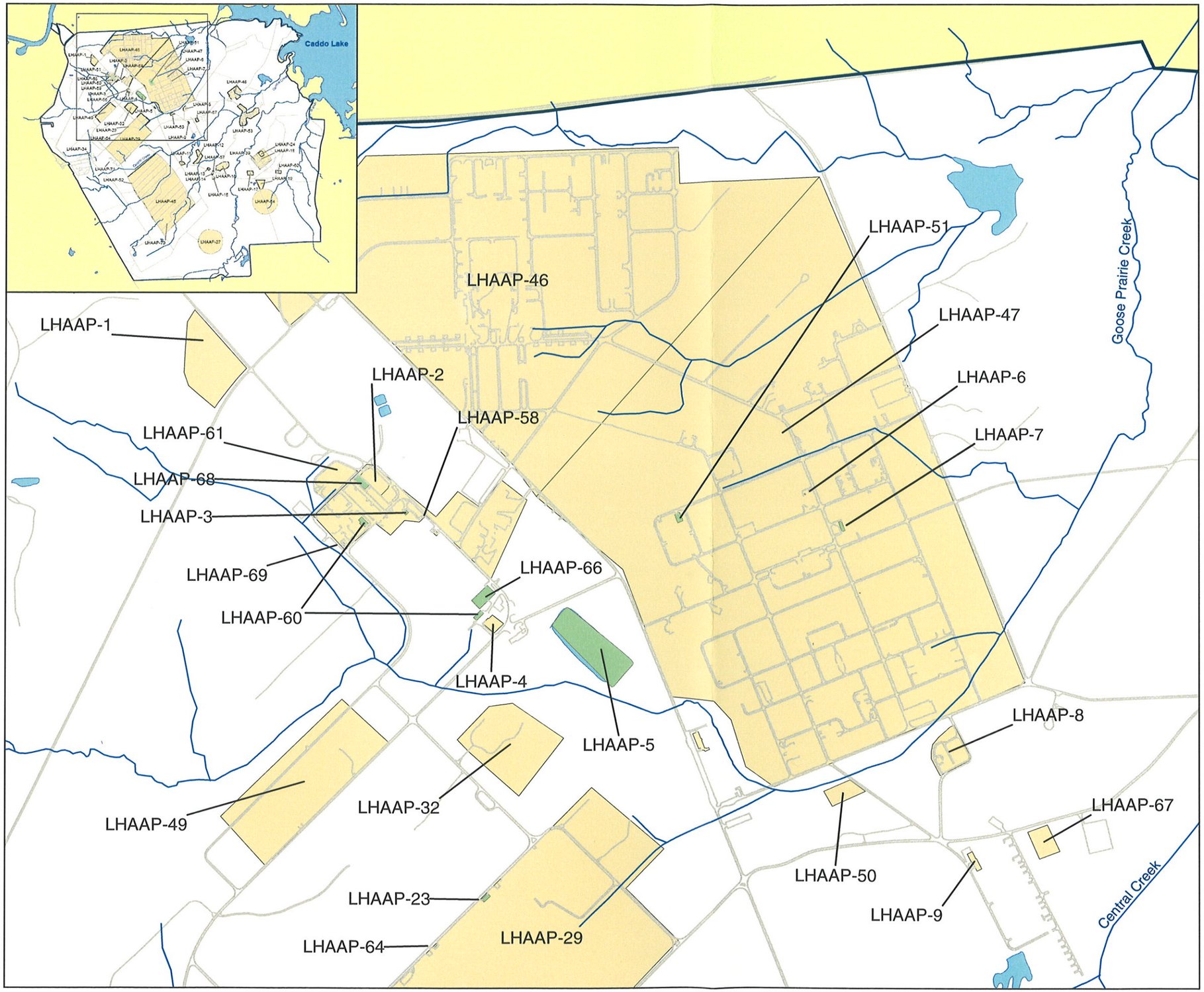
Site	Brief Description	Documentation	Remarks
LHAAP-03 (Waste Water Collection at Paint Shop)	The site was used from early 1970s for collection of waste (may have included paint thinner, paints, kerosene) produced from the paint shop. The paint shop was located in Building 722. The site consisted of one 55-gallon drum set on a gravel pad in an open-sided shed, with a galvanized metal roof.	Texas Water Commission, 1988, Final Report RCRA Facility Assessment (RFA), LHAAP-1 through LHAAP-34, LHAAP, Marshall, Texas, April. (Admin Records: 1988-Vol.2.pdf Bate Stamp 001279-001284). Maley, Don, 1988, Potential Hazardous Waste Site Preliminary Assessment, EPA Form 2070-12, April	Based on the preliminary assessment findings, no further action is required for the site.
LHAAP-06 (Building 54F) (Group 4)	The site served as a collection point for waste solvents from production processes. The site consisted of a single 55-gallon drum stored in a three sided shed, approximately 8 by 10 feet in size with fiberglass. The shed was set on a curbless concrete pad. Full drums were taken to Bldg. 31-W. The site was in operation until mid-1985.	Texas Water Commission, 1988, Final Report RCRA Facility Assessment (RFA), LHAAP-1 through LHAAP-34, LHAAP, Marshall, Texas, April. (Admin Records: 1988-Vol.2.pdf Bate Stamp 001298-001302). Maley, Don, 1988, Potential Hazardous Waste Site Preliminary Assessment, EPA Form 2070-12, April	Based on the preliminary assessment findings, no further action is required for the site.
LHAAP- 23 (Building 707-C Storage Area for PCBs) (Group 4)	The site consisted of a 30 by 150 feet, wooden, storage building, with shingle siding and a concrete floor. Drums or transformers containing PCB-contaminated oil were stored in galvanized steel cattle watering troughs inside the building. Operated from 1980 to March 1986.	Maley, Don, 1988, Potential Hazardous Waste Site Preliminary Assessment, EPA Form 2070-12, April Letter from Heyer Ernest, Team I, Corrective Action Section, Remediation Division, TNRCC to William Corrigan, CES,: Approval of Closure Final Report - Risk Reduction Standard No. 1 Building 707-C(NOR 010), LHAAP, dated September 28, 2000. Complete Environmental Services, 2000, Closure Report TNRCC Solid Waste Registration No. 30990, NOR Waste Management Unit No. 010, Building 707-C, September	RCRA Closure (closed on 11/27/2000), no further action is required for the site.

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00039851

APPROVED BY	P.SRIVASTAV	10/27/04	
CHECKED BY	A.MAYILA	10/27/04	
COMPILED BY	B.LU	10/27/04	
OFFICE	Houston, TX		
FILE LOCATION	seiknxgis01/longhorn/gisworkspace/mxd/Env_Decision_Doc.mxd		

PLOT DATE: 04/26/04
REVISION FORMAT: 10/05/04



Legend

- Creek/Bayou
- Road
- Longhorn Army Ammunition Plant Approximated Boundary
- Sites Included in the Decision Document
- Sites Not Included in the Decision Document
- Water Body

Note: LHAAP-55 consists of 10 septic tanks.

N
W E
S

0 500 1,000 2,000 Feet

Shaw®

U.S. Army Corps of Engineers
Tulsa District
Tulsa, Oklahoma

Figure 1

Environmental Sites - Decision Document

Longhorn Ammunition Plant
Karnack, Texas

LHAAP-03

WASTE WATER COLLECTION AT PAINT SHOP

00039853

001252

RCRA FACILITY ASSESSMENT (RFA)
CONDUCTED BY
TEXAS WATER COMMISSION
FOR
LONGHORN ARMY AMMUNITION PLANT

APRIL 8, 1988

001279 28

PRELIMINARY REVIEW UNIT CHECKLIST

FACILITY: Longhorn Army Ammunition Plant
EPA I.D.#: TX 6213820529
HAZIT #: TX 05886

Reviewer: Alan Church
Date: 8 April, 1988
Amended: 9 June, 1988

Waste Management Unit:

SWMU: LHAAP-3, Bldg 722-P, Paint Shop

Evidence of Release:

There is no evidence of release of hazardous waste or hazardous constituents to the environment from this unit.

Pollutant Dispersal Pathways:

Lack of impermeable containment pad allows for small possibility of offsite migration of drum spillage should spillage occur. Spilled material could migrate through soil to ground water or through surface runoff to surface water. Emissions are also possible through volatilization.

Waste Characteristics:

Paint residues including paint thinner, paints, and kerosene.

Target Populations of Concern:

See Attachment II.

Documents Reviewed:

Correspondence File, inspection reports, Parts A and B of the Permit Application, and Groundwater Contamination Survey No. 38-26-0851-87 Evaluation of Solid Waste Management Units, Longhorn Army Ammunition Plant, Marshall, Texas 18-22 May, 1987.

Site Description:

(1) Type of Unit: Collection point.
(2) Design Features: One 55-gallon drum set on a gravel pad in an open-sided shed with galvanized metal roof.
(3) Operating Practices: Paint residues from paint shop are collected here until drum becomes full. Full drum is taken from here to Bldg 31-W.
(4) Period of Operation: Early 1970's until present.

Summary:

Additional information is needed about this unit, and the area which it occupies.

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Recommended Actions:

A Visual Site Inspection is recommended to determine 1) operating parameters, 2) construction characteristics, 3) wastes managed, and 4) visual evidence of releases.

001281 30

Ground-Water Contamination Surv No. 38-26-0851-87, LHAAP, Marshall, TX,
18-22 May 87

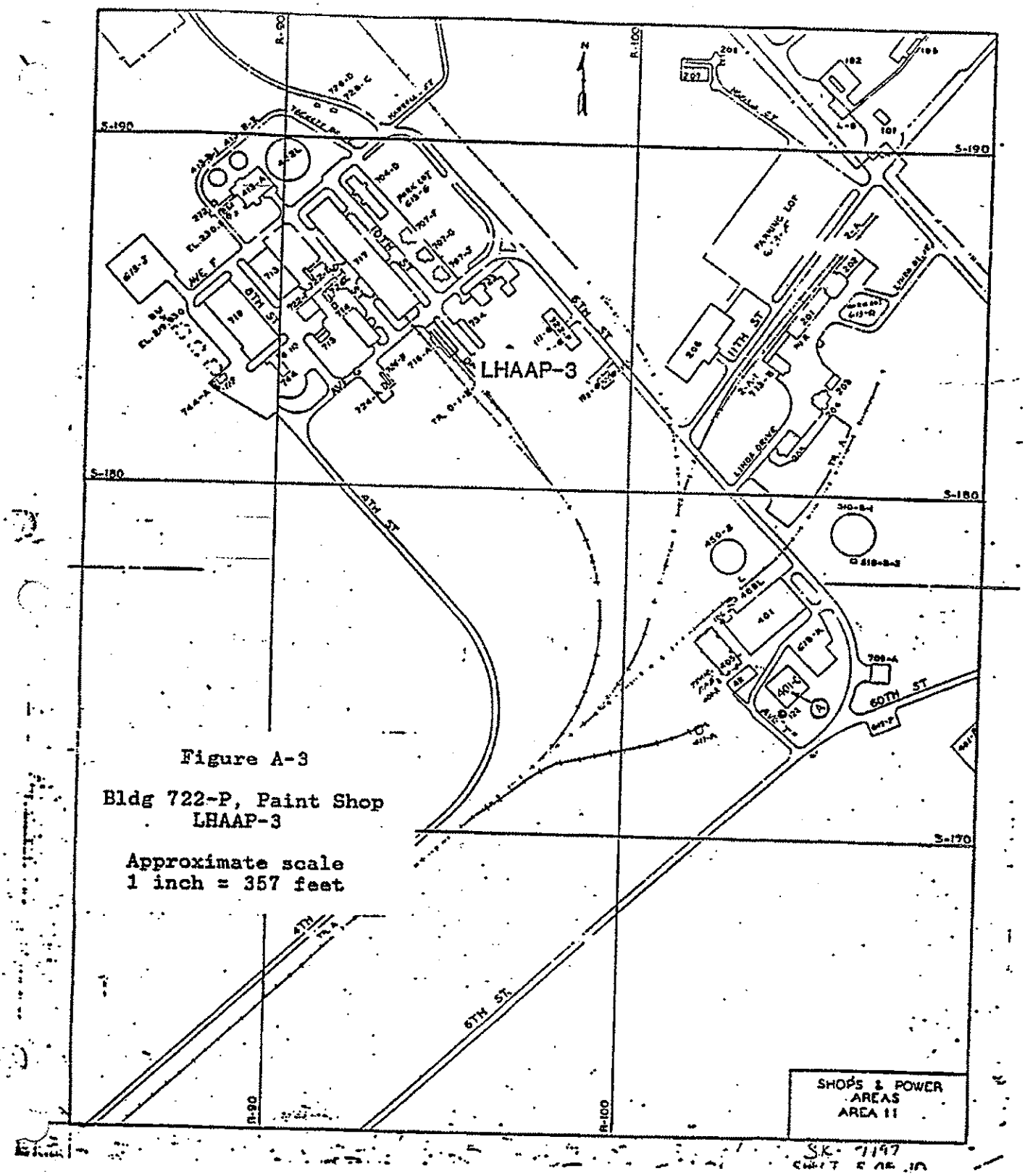


Figure A-3

Bldg 722-P, Paint Shop
LHAAP-3

Approximate scale
1 inch = 357 feet

001282 31

Longhorn Army Ammunition Plant
Karnack, Texas

APRIL 25 → 28 & MAY 2 → 5, 1988

PART II - UNIT EVALUATION

CONTAINER STORAGE

TWC Regis. No. _____

Regis. Facility No. 35W 30990

UNIT IDENTIFICATION: LHAAP-3 Paint Shop Container Accumulation

A. Verification of Physical Construction and Operation (dimensions, years of service, containment features eg. concrete pads, dikes, indoor)

As depicted on the Preliminary Review

B. Characterization of Waste Materials (facility records, sample results, process description, constituents of concern, documentation)

As depicted on the Preliminary Review

C. Visual/Physical Inspection of Unit

1. Conditions of drums

Good Condition

001283 32

2. Rainfall controls (run-on/runoff controls, stormwater collection and disposal, analyses)

A modest sheet metal roof covers the drum. The drum is elevated above low grade by a wooden pallet.

3. Evidence of spillage/leakage (visual and olfactory evidence, dead vegetation, etc.)

No evidence of spillage or leakage that would suggest mismanagement of this unit.

4. Evidence of actual or potential groundwater contamination (samples from monitor wells, knowledge of shallow water tables, operating practices)

Upon inspection, it seems unlikely that this unit would contribute to any significant groundwater contamination.

5. Air quality concerns (TACB complaints, odors, particulate dispersal, sampling records)

None known.

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D. Other Areas of Concern

E. Summary/General Comments

Under Title 40 CFR Part 262, Subpart C Paragraph C 1, this unit is exempt from permitting and certain interim status requirements.

Because this is a well-managed unit, no further RFA action is recommended.

ENCLOSURE 2

02/22/88 20:59 CDR USA THAMA 002

Environmental Protection Agency

Washington, DC 20460

EPA Form 2070-12
July, 1991

EPA

Potential Hazardous Waste Site

Preliminary Assessment

00039862

06/22/88 21:03 CDR USA HQTR 003

EPA

POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT
PART 1 - SITE INFORMATION AND ASSESSMENT

I. IDENTIFICATION
01 STATE: TX

II. SITE NAME AND LOCATION

01 SITE NAME: Longhorn Army Ammunition Plant
02 STREET, ROUTE NO., OR SPECIFIC LOCATION IDENTIFIER:
03 CITY: Marshall
04 STATE: TX
05 ZIP CODE: 75671
06 COUNTY: Harrison
07 COUNTY CODE: 102
08 CONG DIST: 01
09 COORDINATES: LATITUDE 32 40 14.6 LONGITUDE 94 02 55.8
10 DIRECTIONS TO SITE: Highway 43 North, eastfrom Marshall, TX, (15 miles) to Karnack, TX

III. RESPONSIBLE PARTIES

01 OWNER: U. S. Army
02 STREET:
03 CITY: Marshall
04 STATE: TX
05 ZIP CODE: 75671
06 TELEPHONE NUMBER: (214) 679-3181
07 OPERATOR: Morton Thiokol, Inc.
08 STREET: P.O. Box 1149
09 CITY: Marshall
10 STATE: TX
11 ZIP CODE: 75671
12 TELEPHONE NUMBER: (214) 679-3181
13 TYPE OF OWNERSHIP: ☐ A. PRIVATE ☒ B. FEDERAL U. S. Army ☐ C. STATE ☐ D. COUNTY ☐ E. MUNICIPAL ☐ F. OTHER ☐ G. UNKNOWN
14 OWNER/OPERATOR NOTIFICATION ON FILE: ☐ A. RCRA 3001 DATE RECEIVED ☐ B. UNCONTROLLED WASTE SITE (CERCLA 103 e) DATE RECEIVED ☐ C. NONE

IV. CHARACTERIZATION OF POTENTIAL HAZARD

01 ON SITE INSPECTION: ☒ YES DATE 5-22-87 ☐ NO
02 BY: ☐ A. EPA ☐ B. EPA CONTRACTOR ☐ C. STATE ☐ D. OTHER CONTRACTOR ☐ E. LOCAL HEALTH OFFICIAL ☒ F. OTHER: U. S. Army
CONTRACTOR NAME(S):
03 SITE STATUS: ☒ A. ACTIVE ☐ B. INACTIVE ☐ C. UNKNOWN
04 YEARS OF OPERATION: 1970's | Present ☐ UNKNOWN
05 DESCRIPTION OF SUBSTANCES POSSIBLY PRESENT, KNOWN, OR ALLEGED:

See Attached Survey LHAAP- 3

06 DESCRIPTION OF POTENTIAL HAZARD TO ENVIRONMENT AND/OR POPULATION:

See Attached Survey LHAAP- 3

V. PRIORITY ASSESSMENT

01 PRIORITY FOR INSPECTION: ☐ A. HIGH ☐ B. MEDIUM ☒ C. LOW ☐ D. NONE

VI. INFORMATION AVAILABLE FROM

01 CONTACT	02 OF (Agency/Organization)	03 TELEPHONE NUMBER
Don Maley	Longhorn Army Ammunition Plant	(214) 679-2613
04 PERSON RESPONSIBLE FOR ASSESSMENT	**05 AGENCY / 06 ORGANIZATION / 07 TELEPHONE NUMBER**	**08 DATE**
Allen L. Germain, LTC	U. S. Army / LHAAP / (214) 679-2100	04 14 88 (MONTH DAY YEAR)

EPA FORM 2070-12 (7-81)

See Attached Survey

EPA

POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT
PART 2 - WASTE INFORMATION

I. IDENTIFICATION
01 STATE: TX | 02 SITE NUMBER:

II. WASTE STATES, QUANTITIES, AND CHARACTERISTICS

01 PHYSICAL STATES (Check all that apply)
- [ ] A. SOLID
- [ ] B. POWDER, FINES
- [ ] C. SLUDGE
- [ ] D. OTHER _____ (Specify)
- [ ] E. SLURRY
- [ ] F. LIQUID
- [ ] G. GAS

02 WASTE QUANTITY AT SITE (Measures of waste quantities must be independent)
- TONS: _____
- CUBIC YARDS: _____
- NO. OF DRUMS: _____

03 WASTE CHARACTERISTICS (Check all that apply)
- [ ] A. TOXIC
- [ ] B. CORROSIVE
- [ ] C. RADIOACTIVE
- [ ] D. PERSISTENT
- [ ] E. SOLUBLE
- [ ] F. INFECTIOUS
- [ ] G. FLAMMABLE
- [ ] H. IGNITABLE
- [ ] I. HIGHLY VOLATILE
- [ ] J. EXPLOSIVE
- [ ] K. REACTIVE
- [ ] L. INCOMPATIBLE
- [ ] M. NOT APPLICABLE

III. WASTE TYPE

CATEGORY	SUBSTANCE NAME	01 GROSS AMOUNT	02 UNIT OF MEASURE	03 COMMENTS
SLU	SLUDGE			
OLW	OILY WASTE			
SOL	SOLVENTS			
PSD	PESTICIDES			
OCC	OTHER ORGANIC CHEMICALS			
IOC	INORGANIC CHEMICALS			
ACD	ACIDS			
BAS	BASES			
MES	HEAVY METALS			

IV. HAZARDOUS SUBSTANCES (See Appendix for most frequently cited CAS Numbers)

01 CATEGORY	02 SUBSTANCE NAME	03 CAS NUMBER	04 STORAGE/DISPOSAL METHOD	05 CONCENTRATION	06 MEASURE OF CONCENTRATION

V. FEEDSTOCKS (See Appendix for CAS numbers)

CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER	CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER
FDS			FDS		
FDS			FDS		
FDS			FDS		
FDS			FDS		

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports.)

Groundwater Contamination Survey No. 38-26-0851-87, Evaluation of Solid Waste Management Units, Longhorn Army Ammunition Plant, Marshall, TX 18-22 May 1987

See Attached Survey

EPA

POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION	
01 STATE	02 SITE NUMBER
TX	

II. HAZARDOUS CONDITIONS AND INCIDENTS

01 ☐ A. GROUNDWATER CONTAMINATION — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED _____ 04 NARRATIVE DESCRIPTION

01 ☐ B. SURFACE WATER CONTAMINATION — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED _____ 04 NARRATIVE DESCRIPTION

01 ☐ C. CONTAMINATION OF AIR — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED _____ 04 NARRATIVE DESCRIPTION

01 ☐ D. FIRE/EXPLOSIVE CONDITIONS — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED _____ 04 NARRATIVE DESCRIPTION

01 ☐ E. DIRECT CONTACT — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED _____ 04 NARRATIVE DESCRIPTION

01 ☐ F. CONTAMINATION OF SOIL — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 AREA POTENTIALLY AFFECTED _____ Meters 04 NARRATIVE DESCRIPTION

01 ☐ G. DRINKING WATER CONTAMINATION — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED _____ 04 NARRATIVE DESCRIPTION

01 ☐ H. WORKER EXPOSURE/INJURY — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 WORKERS POTENTIALLY AFFECTED: _____ 04 NARRATIVE DESCRIPTION

01 ☐ I. POPULATION EXPOSURE/INJURY — 02 ☐ OBSERVED (DATE _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: _____ 04 NARRATIVE DESCRIPTION

See Attached Survey

EPA

POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION
01 STATE: TX | 02 SITE NUMBER:

II. HAZARDOUS CONDITIONS AND INCIDENTS

01 ☐ J. DAMAGE TO FLORA — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ K. DAMAGE TO FAUNA — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ L. CONTAMINATION OF FOOD CHAIN — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ M. UNSTABLE CONTAINMENT OF WASTES — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: _____ 04 NARRATIVE DESCRIPTION

01 ☐ N. DAMAGE TO OFFSITE PROPERTY — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ O. CONTAMINATION OF SEWERS, STORM DRAINS, WWTPs — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ P. ILLEGAL/UNAUTHORIZED DUMPING — 02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

05 DESCRIPTION OF ANY OTHER KNOWN, POTENTIAL, OR ALLEGED HAZARDS

III. TOTAL POPULATION POTENTIALLY AFFECTED: _____

IV. COMMENTS

V. SOURCES OF INFORMATION

Groundwater Contamination Survey, No. 38-26-0851-87, Evaluation of Solid Waste Management Units, Longhorn Army Ammunition Plant, Marshall, TX, 18-22 May 1987.

EPA FORM 2070-12 (7-81)

Ground-Water Contamination Surv No. 38-26-0851-87, LHAAP, Marshall, TX, 18-22 May 87

MAP LOCATION/SITE NUMBER: LHAAP-3 (see Figure A-3).

a. SWMU Name: Bldg 722-P, Paint Shop.

b. Unit Characteristics.

(1) Type of Unit: Collection point.

(2) Design Features: Two 55-gallon drums set on a gravel pad in an open sided shed with galvanized metal roof.

(3) Operating Practices: Paint residues from paint shop are collected here until drum becomes full. Full drums are taken from here to Bldg 31-W.

(4) Period of Operation: Early 1970's until present.

c. Waste Characteristics.

(1) Type of Wastes Placed in the Site: Paint residues including paint thinner, paints, and kerosene.

(2) Migration and Dispersal Characteristics of the Waste: Lack of impermeable containment pad allows for small possibility of offsite migration of drum spillage should spillage occur.

d. Migration Pathways: Spilled material could migrate through soil to ground water or through surface runoff to surface water. An emissions is also possible through volatilization.

e. Evidence of Release: None.

f. Exposure Potential: Low.

Ground-Water Contamination Surv No. 38-26-0851-87, LHAAP, Marshall, TX,
18-22 May 87

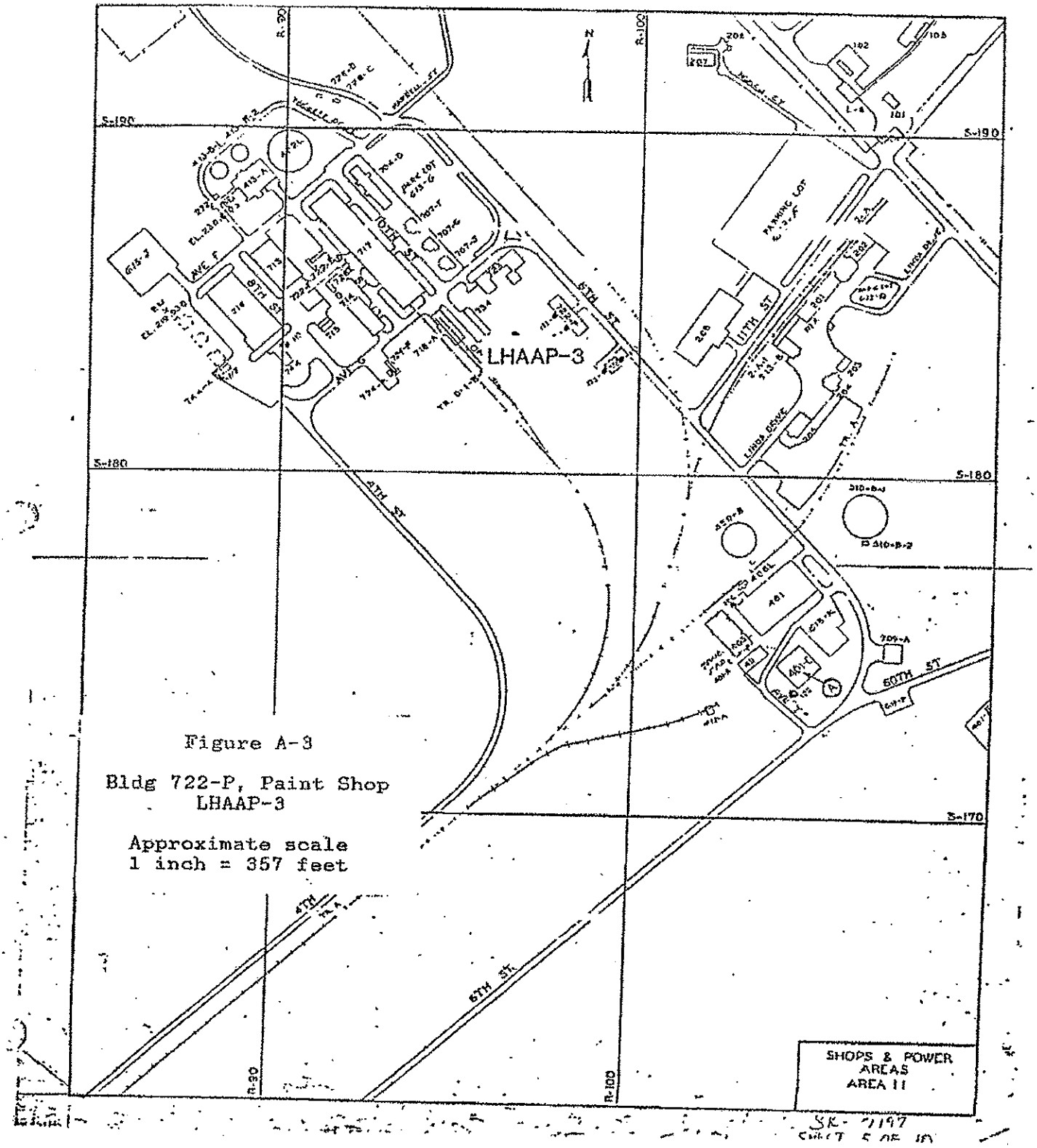


Figure A-3

Bldg 722-P, Paint Shop
LHAAP-3

Approximate scale
1 inch = 357 feet

LHAAP-06

BUILDING 54F

00039869

001252

RCRA FACILITY ASSESSMENT (RFA)
CONDUCTED BY
TEXAS WATER COMMISSION
FOR
LONGHORN ARMY AMMUNITION PLANT

APRIL 8, 1988

001298 47

PRELIMINARY REVIEW UNIT CHECKLIST

FACILITY: Longhorn Army Ammunition Plant
EPA I.D.#: TX 6213820529
HAZIT #: TX 05886

Reviewer: Alan Church
Date: 8 April, 1988
Amended: 9 June, 1988

Waste Management Unit:

SWMU: LHAAP-6, Bldg. 54-F, Collection Point.

Evidence of Release:

There is no evidence of release of hazardous waste or hazardous constituents to the environment from this unit.

Pollutant Dispersal Pathways:

Lack of curbing on concrete pad allows for small potential of uncontained drum spillage.

Waste Characteristics:

Acids and solvents.

Target Populations of Concern:

See Attachment II.

Documents Reviewed:

Correspondence File, inspection reports, Parts A and B of the Permit Application, and Groundwater Contamination Survey No. 38-26-0851-87 Evaluation of Solid Waste Management Units, Longhorn Army Ammunition Plant, Marshall, Texas 18-22 May, 1987.

Site Description:

(1) Type of Unit: Collection point.
(2) Design Features: A single 55-gallon drum stored in a three-sided shed, approximately 8 x 10 feet in size, with fiberglass siding and a roof of galvanized metal and fiberglass. Shed was set on curbless concrete pad.
(3) Operating Practices: Drum is used as collection point for waste solvents from production processes. Full drums are taken to Bldg 31-W.
(4) Period of Operation: Mid 1985 until present.

Summary:

Additional information is needed about this unit, and the area which it occupies.

Recommended Actions:

A Visual Site Inspection is recommended to determine 1) operating parameters, 2) construction characteristics, 3) wastes managed, 4) secondary containment, and 5) visual evidence of releases.

ZONE	REV	REVISIONS DESCRIPTION	DATE

00030872

FIRST STREET

30′

707C-SS-2

707C-N-SS-1 & 707C-N-SS

707C-SS-4

10′

6′

707C-SS-5

15′-6″

707C-SS-2

10′-6″

5′

79′

707C-SS-3

707C-SS-4

4′

8′

707C-N-SS-1 & 707C-W-SS

707C-SS-5

707C-SS-3

West Entrance

Bathroom

Bathroom

East Entrance

10′-6″

30′ 707C-E-SS

15′

150′

13′ South Entrance

Boiler Room

707C-S-SS

9′

N

W

E

S

LEGEND

+ Soil Sample Location

---- Limits of Excavation Area

Longhorn AAP

Building 707-C

Soil Sample Locations

SIZE	FSCM NO.	DWG NO.	REV
C		Figure 7-1	
SCALE	Text	Sept. 00	SHEET

A B C D

1 2 3 4

001300 49

Longhorn Army Ammunition Plant
Karnack, Texas

APRIL 25 → 28 & MAY 2 → 5, 1988

PART II - UNIT EVALUATION

CONTAINER STORAGE

TWC Regis. No. _____

Regis. Facility No. HSW 30990

UNIT IDENTIFICATION: LHAAP-6 - Bldg 54 F, Collection Point

A. Verification of Physical Construction and Operation (dimensions, years of service, containment features eg. concrete pads, dikes, indoor)

As depicted in the Preliminary Review

B. Characterization of Waste Materials (facility records, sample results, process description, constituents of concern, documentation)

Waste acids and solvents

C. Visual/Physical Inspection of Unit

1. Conditions of drums

Good Condition

001301

50

2. Rainfall controls (run-on/runoff controls, stormwater collection and disposal, analyses)

Protected on 3 sides and the roof - There is little exposure to the elements

3. Evidence of spillage/leakage (visual and olfactory evidence, dead vegetation, etc.)

No evidence of spillage or leakage that would suggest mismanagement of this unit.

4. Evidence of actual or potential groundwater contamination (samples from monitor wells, knowledge of shallow water tables, operating practices) .

Upon inspection, it seems unlikely that this unit would contribute to any significant groundwater contamination.

5. Air quality concerns (TACB complaints, odors, particulate dispersal, sampling records)

None known.

001302

51

D. Other Areas of Concern

E. Summary/General Comments

Under Title 40 CFR Part 262, Subpart C Paragraph c.1, this unit is exempt from permitting and certain interim status requirements.

Because this is a well-managed unit, no further RFA action is recommended.

02/22/88 20:59 CDR USA THAMA ENCLOSURE 2
002

Environmental Protection Agency
Washington, DC 20460
July, 1981

EPA

Potential Hazardous Waste Site

Preliminary Assessment

04/22/88 21:00 USA USH INFO 003

EPA

POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT
PART 1 - SITE INFORMATION AND ASSESSMENT

I. IDENTIFICATION
01 STATE: TX
02 SITE NUMBER:

II. SITE NAME AND LOCATION

01 SITE NAME: Longhorn Army Ammunition Plant
02 STREET, ROUTE NO., OR SPECIFIC LOCATION IDENTIFIER:
03 CITY: Marshall
04 STATE: TX
05 ZIP CODE: 75671
06 COUNTY: Harrison
07 COUNTY CODE: 102
08 CONG. DIST: 01
09 COORDINATES: LATITUDE 32 40 14.6 LONGITUDE -94 09 55.8
10 DIRECTIONS TO SITE: Highway 43 North, east from Marshall, TX, (15 miles) to Karnack, TX

III. RESPONSIBLE PARTIES

01 OWNER: U. S. Army
02 STREET:
03 CITY: Marshall
04 STATE: TX
05 ZIP CODE: 75671
06 TELEPHONE NUMBER: (214) 679-3181
07 OPERATOR: Morton Thiokol, Inc.
08 STREET: P.O. Box 1149
09 CITY: Marshall
10 STATE: TX
11 ZIP CODE: 75671
12 TELEPHONE NUMBER: (214) 679-3181
13 TYPE OF OWNERSHIP: ☐ A. PRIVATE ☒ B. FEDERAL U. S. Army ☐ C. STATE ☐ D. COUNTY ☐ E. MUNICIPAL ☐ F. OTHER ☐ G. UNKNOWN
14 OWNER/OPERATOR NOTIFICATION ON FILE: ☐ A. RCRA 3001 DATE RECEIVED: / / ☐ B. UNCONTROLLED WASTE SITE DATE RECEIVED: / / ☐ C. NONE

IV. CHARACTERIZATION OF POTENTIAL HAZARD

01 ON SITE INSPECTION: ☒ YES DATE 5-23-87 ☐ NO
BY: ☐ A. EPA ☐ B. EPA CONTRACTOR ☐ C. STATE ☐ D. OTHER CONTRACTOR ☐ E. LOCAL HEALTH OFFICIAL ☒ F. OTHER: U. S. Army
CONTRACTOR NAME(S):
02 SITE STATUS: ☒ A. ACTIVE ☐ B. INACTIVE ☐ C. UNKNOWN
03 YEARS OF OPERATION: 1985 | Present ☐ UNKNOWN
04 DESCRIPTION OF SUBSTANCES POSSIBLY PRESENT, KNOWN, OR ALLEGED:

See Attached Survey LHAAP- 6

05 DESCRIPTION OF POTENTIAL HAZARD TO ENVIRONMENT AND/OR POPULATION:

See Attached Survey LHAAP- 6

V. PRIORITY ASSESSMENT

01 PRIORITY FOR INSPECTION: ☐ A. HIGH ☐ B. MEDIUM ☐ C. LOW ☒ D. NONE

VI. INFORMATION AVAILABLE FROM

01 CONTACT: Don Naley
02 OF (AGENCY/ORGANIZATION): Longhorn Army Ammunition Plant
03 TELEPHONE NUMBER: (214) 679-2613
04 PERSON RESPONSIBLE FOR ASSESSMENT: Allen L. Germain, LTC
05 AGENCY: U. S. Army
06 ORGANIZATION: LHAAP
07 TELEPHONE NUMBER: (214) 679-2100
08 DATE: 04 ,14, 88

EPA FORM 2070-12 (7-81)

02/22/88 21:01 CDR USA THAMA 004

See Attached Survey

EPA

POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT
PART 2 - WASTE INFORMATION

I. IDENTIFICATION
01 STATE: TX
02 SITE NUMBER:

II. WASTE STATES, QUANTITIES, AND CHARACTERISTICS

01 PHYSICAL STATES (Check all that apply)
☐ A. SOLID ☐ E. SLURRY
☐ B. POWDER, FINES ☐ F. LIQUID
☐ C. SLUDGE ☐ G. GAS
☐ D. OTHER (Specify)

02 WASTE QUANTITY AT SITE (Measures of waste quantities must be independent)
TONS
CUBIC YARDS
NO. OF DRUMS

03 WASTE CHARACTERISTICS (Check all that apply)
☐ A. TOXIC ☐ E. SOLUBLE
☐ B. CORROSIVE ☐ F. INFECTIOUS ☐ J. EXPLOSIVE
☐ C. RADIOACTIVE ☐ G. FLAMMABLE ☐ K. REACTIVE
☐ D. PERSISTENT ☐ H. IGNITABLE ☐ L. INCOMPATIBLE
☐ I. HIGHLY VOLATILE ☐ M. NOT APPLICABLE

III. WASTE TYPE

CATEGORY	SUBSTANCE NAME	01 GROSS AMOUNT	02 UNIT OF MEASURE	03 COMMENTS
SLU	SLUDGE			
OLW	OILY WASTE			
SOL	SOLVENTS			
PSD	PESTICIDES			
OCC	OTHER ORGANIC CHEMICALS			
IOC	INORGANIC CHEMICALS			
ACD	ACIDS			
BAS	BASES			
MES	HEAVY METALS			

IV. HAZARDOUS SUBSTANCES (See Appendix for most frequently used CAS Numbers)

01 CATEGORY	02 SUBSTANCE NAME	03 CAS NUMBER	04 STORAGE/DISPOSAL METHOD	05 CONCENTRATION	06 MEASURE OF CONCENTRATION

V. FEEDSTOCKS (See Appendix for CAS Numbers)

CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER	CATEGORY	01 FEEDSTOCK NAME	02 CAS NUMBER
FDS			FDS		
FDS			FDS		
FDS			FDS		
FDS			FDS		

VI. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Groundwater Contamination Survey No. 38-26-0851-87, Evaluation of Solid Waste Management Units, Longhorn Army Ammunition Plant, Marshall, TX 18-22 May 1987

EPA FORM 2070-13 (7-81)

See Attached Survey

EPA

POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION
01 STATE: TX | 02 SITE NUMBER:

II. HAZARDOUS CONDITIONS AND INCIDENTS

01 ☐ A. GROUNDWATER CONTAMINATION — 02 ☐ OBSERVED (DATE: ____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ____ 04 NARRATIVE DESCRIPTION

01 ☐ B. SURFACE WATER CONTAMINATION — 02 ☐ OBSERVED (DATE: ____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ____ 04 NARRATIVE DESCRIPTION

01 ☐ C. CONTAMINATION OF AIR — 02 ☐ OBSERVED (DATE: ____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ____ 04 NARRATIVE DESCRIPTION

01 ☐ D. FIRE/EXPLOSIVE CONDITIONS — 02 ☐ OBSERVED (DATE: ____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ____ 04 NARRATIVE DESCRIPTION

01 ☐ E. DIRECT CONTACT — 02 ☐ OBSERVED (DATE: ____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ____ 04 NARRATIVE DESCRIPTION

01 ☐ F. CONTAMINATION OF SOIL — 02 ☐ OBSERVED (DATE: ____) ☐ POTENTIAL ☐ ALLEGED
03 AREA POTENTIALLY AFFECTED: ____ (Acres) 04 NARRATIVE DESCRIPTION

01 ☐ G. DRINKING WATER CONTAMINATION — 02 ☐ OBSERVED (DATE: ____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ____ 04 NARRATIVE DESCRIPTION

01 ☐ H. WORKER EXPOSURE/INJURY — 02 ☐ OBSERVED (DATE: ____) ☐ POTENTIAL ☐ ALLEGED
03 WORKERS POTENTIALLY AFFECTED: ____ 04 NARRATIVE DESCRIPTION

01 ☐ I. POPULATION EXPOSURE/INJURY — 02 ☐ OBSERVED (DATE: ____) ☐ POTENTIAL ☐ ALLEGED
03 POPULATION POTENTIALLY AFFECTED: ____ 04 NARRATIVE DESCRIPTION

EPA FORM 2070-13 (7-81)

See Attached Survey

EPA

POTENTIAL HAZARDOUS WASTE SITE
PRELIMINARY ASSESSMENT
PART 3 - DESCRIPTION OF HAZARDOUS CONDITIONS AND INCIDENTS

I. IDENTIFICATION
01 STATE: TX | 02 SITE NUMBER:

II. HAZARDOUS CONDITIONS AND INCIDENTS (continued)

01 ☐ J. DAMAGE TO FLORA
04 NARRATIVE DESCRIPTION
02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED

01 ☐ K. DAMAGE TO FAUNA
04 NARRATIVE DESCRIPTION (Include species of concern)
02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED

01 ☐ L. CONTAMINATION OF FOOD CHAIN
04 NARRATIVE DESCRIPTION
02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED

01 ☐ M. UNSTABLE CONTAINMENT OF WASTES (Runoff/standing liquids/leaking containers/soil erosion)
03 POPULATION POTENTIALLY AFFECTED: _____
02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED
04 NARRATIVE DESCRIPTION

01 ☐ N. DAMAGE TO OFFSITE PROPERTY
04 NARRATIVE DESCRIPTION
02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED

01 ☐ O. CONTAMINATION OF SEWERS, STORM DRAINS, WWTPs
04 NARRATIVE DESCRIPTION
02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED

01 ☐ P. ILLEGAL/UNAUTHORIZED DUMPING
04 NARRATIVE DESCRIPTION
02 ☐ OBSERVED (DATE: _____) ☐ POTENTIAL ☐ ALLEGED

06 DESCRIPTION OF ANY OTHER KNOWN, POTENTIAL, OR ALLEGED HAZARDS

III. TOTAL POPULATION POTENTIALLY AFFECTED: _____

IV. COMMENTS

V. SOURCES OF INFORMATION (Cite specific references, e.g., state files, sample analysis, reports)

Groundwater Contamination Survey, No. 38-26-0851-87, Evaluation of Solid Waste Management Units, Longhorn Army Ammunition Plant, Marshall, TX, 18-22 May 1987.

Ground-Water Contamination Surv No. 38-26-0851-87, LHAAP, Marshall, TX, 18-22 May 87

MAP LOCATION/SITE NUMBER: LHAAP-6 (see Figure A-6).

a. SWMU Name: Bldg 54-F.

b. Unit Characteristics.

(1) Type of Unit: Collection point.

(2) Design Features: A single 55-gallon drum stored in a three-sided shed, approximately 8 x 10 feet in size, with fiberglass siding and a roof of galvanized metal and fiberglass. Shed was set on curbless concrete pad.

(3) Operating Practices: Drum is used as collection point for waste solvents from production processes. Full drums are taken to Bldg 31-W.

(4) Period of Operation: Mid 1985 until present.

c. Waste Characteristics.

(1) Type of Wastes Placed in the Site: acids, solvents.

(2) Migration and Dispersal Characteristics of the Waste: Lack of curbing on concrete pad allows for small potential of uncontained drum spillage.

d. Migration Pathways: Should uncontained drum spillage occur, contaminants could migrate through soil to ground water. Air emissions are also possible through volatilization.

e. Evidence of Release: None

f. Exposure Potential: None

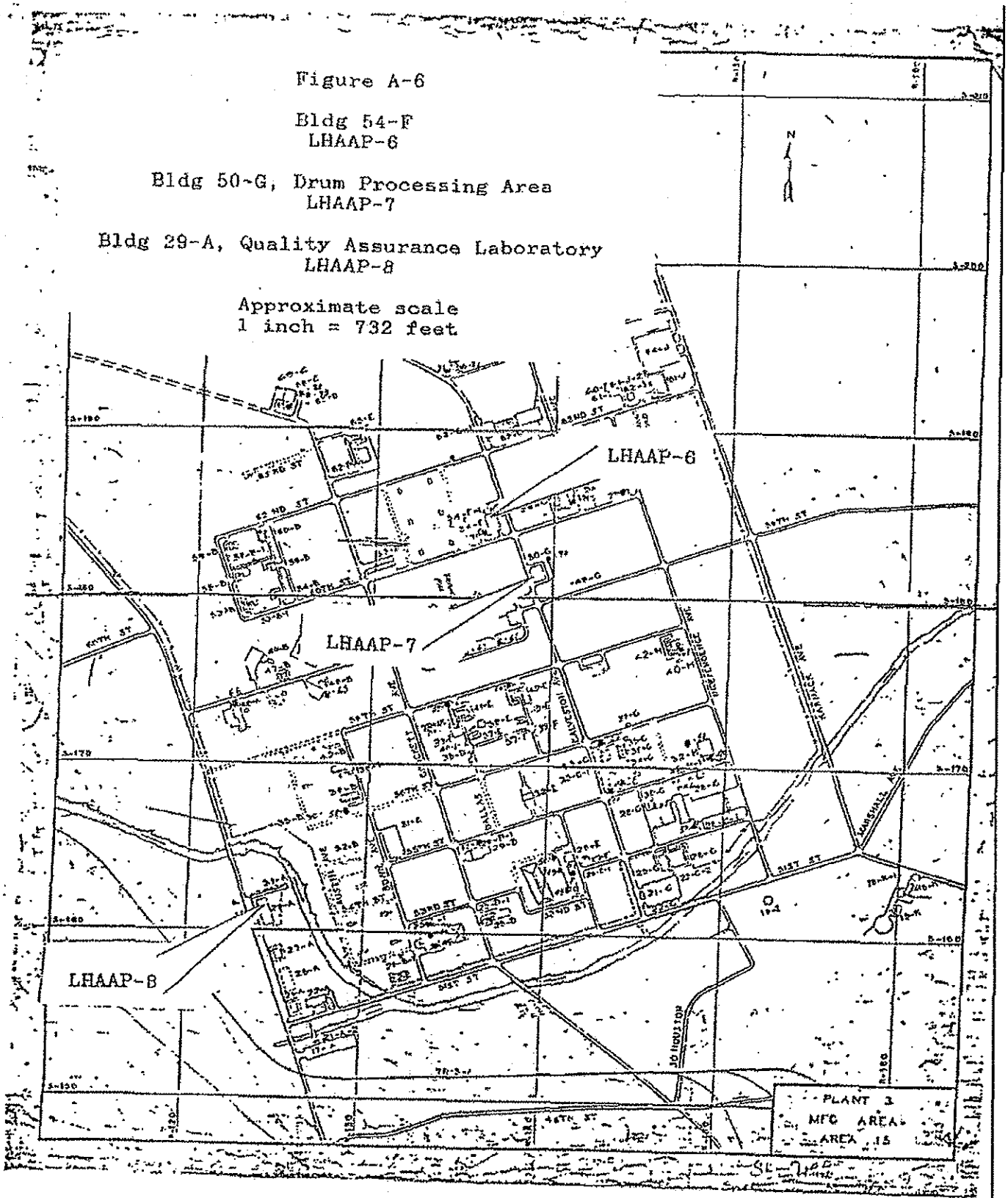
Figure A-6

Bldg 54-F
LHAAP-6

Bldg 50-G, Drum Processing Area
LHAAP-7

Bldg 29-A, Quality Assurance Laboratory
LHAAP-8

Approximate scale
1 inch = 732 feet



LHAAP-23

BUILDING 707-C STORAGE AREA FOR PCBs

Robert J. Huston, *Chairman*
R. B. "Ralph" Marquez, *Commissioner*
John M. Baker, *Commissioner*
Jeffrey A. Saitas, *Executive Director*

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

September 28, 2000

Mr. William Richard Corrigan
Environmental Manager
Complete Environmental Service
P.O. Box 170
Karnack, Texas 75661

Re: Approval of Closure Final Report - Risk Reduction Standard No. 1
Building 707-C (NOR 010)
Longhorn Army Ammunition Plant
Harrison County, Texas
TNRCC SWR No. 30990
EPA ID No. TX6213820529

Dear Mr. Corrigan:

The Texas Natural Resource Conservation Commission (TNRCC) received your Final Report dated September, 2000 indicating that remediation and closure activities have been completed in accordance with the TNRCC Risk Reduction Standard (RRS) No. 1 pursuant to Title 30 Texas Administrative Code (TAC) Chapter 335 Subchapters A and S.

In order to attain RRS No. 1, all industrial solid waste and municipal hazardous waste and waste residues must be removed or decontaminated from affected media (i.e., soil, surface water groundwater, air) to naturally occurring background levels. Waste constituents which are not naturally occurring (such as most organic chemicals) must be cleaned to the analytical method detection limits. EPA defines these limits as Practical Quantitation Limits - the minimum concentration of a substance that can be measured within specified limits of precision and accuracy under routine operating lab conditions.

The TNRCC has completed a review of the Final Report. Based on the information contained in the Final Report and other information available to staff, it appears that cleanup at Building 707-C at Longhorn Army Ammunition Plant has attained RRS No. 1. The Longhorn Army Ammunition Plant is released from deed recordation and post-closure care requirements. Please submit a written request to the TNRCC Registration and Reporting Section at Mail Code MC-129 to update your Notice of Registration (NOR) with a copy of this letter as an attachment.

Please be aware that it is the continuing obligation of persons associated with a site to ensure that municipal hazardous waste and industrial solid waste are managed in a manner which does not cause the discharge or imminent threat of discharge of waste into or adjacent to waters in the state, a nuisance, or the endangerment of the public health and welfare as required by 30 TAC §335.4. If the actual remediation and closure fails to comply with these requirements, the burden remains upon Longhorn Army Ammunition Plant to take any necessary and authorized action to correct such conditions. A TNRCC field inspector may review your Final Report and conduct a closure inspection of the site.

Questions concerning this letter should be directed to me at (512) 239-1675. When responding by mail, please submit an original and one copy of all correspondence and reports to the Corrective Action Section at Mail Code MC-127 with an additional copy submitted to the TNRCC Region 05 Office in Tyler. The TNRCC Solid Waste Registration Number and unit name should be referenced in all submittals.

Sincerely,

Ernest W. Heyer, Project Manager
Team I, Corrective Action Section
Remediation Division
Texas Natural Resource Conservation Commission

EH/eh

cc: Mr. Michael Brashear, Waste Program Manager, TNRCC Region 05 Office, Tyler

Complete
Environmental Service
Hwy. 134 @ Spur 449 - P.O. Box 170 - Karnack, Texas 75661
Ph 903-679-2062 Fax 903-679-2056 E-mail billr@prysm.net

September 20, 2000

Mr. Ernest Heyer, Building D, RM 241
Texas Natural Resource Conservation Commission
Industrial & Hazardous Waste Division, MC 127
Corrective Action Section Remediation Division
Post Office Box 13087
Austin, TX 78711

Re: Longhorn Army Ammunition Plant (LHAAP)
TNRCC Solid Waste Registration No. 30990
Building 707-C Closure (NOR 010)

Dear Mr. Heyer:

Enclosed are an original and two copies of the closure report for Building 707-C.

Call me at 903/679-2062 if you have any questions concerning this submission.

Sincerely,

William R. Corrigan

William Richard Corrigan
Complete Environmental Service

Encl.

CC: SMALL-CR

CLOSURE REPORT



Building 707-C

TNRCC Solid Waste Registration No. 30990
NOR Waste Management Unit No. 010
Building 707-C

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TX

September 2000

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APPENDIX

I. US Army Environmental Hygiene Agency Data on Building 707-C
II. PCB Trough Decontamination Data
III. Laboratory Reports
IV. Soil Disposal Documents
V. Building 707-C Inspection Records

1.0 INTRODUCTION

The U.S. Army has declared Longhorn Army Ammunition Plant excess and there is no further use for non-hazardous waste management units. To satisfy the requirements of State regulations, each of these units will be decontaminated and closed. This report documents the closure of Building 707-C, which was used from 1980 until 1986 for the storage of PCB transformers.

Building 707-C has previously been included in an evaluation for compliance with Title 40 CFR, 1987 rev, Section 264.101, Corrective Action for Solid Waste Management Units. The evaluation was performed by the United States Army Environmental Hygiene Agency (USEHA) in 1987. The report concluded that there was no indication of releases that would contaminate groundwater. The introduction of the USEHA report and the section describing Building 707 is included in this report as Appendix 1.

Wastes handled in this building were stored in galvanized steel containers (cattle watering troughs). When use of building 707-C was discontinued, the troughs were transferred to building 31-W where they were utilized to store transformers. These troughs were subsequently decontaminated prior to the closure of building 31-W. Documents pertaining to the decontamination of the troughs are located in Appendix II.

A survey of building 707-C at the time this report was written confirmed that there are no oil stains on the concrete floor of the building. A subsequent examination prior to sampling activities revealed the same.

2.0 BACKGROUND INFORMATION

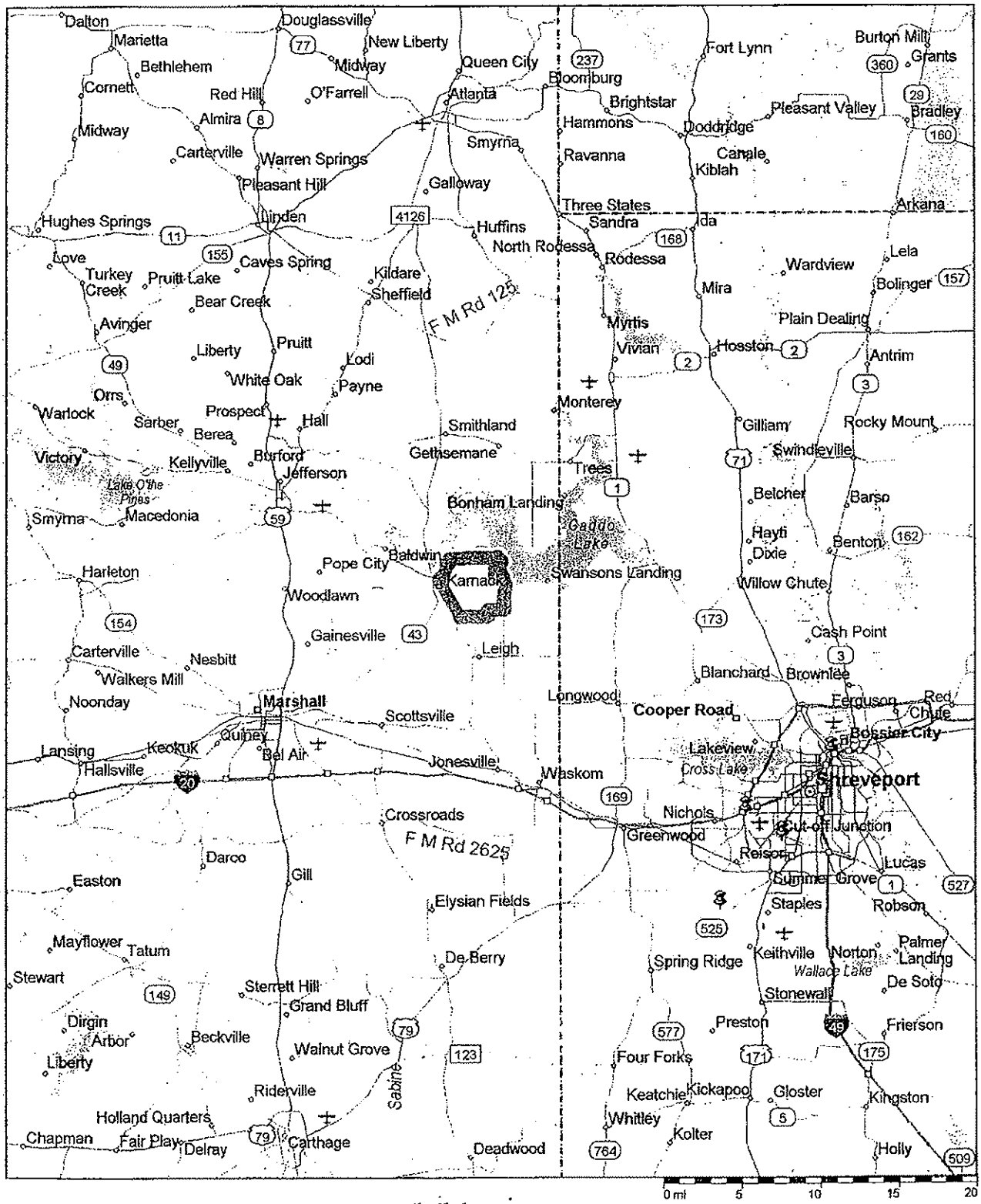
2.1 Location of Longhorn Army Ammunition Plant

Longhorn Army Ammunition Plant (LHAAP) is located in the northeast corner of Harrison County, Texas, approximately 3.6 miles from the Louisiana border. LHAAP is bordered by Caddo Lake, Caddo Lake State Park and the small town of Karnack. The plant is located approximately 30 miles west of Shreveport, Louisiana, with the nearest major city being Marshall, Texas, 15 miles to the southwest. Figure 1-1 illustrates the location of LHAAP. The installation has a total area of approximately 8,493 acres. State Highways 43 (Spur 449) and 134 access the installation.

2.2 Location of Building 707-C

Building 707 is located on Zeugner Drive within the confines of Longhorn Army Ammunition Plant, Harrison County, Texas. The storage area is located near the central portion of LHAAP. Figure 2-2 shows the location of building 707-C at Longhorn Army Ammunition Plant.

LOCATION OF LONGHORN ARMY AMMUNITION PLANT



Streets98

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00039894

LONGHORN ARMY AMMUNITION PLANT
KARNACK TX
Location of Building 707-C
FIGURE 2-2
707
1 mile

2.3 Description of Building 707-C

The storage area is designated as site LHAAP-23 in the CERCLA Installation Action Plan. The storage area is designated as Waste Management Unit Number 010 in the Longhorn AAP Notice of Registration. The Longhorn AAP Solid Waste Registration Number is 30990.



Interior of building 707-C looking in from the door at the west side of the building toward the outside door on the far end of the building.

Building 707-C is a 30 by 150 feet, wooden, storage building with shingle siding and a concrete floor. The building was originally constructed during the 1940's and used as a change house. Later, when the building was abandoned, drums or transformers containing PCB-contaminated oil were stored in galvanized steel cattle watering troughs inside the building. The building is completely empty.

2.4 Description of Wastestreams

Wastestreams 178160 (PCB Transformer) and 179430 (PCB Contaminated Solids) are listed in the Longhorn AAP Notice of Registration as having been stored at 707-C.

There were no wastes stored in the building at the time of this closure. The contaminated troughs used to store transformers had been transferred to building 31-W, a permitted storage area at LHAAP. The troughs were decontaminated and the subsequent information regarding decontamination of the troughs is included in this report in Appendix II.

Water used to decontaminate equipment was collected and analyzed for PCBs. None were detected in the water. The water was sent to the onsite groundwater treatment plant and processed through the system prior to release.

3.0 DECONTAMINATION OF METAL TROUGHS FROM BUILDING 707-C

All solids in the storage troughs had been previously removed and disposed of when the last shipment of transformers was shipped from LHAAP for disposal. The decontamination procedure for the troughs was followed as listed below.

- Decontaminate troughs by triple rinsing with appropriate solvent (acetone).
- Collect rinseate in drum and label accordingly.
- Label each trough with a unique number.
- Verify that each trough is PCB free by the analysis of wipe samples.
- Classify waste by sampling and analysis for PCB's.
- Dispose of wastes by incineration at an EPA permitted facility.
- Classify troughs for disposal if necessary. Troughs that are PCB free will be sold as a salvageable item.
- All decontamination, marking, shipping, disposal, records, and other actions taken under the course of this work must meet the regulatory requirement of 40 CFR Chapter 761 (pertaining to PCBs) and the EPA requirements under the Resource Conservation and Recovery Act (RCRA).

Eleven cattle watering troughs were used for the storage of transformers. Acetone was used for the decontamination solvent because PCB contaminated oils will readily dissolve in the acetone and the acetone would be simple to dispose of by incineration.

Each of the troughs were filled with several gallons of acetone and scrubbed with a nylon brush. Acetone was collected from each trough and placed into a steel 55-gallon drum. The troughs were rinsed twice more with acetone or until there was no indication of oil stains on the metal.

After the final rinse of each trough a wipe test was performed on each trough to verify decontamination. A 100 cm^2 cardboard template was taped to the bottom of each trough. Q-tips were dipped in hexane and the 100 cm^2 area brushed with the Q-tip. The used Q-tip/s were numbered and sealed in glass 20ml bottles and shipped to Electric Technologies Inc. for analysis of PCB's.

3.1 Classification and Disposition of Wastestreams

The acetone collected from the decontamination of the storage troughs was classified in accordance with 40 CFR part 261 and 30 TAC Subchapter R. The acetone was sampled for PCB's and contained 12 ppm of Araclor 1260. The acetone was classified as a flammable solvent, EPA code D001 due to its flashpoint. A Texas Waste Code number DZDP203H for a one-time shipment was obtained from the TNRCC.

One drum of waste acetone waste was collected from the decontamination of the storage troughs. The acetone was sent to Treatment One for treatment and disposal. The waste was classified as a TSCA/RCRA waste and was incinerated in a TSCA/RCRA approved facility. Manifests are included in Appendix II.

3.2 Discussion of Decontamination Results

As indicated in the table below, each trough was fully decontaminated from any residuals of PCB's. A copy of the lab report is included in Appendix II.

Table 3.2-1
Trough Decontamination Results

Client ID #	Sample	Araclor Present	Results
Trough #1	Wipe	None Detected	<1 ug/100 cm^2
Trough #2	Wipe	None Detected	<1 ug/100 cm^2
Trough #3	Wipe	None Detected	<1 ug/100 cm^2
Trough #4	Wipe	None Detected	<1 ug/100 cm^2
Trough #5	Wipe	None Detected	<1 ug/100 cm^2
Trough #6	Wipe	None Detected	<1 ug/100 cm^2
Trough #7	Wipe	None Detected	<1 ug/100 cm^2
Trough #8	Wipe	None Detected	<1 ug/100 cm^2
Trough #9	Wipe	None Detected	<1 ug/100 cm^2
Trough #10	Wipe	None Detected	<1 ug/100 cm^2
Trough #11	Wipe	None Detected	<1 ug/100 cm^2

4.0 DESCRIPTION OF CLOSURE PROCEDURE FOR BUILDING 707-C

Closure of Building 707-C was performed by the following:

- Collection of wipe test samples from concrete floor.
- Collection of soil samples from perimeter of building.
- Removal of contaminated soil for offsite disposal.
- Verification sampling of soil around excavation areas.

The following information will support the rational for closure of building 707-C to LHAAP background.

4.1 Collection of Wipe Test Samples

Building 707-C was visually inspected for oil stains. The concrete slab was clean with no visual indication of an oil spill. A location to collect a wipe test sample of the concrete (100 cm^2) was randomly chosen on February 14, and one of August 1. Each location was different and randomly chosen. Each wipe test was analyzed for Total Petroleum Hydrocarbons (TPH) and Polychlorinated BiPhenyls (PCB's).

Table 4.1-1 and Table 4.1-2 lists the concrete wipe test sample analysis results for PCB's and TPH. Neither constituent was detected in the analysis. Two wipe tests were collected, one on February 14, 2000 and one on August 1, 2000.

Table 4.1-1
Wipe Test Analysis Results
Analysis Date: 2/14/00

Sample ID	Analysis Method	Constituent	Media	Results	Detection Limit
707-C	EPA Method 8082	PCB-1016	Concrete Wipe Test	ND	20 ug/wipe
		PCB-1221	Concrete Wipe Test	ND	20 ug/wipe
		PCB-1232	Concrete Wipe Test	ND	20 ug/wipe
		PCB-1242	Concrete Wipe Test	ND	20 ug/wipe
		PCB-1248	Concrete Wipe Test	ND	20 ug/wipe
		PCB-1254	Concrete Wipe Test	ND	20 ug/wipe
		PCB-1260	Concrete Wipe Test	ND	20 ug/wipe
707-C	TX Method 1005	>C10 to C28 TPH	Concrete Wipe Test	ND	1000 ug/wipe
		C6 to C10 TPH	Concrete Wipe Test	ND	1000 ug/wipe
		Total C6 to C28 TPH	Concrete Wipe Test	ND	1000 ug/wipe

Table 4.1-2
Wipe Test Results
Analysis Date: 08/01/00

Sample ID	Analysis Method	Constituent	Media	Results	Detection Limit
707-C	EPA Method 8082	PCB-1016	Concrete Wipe Test	ND	10 ug/100cm^2
		PCB-1221	Concrete Wipe Test	ND	10 ug/100cm^2
		PCB-1232	Concrete Wipe Test	ND	10 ug/100cm^2
		PCB-1242	Concrete Wipe Test	ND	10 ug/100cm^2
		PCB-1248	Concrete Wipe Test	ND	10 ug/100cm^2
		PCB-1254	Concrete Wipe Test	ND	10 ug/100cm^2
		PCB-1260	Concrete Wipe Test	ND	10 ug/100cm^2
7007-C	TX Method 1005	>C10 to C28 TPH	Concrete Wipe Test	ND	1000 ug/wipe
		C6 to C10 TPH	Concrete Wipe Test	ND	1000 ug/wipe
		Total C6 to C28 TPH	Concrete Wipe Test	ND	1000 ug/wipe

5.0 SPILL EVENTS

Inspection records for building 707-C dated from July 6, 1984 until November 15, 1985 indicated that transformers have leaked at building 707-C, although in the storage troughs. The records indicate that all leaks were cleaned up by LHAAP Environmental personnel. These records are located in Appendix V.

6.0 DATA QUALITY

The following procedures were followed in order to ensure that data from sampling is of acceptable quality.

6.1 Quality Assurance Samples

Approximately 10% of the field samples collected during closure of Building 707-C were split for QA/QC samples. Sample No. 707-C-W-SS was collected and split in duplicate as a QA/QC sample for the sampling event on 12 February 2000 and sample 707-C-N-SS-5-Dup was collected as a QA/QC sample on 1 August 2000 during the soil verification sampling event. The field samples and duplicates were submitted to Analab Corporation. Analysis of the QC duplicate provides a measure of sample homogeneity.

6.2 Matrix Spike/Matrix Spike Duplicate Samples

One matrix spike and matrix spike duplicate (MS/MSD) were collected for approximately 5% of the samples taken. MS/MSD's are samples of the environmental media that are spiked in the laboratory with a known concentration of a target analyte(s) to verify percent recoveries. They are primarily used to check sample matrix interference's and the precision of a given sample matrix. A MS/MSD is analyzed with every batch of samples; however, it is selected randomly by the laboratory and may not be from the same group of samples as those submitted for a particular project. The results for MS/MSD's are included in the lab reports provided in Appendix III.

6.3 Equipment Blank

Sample 707-C-EB was collected as an Equipment Blank and shipped in the ice chest containing all samples. No contaminants were detected in the Equipment Blank.

6.4 Discussion of Quality Assurance Sample Results

All laboratory quality control information is complete. All analyses were performed using specified methods within proper holding times. All matrix spikes and standards were within control limits for the wipe test sample. All laboratory instrument calibration and procedures were carried out as required by the laboratory.

7.0 INVESTIGATION OF SOILS

The US Army Environmental Hygiene Agency Groundwater Contamination Survey of Building 707-C area and a current evaluation of the area do not indicate that any releases of wastes to the concrete floor in Building 707-C or the outside area occurred. However, even though wastes were stored in galvanized troughs inside of a covered building with a concrete slab there was a possibility that a waste release.

Soil sampling was performed in order to determine if the soils at the building 707-C storage area were impacted from waste handling and storage during past use. Soil samples were collected after decontamination of the storage area and in accordance SW-846 guidelines. Investigation for impact of soils from waste storage included total petroleum hydrocarbons and PCB's. The soil samples were collected on February 14, 2000. Quality of the samples and analysis was ensured by the collection of a quality assurance/quality control (QA/QC) sample. The sample 707-C-W-SS was collected and split in duplicate as a QA/QC sample.

Soil samples were collected using a stainless steel auger. The auger was decontaminated between collection of each sample to prevent cross contamination. All sample locations were marked with a wooden stake and the ID number of the sample written on the wooden stake. Sample containers were sealed and placed into an ice chest on ice for shipment to the laboratory. Samples were shipped utilizing a chain-of-custody. Nitrile gloves were worn during sample collection and changed prior to each sample collection. No compositing of the soil samples was performed. Laboratory reports are located in Appendix III.

7.1 Soil Sample Locations

Four soil samples were collected from the parameter of building 707-C. The building is surrounded on three sides with asphalt that has a thin layer of soil on top. Access to the building is from double doors at either end of the building or a single door at the rear of the building. The soil samples collected from the east and the south side were immediately outside of the double doors. The sample collected from the north side of the building was on a asphalt parking lot that had two inches of soil on the surface. Each soil sample was collected from a depth of 0-6 inches deep. Figure 7-1 lists the location of each soil sample collected.

7.2 Discussion of Soil Analysis Results

As indicated in the following table, one soil sample and a duplicate collected exhibited some concentrations of PCBs above LHAAP background levels. For each sample that contained PCB, the soil was excavated and shipped offsite to a hazardous waste landfill.

Two soil samples, numbers 707-C-N-SS and 707-C-W-SS from the parameter of Building 707-C exhibited levels of PCB-1254 above LHAAP soil background levels and were also above 30 TAC 335.668 Appendix II levels for residential groundwater protection standards.

00039900

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

January 10, 2006

DAIM-BD-H-LO

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

Re: Final Installation-Wide Work Plan,
Longhorn Army Ammunition Plant, Karnack, Texas, January 2006

Dear Mr. Villarreal,

Enclosed please find the final version of Shaw's Installation-Wide Work Plan for your files. This plan will serve as the basis for work going forward under Shaw's GFPR contract at Longhorn Army Ammunition Plant and, when required, addenda will be issued to address specific tasks not covered by these facility-wide plans. As discussed, please forward a brief letter that 1) states you have received the plan and will incorporate it into your file as final and 2) confirms that you have decided regulator review and approval is not required for this particular work plan and there will be no comments from regulators.

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

Enclosure: Final Installation-Wide Work Plan, January 2006
Copies furnished:
Alan Etheredge, TCEQ, Austin, TX
Paul Bruckwicki, Caddo Lake NWR, TX
Cliff Murray, COE-Tulsa District, OK
Richard P. Smith, COE – Tulsa District, OK

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

January 10, 2006

DAIM-BD-H-LO

Mr. Alan Etheredge
Texas Commission on Environmental Quality
Superfund Investigation (MC-143)
12100 Park 35 Circle, Bldg D
Austin, TX 78753

Re: Final Installation-Wide Work Plan,
Longhorn Army Ammunition Plant, Karnack, Texas, January 2006

Dear Mr. Etheredge,

Enclosed please find the final version of Shaw's Installation-Wide Work Plan for your files. This plan will serve as the basis for work going forward under Shaw's GFPR contract at Longhorn Army Ammunition Plant and, when required, addenda will be issued to address specific tasks not covered by these facility-wide plans. As discussed, please forward a brief letter that 1) states you have received the plan and will incorporate it into your file as final and 2) confirms that you have decided regulator review and approval is not required for this particular work plan and there will be no comments from regulators.

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, Ph.D.
Longhorn AAP Site Manager

Enclosure: Final Installation-Wide Work Plan, January 2006
Copies furnished:
Chris Villarreal, USEPA Region 6, Dallas, TX
Paul Bruckwicki, Caddo Lake NWR, TX
Cliff Murray, COE-Tulsa District, OK
Richard P. Smith, COE – Tulsa District, OK

FINAL

INSTALLATION-WIDE WORK PLAN
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.
3010 Briarpark Drive, Suite 4N
Houston, Texas 77042

Contract Number W912QR-04-D-0027
Task Order No. DS02

January 2006

INSTALLATION-WIDE WORK PLAN
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
JANUARY 2006

PRAVEEN SRIVASTAV
Name of Texas Professional Geoscientist

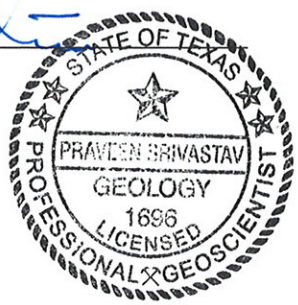
1696
License Number

SHAW ENVIRONMENTAL, INC.
Company

3010 BRIARPARK DRIVE, SUITE 4N, HOUSTON, TX 77042
Address

I certify with my signature below, that the written descriptions and graphical depictions of geology and hydrogeology contained within this report were prepared under my supervision, and accurately reflect existing knowledge about the geology and hydrogeology of the referenced site.

Signature



1/10/06
Date Signed

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Appendix A Health and Safety Plan
Appendix B Contractor Quality Control Plan
Appendix C Chemical Data Acquisition Plan
Appendix D Field Procedures

Acronyms and Abbreviations

°F	degrees Fahrenheit
bgs	below ground surface
CDAP	Chemical Data Acquisition Plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
FS	feasibility study
GPS	Global Positioning System
GWTP	groundwater treatment plant
HASP	Health and Safety Plan
HDPE	high-density polyethylene
LHAAP	Longhorn Army Ammunition Plant
MARC	Multiple Award Remediation Contract
OVA	organic vapor monitor
pH	hydrogen ion concentration
PMP	Project Management Plan
PVC	polyvinyl chloride
QA	quality assurance
QASP	Quality Assurance Surveillance Plan
QC	quality control
RI	remedial investigation
Shaw	Shaw Environmental, Inc.
TNT	trinitrotoluene
USACE	U.S. Army Corps of Engineers
USC	United States Code
USFWS	U.S. Fish and Wildlife Service

1.0 Introduction

Shaw Environmental, Inc. (Shaw) was contracted by the U.S. Army Corps of Engineers (USACE), Tulsa District, to perform remediation activities associated with Site Closure of Multiple Sites at the Longhorn Army Ammunition Plant (LHAAP) under the Louisville District's Multiple Award Remediation Contract (MARC) No. W912QR-04-D-0027. Management of work performed under this contract will be performed by the Tulsa district of USACE. Work by Shaw at the Longhorn facility will be performed under Task Order DS02 of the above-referenced contract. As part of the remediation activities, Shaw has been tasked with preparing plans to support field implementation of investigation and remediation activities during the completion of work under this Task Order. This document and its appendices fill that role.

This work plan provides descriptions of common field activities that are likely to be implemented at one or more sites during Shaw's performance of Task Order DS02. These descriptions are meant to be generally applicable and thus eliminate the need for repeatedly describing these activities in site-specific work plans. However, site-specific addenda to this work plan will be issued as Shaw deems necessary to address:

- The locations and rationale of activities within specific sites
- Significant deviations from the proposed approach presented in the Project Management Plan (PMP)
- Modifications of the activities described in this work plan
- Specialized technologies not described in this work plan
- Health and safety and quality control (QC) issues associated with modified activities or specialized technologies

LHAAP is an inactive, government-owned, formerly contractor-operated and maintained Department of Defense facility located in central-east Texas. Extensive demolition and salvaging of materials has occurred at LHAAP, but there are still many buildings or portions of buildings remaining. The entire installation was under the control of the U.S. Department of the Army (Army) until May 5, 2004, when approximately two thirds of the property was transferred to the U.S. Fish and Wildlife Service (USFWS). Additional property has been transferred since then and the property transfer process will continue as response is completed at additional sites. The U.S. Army Environmental Center has the responsibility for the environmental restoration activities at LHAAP, with the management of the Army's property provided by the Base Realignment and Closure Office. The groundwater, surface water, sediment, and soil at LHAAP

have been contaminated by past operations. Studies conducted at LHAAP identified contaminants such as volatile organic compounds, heavy metals, perchlorate, and explosives in on-site media. Several areas of contamination are subject to investigation and cleanup under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) (42 United States Code [USC] 9604). LHAAP sites were originally subdivided into five groups for environmental assessment. Environmental investigations were completed for Groups 1, 3, and 5 with a determination of no further action. Remedial investigation (RI) and feasibility study (FS) activities are ongoing for certain sites in Groups 2 and 4. Previous reports for these sites are available in the Administrative Record for LHAAP.

The field activities described in this work plan are potentially applicable to any of the LHAAP sites addressed by the task order. Those sites are listed in **Table 1-1**. However, many of those sites are likely to be closed based on existing data and without remediation. Therefore, field activities will not necessarily take place at all sites. The Project Management Plan (Shaw, 2005) provides a description of the proposed approach at each site.

This work plan is composed of the following sections:

- **Section 2**, "Facility Description," summarizes the background and setting of LHAAP.
- **Section 3**, "Common Field Activities," describes field activities such as sampling and excavation that are expected to be implemented at several project sites.
- **Section 4**, "Safety and Health," introduces Shaw's safety culture and the installation-wide Health and Safety Plan (HASP).
- **Section 5**, "Quality Assurance/Quality Control," discusses general quality assurance (QA)/QC processes and introduces the installation-wide Contractor Quality Control Plan.
- **Section 6**, "References," presents a listing of the references cited in this document.

This work plan is supported by a number of installation-wide planning tools. These tools are presented in the following appendices:

Appendix A Health and Safety Plan
Appendix B Contractor Quality Control Plan
Appendix C Chemical Data Acquisition Plan
Appendix D Field Procedures

Table 1-1
Sites Addressed by Task Order DS02

Site	Brief Description
LHAAP-02	Vacuum Truck Overnight Parking Lot
LHAAP-03	Building 722 Paint Shop
LHAAP-04	Pilot Wastewater Treatment Plant
LHAAP-06	Building 54F Solvent
LHAAP-07	Bldg 50G Drum Processing
LHAAP-08	Sewage Treatment Plant
LHAAP-12	Landfill 12 (SWMU 12)
LHAAP-16	Old Landfill (SWMU 16)
LHAAP-17	No. 2 Flashing Area/Burning Ground (SWMU 17)
LHAAP-18	Burning Ground/Washout Pond (SWMU 18)
LHAAP-23	Building 707-C Storage Area for PCBs
LHAAP-24	Former Unlined Evaporation Pond (SWMU 24) *Note: This site is grouped with LHAAP-18.*
LHAAP-29	Former TNT Production Area (SWMU 29)
LHAAP-35	Sumps (145) Various
LHAAP-36	Explosive Waste Pads (27)
LHAAP-37	Chemical Laboratory Waste Pad
LHAAP-46	Plant 2/Pyrotechnic Operation
LHAAP-47	Plant 3 Area, Solid Rocket Fuel Motor Production
LHAAP-49	Former Acid Storage Area
LHAAP-50	Former Waste Disposal Facility
LHAAP-51	Photographic Laboratory Building 60B
LHAAP-55	Septic Tanks
LHAAP-58	Maintenance Complex
LHAAP-60	Former Storage Building 411 & 714
LHAAP-64	Transformer Storage (Southwest Building of 707-B)
LHAAP-66	Transformer at Building 401
LHAAP-67	Above Ground Storage Tanks
LHAAP-68	Mobile Storage Tank Parking Area
Pistol Range	Small Arms Firing Range

2.0 Facility Description

2.1 Location

LHAAP is located in central-east Texas in the northeastern corner of Harrison County. The former Army installation occupies nearly 8,500 acres between State Highway 43 at Karnack, Texas, and the southwestern shore of Caddo Lake, as shown in **Figure 2-1**. The Army transferred approximately 5,032 acres to the USFWS on May 5, 2004 for management as the Caddo Lake National Wildlife Refuge, and additional areas have been transferred since then. The remaining approximately 2,000 acres still under the Army's control include Group 2 and Group 4 sites, which are currently in various stages of the RI/FS process. The Army intends to transfer the remaining property to the USFWS after the environmental response is completed.

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.

2.2 History

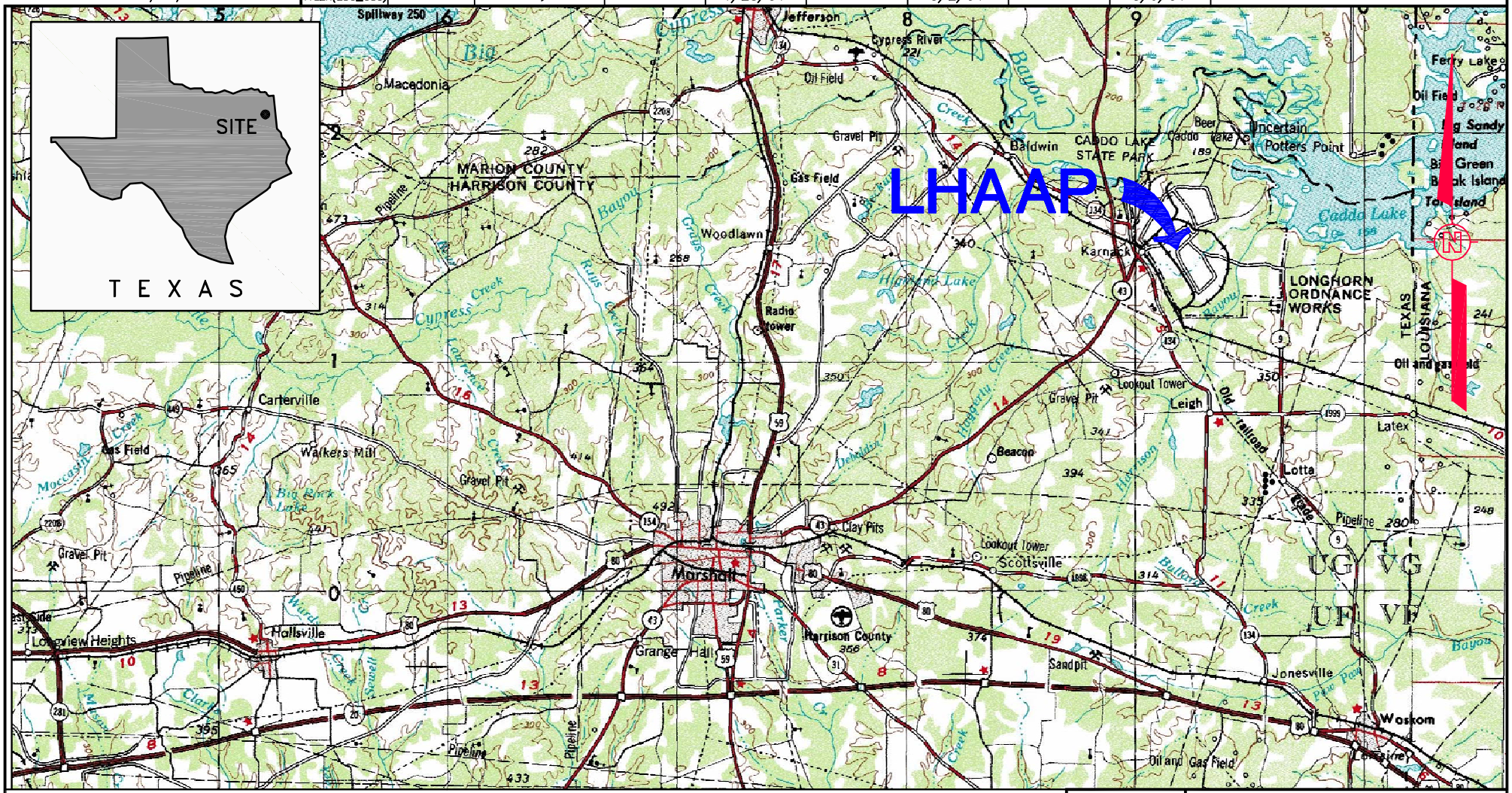
LHAAP was established in December 1941, near the beginning of World War II, when the Army issued a contract to build a six-line production facility for manufacturing trinitrotoluene (TNT) (Plant 1 area). The first flake of TNT was produced in October 1942. LHAAP ultimately produced 414 million pounds of TNT before production was halted in August 1945, near the end of the war, and the facility went on standby status.

In 1952, during the Korean War, the government undertook two new initiatives at LHAAP:

- A partially constructed facility on the site (Plant 2) was reactivated and refitted for pyrotechnics production. This facility produced 3.4 million pyrotechnic devices (e.g., photoflash bombs, simulators, hand signals, and 40-millimeter tracers) before production was discontinued in April 1956.
- A facility (Plant 3) was designed and built for producing solid-fuel rocket motors for tactical missiles. Actual rocket motor production began in December 1954. The last major propellant-loading activity in Plant 3 occurred in 1980. Over the intervening quarter century, LHAAP manufactured over 50 million pounds of composite propellant and delivered over 200,000 rocket motors.

PLOT DATE: 11/3/05
FORMAT REVISION 5/13/02

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FIGURE 2-1
LHAAP LOCATION MAP
INSTALLATION-WIDE WORK PLAN
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Production of rocket motors continued to be the primary operation at LHAAP until 1965 when, due to the Vietnam conflict, Plant 2 was reactivated for the production of pyrotechnic and illuminating ammunition. In the years following Vietnam, LHAAP continued to produce flares and other basic pyrotechnic or illuminating items for the U.S. Department of Defense inventory. From September 1988 to May 1991, LHAAP was also used for the static firing and elimination of Pershing I and II rocket motors in compliance with the Intermediate-Range Nuclear Force Treaty in effect between the United States and the former Union of Soviet Socialist Republics.

Various media have been contaminated in certain areas by past industrial operations and waste management practices at LHAAP. Industrial operations involved the use of secondary explosives, rocket motor propellants, and various pyrotechnics, such as illuminating and signal flares and ammunition. Explosives included TNT and black powder. Typical composite propellants were composed of a rubber binder, an oxidizer such as ammonium perchlorate, and a powdered metal fuel such as aluminum. Pyrotechnics were generally composed of an inorganic oxidizer such as sodium nitrate, a metal powder such as magnesium, and a binder. Other materials used in the industrial operations included acids, lubricants, and solvents; particularly trichloroethene and methylene chloride. Waste management included sanitary wastewater treatment, industrial wastewater treatment, holding/evaporation ponds, storm water drainage, sanitary and industrial waste landfills, and demolition/burning grounds. Discharges and releases to surface water, groundwater, and other secondary media have occurred from the historical operations.

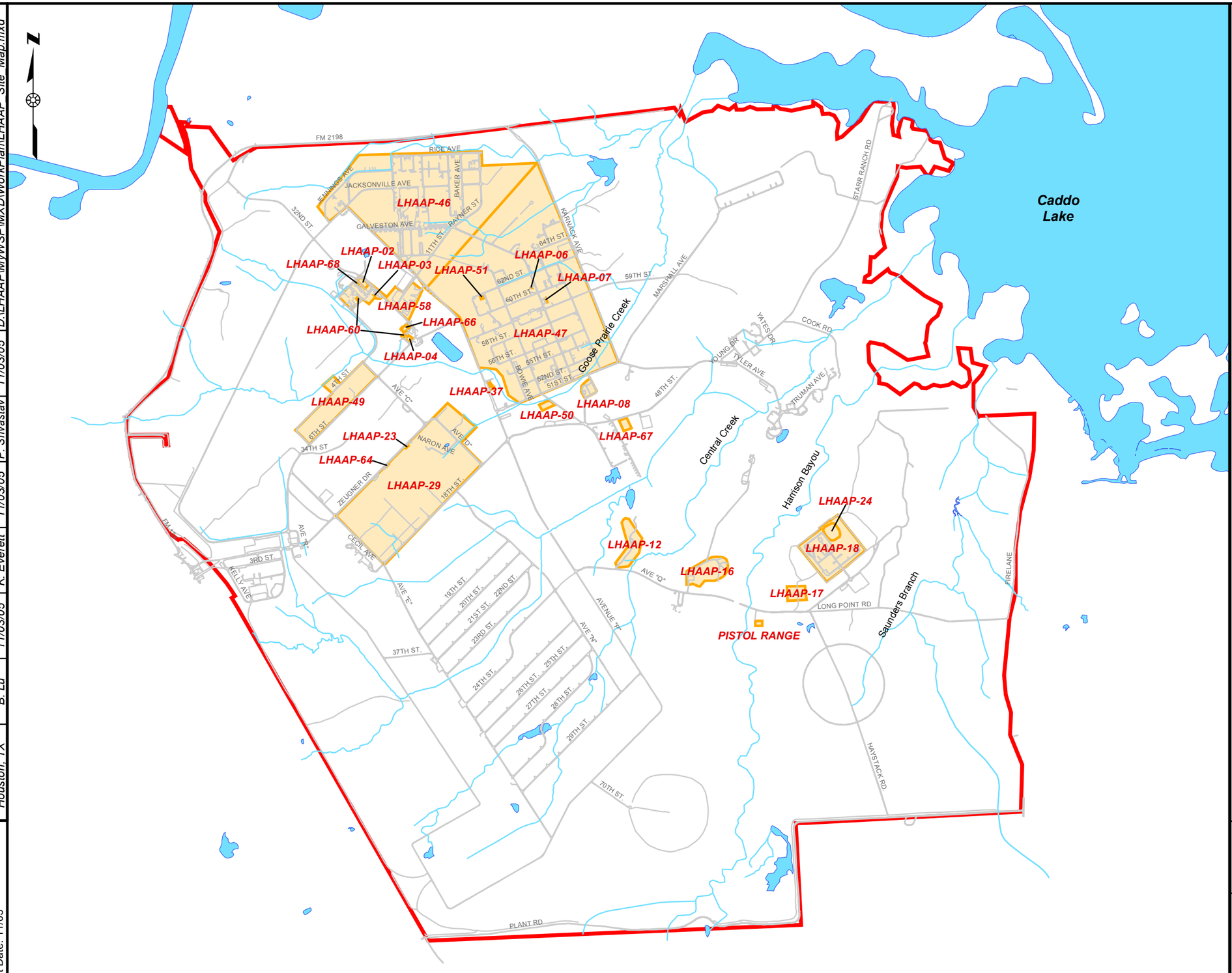
LHAAP was placed on the National Priorities List on August 9, 1990. A Federal Facility Agreement among the U.S. Environmental Protection Agency, the Army, and the Texas Natural Resources Conservation Commission, now the Texas Commission on Environmental Quality, became effective December 30, 1991. LHAAP became inactive in July 1997, and a year later the Army issued a contract to remove salvageable property. On May 5, 2004, the Army transferred control of approximately 5,032 acres of land to the USFWS. The RI/FS process is continuing at the Groups 2 and 4 sites with the land still under the Army's control. Those sites addressed by Task Order DS02 are presented in **Figure 2-2**.

2.3 Physical Setting

LHAAP is located in an area of the country characterized by a mild climate with an average low temperature of 35 degrees Fahrenheit (ºF) and an average high of 91ºF. Precipitation averages 46.9 inches per year with a slight peak in the spring. LHAAP is characterized by mixed pine-hardwood forests that cover flat to gently rolling terrain. Most of the terrain at LHAAP has an average slope of 3 percent or less, but slopes as steep as 12 percent can be found in the western and northwestern portions of the installation and along Harrison Bayou.

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Legend

- Stream
- Road
- Site
- Water Body
- LHAAP Boundary

LHAAP TASK ORDER DS02 SITES

LHAAP-02	Vacuum Truck Overnight Parking Lot
LHAAP-03	Building 722 Paint Shop
LHAAP-04	Pilot Wastewater Treatment Plant
LHAAP-06	Building 54F Solvent
LHAAP-07	Building 50G Drum Processing
LHAAP-08	Sewage Treatment Plant
LHAAP-12	Landfill 12
LHAAP-16	Landfill 16
LHAAP-17	Burning Ground No.2/Flashing Area
LHAAP-18	Burning Ground No.3/Unlined Evaporation Pond
LHAAP-23	Building 707-C Storage Area for PBCs
LHAAP-24	Burning Ground No.3/Unlined Evaporation Pond
LHAAP-29	Former TNT Production Area
LHAAP-35	Sumps Various
LHAAP-36	Explosive Waste Pads
LHAAP-37	Chemical Laboratory Waste Pad
LHAAP-46	Plant Area 2
LHAAP-47	Plant Area 3
LHAAP-49	Former Acid Storage Area
LHAAP-50	Former Sump Water Tank
LHAAP-51	Photographic Laboratory Building 60B
LHAAP-55	Septic Tanks
LHAAP-58	Maintenance Complex
LHAAP-60	Pesticide Storage Buildings
LHAAP-64	Transformer Storage
LHAAP-66	Transformer at Building 401
LHAAP-67	Aboveground Storage Tank Farm
LHAAP-68	Mobile Storage Tank Parking Area
Pistol Range	

Note:

Site LHAAP-35 consists of 125 sumps. Site LHAAP-36 consists of 20 waste pads. Site LHAAP-55 consists of 10 septic tanks.

0 1,250 2,500 5,000 Feet

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FIGURE 2-2

LHAAP MAP OF TASK ORDER DS02 SITES
INSTALLATION-WIDE WORK PLAN

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Plot Date: 11/05

LHAAP is a part of the Cypress Bayou Basin occurring in the Piney Woods ecological region of Texas. The gentle topography and mild climate support an abundant and diverse plant community with a diversity of habitats. This diversity suggests the potential for a large variety of animal species to inhabit LHAAP. As the buildings have been demolished, more and more of the facility has been left to nature with pine trees growing among concrete remnants. Common mammals found at LHAAP include white-tailed deer, red and gray foxes, rabbits, squirrels, opossums, skunks, armadillos, beavers, and raccoons. In addition to mammals, a total of 334 bird species have been documented as inhabiting Caddo Lake's drainage system and potentially inhabiting LHAAP sometime during the year. A reported 53 different reptile species inhabit the Cypress Bayou Basin.

Surface water at LHAAP drains to the northeast into Caddo Lake, part of Big Cypress Bayou, via four drainage systems **(Figure 2-2)**: Saunder's Branch, Harrison Bayou, Central Creek, and Goose Prairie Creek. Saunder's Branch of Martin's Creek flows onto LHAAP near the southeastern corner of the installation and flows northward into Caddo Lake. Approximately 11 percent of the heavily wooded eastern section of the plant is drained by this system. Harrison Bayou enters LHAAP on the southern edge of the installation. The bayou captures approximately 30 percent of the surface drainage of LHAAP and bisects the installation in a northeasterly direction. Central Creek enters LHAAP on its western edge just south of the town of Karnack. Approximately 30 percent of the surface drainage from the installation is transported to Caddo Lake via this drainage course. The headwaters of Goose Prairie Creek are located near the northwestern corner of the plant and consist of one larger creek and several smaller tributaries. Goose Prairie Creek flows across the northern edge of the installation and drains approximately 30 percent of LHAAP. The flows of Central Creek and Goose Prairie Creek are intermittent.

The subsurface geology at LHAAP consists of a thin veneer of Quaternary alluvium overlying Tertiary age rocks of the Wilcox and Midway Groups. Underlying these sediments are Cretaceous age rocks of the Navarro and Taylor Groups.

The stratigraphic thickness of the uppermost Wilcox Group ranges from a maximum of 350 feet in the northwest corner of LHAAP to approximately 130 to 140 feet along the east side of the facility near Caddo Lake. The Wilcox Group constitutes the majority of the unconsolidated sediments underlying LHAAP. The Wilcox Group consists of interbedded sands, silts, and clays. These sediments were deposited in a regressive fluvial-deltaic and transgressive marine environment that resulted in considerable stratigraphic heterogeneity over short distances across the site.

The unconsolidated sediments of the Wilcox Group typically consist of three sandy, water-bearing zones separated by silty clay layers. The uppermost portion of the Wilcox Group at

LHAAP consists of medium plastic sandy silts and clays ranging in thickness from approximately 5 to 15 feet. These surficial sediments are underlain by the first or shallow saturated sand zone, which ranges in thickness from 10 to 20 feet. This sand zone consists of silty fine sand containing some silt and clay lenses and is at first dry to moist and then generally becomes saturated at 15 to 20 feet below ground surface (bgs). A 5- to 20-foot-thick medium to highly plastic silt and clay layer underlies the shallow saturated sand zone. An intermediate saturated sand zone, consisting of fine to medium silty sand, is then encountered below the silty clay layer at 30 to 50 feet bgs. The intermediate saturated sand zone is generally less silty than the shallow saturated sand zone and exhibits higher hydraulic conductivity. A silt to silty clay layer is encountered beneath the intermediate saturated sand zone and ranges in thickness from 5 to 30 feet. Underlying this silt to silty clay layer, a massive homogeneous silty, clayey, fine sand layer is encountered at a depth that continues to the top of the underlying Midway Group (approximately 200 to 300 feet bgs).

Because of the high degree of stratigraphic heterogeneity, the level of interconnection between the shallow, intermediate, and deep water-bearing zones in the Wilcox Group deposits at LHAAP is highly variable. The depth to groundwater across the facility ranges from 1 to 70 feet bgs, with the typical depth at 12 to 16 feet. The regional groundwater flow direction is generally east-northeast towards Caddo Lake, but varies by site location.

Additional geologic and hydrogeologic information in included in the RI reports (Jacobs, 2001, 2002).

2.4 Current and Future Land Uses

LHAAP is located near the unincorporated community of Karnack, Texas. Karnack is a rural community with a population of 775 people. The incorporated community of Uncertain, Texas, population 205, is a resort area located to the northeast of LHAAP on the edge of Caddo Lake and an access point to Caddo Lake. The industries in the surrounding area consist of agriculture, timber, oil and natural gas production, and recreation.

LHAAP has been an industrial facility since 1942. Large production activities continued until the facility was determined to be in excess of the Army's needs. The plant area is now inactive and approximately three-fourths of the former plant area is now controlled by the USFWS. LHAAP is surrounded by a fence (except on the border with Caddo Lake), and current security measures at LHAAP preclude unlimited public access to areas within the fence. Approved access for hunters is very limited. It is expected that trespassers occasionally enter the fenced area. The anticipated future use of the entire facility is as a wildlife refuge.

3.0 Common Field Activities

In this installation-wide work plan, several field activities are planned at various sites. These activities are divided into the following major tasks. Each task is described in the succeeding sections.

Task 1	Mobilization and Site Setup
Task 2	Monitoring Well/Compliance Well Installation
Task 3	Survey of Monitoring Well Locations
Task 4	Groundwater Sampling
Task 5	Soil Sampling
Task 6	Surface Water/Sediment Sampling
Task 7	Investigation-Derived Waste Management
Task 8	Soil Excavation and Disposal
Task 9	Well Abandonment

Additional information regarding these tasks can be found in **Appendix C**, Chemical Data Acquisition Plan (CDAP), and **Appendix D**, Field Procedures. The field procedures described in this document are consistent with those employed previously at the site (Shaw, 2004a,b).

Site-specific work scope descriptions will be provided in later addenda to the work plan as needed. Those addenda will define the specific locations where common field activities will be conducted and will describe the implementation of remedial activities that are unique to specific sites.

3.1 Task 1 — Mobilization and Site Setup

Prior to the mobilization of subcontractors to the installation, Shaw will inspect drilling locations for overhead and ground level accessibility. In areas that have excessive vegetation and/or tree growth, a backhoe or excavator will be used to clear the areas to allow rig equipment access. After coordinating with underground utility locators for utility clearances, drilling locations and areas that require surface soil removal will be located and staked.

Shaw anticipates mobilizing the appropriate personnel, subcontractors, and equipment necessary for the specific task(s). A permanent decontamination station is located at the on-site groundwater treatment plant (GWTP) at LHAAP-18/24 and can accommodate large equipment.

Temporary decontamination pads will be constructed at approved on-site locations as needed to decontaminate drilling equipment and prevent cross contamination between sites. The decontamination pad will be approximately 15 feet in length and width, bermed, and covered with high-density polyethylene (HDPE) sheeting. The pad can be constructed in a staging area that can be used between sites. Wash water will be contained and transported to the GWTP for disposal when necessary.

3.2 Task 2 — Monitoring Well/Compliance Well Installation

Monitoring and compliance wells will be drilled and installed using a high-torque-stem auger or mud rotary drill rig depending upon site conditions. Each well will be constructed with flush-joint threaded, schedule 40, polyvinyl chloride (PVC). If necessary, soil samples will be collected continuously using a split barrel core sampler advanced ahead of the drill bit. The soil (or sediment) samples will be described according to American Society for Testing and Materials (ASTM) D2488-00, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), and logged on USACE Engineering Form 1836 (Drilling Log) or equivalent. Additional details for well installation are found in Attachment 13 of **Appendix D**, Field Procedures.

The monitoring wells will be installed in the annulus of hollow-stem augers. The PVC well screen for each well will be 0.01-inch slotted and 10 feet in length. A threaded PVC bottom cap will be secured to the bottom of the screen interval. Solid PVC casing will be installed from the top of the screen interval to approximately 3 feet above surface grade. A filter pack consisting of clean silica sand (20-40 size) will be placed in the auger-well annulus from approximately 0.5 feet below the well bottom to approximately 2 feet above the screen interval. A 3-foot thick bentonite seal (pellets or chips) will be placed above the sand filter pack and hydrated with portable water. The annular space form the top of the bentonite seal to the surface will be filled with a bentonite-cement grout. The screen length and sealing criteria may be adjusted on a site-specific basis.

For the wells installed in the intermediate groundwater zone, the shallow groundwater zone will be isolated using a suitable diameter, schedule 40 steel casing. The casing will be installed from near surface grade to the top of the first confining layer. Upon grouting and setting of the isolation casing, drilling will proceed into the intermediate zone. For any wells installed in the deep groundwater zone, both the shallow and intermediate groundwater zones will be isolated using suitable diameter steel casings for each string.

The drilling equipment will be decontaminated prior to the arrival at the site and between wells. Additional information on decontamination procedures can be found in Attachment 9 of **Appendix D**. Core samplers will be washed between sampling intervals in a detergent/water

solution and double rinsed with tap water in clean buckets. The decontamination wastewater and drill cuttings will be placed in 55-gallon drums and handled as described in Task 7.

Aboveground surface completions will be constructed for each monitoring/compliance well installed (**Appendix D**). The surface completion will consist of protective steel casing, with a hinged, lockable lid set in a concrete pad. Concrete-filled steel bollards will be installed at the corners of the concrete pad.

The monitoring wells and surface completions will be installed in general accordance with USACE and State of Texas requirements by a drilling subcontractor licensed in the State of Texas. At the end of the field work, a State of Texas Well Report will be submitted to the Texas Department of Licensing and Regulations for construction of each well.

3.2.1 Well Development

The newly installed monitoring wells will be developed to remove drilling fines and enhance hydraulic communication between the well and the groundwater zone. The wells will be developed no sooner than 48 hours and no later than 7 days after installation of the well. Well development will be performed by pumping and gentle surging of the screened interval using a rubber-lined surge block. A minimum of three well borehole volumes of water will be removed. The volume of groundwater removed from each well will be calculated from the static water level measurement referenced from the top-of-casing. An electronic interface probe will be used to measure the water levels. As an alternative to pumping, a bottom-filling bailer may be used to remove water from low-yielding wells. Water quality parameters (temperature, pH, conductivity, and turbidity) of the development discharge water will be monitored. Development will continue until the water quality parameters have stabilized to within 10 percent and the water is visually clear. Additional guidance on well development is provided in Attachment 3 of **Appendix D**.

A Shaw hydrogeologist will supervise well development, and document the development process and measurements in a Well Development Record specific to each well. Downhole development equipment will either be disposed after each use or will be decontaminated prior to and following use at each well location by cleaning in a detergent/water solution and double rinsing with tap water in clean buckets. The development and decontamination wastewater will be placed in 55-gallon drums and handled as described in **Section 3.7**.

3.3 Task 3 — Surveying

A State of Texas-licensed professional land surveyor will survey the locations and elevations of the newly installed monitoring wells. The horizontal coordinates (northing and easing) of the wells will be surveyed to the nearest foot and will be based on the North American Datum of 1983. The vertical elevations of the top of the wells (top-of-casing) will be survey to nearest

0.01 feet. The ground surface elevation at each well location will be surveyed to the nearest 0.1 feet. To ensure compatibility with pre-existing well elevations, the top-of-casing for one of the existing wells at each site will be surveyed. If discrepancies are noted, the USACE will be consulted for resolution.

For identifying locations of soil confirmation samples and limits of excavation, either land surveying or Global Positioning System (GPS) may be used. Shaw will coordinate with the USACE prior to the use of GPS.

3.4 Task 4 — Groundwater Sampling

Monitoring wells will be sampled using the low flow method. The only exceptions would be slow recharging wells that go dry or proceed to drawdown significantly whereby equilibrium cannot be maintained. Procedures for purging and sampling the monitoring wells with the low flow method or alternative means are detailed in Attachment 2 of **Appendix D**. Detailed information on groundwater sampling can also be found in the CDAP (**Appendix C**). Analytical parameters and the frequency of sampling will be discussed in site-specific addenda to this plan.

3.5 Task 5 — Soil Sampling

Surface soil is defined as that which exists from the land surface extending approximately one foot bgs. Surface soil samples may be collected during various investigation or remediation activities. Surface soil sampling equipment and procedures are detailed in Attachment 6 of **Appendix D**.

Subsurface soil samples may be collected during various activities including drilling of soil borings, test pits, or installation of monitoring wells for investigation activities. Soils samples will be collected during drilling activities and will be described according to the ASTM D2488-00, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). Each boring will be logged on USACE drilling forms or equivalent. Soil samples will be screened using an organic vapor monitor (OVA) and headspace readings will be taken and entered on the drilling form. Generally, samples collected for chemical analysis will be from the highest OVA reading, from the first two feet of the boring or well, and at boring terminus unless otherwise specified by the site-specific work plan addendum. More information regarding subsurface soil samples can be found in Attachment 5 of **Appendix D**.

Test pits may be dug at the facility to fulfill specific objectives relating to site investigations or for confirmation purposes. Generally, test pits will be utilized in order to identify the location of pipelines, the condition of pipelines, and to characterize the surrounding soil to determine if there have been any impacts to the soil during past operations. Additional procedural criteria and sampling protocols will be defined in future addenda to this plan.

3.6 Task 6 — Surface Water/Sediment Sampling

During various phases of work, surface water and sediment samples may be collected to satisfy specific requirements. Using clean disposable gloves, surface water sample bottles should be totally submerged with a slight tilt to effectively fill the bottle without displacing any preservatives, if any. The bottle should be tightly capped immediately after filling. Other sampling equipment may be utilized depending on sample objectives and site conditions (e.g., Kemmerer samplers, etc.). Sampling after a heavy rain is not recommended, since sediments can be stirred up by agitation and the result would not be a representative sample. Sampling should be postponed until better conditions are present. Surface water samples should be collected prior to any sediment sampling at the same location.

Sediment samples are usually collected in conjunction with a surface water sample, and as close as possible to the location the surface water sample was collected. Sediments should be collected using clean disposable gloves, a decontaminated trowel or shovel to loosen and remove the sediment and placed in a laboratory-supplied soil jar. As with other media, samples should first be collected from the point suspected to be the least contaminated and later from more contaminated points to minimize the risk of cross-contamination (e.g., collection near a pipe outfall should not be the first sample if several samples are planned for the water body).

3.7 Task 7 — Investigation-Derived Waste Management

Wastes generated during installation and sampling of monitoring wells will include drill cuttings; wastewater from equipment decontamination, well development, or purging; and miscellaneous wastes. Management of the waste streams is described below.

3.7.1 Drill Cuttings

Drill cuttings may initially be placed in 55-gallon drums or similar containers, or directly placed in an HDPE-lined roll-off container. Upon completion of each well, drums will be sealed and transported to a staging area. Drill cuttings in drums will be transferred to an HDPE-lined roll-off container if the quantity of drill cuttings is large. Composite samples will be collected from drums or roll-off boxes for characterization before disposal. The procedures for sampling the drill cuttings in drums or roll-offs are detailed in the CDAP (**Appendix C**). A procedure for handling of investigation-derived waste is presented in Attachment 10 of **Appendix D**.

Following characterization, drill cuttings will be disposed on site if they are determined to be non-hazardous. The cuttings will be transported to a permitted landfill if they are determined to be hazardous.

3.7.2 Wastewater

Wastewater generated from equipment decontamination, well development, sampling, and purging activities will be stored in 55-gallon drums or larger containers. Containers will be transported to the GWTP at LHAAP-18/24 for disposal and will be released in the influent stream of the plant.

3.7.3 Miscellaneous Wastes

Miscellaneous wastes include spent personnel protective equipment, HDPE sheeting, rags, paper towels, etc. These wastes will not be characterized and will be placed in plastic bags for disposal as municipal solid waste.

3.8 Task 8 — Soil Excavation and Disposal

Excavated soils will typically be staged at the site and sampled for waste characterization and profiling. The process of staging and handling waste soil will depend on expected contaminant concentrations and soil volumes. If it is necessary to excavate clean soil, that material will be segregated from soil that is expected to exceed site-specific cleanup levels. For soil that exceeds site-specific cleanup levels, assumed hazardous soils will be staged separately from assumed non-hazardous soils. The staging of contaminated soil will typically be performed as follows:

- Material from small excavations (less than approximately 200 in-place cubic yards) will be placed directly in roll-off containers. If the excavated material is expected to be characteristically hazardous waste, the containers will be lined. The containers will be maintained in a designated staging area at the remediation site while waste characterization samples are analyzed. The containers will be covered by tarps while awaiting disposition.

- Material from large excavations will be placed in daily piles while awaiting waste characterization analyses. The piles will be in designated contaminated-soil staging areas adjacent to the excavations. A staging area will be underlain by two layers of 6-mil polyethylene; additional soil will be spread atop the polyethylene to minimize damage from heavy equipment and trucks. Soil in the staging area will be protected from run-on by construction of temporary berms to divert potential run-on away from the area. Polyethylene sheeting will be kept on hand to cover piles in the event that rainfall is forecast.

At excavations with sufficient soil analytical results, Shaw may apply a somewhat different procedure. Shaw will coordinate with the selected disposal facility to evaluate the potential for pre-excavation acceptance of the soil by the facility. Pre-excavation acceptance will allow direct loading of contaminated soil and thus avoid staging and double-handling of material. In these instances, the soil will be removed from the excavation and placed directly in an end-dump for immediate transport to the disposal facility. Composite samples will be collected from staged

material as required to gain acceptance at specified disposal facilities. Each composite sample will consist of equal parts of five samples collected at evenly spaced locations within the stockpile. The composite sample will be analyzed for constituents and properties according to the selected disposal facility requirements. The procedures for collecting composite samples are described in the CDAP, **Appendix C**.

The fully characterized excavation stockpile soil will be removed from the site for proper disposal in accordance with state and federal regulations.

3.9 Task 9 — Well Abandonment

The abandonment procedures used at a site are dependent upon specific regulatory requirements and generally fall into two different methods – abandonment of the well in place or removal of the well and associated materials from the aquifer. Abandonment in place will be considered when contamination cannot enter from the surface and cross-contamination cannot occur between various zones. In other circumstances, removal of the well materials will be implemented by overdrilling the well casing using a hollow stem auger drill. The auger is centered over the casing with the center plug and pilot bit removed, or a small guide plug is inserted in the casing, guiding the drill string downhole and bringing well completion materials to the surface.

Several goals should be met while conducting well abandonment activities. These include the prevention of vertical migration of fluids in the borehole and prevention of intermixing of waters from different water-bearing zones. In addition, any physical hazards that may be present, such as an open borehole, should be eliminated after conducting well abandonment procedures. Lastly, well abandonment activities should be conducted in such a way to preserve aquifer properties. Additional information is in **Appendix D**, Attachment 11, Monitoring Well and Borehole Abandonment.

3.10 Other Remediation Tasks

For tasks not otherwise described in this work plan, addenda to the work plan will be issued that will specifically address a site and the scope of work that will be required for that site. Proposed tasks that are likely to be addressed in future addenda include the following:

1. Biobarrier installation
2. Groundwater pump and treat
3. Soil excavation
4. GWTP optimization and effluent reinjection
5. Soil and groundwater flushing
6. Enhanced in situ bioremediation
7. In situ chemical oxidation

8. Piping remediation
9. Test pits

3.11 Site Restoration and Demobilization

Following completion of remediation activities, Shaw will restore the site and demobilize. Disturbed areas will be graded, if necessary, for proper drainage and reseeded with native vegetation. Equipment and personnel will be demobilized from the project site immediately following completion of field operations. Equipment will be decontaminated before leaving the site.

4.0 Safety and Health

The HASP defines and establishes the policies and procedures that protect workers and the public from potential hazards posed by planned project activities during this installation-wide investigation and remediation effort at LHAAP. The HASP incorporates health and safety policies and safe operating procedures for individual project site activities proposed under this contract. These procedures allow work activities to be carried out in a controlled, effective manner, consistent with Shaw policies.

Prior to initiating work at the facility for any site, workers will have signed the HASP in the designated area to indicate they have read and understood the document. Also, daily safety meetings will be held with all field crew members prior to starting work each day in order to review the day's scope of work, any site conditions expected, and any hazards that need to be addressed or acknowledged. The HASP is in **Appendix A**.

Each site-specific addendum to this work plan will include a section on Safety and Health. That section will address hazards that are not addressed by this work plan because the hazards are unique to the site or associated with specialized technologies.

5.0 Quality Assurance/Quality Control

The Contractor Quality Control Plan in **Appendix B** provides additional information on QA/QC procedures. This plan identifies personnel, procedures, controls, instructions, tests, verifications, documents, and forms to be used and what type of records to be maintained. The USACE Three-Phase QC process will be used to enforce QA/QC requirements and include preparatory inspections, initial inspections, and follow-up inspections. The three phases of inspections will target each definable feature of work during execution of project activities.

Shaw will coordinate with the USACE to meet the requirements of the Quality Assurance Surveillance Plan (QASP). The QASP, developed by the USACE, will incorporate key quality control activities that the USACE will use to assess progress toward milestones as described in the PWS.

Each site-specific addendum to this work plan will include a section on Quality Control. That section will address quality control requirements specific to any specialized technologies that are being applied at the site and not addressed by this work plan.

6.0 References

ASTM International, 2003, ASTM D2488-00, *Standard Practice for Description and Identification of Soils*, West Conshohocken, PA 19428-2959.

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

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Appendix A

Health and Safety Plan

APPENDIX A
HEALTH AND SAFETY PLAN

FINAL
INSTALLATION-WIDE WORK PLAN
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

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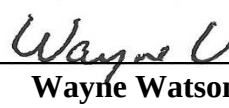
Contract Number W912QR-04-D-0027
Task Order No. DS02

January 2006

APPENDIX A
HEALTH AND SAFETY PLAN

FINAL
INSTALLATION-WIDE WORK PLAN
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Prepared by:

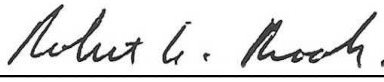


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January 2006

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Acronyms and Abbreviations

AHA	activity hazard analysis
CFR	Code of Federal Regulations
CGI	combustible gas indicator
CIH	Certified Industrial Hygienist
CPR	cardiopulmonary resuscitation
CRZ	contamination reduction zone
EC	Emergency Coordinator
EMS	emergency medical services
EO	equipment operator
ERCP	Emergency Response and Contingency Plan
eV	electron volts
EZ	exclusion zone
F/B	flash/bang
FM	Factory Mutual
GFCI	ground fault circuit interrupter
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSM	Health and Safety Manager
HSO	Health and Safety Officer
IP	ionization potential
kV	kilovolt
LEL	lower explosive limit
LEPC	Local Emergency Planning Committee
LHAAP	Longhorn Army Ammunition Plant
LSP	lightning safety position
MARC	Multiple Award Remediation Contract
mm	millimeters
mph	miles per hour
MSDS	material safety data sheets
NIOSH	National Institute for Occupational Safety and Health
NLSI	National Lightning Safety Institute
O_2	oxygen
OSHA	Occupational Safety and Health Administration
PM	Project Manager
PPE	personal protective equipment
ppm	parts per million

Acronyms and Abbreviations (continued)

PSO	Project Safety Officer
PVC	polyvinyl chloride
RM	Remediation Manager
Shaw	Shaw Environmental, Inc.
SS	Site Superintendent
SZ	support zone
TBD	to be determined
TCE	trichloroethene
TCEQ	Texas Commission on Environmental Quality
TNT	trinitrotoluene
TO	task order
UL	Underwriters Laboratories
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
UV	ultraviolet
XRF	X-ray fluorescence

1.0 Introduction

This Health and Safety Plan (HASP) defines and establishes the policies and procedures that protect workers and the public from potential hazards posed by planned project activities at the former Longhorn Army Ammunition Plant (LHAAP) Karnack, Texas. The work is being performed by Shaw Environmental, Inc. (Shaw) under the Multiple Award Remediation Contract (MARC) No. W912QR-04-D-0027, Task Order (TO) No. DS02, for the U.S. Army Corps of Engineers (USACE).

The plan incorporates health and safety policies and safe operating procedures for individual project activities. These project activities will comply, at a minimum, with *Health & Safety Program, Volume I & II* (Shaw, 2003) and the *Requirements Manual* (EM-385-1-1) (USACE, 2003a), which define the minimum health and safety requirements for project site activities under this TO. These procedures allow work activities to be carried out in a controlled, effective manner, consistent with Shaw policies.

Note: This HASP has been designed for the methods presently contemplated by Shaw for the execution of the proposed work. Therefore, this HASP may not be appropriate if the work is not performed by Shaw or does not use the methods presently contemplated by Shaw, or if the scope of work is modified. Each company or contractor is responsible for the safety and health of their personnel, for their actions, and for the work they perform. It is highly recommended that each company or contractor working at LHAAP perform their work under the supervision of their internal health and safety professionals.

In addition, as the work is performed, conditions different from those anticipated may be encountered and the HASP may have to be modified. Therefore, Shaw makes no representations or warranties as to the adequacy of the HASP, except for warranties specifically stated in the HASP itself and for work performed by Shaw.

2.0 Site-Specific Environmental Safety and Health Plan

Shaw has developed this HASP specifically for field activities to be conducted under TO DS02 at LHAAP, Karnack, Texas. The Shaw team considers safety the highest priority when working at a site that contains potentially hazardous materials and has established a policy of minimizing exposures. This policy must be upheld on all projects. Project activities will be conducted in a manner that minimizes the probability of injury, accident, or incident occurrence. **Shaw team employees, subcontractors, and visitors are required to be familiar with the HASP prior to site entry and to sign the Health and Safety Plan Worker Acknowledgment (Attachment 1)**.

The HASP and site activities will be in compliance with the following regulations, contract requirements, and guidelines:

- *Safety and Health Requirements Manual* (EM 385-1-1) (USACE, 2003a)
- *Health & Safety Program, Volumes I & II* (Shaw, 2003). **Attachment 2** provides a list of relevant health and safety forms.
- U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) standards, specifically:
  - √ Title 29 Code of Federal Regulations (CFR) 1910 – Safety and Health Regulations for General Industry
  - √ Title 29 CFR 1910.1200 – Hazard Communication
  - √ Title 29 CFR 1926.59 – Hazard Communication
  - √ Title 29 CFR 1926 – Safety and Health Regulations for Construction
- U.S. Environmental Protection Agency (USEPA), 1988, Standard Operating Safety Guidelines
- State-specific safety and health regulations
- Shaw policies and procedures

Although the HASP focuses on the specific work activities planned for this project site, it must remain flexible because of the nature of the work. Conditions may change and unforeseen situations may arise that require deviations from the original plan. This flexibility allows modification by the Site Superintendent (SS) and Project Safety Officer (PSO) who take into account changing site conditions, such as new data on chemical hazards, weather, and changes in scope of work. **Changes to the HASP must be approved by the Program Certified Industrial Hygienist (CIH), Program Health and Safety Manager (HSM), or the Program Health and Safety Officer (HSO), and Project Manager (PM), Remediation Manager (RM),**

or SS. A change to the HASP must be documented in an amendment to the HASP (see Attachment 3) and forwarded to the Program HSO.

This HASP is based on the scope of work, project work plan, and site-specific information provided in the TO that includes the following:

- Background information on previous site operations
- Location and approximate size of the site
- Site description and site map
- Anticipated contaminants and characteristics
- Applicable federal, state, and local regulations and codes

2.1 Scope of Work

Shaw will perform the following site work tasks to complete the project scope of work. The activity hazard analysis (AHA) for the tasks listed are included as **Attachment 5** to this HASP.

- Mobilization and Site Setup
- Monitoring Well Installation/Development/Abandonment
- Surveying
- Groundwater / Soil Sampling
- Surface Water/Sediment Sampling
- Investigation Derived Waste Management
- Soil Excavation and Disposal
- Field Screening (e.g., X-Ray Fluorescence [XRF])
- Site Restoration and Demobilization

2.2 Site Description

LHAAP is located in central-east Texas, in Harrison County, between State Highway 43 at Karnack, Texas, and Caddo Lake. Figure 1-1 in the main volume Work Plan shows the location of LHAAP and surrounding communities. The former installation occupied nearly 8,500 acres. The nearest cities are Marshall, Texas, approximately 14 miles to the southwest, and Shreveport, Louisiana, approximately 40 miles to the east.

The LHAAP was established in 1941 when the Army issued a contract to build a six-line production facility for manufacturing trinitrotoluene (TNT). From 1942 to 1945, the facility produced 414 million pounds of TNT. From 1952 to 1956, the facility produced 3.4 million pyrotechnic devices, photoflash bombs, simulators, hand signals, and 40-millimeter (mm) tracers. During the Vietnam conflict, pyrotechnic and illuminating ammunition was produced. From 1954 to 1980, solid-fuel rocket motors for tactical missiles were produced. During this period, the LHAAP manufactured approximately 50 million pounds of propellant and 200,000

rocket motors. From 1988 to 1991, LHAAP was also used for the static firing and elimination of Pershing I and II rocket motors.

Various media have been contaminated by past industrial operations and waste management practices at LHAAP. LHAAP was placed on the National Priorities List on August 9, 1990. A Federal Facility Agreement among USEPA, the Army, and the Texas Commission on Environmental Quality (TCEQ) (formerly Texas Natural Resource Conservation Commission), became effective December 30, 1991.

3.0 Key Personnel and Management

The PM, RM, SS, Program HSM, Program CIH, Program HSO, and the PSO are responsible for formulating and enforcing health and safety requirements, and for implementing this HASP. The superintendent's and employee safety responsibilities are detailed in *Health & Safety Program, Volumes I & II*, HS010 (Shaw, 2003). The following summarizes the health and safety responsibilities of the site management.

3.1 Project Safety Management Responsibilities

The PM has the overall responsibility for the project and assures that the requirements of the contract are attained in a manner consistent with the HASP requirements. The PM or RM will coordinate with the SS and the PSO to assure that the work is completed in a manner consistent with the HASP. The SS is responsible for field implementation of the HASP. The SS will be the main contact in any on-site emergency situation and will contact off-site emergency agencies prior to the start of work. The SS will act as the PSO when the assigned PSO is not on the project site. The PSO is authorized to administer this HASP. The PSO is authorized to stop work when an imminent health or safety risk exists. The Program CIH is responsible for reviewing the HASP and determining that the HASP is complete and accurate. The CIH may designate any of these responsibilities to the HSM or HSO.

3.2 Equipment Operators

Equipment operators (EOs) will be responsible for the maintenance, inspection, and safe operation of their equipment. EOs are responsible for daily inspection of the equipment and verifying that it is in safe operating condition.

3.3 Employee Safety Responsibility

Each employee is responsible for his own safety as well as the safety of those around him. The employee shall use the equipment provided in a safe and responsible manner as directed by his supervisor. Shaw personnel will follow the policies set forth in *Health & Safety Program, Volumes I & II* (Shaw, 2003).

3.4 Responsible Shaw Health and Safety Personnel

The following personnel are responsible for health and safety on site:

Project Manager:	David Cobb	(617) 589-5561 (508) 667-3608 (cell)
Remediation Manager	Praveen Srivastav	(713) 996-4588 (281) 639-8743 (cell)
Site Superintendent:	To Be Determined (TBD)	

Project Safety Officer:	TBD	
Program Health and Safety Officer:	Wayne Watson	(713) 996-4516
		(409) 457-5805 (cell)
Program Certified Industrial Hygienist:	David Mummert	(419) 425-6129
Program Health and Safety Manager:	Robert Brooks	(973) 770-5325
Quality Control Manager:	John Patin	(713) 996-4582
Program Manager:	Bob Culbertson	(865) 694-7402
Shaw H&S Help Desk (24 hours)		(866) 299-3445

4.0 Project Hazard Analysis

This section outlines the potential chemical and physical hazards that workers may be exposed to during work on this project. The assessment of chemical and physical hazards in this section is based on the information provided in the scope of work for TO DS02. **Table 4-1** lists primary contaminants known to be present at the site. A list and material safety data sheets (MSDSs) for chemicals that may be brought to the site are included in **Attachment 4** of this HASP.

Table 4-1
Potential Chemical Hazards

Chemical	Exposure Routes	PEL/TLV	Health Hazards/Physical Hazards
Lead	Inhalation, ingestion	0.050 mg/m^3	Weakness, insomnia; loss of appetite, loss of weight, abdominal pain; anemia; tremors; weakness of wrists/ankles; kidney damage; low blood pressure. Incompatible with strong oxidizers, hydrogen peroxide and acids
Mercury	Inhalation, skin contact	0.025 mg/m^3 SKIN alkyl compounds 0.01 mg/m^3	Cough, chest pain, shortness of breath; tremor, insomnia, irritability, headache, weakness, stomach pain, loss of appetite; kidney damage. Reacts with acetylene, ammonia, chlorine dioxide, copper and other metals
Trichloroethene	Skin, eye, inhalation, ingestion	50 ppm	A skin and eye irritant; dermatitis, headache, vertigo, visual distortion, fatigue, nausea, vomiting, irregular heart rhythm. A dangerous fire hazard, reacts with strong caustics and chemically reactive metals, will emit toxic phosgene gas when heated.
Trinitrotoluene	Skin, eye, inhalation, ingestion	0.5 mg/m^3	A skin and eye irritant; headache, weakness, anemia, liver injury, hallucinations, visual distortions, cyanosis. A severe explosion hazard, will explode on heating or strong shock; thermal decomposition will emit NO_x gases and/or detonation.
Methylene Chloride	Skin, eye, inhalation, ingestion	50 ppm	A suspected human carcinogen; headache, narcosis, fatigue, tingling in the limbs, stupor; a strong skin, eye irritant. Can react violently with strong oxidizers, light metals, potassium hydroxide; low combustability, flammable at elevated (>100 C) temperatures; emits toxic gases when burned
Ammonium Perchlorate	Skin, eye, inhalation, ingestion		Can irritate the nose causing coughing and wheezing and can interfere with the ability of the blood to carry oxygen causing headache, fatigue, dizziness, and a blue color to the skin and lips. Is a powerful oxidizer. Stable in pure form, but decomposes at a temperature 150 degrees C or above. It becomes explosive when mixed with finely divided organic materials and can exhibit explosive sensitivity to shock and friction when contaminated with small amounts of some impurities such as sulfur, powdered metals and carbonaceous materials. May explode in fire.

Abbreviations:

CNS	*central nervous system*	*STEL*	*short-term exposure limit*
PEL/TLV	*permissible exposure limit/threshold limit value*	*mg/m^3*	*milligrams per cubic meter*
ppm	*parts per million*	*NO_x*	*nitrogen oxides*

4.1 Chemical Hazards

Chlorinated Solvents

Chlorinated solvents include trichloroethene (TCE), methylene chloride, and other similar compounds. TCE is irritating and toxic to the central nervous system. Inhalation of high concentrations have led to death due to ventricular fibrillation. Chronic exposure may lead to heart, liver, and kidney damage. The liquid is absorbed through the skin. Although it has a relatively low flash point, TCE burns with difficulty. Methylene chloride can cause irritation to the respiratory and gastrointestinal tract. Skin contact can result in irritation, redness, and pain. Chronic exposure can cause headache, mental confusion, depression, liver effects, among other effects. Methylene chloride may cause cancer in humans. Avoid exposure to methylene chloride through engineering controls and wearing personal protective equipment (PPE).

Lead

Exposure to lead can be from inhalation of dusts or from skin exposure. Symptoms are non-specific and can be hard to distinguish from minor seasonal illnesses. The symptoms are decreased physical fitness, fatigue, sleep disturbance, headache, aching bones and muscles, digestive disorders (particularly constipation), abdominal pains, and decreased appetite.

Mercury

Mercury is a naturally occurring element that is found in air, water and soil. It exists in several forms that include elemental or metallic mercury, inorganic mercury compounds, and organic mercury compounds. Pure mercury is a liquid metal that volatizes readily to become an invisible, odorless toxic vapor.

Mercury exposure at high levels can harm the brain, heart, kidneys, lungs, and immune system of people of all ages. Mercury in the air eventually settles into water or onto land where it can be washed into water. Once deposited, certain microorganisms can change it into methylmercury, a highly toxic form that bioaccumulates in fish, shellfish and animals that eat these fish. At high levels of exposure, methylmercury's harmful effects on these animals include death, reduced reproduction, slower growth and development, and abnormal behavior.

Symptoms of methylmercury poisoning may include:

- impairment of the peripheral vision;
- “pins and needles” feelings, usually in the hands, feet, and around the mouth;
- lack of coordination of movements;
- impairment of speech, hearing, walking; and muscle weakness.

Perchlorate

Perchlorate is both a naturally occurring and man-made chemical. Most of the perchlorate manufactured in the United States is used as the primary ingredient of solid rocket propellant. Wastes from the manufacture and improper disposal of perchlorate-containing chemicals are increasingly being discovered in soil and water. Perchlorate is associated with the disruption of thyroid function, which can potentially lead to thyroid tumor formation. The USEPA, federal, state, and water suppliers are already actively addressing perchlorate in drinking water and surface water.

Residual amounts of these chemicals may be present during soil excavation, well installation and groundwater sampling activities; however, potential for worker exposure to these substances is remote. Airborne dust and particulate at well installation sites will be closely controlled. Real-time air monitoring will be conducted during these activities to monitor potential exposure and action levels established to initiate PPE upgrades. Workers will undergo initial personal monitoring to determine actual exposure levels, and confirm PPE levels.

The following general symptoms may indicate exposure to a hazardous chemical. Personnel will be removed from the work site and provided immediate medical attention if the following symptoms occur:

- Dizziness or stupor
- Nausea, headaches, or cramps
- Irritation of the eyes, nose, or throat
- Euphoria
- Chest pains and coughing
- Rashes or burns

4.2 Hazard Communication

The purpose of hazard communication (employee right-to-know) is to verify that the chemical hazards located at this field project site are communicated according to 29 CFR 1926.59 to all Shaw personnel and Shaw subcontractors. Hazard communication will include the following elements.

4.2.1 Container Labeling

Shaw personnel will ensure that all drums and containers are labeled according to contents. These drums and containers will include those from manufacturers and those produced on site by operations. All incoming and outgoing labels shall be checked for identity, hazard warning, and name and address of responsible party.

4.2.2 Material Safety Data Sheets

There will be MSDSs located on site for each chemical used on site. Hazardous chemical MSDSs are located in **Attachment 4** of the HASP.

4.2.3 Employee Information and Training

Training employees on chemical hazards is accomplished through an ongoing corporate training program. Additionally, chemical hazards are communicated to employees through daily safety meetings held at Shaw field projects and by an initial site orientation program.

At a minimum, Shaw and subcontractor employees will be instructed about the following:

- Chemicals and their hazards in the work area
- How to prevent exposure to these hazardous chemicals
- What the company has done to prevent workers' exposure to these chemicals
- Procedures to follow if they are exposed to these chemicals
- How to read and interpret labels and MSDSs for hazardous substances found on Shaw sites
- Emergency spill procedures
- Proper storage and labeling

Before a new chemical is introduced on-site, each Shaw and related subcontractor employee will be given information in the same manner as during the initial site orientation program. The SS will be responsible for seeing that the MSDS for the new chemical is available for review by on-site personnel. The information pertinent to the chemical hazards will be communicated to project personnel.

Morning safety meetings will be held and the hazardous materials used on site will be discussed. Attendance is mandatory for all on-site employees.

Refer to **Attachment 4** of this HASP for a list of hazardous chemicals anticipated to be brought to the site and their MSDS.

4.3 Physical Hazards

To minimize physical hazards, Shaw has developed standard safety protocols that will be followed. Failure to follow safety protocols will result in removal of an employee from the site and appropriate disciplinary actions.

The SS and PSO will observe the general work practices of each crew member and EO, and enforce safe procedures. Work areas will be inspected by the crew leaders, SS and PSO. Hazards will be corrected in a timely manner. A variety of physical hazards may be encountered during work activities at this site. An AHA Table, **Attachment 5**, has been developed for each

principal activity, and will identify the major hazards to which employees may be exposed. Hard hats, safety glasses, and steel toe safety boots are required in all areas of the site. Site-specific hazards and the necessary precautions will be discussed at the daily safety meetings. ***Health & Safety Program, Volumes I & II*** **(Shaw, 2003) will be maintained at the project site as a reference document.**

Physical hazards include safety and environmental hazards. The following physical hazards may be present during project activities:

- Heat stress
- Cold stress
- Biological hazards (poison ivy, ticks, Lyme disease)
- Manual lifting/back strain
- Noise
- Fire/explosion
- Vehicle traffic

Heat stress prevention procedures will be implemented according to *Health & Safety Program, Volumes I & II,* HS400 (Shaw, 2003) and EM 385-1-1 (USACE, 2003a). Cold stress prevention procedures will be implemented according to *Health & Safety Program, Volumes I & II,* HS 401 (Shaw, 2003) and USACE EM 385-1-1. Personal noise exposures will be controlled by instituting the Hearing Conservation Program according to *Health & Safety Program, Volumes I & II,* HS402 (Shaw, 2003).

4.3.1 Safety Hazards

Site personnel shall become familiar with the field activities that shall be conducted at the site and trained to work safely under various field conditions. In addition, the PSO shall observe the general work practices of each crew member and EO and enforce safe procedures to minimize safety hazards. The *Shaw Health & Safety Program, Volumes I & II* shall be maintained on site. The following sections shall be typical safety hazards and the relevant hazard control procedures.

4.3.1.1 Heavy and Bulky Loads

Load size and weight shall be considered before heavy and bulky loads are lifted or handled manually by personnel. Mechanical equipment such as forklifts, wheelbarrows, hand-trucks, loaders, and cranes shall be utilized when possible and needed.

Employees shall make certain the load can be safely handled by considering the size, weight, and shape of the load. No loads over 60 pounds shall be lifted by a single person. Proper lifting techniques shall be utilized: feet shall be shoulder width apart, one foot shall be placed along

side the load, bend at knees, maintain arch in back, keep the load close to the body, lift with the legs not the back.

4.3.1.2 Heavy Equipment Operation and Inspection

Heavy construction EOs present construction safety hazards to operating and ground personnel. Only trained and qualified operators shall be authorized to operate heavy construction equipment.

The operators shall be responsible for performing and documenting daily equipment inspections to identify, take out of service, and correct equipment defects of non-functioning safety devices that would render the equipment unsafe to operate. Standard safety devices and equipment required to be inspected and functional during use includes the following:

- Seat belts
- Safety glass in enclosed cab
- Braking system
- Back-up alarms
- Portable fire extinguisher
- Horn
- Tires
- Steering and hydraulic systems

Operators shall be required to wear seat belts when operating equipment and shall be responsible for the location of ground personnel (i.e., spotters) in their work area.

4.3.1.3 Bulk Fuel Storage

At least one dry chemical, ABC-type fire extinguisher will be positioned in this area.

4.3.1.4 Flame, Heat, or Spark-Producing Operations

Because of the possibility of flammable materials being present at this site, flame, heat, or spark-producing operations shall be limited. If a case arises where hot work is necessary, it shall be performed in accordance with the Hot Work Procedure, HS314.

This procedure requires a hot work permit and shall be inspected by the PSO prior to commencing hot work. Combustible materials shall be removed from the area before the start of hot work. A fire watch shall be posted and the atmosphere shall be tested for combustible gases. A hot work permit shall be completed by the PSO. The permit shall indicate the area, the employees involved, air monitoring results, fire protection systems, and fire department phone

number. All flammable materials/fuels shall be stored in safety containers and backflow preventers shall be required for welding/cutting torches.

4.3.1.5 Small Quantity Flammable Liquids

Small quantities of flammable liquids shall be stored in safety cans and properly labeled as to their contents.

4.3.1.6 Electrical Hazards

Overhead power lines, downed electrical wires, and buried cables pose a danger of shock or electrocution if workers contact or sever them during site operations

To help minimize the hazard posed to workers by electrical equipment, low-voltage equipment with ground-fault interrupters and water-tight, corrosion-resistant connecting cables shall be used on site. In addition, lightning is a hazard during outdoor operations, particularly for workers handling metal containers or equipment. To eliminate this hazard, weather conditions shall be monitored and work shall be suspended during electrical storms. An additional electrical hazard involves capacitors that may retain a charge. Such items shall be properly grounded before handling. OSHA's standard in Title 29, CFR 1910.137 describes clothing and equipment for protection against electrical hazards.

Electrical work shall be performed only by approved electricians. No electrical work should be performed on an energized circuit. Single-phase electrical hand tools must be approved by a recognized testing agency, and all exposed non-current carrying metal parts must be grounded or double insulated. Electrical equipment cannot be used if there are deficiencies in the appliance, cord, or plug.

4.3.1.7 Underground/Overhead Utilities

Intrusive activities are defined as any activity that produces a man-made cut, cavity, trench, or depression into the earth's surface formed by earth removal or any activity that results in an object placed into the earth below the surface. These activities include excavating, drilling, augering, boring, shoveling, fence post driving, driving stakes, etc. Intrusive activities can be dangerous and can result in severe personal injury or death. Intrusive activities can also cause significant property damage to both utilities/structures and operational equipment. Breaching underground utilities can result in electrocution from damaged electric lines, fires from broken fuel/gas lines, and disruption of telephone service.

Before any intrusive activity at the site begins, positive steps shall be taken to determine if the area contains underground utilities or overhead hazards. It is important to understand that underground utilities have been found in areas that have been properly investigated and thought

not to have utilities present. Personnel shall always be alert for marking tape, wires, pipes, previously disturbed soils, crushed stone or sand bedding/backfill, containers, discolored soil, or anything else unusual.

Procedure HS307, "Excavation and Trenching" describes general requirements for excavation safety. The procedure detailed in HS 308, "Underground/Overhead Utility Contact Prevention" prescribes the steps to be taken to identify and protect underground installations or indicate that none exists. This project will be performed in accordance with both procedures.

4.3.1.8 Slip/Trip/Fall Hazards

Some areas may have wet surfaces that greatly increase the possibility of inadvertent slips. Caution must be exercised when using steps and stairs.

Use of handrails when climbing stairs shall be enforced, and handrails shall remain secure until the support itself is removed and lowered to ground level. Good housekeeping practices are essential to minimize trip hazards. Full body harnesses shall be used by personnel working 4 feet or more above surfaces, including man lifts.

The work area shall be kept clean and orderly. Tools and debris must be picked up and placed in the proper place to prevent a tripping hazard. Walkways and grating shall be kept in good condition. Spills shall be cleaned up immediately. Personnel shall not walk or climb on piping, valves, fittings, or any other equipment not designed as walking surfaces

4.3.1.9 Ground Personnel

All ground personnel should be constantly aware of the possibility of slips, trips, and falls due to poor and possibly slippery footing in the work areas. Before crossing either in front of or behind a piece of heavy equipment, ground personnel shall signal the EO and receive confirmation before moving.

4.3.1.10 Head and Back Injuries

As minimum requirements, hard hats and safety glasses shall be donned prior to performing site activities. At the daily safety meeting, personnel shall be instructed in proper lifting techniques and reminded not to lift heavy items without assistance.

4.3.1.11 Heavy Equipment and Vehicle Traffic

The use of heavy equipment for excavation presents the greatest potential for injury to personnel. In order to minimize these hazards, designated routes shall be established for mobilization through the facility, and specific traffic patterns shall be established. Trucks and other heavy equipment shall have spotters for backing maneuvers. Those crew members directly involved

with spotting for the operator shall be the only personnel allowed in the vicinity of the heavy equipment. Other personnel shall remain a safe distance away from these operations. Personnel who need to approach heavy equipment while in operation shall observe the following protocols:

- Make eye contact with the operator (and spotter)
- Signal the operator to cease heavy equipment activity
- Approach the equipment and inform the operator of intentions

Shaw and subcontractor personnel shall follow traffic rules. Company vehicles shall yield to bikes, pedestrians, and railroad crossings. Vehicles must come to a complete stop at railroad crossings. Vehicles must be operated in a safe and legal manner. Motor vehicles that are defective or not operating properly must be reported immediately. Seat belts must be worn while driving. Personnel shall drive at posted speed limits or at speeds consistent with prevailing road, traffic, or weather conditions.

4.3.2 Heat Stress

With the possible combination of ambient factors such as high air temperature, high relative humidity, low air movement, high radiant heat, and protective clothing, the potential for heat stress is a concern. The potential exists for the following:

- Heat rash
- Heat cramps
- Heat exhaustion
- Heat stroke

Heat stroke, heat cramps, and heat exhaustion shall be discussed during safety tailgate meetings, which shall be conducted before each workday. Workers shall be encouraged to increase consumption of water and electrolyte-containing beverages such as Gatorade™ during warm weather. Water and electrolyte-containing beverages shall be provided on site and shall be available for consumption during work breaks. Site personnel shall follow the Shaw procedures for heat stress prevention.

4.3.3 Cold Stress

With outdoor work in the winter months, the potential exists for hypothermia and frostbite. Protective clothing greatly reduces the possibility of hypothermia in workers. Personnel shall be instructed to wear warm clothing and to stop work to obtain more clothing if they become too cold. Employees shall also be advised to change into dry clothes if their clothing becomes wet from perspiration or from exposure to precipitation.

In cold weather, the potential for frostbite exists, especially in body extremities. Personnel shall be instructed to pay particular attention to hands, feet, and exposed skin when dressing. Personnel shall obtain more clothing if they begin to experience loss of sensation due to cold exposure.

Employees shall be encouraged to use heated shelters on site at regular intervals depending upon the severity of exposure. Symptoms of cold stress, including heavy shivering, excessive fatigue, drowsiness, irritability, or euphoria should be treated with an immediate return to the shelter.

4.3.4 Hearing Conservation Program

On projects where noise levels may exceed a time-weighted average of 85 dBA (decibels, A-scale), hearing protection shall be made available to all exposed employees. Additionally, sound level monitoring shall be conducted on-site. Shaw personnel shall be restricted from high noise exposure without appropriate hearing protection. The Shaw Hearing Conservation Program is in compliance with OSHA regulations found in Title 29 CFR 1910.95.

4.3.5 Excavation Procedures

When performing excavation activities (i.e., test pits), the Shaw Procedure HS307 for excavation and trenching must be followed. A copy of this procedure along with all other Shaw H&S Policies and Procedures will be maintained with the field office or field vehicle. Any excavation 5 feet deep or greater into which persons will enter and perform work must be shored, sloped, or otherwise made safe for entry. Excavations less than 5 feet in depth and which a competent person examines and determines there to be no potential for cave-in do not require protective systems. Excavations will be done in compliance with OSHA regulation 29CF 1926.650.

All excavations shall be performed from a stable ground position. Daily inspections of the excavation shall be made by a competent person, one who has received training in excavation safety. The inspector shall determine the likelihood of a cave-in, and remedial action such as sloping or shoring shall be taken if the walls appear to be unstable. The inspector shall verify that adequate means of egress are in place.

All spoil shall be located at least 2 feet from the edge of the excavation to prevent it from falling back into the excavation and surcharging the excavation face. Perimeter protection will be used for all excavation activities at the site, consisting of warning barricades or fencing placed at a distance not closer than 6 feet from the edge of the excavation, and displays adequate warning at an elevation of 3 feet to 4 feet above ground.

All project personnel shall participate in the site-specific training session and be instructed on the following requirements.

Before excavating, the existence and location of underground pipe, electrical equipment, and gas lines will be determined and documented. If the locations of any lines are in question, a cable-avoiding tool will be used to positively locate them.

No ignition sources are permitted if the ambient airborne concentration of flammable vapors exceeds 10 percent of the lower explosive limit (LEL) during the excavation. A combustible gas indicator (CGI) will be used to make this determination.

Operations must be suspended and the area vented if the airborne flammable concentration reaches 10 percent of the LEL in the area of an ignition source (i.e., sparks from bucket of excavator).

Combustible gas readings of the general work area will be made regularly.

If excavating equipment is located in the vicinity of overhead power lines, maintain at least 10 feet from overhead power lines, up to 50 kilovolt (kV). For voltages over 50 kV, add 0.4 inches per kV to obtain the safe distance between equipment and power lines.

Ladders will be provided and placed at an angle not more than 30 degrees from vertical, and secured as necessary. Ladder side rails shall extend at least 3 feet above the ground surface.

Excavations greater than four feet in depth that require personnel to enter shall have sufficient means of entry and egress (stairs, ladders, ramps). Means of entry/egress shall not require personnel to travel laterally more than 25 feet.

Excavations occurring within 3 feet of communication cables will be performed by hand digging until the cable is exposed.

4.3.6 Drilling and Well Installation

All drillers performing work must possess required state or local licenses to perform such work. All members of the drill crew must receive site-specific safety training prior to beginning work. The lead driller responsible for the safe operation of the drill rig as well as the drill crew's adherence to the requirements of this HASP.

The lead driller must ensure that all safety equipment is in proper condition and is properly used. The members of the crew must follow all instructions for the lead driller, wear all required PPE, and be aware of all hazards and control procedures. The drill crews must participate in the daily tailgate safety meeting and be aware of all emergency procedures.

Rig Inspection. Each day, prior to the start of work, the drill rig and associated equipment must be inspected by the driller and/or drill crew. The following items must be inspected:

- Vehicle/equipment condition
- Proper storage of equipment
- Condition of all wire rope and pulleys
- Location of fire extinguisher and first aid kit.

Rig Set Up. The drill rig must be properly blocked and leveled prior to raising the derrick. The wheels which remain on the ground must be chocked. The rig can only be moved after the derrick has been lowered. The leveling jacks must not be raised until the derrick is lowered.

Site drilling will comply with the following rules:

- Before drilling, the existence and location of underground pipe, electrical equipment, and gas lines will be determined. The Utility Line Protection Law requires that anyone planning borings call the state's ONE-CALL number at least three, but not more than ten business days prior to conducting drilling activities.
- If drilling is conducted in the vicinity of overhead power lines, maintain at least 10 feet from overhead power lines, up to 50 kV. For voltages over 50 kV, add 0.4 inches per kV to obtain the safe distance between equipment and power lines.
- Restricting work area access from vehicular/pedestrian traffic by utilizing temporary fencing or warning tape will be required.
- If lubrication fittings are not accessible with guards in place, machinery must be stopped before oiling and greasing. Fuel, hydraulic fluid, or oil will not be refilled in the drill rig unless the engine has been turned off.
- All drilling will occur a minimum of 3 feet from any known or suspected location of an underground structure or utility. A hand auger or posthole digger must be utilized to advance through the first 5 feet of the subsurface.
- Rigging equipment for material handling must be checked prior to use on each shift and as often as necessary to ensure it is safe. Defective rigging must be removed from service immediately.
- Drillers will not add or remove pipe from the drill stem without the assistance of the driller's helper.
- Lifting and transporting of drums should be completed using the appropriate equipment and following safe loading and unloading procedures.

Hoisting Operations

- Drillers must never engage the rotary clutch without watching the rotary table and ensuring it is clear of personnel and equipment.

- Unless the drawworks is equipped with an automatic feed control, the brake must not be left unattended without first being tied down.
- Casing or pipe must not be picked up suddenly.
- Drill pipe must not be hoisted until the driller is sure that the pipe is latched and the drilling assistant has signaled that he/she may safely hoist the load.
- During instances of unusual loading of the derrick or mast, such as when making an unusually hard pull, only the driller will be on the rig floor and no one will be on the rig or derrick.
- The brakes on the drawworks of every drilling rig must be tested by each driller at the beginning of each shift to determine whether they are in good order. The brakes must be thoroughly inspected by a competent individual each week.
- A hoisting line with a load imposed will not be permitted to be in direct contact with any derrick member or stationary equipment unless it has been specifically designed for line contact.
- Hoisting control stations must be kept clean and controls labeled as to their functions.

Riding Hoisting Equipment. Under no circumstances will personnel be permitted to ride the traveling block or elevators, nor will be the cat line be used as a personnel carrier.

Cat Line Operations

- Only experienced workers will be allowed to operate the cathead controls. The kill switch must be clearly labeled and operational prior to operation of the cat line.
- The cathead area must be kept free of obstruction and entanglements.
- The operator will not use more wraps than necessary to pick up the load. More than one layer of wrapping is not permitted.
- Personnel must not stand near, step over, or go under a cable or cat line which is under tension.
- Employees rigging loads on cat lines must:
- Keep out from under the load
- Keep fingers and feet where they will not be crushed
- Be sure to signal clearly when the load is being picked
- Use standard visual signals only, and not depend on shouting to coworkers

- Make sure that the load is properly rigged, since a sudden jerk in the cat line will shift or drop the load.

Pipe Handling

- Pipe must be loaded and unloaded, layer by layer, with the bottom layer pinned or blocked securely on all four corners. Each successive layer must be effectively blocked or chocked.
- Workers will not be permitted to top off the load during loading, unloading, or transferring or pipe or rolling stock.
- Employees must be instructed never to try to stop rolling pipe or casing; they must be instructed to stand clear of rolling pipe.
- When pipe is being hoisted, personnel will not stand where the bottom end of the pipe could whip and strike them

4.3.7 Confined Space Entry

Shaw Health & Safety Procedure HS300 for confined space entry will be followed if such an activity is needed during the execution of this project. A confined space is defined as a space large enough and so configured that an employee can bodily enter and perform assigned work, has limited means for entry or exit, and is not designed for continuous employee occupancy. Contaminated soil excavations, storage vessel entries, and other confined space work may pose additional hazards such as air contamination, flammable or explosive atmosphere, and oxygen deficiency. Excavation entry may pose the possibility of engulfment.

Shaw has detailed training for confined space entry, and only personnel properly trained shall supervise and participate in confined space entry procedures or serve as standby attendants. All confined spaces are initially considered permit required. Under certain conditions, a space may be reclassified as a non-permit confined space provided the HSO approves the reclassification and the space meets the criteria outlined in Shaw's Confined Space Entry Procedure, HS300.

4.3.8 Fire Prevention and Protection

Clothes, cotton waste, and other combustible materials that might constitute a fire hazard will be placed in closed metal containers and placed outside or destroyed at the end of each day. Shaw will provide and maintain portable fire extinguishers in the following manner:

Portable fire extinguishers will be provided, where needed, and inspected on a monthly basis. A visual inspection will be made to ensure that extinguishers are fully charged and in an operable condition.

Hoses, nozzles, brackets, and supports will be inspected for deficiencies and corrected. Gauge pressure will be checked on pressurized units on a monthly basis to ensure units are fully charged

and non-pressurized units will have their cartridges weighed on an annual basis. The chemical within dry chemical extinguishers will be inspected on an annual basis to ensure that it is powdery and in a free-running condition. An inspection tag will be attached to all extinguishers to designate that they have received an annual inspection. Fire extinguishers will be suitably placed, distinctly marked, and readily accessible.

A fire extinguisher with a rating of not less than 10-B will be located within 50 feet or wherever more than 5 gallons of flammable gas are being used on the work site (this does not apply to integral fuel tanks of motor vehicles).

A fire extinguisher with a rating of not less than 20-B will be located outside of and within 10 feet of the door opening into any room, building, or trailer used for storage of more than 60 gallons of flammable or combustible liquids.

If flammable liquids are being stored in an outside location, at least one portable fire extinguisher with a rating of not less than 20-B will be located at least 25 feet from the storage area, but not more than 75 feet away.

All tank trucks or vehicles used for transporting and/or dispensing flammable or combustible liquids will have a portable fire extinguisher with not less than a 20-BC rating.

A portable fire extinguisher with a rating of not less than 20-BC will be placed within 50 feet of each service or fueling area.

Fire extinguishers will be placed in storage areas so they are capable of extinguishing materials being stored.

All fire extinguishers will be approved by a nationally recognized testing laboratory.

A fire extinguisher with a rating of not less than 2-A will be provided where torches or open flames are in use.

At least one dry chemical or carbon dioxide fire extinguisher, with a 5-BC rating minimum, will be available for placement on each unit of heavy equipment, and each site vehicle (excluding rental cars).

Fuel handling is another hazard which will be present during this task. Refueling of the mechanical equipment poses burn hazards. All refueling and fuel handling equipment must be Underwriters Laboratories (UL) listed and Factory Mutual (FM) approved. The refueling must be done in a designated area to prevent contamination from minor spills and to reduce the risk of fires. The following guidelines must be followed whenever personnel are dispensing flammable and combustible liquids:

Flammable liquid dispensing systems will be electrically bonded and grounded. All tanks, hoses, and containers of 5 gallons or less will be kept in metallic contact while flammable liquids are being transferred; transfer of flammable liquids in containers in excess of 5 gallons will be done only when the containers are electrically bonded.

Flammable or combustible liquids will be drawn from, or transferred into, vessels, containers, or tanks within a building or outside only through a closed piping system, from safety cans, by means of a device drawing through the top, or from a container, or portable tanks, by gravity or pump, through an approved self closing valve. Transferring by means of air pressure on the container or portable tanks is prohibited.

Areas in which flammable or combustible liquids are transferred in quantities greater than 5 gallons from one tank or container to another will be separated from other operations by at least 25 feet or a barrier having a fire resistance of at least 1 hour. Drainage or other means will be provided to control spills.

Natural or mechanical ventilation will be provided to maintain the concentration of flammable vapor at or below 10% of the lower explosive level.

Dispensing units will be protected against collision damage.

Dispensing nozzles and devices for flammable liquids will be of an approved type.

Lamps, lanterns, heating devices, and similar equipment will not be filled while hot: these devices will be filled only in well-ventilated rooms free of open flames or in open air and shall not be filled in storage buildings.

4.3.9 Electrical Power

All electrical equipment must have a ground fault circuit interrupter (GFCI) as part of the circuit. All equipment must be suitable and approved for the class of hazard. Temporary wiring conductors installed for operation of construction tools and equipment will be either Type TW or THW contained in metal raceways, or will be hard usage or extra hard usage multiconductor cord. Temporary wiring will be secured above the ground or floor in a workmanlike manner and will not present an obstacle to persons or equipment. Applicable OSHA standards for electrical power, 29 CFR 1926 Subpart K, shall apply.

4.3.10 Ladder Safety

The following safe work practices will be adhered to during use of ladders:

- Assess work areas for fall hazards. A fall protection system is required if work is conducted 6 feet or over.

- Use Type 1A rated ladders.
- Make sure ladder rungs are sturdy and free of cracks.
- Use ladders with secure safety feet.
- Pitch ladders at a 4:1 ratio.
- Secure ladders at the top or have another person at the bottom to help stabilize it.
- Ladders used to access an upper landing surface shall extend at least three (3) feet above the upper landing surface.
- Use non-conductive ladders near electrical wires.
- The top step of a stepladder should not be used as a step.
- Do not carry any object or load that could cause a loss of balance or a fall.

4.3.11 Manual Material Lifting

Many different types of objects may be handled manually during site operations. Care should be taken when lifting and handling heavy or bulky items because they are the cause of many back injuries. The following fundamentals address the proper lifting techniques that are essential in preventing back injuries:

The size, shape, and weight of the object to be lifted must first be considered. No individual employee is permitted to lift any object that weights over 60 pounds. Multiple employees or the use of mechanical lifting devices are required for objects over the 60-pound limit. The anticipated path to be taken by the lifter should be inspected for the presence of slip, trip, and fall hazards.

The feet shall be placed far enough apart for good balance and stability (typically shoulder width). THE FOOTING SHALL BE SOLID. The worker shall get as close to the load as possible. The legs shall be bent at the knees. The back shall be kept as straight as possible and abdominal muscles should be tightened.

To lift the object, the legs are straightened from their bending position.

A worker shall never carry a load that cannot be seen over or around.

When placing an object down, the stance and position are identical to that for lifting. The legs are bent at the knees and the object lowered.

When two or more workers are required to handle the same object, coordination is essential to ensure that the load is lifted uniformly and that the weight is equally divided between the individuals carrying the load. When carrying the object, each worker, if possible, shall face the direction in which the object is being carried. In handling bulky or heavy items, the following guidelines shall be followed to avoid injury to the hands and fingers:

A firm grip on the object is essential; leather gloves shall be used if necessary.

The hands and object shall be free of oil, grease, and water which might prevent a firm grip, and the fingers shall be kept away from any points that could cause them to be pinched or crushed, especially when setting the object down.

The item shall be inspected for metal slivers, jagged edges, burrs, and rough or slippery surfaces prior to being lifted.

4.3.12 Clearing - General Practices

If personnel are clearing brush using machetes, the following rules apply:

When employees are using a machete to clear the area, no one is permitted within 30 feet of the person swinging the machete.

Personnel will be instructed to not stand with their backs toward the active machete work area.

All personnel must wear leg chaps and wrist thongs and be familiar with the use of a machete.

When trees are being felled, the following rules must be adhered to:

Before beginning the operation, alert all personnel in the area that the operation is about to commence. Then check that the area around the landing point of the tree is clear. Use a spotter to make sure that area remains clear.

Check that there are no overhead power lines or obstructions that may catch or deflect the tree as it falls.

Never turn your back on the tree while it is being felled.

Watch for kickback from the saw and do not force the saw if it becomes stuck in the tree.

Make use of wedges to insure fall direction and prevent saw binding on larger diameter trees.

4.3.13 Lockout/Tagout of Hazardous Energy Sources

Lockout/tagout procedures will be implemented to assure the safety of personnel during servicing or maintenance of machines and equipment where the unexpected release of stored energy or the energization of these machines or equipment could cause employee injury. These procedures are contained in Shaw Procedure HS315—Control of Hazardous Energy and Hazardous Material Sources (Lockout/Tagout) and comply with the requirements established in 29 CFR 1926.417. All portable electrical equipment and extension cords shall be protected with a GFCI as part of the circuit. The applicable requirements found in 29 CFR 1926, Subpart K, *Electrical* shall be implemented.

Subcontractors may implement their own lockout/tagout procedure if the SHM has approved its use and verifies that it is no less protective than the Shaw procedure.

4.3.14 Vehicle Safety Management

Motor vehicle incidents are the number one cause of occupational fatalities, accounting for one in three deaths. Fifty percent or more of vehicle safety incidents occur while backing up. Shaw employees involved in the operation and use of Shaw and/or leased or rented vehicles will comply with the ***Shaw Motor Vehicle/Commercial Vehicle Operation and Maintenance Procedures*** (HS800/810). Shaw requires employees to use seat belts at all times when traveling in Shaw owned or leased/rented vehicles. The SS and/or HSO will develop a parking area plan, including backing vehicles into parking spaces, using spotters for backing vehicles and policy mandated vehicle inspections.

All Shaw E&I personnel and subcontractors shall obey all vehicle traffic safety requirements imposed by local and state agencies. Designated routes for parking and truck traffic relating to construction activities must be established before doing the work. An emergency contact person must be established before work to ensure proper notifications in the event of an incident.

Shaw employees are expected to incorporate safe actions and preparations to avoid vehicle accidents and personal injury during work and off-hours. Breaks should be planned into lengthy job mobilizations and demobilizations, including rotation of drivers at regular intervals. If parking areas are busy or crowded and more than one worker is traveling in the same vehicle, one worker should remain outside the vehicle as it leaves the parking space to assist the driver with traffic observation. Vehicles traveling before dawn and at dusk in rural or wooded areas should be prepared to brake for wildlife, e.g. deer crossing roadways.

Shaw employees arriving at work areas should park vehicles away from delivery, heavy equipment and vehicle loading/unloading locations to prevent parked vehicles from damage by various deliveries. Heavy EOs should inspect areas and request vehicles to be moved or spotters

used if necessary, to maneuver equipment in tight areas. Employees who observe near misses or potential risks to parked or moving vehicles must report these to the SS or HSO immediately.

Shaw employees are expected to use the vehicle inspection form and check/test the safety systems on the vehicle on a daily basis. Check the following: brakes, mirrors, seat belts, tires, leakage from the undercarriage, lights and turn signals. Vehicles with safety deficiencies must be reported immediately and not driven until properly repaired. Vehicles running errands from different project sites should have telephone numbers of the job site in the vehicle in case calls for assistance are required.

Because of the different ways alcohol can affect behavior, even in very small amounts, the best and safest course is not to drink before driving. At Shaw, a driver with blood alcohol concentration over 0.04% is considered to be under the influence and subject to disciplinary action. Personnel involved in motor vehicle incidents are subject to drug and alcohol testing.

Weather conditions can have a profound effect on driving. On slippery roads, drive more slowly. Stop and turn with care. Keep several car lengths from other vehicles. At speeds in excess of 35 miles per hour (mph), the chances of hydroplaning increase with speed. In general, keep back 1 car length for every 10 mph to prevent striking the car ahead.

Vehicles will be operated in accordance with the requirements listed below:

- Seatbelt use is mandatory for all passengers;
- Personnel may not ride in the back of cargo vehicles;
- The driver must make a 360 degree walk around the assigned vehicle prior to vehicle movement;
- A ground guide is used to back up any vehicle;
- Vehicle speed is limited to the posted speed limits for developed roadways, 25 mph maximum on dirt roads and 10 mph maximum off-road (based on conditions);
- Vehicle driven in four wheel low and low gear when on dirt roads or off road driving where steep grades dictate;
- All operators must possess a valid drivers license;
- Fuel or gasoline are not transported inside the passenger compartment;
- No vehicle is left running when unattended; and
- Parking brakes are used when vehicles are parked.

In the event of a vehicle incident, notify your Site Supervisor ***immediately*** and complete all required reports.

4.3.15 Heavy Equipment Safety

There may be various types of heavy construction equipment that Shaw may be using during the execution of this project. All operators of this equipment will be familiar with the requirements for inspection and operation of the equipment they will be using. Before equipment is placed into use, it will be inspected by the operator to ensure that it is in safe operating condition. The following guidelines will be adhered to while operating heavy construction equipment:

- Equipment will not be operated in a manner that will endanger persons or property nor will the safe operating speeds or loads be exceeded.
- Getting off or on any equipment while it is in motion is prohibited.
- Use the three-point contact rule when getting on and off of equipment.
- Always clear the tracks with debris to ensure good footing and to prevent slippage, especially in wet conditions.
- Spotters will be used to back-up equipment and direct traffic in all "blind" areas.
- Equipment will be operated in accordance with the manufacturer's instructions and recommendations.
- Determinations of road conditions and structures will be make in advance to assure that clearances and load capacities are safe for the passage of equipment.
- All machinery or equipment will be shut down and positive means taken to assure that clearances and load capacities are safe for the passage of equipment.
- Bulldozer and scraper blades, end-loader buckets, dump bodies, and similar equipment will be either fully lowered or blocked when being done. Equipment designed to be services while running are exempt form this requirement.
- Bulldozer and scraper blades, end-loader buckets, dump bodies, and similar equipment will be either fully lowered or blocked when being repaired or when not in use. All controls shall be in a neutral position, with the engines stopped and brakes set, unless work being performed on the machine requires otherwise.
- No guard, safety appliance, or device will be removed from machinery or equipment, or made ineffective except for making immediate repairs, lubrications, or adjustments, and them only after the power has been shut off.

All guards and devices will be replaced immediately after completion of repairs and adjustments and before power is turned on.

- Mechanized equipment will be shut down prior to and during fueling operations. Closed systems, with automatic shut-off which will prevent spillage if connections are broken, may be used to fuel diesel powered equipment left running.
- Each bulldozer, scraper, dragline, crane, motor grader, front-end loader, mechanical shovel, backhoe, and other similar equipment will be equipped with at least one dry chemical or carbon dioxide fire extinguisher with a minimum rating of 5-B;C.
- Personnel will not work or pass under or ride in the buckets or booms of loaders in operations.
- All self-propelled construction equipment, whether moving alone or in combination, be equipped with a reverse signal alarm.
- Standard hand signals will be used to communicate between operators and ground crew.
- All heavy equipment will be equipped with operable seat belts; belts will be used by all operators.

4.3.16 Knife Safety

The following requirements will be adhered to for protection of employee cut injuries during sampling activities or other activities where knives are used:

- Ensure that hand knives are actually the most practical tool for the task. Where possible use the safest cutting tool for the job (e.g. scissors, snips or wire strippers).
- Cutting tools, such as scissors, snips, side cutters, etc., are also to be used in lieu of box cutters.
- If box cutters are determined to be the appropriate tool for the job, the only type that should be used are the designs that have a self retracting blade capability and employees must utilize appropriate PPE to allow for further protection
- If the knife happens to be the correct tool, keep the knife sharp and clean. A dull blade can cause accidents because more force is needed to cut an object. However, a knife or any other unprotected blade tool must be the last resort when choosing a cutting tool.
- Have a supply of either replacement knives and/or blades and make them readily available.

- Cut away from yourself, ending the knife stroke away from your body. Hold the item you're cutting firmly, and don't cut downwards and towards your body. Cut into the air or onto something hard.
- Confirm that appropriate PPE (e.g. gloves) specific to the task is available to employees and mandate the use of gloves when the possibility of injury exists.
- Personal knives (e.g. pocket knives) shall not be considered as a tool for any type of work-related cutting. This must be communicated to employees such that they are required to ask for a cutting tool from site / project / office supervision, thereby resulting in an additional review of using the right cutting tool for the job.
- Project / Site Managers must instruct Site Supervisors to inspect all material handling activities to assure that leather gloves are being used to protect hands.

There are many cutting tool manufacturers and they offer a variety of safety knives that are available for all types of cutting.

4.4 Biological Hazards

4.4.1 Ticks

Ticks are vectors of many different diseases, including Rocky Mountain spotted fever, Q fever, tularemia, Colorado tick fever, and Lyme disease. They attach to their host's skin and intravenously feed on blood, creating an opportunity for disease transmission. Covering exposed areas of the body and the use of tick repellent are two ways to prevent tick bites. Periodically during the workday, employees will inspect themselves for the presence of ticks. If a tick is discovered, the following procedure should be used to remove it:

- Do not try to detach a tick with bare fingers; bacteria from a crushed tick may be able to penetrate even unbroken skin. Fine-tipped tweezers should be used.
- Grip the tick as close to the skin as possible and gently pull it straight away from the skin until it releases its hold.
- Do not twist the tick while pulling, and do not squeeze its bloated body. That may actually inject bacteria into the skin.
- Thoroughly wash hands and the bite area with soap and water, and apply an antiseptic to the bite area.
- Save the tick in a small container and note the date, the body location of the bite, and where the tick came from.
- Notify the PSO of tick bites as soon as possible.

Recently, Lyme disease has been the most prevalent type of disease transmitted by ticks in the United States.

4.4.2 Poisonous Plants

Toxic plants are found among trees, shrubs, vegetables, and vines. The largest number of plant poisonings occurs from ingestion. However, the largest concern for field workers comes from contact poisons that are most irritating to the skin: poison ivy, poison oak, and poison sumac; all plants native to Oklahoma.

Poison Ivy

Physical Description. Poison ivy is a woody shrub or vine that climbs high in trees or along the ground, having alternate leaves with three leaflets. Small greenish flowers hang in clusters and form globe-shaped, yellowish, berry-like fruits. The leaf margins may be smooth or finely-toothed, or may be variously lobed.

Habitat. Poison ivy is found growing in rocky fields, pastures, thickets, woods, and waste places, often climbing trees, fences, and dwellings.

Symptoms. Contact results in a burning, itching rash that develops into broken blisters; the rash and blisters spread rapidly when scratched.

Treatment. Blisters may be drained, but tops should not be removed. Topical medication may be applied to the infected area.

Poison Oak

Physical Description. Poison oak is a perennial shrub with slender stems that are erect and woody, with one or a few erect branches. It does not climb nor does it have aerial roots. The leaves are three-parted on long erect stems, and found mostly near the top. The leaflets are found to be elliptic, rhombic, or obviate, and are hairy on the top surface and velvety beneath, with three to seven deep teeth, suggesting oak leaves. The fruit is greenish to buff and approximately 5 mm in diameter.

Habitat. Poison oak grows in dry barrens, sandy wastes, pine woods, and sandy woods.

Symptoms. Contact results in a burning, itching rash that develops into broken blisters; the rash and blisters spread rapidly when scratched.

Treatment. Blisters may be drained, but tops should not be removed. Topical medication may be applied to the infected area.

Poison Sumac

Physical Description. Poison sumac is a shrub or tree growing to 25 feet. It has compound leaves with 7 to 11 pointed leaflets without marginal teeth, and the leaf and leaflet stalks are reddish with clustered whitish fruits that resemble poison ivy.

Habitat. Poison sumac is found growing in the swamps of eastern North America.

Symptoms. Contact results in a burning, itching rash that develops into broken blisters; the rash and blisters spread rapidly when scratched. In severe cases, the infection covers the entire body, producing swelling and fever.

Treatment. Blisters may be drained, but tops should not be removed. Topical medication may be applied to the infected area.

If the work sites are located in areas where poisonous plants may be encountered, personnel should wear long pants, long sleeves, and gloves to minimize the possibility of exposure. In some areas, the use of a Tyvek® or other protective suit may be advisable.

4.4.3 Venomous Arthropods

Many of the organisms in the phylum Arthropoda can produce venomous bites. The black widow and brown recluse spiders are included in the phylum.

Black Widow Spider

Physical Description. The adult female is glossy black with short, almost microscopic hairs. Most female black widow spiders have a crimson hourglass marking on the underside of the abdomen. The spider reaches an overall length equal to 40 mm or 1.5 inches.

Habitat. The female spider is found with her web and egg sacs in protected places such as vacant rodent burrows and under stones, logs, long grass, hollow stumps, and brush piles. They are also found in dark corners of barns, stables, garages, and piles of boxes and crates.

Symptoms. After the bite, a dull, numbing pain in the affected extremity occurs. Also, pain and some muscular rigidity in the abdomen, back, and chest occur. The bite may also produce pain on inspiration (inhalation), headache, dizziness, skin rash, nausea, vomiting, anxiety, and weakness. Increased skin temperature over the affected area may be observed.

Treatment. Ice may be placed over the bite to reduce the pain. Seek immediate medical attention.

Brown Recluse Spider

Physical Description. The brown recluse is a spider of medium size (body 10 to 15 mm in length). It is brown in color, and the legs are long and lack unpaired claws.

Habitat. This spider is found outdoors under rocks and rubble.

Symptoms. After the bite, some localized pain develops within an hour. The bite area becomes swollen and skin temperature increases. The lesion has the appearance of a bull's eye and often becomes larger, ruptures, and leaves an ulcer that may involve underlying tissues, including muscle. Systemic symptoms and signs may develop, including nausea and vomiting.

Treatment. Ice may be placed over the bite to reduce the pain. Seek immediate medical attention.

4.4.4 Snakes

The degree of toxicity resulting from snakebites depends on the potency of the venom, the amount of venom injected, and the size of the person bitten. Poisoning may occur from injection or absorption of venom through cuts or scratches. The most effective way to prevent snakebites is to avoid snakes. Personnel should avoid walking at night or in high grass and underbrush. Visual inspection of work areas should be performed prior to activities. The use of leather boots and long pants will be required, since more than half of all bites are on the lower part of the leg. No attempts at killing snakes should be made; many people are bitten in these attempts.

If someone is bitten by a potentially poisonous snake, the following treatment should be initiated:

- Keep patient calm
- Notify emergency medical services (EMS)
- Wash the wound and keep the affected body part still
- Apply direct pressure to site of bite if bleeding is extreme
- Keep the affected area lower than the heart
- Carry a victim who must be transported, or have him/her walk slowly
- Transport to closest medical facility

If work sites at LHAAP are such that the possibility of encountering snakes exists, all personnel shall be cautioned to be alert. Should a snake bite occur, attempts should be made to kill the snake for positive identification. The victim should be transported to the nearest hospital within 30 minutes. Snake venoms are complex and include proteins, some of which have enzymatic activity. The effects produced by venoms include neurotoxic effects with sensory, motor, cardiac, and respiratory difficulties; cytotoxic effects on red blood cells, blood vessels, heart

muscle, kidneys, and lungs; defects in coagulation; and effects from local release of substances with enzymatic actions. Other noticeable effects of snake bites include swelling, edema, and pain around the bite, and the development of ecchymosis (the escape of blood into tissues from ruptured blood vessels).

4.4.5 Rodents

Rodents, such as rats and deer mice, can potentially carry hantavirus. Rats differ from related mice by their larger size and teeth. Deer mice, such as mesas, usually live at higher elevations, and can be distinguished from other rodents by their small size (2 4/5 inches to 4 inches long) and by their bicolored tail. However, the Centers for Disease Control believes that other rodents also have the potential to carry the virus, so precautions must be taken when dealing with any species of rodent. It is not possible to distinguish whether a rodent carries the hantavirus by observation.

Hantavirus affects the respiratory system in humans. The first symptoms of infection can occur at any time up to 45 days after exposure, and includes one or more of the following: fever, muscle aches, headache, or coughing. These symptoms progress rapidly into a severe lung disease that often requires intensive care treatment. Hantavirus can be transferred to humans, primarily from breathing infected rodent excreta particles that have become airborne or ingesting excreta particles that cling to hands or clothing. It can also be contracted from rodent bites or transferred through broken skin. Though the illness caused by hantavirus is severe, it is relatively rare and can be prevented by simple precautions and common sense.

The best way to avoid contact with the hantavirus is to avoid contact with rodents and their excreta. Do not leave food or garbage where rodents have access to them; this includes leaving food items and wrappers in vehicles. When possible, seal any opening greater than ¼ inch diameter with steel wool to prevent rodent access in vehicles or structures.

Minor amounts of rodent excreta and rodents caught in mouse traps may be disposed of by personnel, provided precautions are taken. A suggested procedure is:

- When excreta or dead rodents are discovered in an enclosed area, ventilate the area for 30 minutes; the more air flow the better.
- Wear the proper PPE.
- Implement dust suppression techniques (such as use of a “bug” sprayer filled with water and a small amount of detergent to lightly spray the floor prior to entry).
- To dispose of wastes, place the rodent excreta or dead rodents in a plastic bag. Rinse gloved hands with bleach solution of 1 part bleach or 10 parts water, then doff any PPE in proper order, placing disposable items such as boot covers and respirator cartridges, in with the wastes. Place the respirator, if any,

into a plastic bag, and mark the bag as "POTENTIALLY INFECTIOUS." Wet the wastes with the bleach solution, seal the plastic bag, place it into a second bag, and seal this bag also. Spray the outside of the plastic bag with commercial spray disinfectant. The waste may be disposed of as regular garbage.

- After the wastes are properly bagged, spray the surfaces where the wastes originally were found with disinfectant.
- Thoroughly wash hands, face, and forearms with soap and water.

4.4.6 Scorpions

Several species of scorpions are found in the south. Only one species, the Bark Scorpion, is regarded as life threatening. The Bark Scorpion may be distinguished from other less toxic species by its more slender tail segments and pincers. Reaching only 1.5 inches at maturity, it is a relatively small scorpion. Scorpions are relatively inactive during the daylight hours. The majority of scorpion bites occur at night during warm summer months. The most effective way to prevent scorpion bites is to avoid conducting work at night, visually inspect work areas prior to activities, and protect hands and legs by wearing the proper PPE.

Symptoms. Scorpion stings can cause immediate local pain with minimal swelling. Numbness and tingling are frequently reported. The injured area may be hypersensitive to touch, pressure, heat, and cold. Small children are at highest risk, as demonstrated by "roving eye" symptoms and hyperactivity.

Treatment. Most scorpion stings can be treated in the field. Clean the bitten area with soap and press a cool compress on the sting. Elevate the stricken limb to the approximate heart level. Take an analgesic to relieve minor pain, as needed. If symptoms are severe, seek immediate medical assistance at an emergency room or urgent care facility.

4.5 Explosive Hazard

Explosive materials produced and handled at LHAAP included cyclonite, TNT, and black powder, rocket propellants, and pyrotechnics. Rocket propellants contained a rubber binder, an oxidizer (ammonium perchlorate), and a powdered aluminum fuel. Pyrotechnics were generally composed of sodium nitrate, magnesium powder, and a binder. The sites of explosive concern include Sites 29, 46, and 47.

Avoidance will be practiced if explosive materials or objects are suspected or encountered. All work will be immediately halted, personnel will move upwind away from the suspected material, and the Shaw PM will be immediately notified for further instructions. Work shall not be resumed until clearance has been obtained for the specific sampling location or a different sampling location is selected with no visible explosive concern.

4.6 Task-Specific Activity Hazard Analyses

The AHA for primary tasks provides a breakdown of the hazards and control measures for each principal task. Pre-mobilization AHA are located in **Attachment 5** of this HASP and are general in nature. They must be made project specific prior to each task by the SS who must list specific equipment and any changes to principle steps. The AHA will be field-checked by the superintendent on an ongoing basis and will be revised as necessary. Revisions will be communicated to the work crew and posted to **Attachment 5** of this plan.

5.0 Site Control and Work Zones

To prevent migration of contamination caused through tracking by personnel or equipment, work zones and PPE are clearly specified prior to beginning field operations. Shaw has designated work zones as suggested by *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities* (National Institute for Occupational Safety and Health [NIOSH], 1985). Each work site will be divided into three zones as follows:

- Exclusion (or "hot") zone
- Contamination reduction zone
- Support zone

A site map will be on site identifying the following:

- Exclusion zone
- Work staging areas
- Contamination reduction zone
- Location of alarms
- Location of emergency response equipment
- Site access control points (entrances and exits)
- Evacuation routes
- Location of telephones

5.1 Exclusion Zone

The exclusion zone (EZ) is the area suspected of contamination and presents the greatest potential for worker exposure. Personnel entering the area must wear the mandated level of protection for that area. In certain instances, different levels of protection will be required depending on the tasks performed and air monitoring results obtained within that zone. The EZ will be demarcated using barrier tape and/or high-visibility fencing. The PSO will establish the EZ for each task/operation. The EZ boundary will be posted with signs to warn on-site personnel of the construction, safety, and health hazards, and to keep unauthorized personnel out of the EZ.

5.2 Contamination Reduction Zone

The contamination reduction zone (CRZ) or transition zone will be established between the EZ and Support Zone (SZ). In this area, personnel will begin the sequential decontamination process required to exit the EZ. To prevent off-site migration of contamination and for personnel accountability, site personnel will enter and exit the EZ through the CRZ.

5.3 Support Zone

The SZ serves as a clean control area. Operational support facilities are located within the SZ. Normal work clothing and support equipment is appropriate in this zone. Contaminated equipment or clothing will not be allowed in the SZ. The support facilities should be located upwind of site activities. There will be a clearly marked controlled access point from the SZ into the CRZ and EZ that is monitored closely by the PSO and the SS to verify that proper safety protocols are followed.

5.4 Site Control Log

A log of personnel visiting, entering, or working on the site will be maintained at the site by the PSO. The log will list the time, date, company or agency, and name of persons entering or exiting the site.

5.5 Safe Work Practices

The following items are requirements to protect the health and safety of workers and will be discussed in the safety briefing prior to initiating work on the site.

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of contaminants is prohibited in the site area.
- Hands and face must be washed upon leaving the site and before eating, drinking, chewing gum or tobacco, smoking, or other activities that may result in ingestion of contaminants.
- During site operations, each worker will consider himself as a safety backup to his partner. Off-site personnel provide emergency assistance. Site personnel will be aware of dangerous situations that may develop.
- Visual contact will be maintained between buddies on site when performing hazardous duties.
- No one will be admitted to the site without the proper safety equipment, training, and medical certification.
- Personnel must comply with established safety procedures. Any staff member who does not comply with safety policy as established by the PSO or the SS may be immediately dismissed from the site.
- Proper decontamination procedures must be followed before leaving the site.
- Employees and visitors must sign in and out of the site.

5.6 Visitor Access

Visitors should check in immediately upon arrival. Only authorized visitors will be allowed access to the contaminated areas. **Visitors and subcontractors with access to contaminated areas must submit proof of current 40-Hour OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) Training and current medical certification** to the Shaw PSO. Each visitor will be required to provide and wear the necessary protective equipment during the visits and shall be escorted by Shaw personnel. Visitors, subcontractors, and personnel entering the site area will be required to sign a safety plan acknowledgement form to certify that they have read, understand, and will comply with the HASP.

Failure to comply with this site entry procedure will result in expulsion from the site. A visitor's log will be kept by the SS or his designee.

5.7 Buddy System

A "buddy system" will be implemented when conditions represent a risk to personnel that can be either physical or chemical. A buddy system requires that two or three people work as a team, each looking out for the other. "Buddies" must always be in each other's line of sight and should maintain verbal or visual communication. No one must enter into the site area alone because hazards are likely to exist, which could render the employee helpless and prevent self-rescue.

5.8 Site Communications

On-site communications will be established between site work zones and will consist of verbal communications or line-of-sight observations. Off-site communications will be established in the site area to summon off-site emergency services and will consist of either on-site cellular telephones or identification of the nearest telephone to the site. (Air horns will be available for emergency conditions in the site area.)

5.9 Health and Safety Inspections

The PSO, SS, and/or designee will perform regular health and safety inspections. A report including results of the inspection and any corrective actions taken will be placed in the project files, with a copy sent to both the client representative and the HSO.

5.10 Accident Investigation

All injuries including cases that require only minor first aid will be reported in accordance with *Health & Safety Program, Volumes I & II,* SOP HS020 (Shaw, 2003). All first aid cases, near miss incidents, occupational injuries or illnesses, and vehicle and equipment damage must be investigated.

6.0 Protective Equipment

This section specifies the levels of PPE, which are or may be required for each principal activity performed at this site. Site personnel must be trained in the use of PPE. The PPE program contained in *Health & Safety Program, Volumes I & II,* SOP HS600 (Shaw, 2003) will be applied to project activities. The use and maintenance of respiratory protection is specified in SOP HS601 (Shaw, 2002).

6.1 Anticipated Protection Levels

The protection levels shown in **Table 6-1** have been established for the site work activities based on the information provided in TO DS02 concerning the level of site contaminants and the scope of work. Results of site air monitoring and visual inspection of the work activities may indicate the need for changes in PPE level(s).

Table 6-1
Personal Protective Equipment

Task	Initial PPE Level	Upgrade PPE Level	Skin Protection	Level C Respiratory Protection	Other PPE
Mobilization/ site preparation	D	—	Coveralls, work gloves	None	Hard-hat, steel-toe work boots, safety glasses, and hearing protection > 85 dBA
Monitoring well installation	D+	C	Tyvek® suit, surgical gloves (minimum of two pairs)	APR with acid gases/organic vapors/P100 filter cartridge	Hard-hat, steel-toe work boots, and hearing protection >85 dBA
Survey wells	D	D+	Tyvek® suit, nitrile gloves, surgical inner gloves	None	Hard-hat, steel-toe work boots, safety glasses, hearing protection >85 dBA
Soil excavation	D+	C	Tyvek® suit, nitrile gloves, surgical inner gloves	APR with acid gases/organic vapors/P100 filter cartridge	Hard-hat, steel-toe work boots, safety glasses
Groundwater/soil/ surface water/ sediment sampling and analysis	D+	C	Tyvek® suit, nitrile gloves, surgical inner gloves	APR with acid gases/organic vapors/P100 filter cartridge	Hard-hat, steel-toe work boots, safety glasses
XRF Survey	D	D+	Tyvek® suit, nitrile gloves, surgical inner gloves	None	Hard-hat, steel-toe work boots, safety glasses, hearing protection >85 dBA
Equipment decontamination	D+		PVC rain suit or Tyvek® coveralls	None	Hard-hat, steel-toe work boots, goggles/face shield, latex gloves, latex boots, and hearing protection >85 dBA
General site activities	D	—	None	None	Hard-hat, steel-toe work boots, safety glasses, and hearing protection > 85 dBA

Abbreviations:
APR air-purifying respirator *PPE personal protective equipment* *XRF x-ray fluorescence*
dBA decibels, A-scale *PVC polyvinyl chloride*

6.2 Protection Level Descriptions

This section lists the minimum requirements for each protection level. Modification to these requirements may have been noted above.

6.2.1 Level D

Level D consists of the following:

- Safety glasses with side shields
- Hard hat
- Safety-toe work boots
- Work clothing as prescribed by weather

6.2.2 Modified Level D

Modified Level D (D+) consists of the following:

- Safety glasses with side shields
- Hard hat
- Safety-toe work boots
- Nitrile, neoprene, or polyvinyl chloride (PVC) gloves over latex sample gloves
- Tyvek® coverall

6.2.3 Level C

Level C consists of the following:

- Full-face, air-purifying respirator with organic vapors/acid gases cartridge P100 filter cartridges
- Tyvek® coveralls (polyethylene-coated Tyveks® required when workers have a potential to be exposed to contaminated liquids or sludges)
- Hard hat
- Steel-toe work boots (use PVC overboots when the potential for exposure to contaminated liquids/sludges exist)
- Nitrile, neoprene, or PVC gloves over latex sample gloves

6.3 Respiratory Protection Program

Respiratory protection is an integral part of employee health and safety at hazardous waste sites where contamination is present or suspected. Respiratory protection is further discussed in *Health & Safety Program, Volumes I and II*, HS600 (Shaw, 2003).

The site respiratory protection program will consist of the following:

- All site personnel who may use respiratory protection will have an assigned respirator.
- All site personnel who may use respiratory protection will have been fit-tested and qualified in the use of an air-purifying/air-supplied respirator within the past 12 months.
- All site personnel who may use respiratory protection must within the past year have been medically certified as being capable of wearing a respirator. Documentation of the medical certification must be provided to the PSO, prior to commencement of site work.
- Only cleaned, maintained, NIOSH/Mine Safety and Health Administration-approved respirators are to be used on this site.
- If full-face air purifying respirators are used, the respirator cartridge is to be properly disposed of at the end of each work shift, or when load-up or breakthrough occurs.
- All site personnel who may use respiratory protection will be clean-shaven. Mustaches and side burns are permitted, but they must not touch the sealing surface of the respirator.
- Respirators will be inspected, and a positive negative pressure test performed prior to each use.

After each use, the respirator will be wiped with a disinfectant, cleansing wipe. When used, the respirator will be thoroughly cleaned at the end of the work shift. The respirator will be stored in a clean plastic bag.

6.4 Air-Purifying Respirators

A NIOSH-approved full-face (Survivair) respirator with appropriate air purifying cartridges will be used for Level C work. The crew members working in Level C will wear respirators equipped with organic vapors/acid gases cartridge/P100 filter air-purifying cartridges approved for organic vapors, chlorine, hydrogen chloride, chlorine dioxide or sulfur dioxide, hydrogen fluoride or hydrogen sulfide (escape only), and at least 99.97% efficiency against all types of particulate aerosols.

6.5 Respirator Cartridges

The crew members working in Level C will wear respirators equipped with air-purifying cartridges approved for the following contaminants:

- Organic vapors <1,000 parts per million (ppm)
- Chlorine gas <10 ppm

- Hydrogen chloride <50 ppm
- Sulfur dioxide <50 ppm
- Dusts, fumes, and mists with a threshold limit value <0.05 mg/m^3
- Asbestos-containing dusts and mists
- Radionuclides

6.6 Cartridge Changes

All cartridges will be changed a minimum of once weekly or more frequently if personnel begin to experience increased inhalation resistance. The project CIH will establish a cartridge changeout schedule if air monitoring indicates action levels requiring respirator protection are achieved (see **Section 8.0**).

6.7 Inspection and Cleaning

Respirators are checked periodically by the PSO and inspected before each use by the wearer. Respirators and associated equipment will be decontaminated and hygienically cleaned after use.

6.8 Fit Testing

Annual respirator fit tests are required of personnel wearing negative pressure respirators. The test will utilize isoamyl acetate or irritant smoke. The fit test must be for the style and size of the respirator to be used. Additionally, a positive and negative fit test shall be conducted each time a respirator is donned.

6.9 Facial Hair

No personnel who have facial hair that interferes with the respirator's sealing surface will be permitted to wear a respirator.

6.10 Corrective Lenses

Normal eyeglasses cannot be worn under full-face respirators because the temple bars interfere with the respirator's sealing surfaces. For workers requiring corrective lenses, special spectacles designed for use with respirators will be provided.

6.11 Medical Certification

Only workers who have been certified by a physician as being physically capable of respirator usage will be issued a respirator. Personnel unable to pass a respiratory fit test or without medical clearance for respirator use will not be permitted to enter or work in areas on-site that require respiratory protection. Employees receive a written physician's opinion that they are fit for general hazardous waste operations as per 29 CFR 1910.120(f)(7).

7.0 Decontamination Procedures

This section describes the procedures necessary to ensure that both personnel and equipment are free from contamination when they leave the work site. A step-by-step description of decontamination procedures for Level D Modified and C has been delineated below.

Air monitoring instruments may be wrapped while using them in the EZ to avoid contamination in very messy conditions. Where conditions are relatively clean, instruments may be wiped down with a damp cloth in the CRZ.

7.1 Personnel Decontamination

Decontamination of personnel shall be performed to ensure that any material that personnel may have contacted in the EZ is removed in the CRZ. All personnel will use the CRZ decontamination sequence listed below during egress from the CRZ.

PPE removed from the decontamination corridor will either be decontaminated or properly bagged to contain any contamination. All used disposable clothing will be placed in polyethylene bags, identified, dated, and stored at the property site pending disposal. Waterproof, non-disposable PPE will be properly decontaminated. Decontamination of personnel exiting the EZ will utilize the following steps as appropriate to the specific work area:

Modified Level D

Step 1: Remove gross contamination from outer boots. Remove and stack boots.
Step 2: Remove outer gloves.
Step 3: Remove hard hat.
Step 4: Remove and discard outer suit.
Step 5: Remove and discard one pair of inner gloves in 55-gallon trash drum (when multiple pairs of inner gloves are used).
Step 6: Remove and discard inner suit (when used).
Step 7: Discard final pair of inner gloves into 55-gallon trash drum.
Step 8: Depart transition zone in work clothes and boots.
Step 9: Wash hands, face, and neck before breaks and lunch.

Level C

Step 1: Remove gross contamination from outer boots. Remove and stack boots.
Step 2: Scrub and remove outer gloves.
Step 3: Remove the hard hat.
Step 4: Remove and discard outer suit.
Step 5: Remove and discard one pair of inner gloves into 55-gallon trash drum (when multiple pairs of gloves used).

Step 6: Remove and discard inner suit (when used).
Step 7: Remove respirators and suitably store while on breaks and during lunch. At the end of shift, discard the cartridges and then clean, disinfect, rinse, and air dry the respirator.
Step 8: Discard final pair of inner gloves into 55-gallon trash drum.
Step 9: Depart transition zone in work clothes and boots.
Step 10: Wash hands, face, and neck before breaks and lunch

7.2 Personal Hygiene

Before eating, smoking, or drinking, personnel will wash hands, arms, neck, and face. Washing facilities with soap will be available in the SZ and in the CRZ.

7.3 Equipment Decontamination

Heavy equipment will be cleaned prior to leaving.

8.0 Air Monitoring

Air monitoring will be conducted in order to characterize personnel exposures and fugitive emissions from site contaminants. The principal contaminants of concern are listed in **Section 4.0** of this HASP. Results of air monitoring will be used to ensure the proper selection of protective clothing and equipment, including respiratory protection, to protect on-site personnel and off-site receptors from exposure to unacceptable levels of site contaminants. Descriptions of air monitoring strategies, procedures, and equipment are provided below. Modification of this plan, including additional monitoring, may be judged necessary by the CIH, in conjunction with the HSM, HSO, and PSO.

8.1 Work Area Air Monitoring

Work area air monitoring during site investigations at LHAAP will include direct reading methods as well as integrated sampling strategies. Air monitoring will be conducted during well installation and groundwater sampling activities.

During well installation, and groundwater sampling activities, direct reading air monitoring will be performed to determine exposure to workers. A summary of air monitoring information is provided in **Table 8-1**.

Table 8-1
Direct Reading Air Monitoring Summary

Monitoring Device	Monitoring Location/ Personnel	Monitoring Frequency	Action Level[a]	Action
PID/OVA (breathing zone)	Soil excavation and sampling, well installation, and groundwater sampling	At start-up, minimum four times daily in work area and breathing zone	>1 ppm for 5 minutes >5 ppm for 5 minutes	Test for benzene (colorometric detector tubes) Upgrade to Level C
LEL/O_2 meters	Soil excavation and sampling, well installation, and groundwater sampling	At start-up, minimum four times daily in work area.	>10% LEL <20.8% 0_2	Stop operations; allow vapors to vent <10% before continuing Upgrade to Level B
Colorometric detector tube (benzene)	Soil excavation and sampling, well installation, and groundwater sampling	Periodic when PID/OVA readings exceed action level	> 0.5 ppm benzene > 25 ppm benzene	Upgrade to Level C Upgrade to Level B

Notes and Abbreviations:

[a] *Sustain levels above background for 5 minutes in breathing zone*

ppm *parts per million*
PID/OVA *photo ionization detector/organic vapor analyzer*
LEL/O_2 *lower explosive limit/oxygen*

8.2 Instrumentation

The following is a description of the air monitoring equipment to be used at this site.

8.2.1 Lower Explosive Limit/Oxygen Meter

8.2.1.1 Types and Operational Aspects

- MSA Watchman LEL/Oxygen (O_2) Meter or equivalent
  - Principle of Operation
- Oxygen detector uses an electrochemical sensor and produces a minute electric current proportional to the oxygen content.
- CGIs use a combustion chamber containing a filament that ignites flammable vapors. The filament is heated or coated with a catalyst (platinum) to facilitate combustion.
- Filament is part of a balanced resistor circuit. Combustion in the chamber causes the filament temperature to increase which results in increased filament resistance.
- Change in the filament's resistance causes an imbalance in the circuit proportional to the percent of the LEL.
- At concentrations lower than the LEL, the meter will read the approximate percent of combustible atmosphere present.
- Concentrations greater than the LEL will have a meter response greater than 100% LEL. This type of response indicates the gas mixture is then in the flammable range, or is too rich to burn and is not combustible. The danger is that the addition of air to the gas mixture could bring it into the flammable range (less than the upper explosive limit) and an explosion will result.
- Oxygen meter set at the factory to alarm at 19.5% (oxygen deficient atmosphere). Combustible gas meter set by the user to alarm at 10% LEL.

8.2.1.2 Calibration Methods/Frequencies

Before the calibration of the CGI can be checked, the unit must be in operating condition. The CGI LEL is normally calibrated on pentane as representative of the flammability characteristics of most commonly encountered combustible gases. The meter scale is calibrated from zero to 100% LEL, which corresponds in actual volume concentrations of 0 to approximately 14% pentane in air. A booklet of response curves is supplied with the Watchman Meter. These curves may be used to interpret meter readings when sampling combustible gases other than pentane.

It is recommended that calibration be checked before and after using each time. The PSO will record and log such calibration information into an air monitoring notebook. The O_2 meter is calibrated by adjusting the O_2 control knob to 20.8% while the meter is operated in a fresh air atmosphere.

8.2.1.3 Preventive Maintenance

The primary maintenance of the unit is the rechargeable 2.4-volt nickel cadmium battery. Recommended charging time is 16 hours. It may be left on charge for longer periods without damaging the battery. The battery sometimes will not supply full power capacity after repeated partial use between charging. Therefore, it is recommended that the battery be exercised at least once a month by running for eight to 10 hours before recharge. If the instrument has not been used for 30 days, the battery should be charged prior to use.

8.2.2 Photoionization Detector

8.2.2.1 Type and Operational Aspects

Photovac Model 20/20 or equivalent

- Principle of Operation
  - Ionization potential (IP) – The energy required to remove the outermost electron from a molecule; measured in electron volts (eV); characteristic property of a specific chemical.
- Photoionization – Using ultraviolet (UV) light to remove the outermost electron from a molecule.
  - Energy of UV light (10.6, 9.5, 11.7 eV) must be equal to or greater than the IP to photoionize the molecule.
  - Fan or pump is used to draw air into the detector where the contaminants are exposed to a UV light source (lamp).
  - Ions are collected on a charged plate and produce a current directly proportional to the number of ionized molecules; current is amplified and displayed on the meter.

8.2.2.2 Calibration Method/Frequencies

The Photovac Model 20/20 is designed for trace gas analysis in ambient air and is calibrated at the manufacturer (HNU) with certified standards of benzene, vinyl chloride, and isobutylene. Other optional calibrations are available (e.g., ammonia, ethylene oxide, H_2S, etc.).

Shaw will use a photoionization detector with a 10.6 eV lamp. This lamp has been determined to be responsive to monitor the contaminants on site. Optional probes containing lamps of 9.5 and

11.7 eV are interchangeable in use within individual read-out assemblies for different applications.

It is recommended that calibration be checked twice each day (beginning and end of shift). The PSO will record and log such calibration information into an air monitoring notebook.

8.2.2.3 Preventive Maintenance

Maintenance of the Photovac Model 20/20 consists of cleaning the lamp and ion chamber, and replacement of the lamp or other component parts or sub-assemblies.

9.0 Emergency Response

9.1 Pre-Emergency Planning

Prior to engaging in investigation activities at the site, the Shaw Team will plan for possible emergency situations and have available adequate supplies and manpower to respond. In addition, site personnel will receive training during the site orientation concerning proper emergency response procedures. The Marshall Fire Department will be contacted when the magnitude of the anticipated emergency conditions warrant.

The situations shown in **Table 9-1** would warrant implementation of the Emergency Response and Contingency Plan (ERCP).

Table 9-1
Situations Warranting Implementation of the Emergency Response and Contingency Plan

Type Hazard	Hazard
Fire/explosion	• The potential for human injury exists • Toxic fumes or vapors are released • The fire could spread on-site or off-site and possibly ignite other flammable materials or cause heat-induced explosions • The use of water and/or chemical fire suppressants could result in contaminated run-off • An imminent danger of explosion exists
Spill or release of hazardous materials	• The spill could result in the release of flammable liquids or vapors, thus causing a fire or gas explosion hazard • The spill could cause the release of toxic liquids or fumes in sufficient quantities or in a manner that is hazardous to or could endanger human health
Natural disaster	• A rain storm exceeds the flash flood level • The facility is in a projected tornado path or a tornado has damaged facility property • Lightning • Severe wind gusts are forecasted or have occurred and have caused damage to the facility
Medical emergency	• Overexposure to hazardous materials • Trauma injuries (broken bones, severe lacerations/ bleeding, burns) • Eye/skin contact with hazardous materials • Loss of consciousness • Heat stress (heat stroke) • Cold stress (hypothermia) • Heart attack • Respiratory failure • Allergic reaction

The following measures will be taken to assure the availability of adequate equipment and manpower resources:

- Sufficient equipment and materials will be kept on site and dedicated for emergencies only. The inventory will be replenished after each use.
- On-site emergency responders will be current in regards to training and medical surveillance programs. Copies of all applicable certificates will be kept on file for on-site personnel required to respond.
- It will be the responsibility of the emergency coordinator (EC) to brief the on-site response team on anticipated hazards at the site. The EC shall also be responsible for anticipating and requesting equipment that will be needed for response activities.
- Emergency response activities will be coordinated with the Local Emergency Planning Committee (LEPC) in compliance with Superfund Amendments and Reauthorization Act Title III requirements.

Communications will be established with LEPC prior to commencement of any activities at the remediation site. Communication will be established so that responders on-site have access to pertinent information to allow them to conduct their activities in a safe and healthful manner. Air horns may be used to alert personnel of emergency conditions. A telephone will be located at the command post to summon assistance in an emergency.

Primary communication with local responders in the event of an emergency will be accomplished using commercial telephone lines.

9.2 Emergency Recognition and Prevention

Because unrecognized hazards may result in emergency incidents, it will be the responsibility of the SS and PSO, through daily site inspections and employee feedback (Safety Observation Program, daily safety meetings, and activity hazard analyses), to recognize and identify the hazards that may be found at the site. Potential hazards are shown in **Table 9-2**.

Table 9-2
Potential Hazards

Type Hazard	Hazard
Chemical	Materials at the site Materials brought to the site IDLH atmospheres
Physical	Fire/explosion Slip/trip/fall Electrocution Confined space Excessive noise
Mechanical	Heavy equipment Stored energy system Pinch points Electrical equipment Vehicle traffic
Environmental	Electrical storms High winds Heavy rain/snow Temperature extremes (heat/cold stress) Poisonous plants/animals

Abbreviations:
IDLH immediately dangerous to life or health

Once a hazard has been recognized, the SS and/or PSO will take immediate action to prevent the hazard from becoming an emergency. This may be accomplished by the following:

- Daily safety meeting
- Task-specific training prior to commencement of activity
- Lockout/tag-out
- PPE selection/use
- Written and approved permits for hot work, confined space
- Trenching/shoring procedure
- Air monitoring
- Following applicable Shaw standard operating procedures
- Practice drills for fire, medical emergency, and hazardous substance spills

9.3 Personnel Roles, Lines of Authority, and Communications

This section describes the various roles, responsibilities, and communication procedures that will be followed by personnel involved in emergency responses.

The primary EC for this site is the SS. In the event an emergency occurs and the EC is not on site, the PSO or the highest-ranking employee on site will serve as the EC until the SS arrives.

The EC will determine the nature of the emergency and take appropriate action as defined by the ERCP in **Section 9.7**. The EC will implement the ERCP immediately as required. The decision to implement the plan will depend upon whether the actual incident threatens human health or the environment. Immediately after being notified of an emergency incident, the EC or his designee, will evaluate the situation to determine the appropriate action.

9.3.1 Responsibilities and Duties

This section describes the responsibilities and duties assigned to the EC.

It is recognized that the structure of the "Incident Command System" will change as additional response organizations are added. Shaw will follow procedures as directed by the fire department, LEPC, state, and federal agencies as required. Shaw will defer to the local Fire Department Chief to assume the role of Incident Commander upon arriving on-site. Additional on-site personnel may be added to the Site Emergency Response Team as required to respond effectively.

9.3.2 On-Site Emergency Coordinator Duties

The on-site EC is responsible for implementing and directing the emergency procedures. Emergency personnel and their communications will be coordinated through the EC. Specific duties are as follows:

- Identify the source and character of the incident, type, and quantity of any release. Assess possible hazards to human health or the environment that may result directly from the problem or its control.
- Discontinue operations in the vicinity of the incident, if necessary, to ensure that fires, explosions, or spills do not recur or spread to other parts of the site. While operations are dormant, monitor for leaks, pressure build-up, gas generation, or ruptures in valves, pipes, or other equipment, where appropriate.
- Notify local emergency response teams if their help is necessary to control the incident. **Table 9-3** provides telephone numbers for emergency assistance.
- Direct on-site personnel to control the incident until, if necessary, outside help arrives.
- Verify that the building, or area where the incident occurred, and the surrounding area are evacuated, and shut off possible ignition sources, if appropriate. The emergency response team is responsible for directing site personnel such that they avoid the area of the incident and leave emergency control procedures unobstructed.
- If fire or explosion is involved, notify the Marshall Fire Department.
- Notify designated EC.

- Notify Shaw PM
- Have protected personnel, in appropriate PPE, on standby for rescue

If the incident may threaten human health or the environment outside of the site, the EC should immediately determine whether evacuation of the area outside of the site may be necessary and, if so, notify the Marshall Fire Department and the Office of Emergency Management.

When required, notify the National Response Center. The emergency telephone number for the National Response Center is 800-424-8802. The following information should be provided to the National Response Center:

- Name and telephone number
- Name and address of facility
- Time and type of incident
- Name and quantity of materials involved, if known
- Extent of injuries
- Possible hazards to human health or the environment outside of the facility

Table 9-3 provides emergency telephone numbers.

Table 9-3
Emergency Telephone Numbers

Emergency Contacts	Phone Numbers
Marshall Fire Department	911 or (903) 935-4580
Police Department	(903) 935-4525
Hospital – Marshall Regional Medical Center	(903) 927-6000
Regional Poison Control Center	(800) 552-4611
State Agencies (TCEQ)	(210) 490-3096
USEPA Region 6 (EPA Regional Branch Response Center)	(214) 665-2222
Agency for Toxic Substances and Disease Registry	(404) 639-0515 (24-hour)
Designated USACE Site Rep (Cliff Murray)	(918) 669-7573
Longhorn AAP Site Manager – Rose M. Zeiler	(479) 635-0110
U.S. Coast Guard	(804) 484-8192
National Response Center	(800) 424-8802
Chem-TEL	(800) 255-3924 (24-hour)
Project Manager – David Cobb	(617) 589-5561 (508) 667-3608 (cell)
Remediation Manager – Praveen Srivastav	(713) 996-4588 (281) 639-8743 (mobile)
Program HSM – Bob Brooks	(973) 770-5325
Program CIH – David Mummert	(419) 425-6129
Program HSO – Wayne Watson	(713) 996-4516 (409) 457-5805 (mobile)
Shaw H&S Help Desk (24-hour)	(866) 299-3445

Additional phone numbers are in Section 3.4 of this HASP.

If hazardous waste has been released or produced through control of the incident, ensure the following:

- Waste is collected and contained.
- Containers of waste are removed or isolated from the immediate site of the emergency.
- Treatment or storage of the recovered waste, contaminated soil or surface water, or any other material that results from the incident or its control is provided.
- Ensure that no waste that is incompatible with released material is treated or stored in the facility until cleanup procedures are completed.
- Ensure that emergency equipment used is decontaminated, recharged, and fit for its intended use before operations are resumed.
- Notify the USEPA Regional Administrator that cleanup procedures have been completed and that emergency equipment is fit for its intended use before resuming operations in the affected area of the facility. The USEPA Regional Administrator's telephone number is included in the emergency contacts above.
- Record time, date, and details of the incident, and submit a written report to the USEPA Regional Administrator. Report is due to USEPA within 15 days of the incident.

9.4 Safe Distances and Places of Refuge

The EC for all activities will be the SS. No single recommendation can be made for evacuation or safe distances because of the wide variety of emergencies that could occur. Safe distances can be determined only at the time of an emergency based on a combination of site and incident-specific criteria. However, the following measures are established to serve as general guidelines.

In the event of minor hazardous material releases (small spills of low toxicity), workers in the affected area will report initially to the site. Small spills or leaks (generally less than 55 gallons) will require initial evacuation of at least 50 feet in all directions to allow for cleanup and to prevent exposure. After initial assessment of the extent of the release and potential hazards, the EC or his designee will determine the specific boundaries for evacuation. Appropriate steps such as caution tape, rope, traffic cones, barricades, or personal monitors will be used to secure the boundaries.

In the event of a major hazardous material release (large spills of high toxicity/greater than 55 gallons), workers will be evacuated from the building/site. Workers will assemble at the entrance to the site for a head count by their foremen and await further instruction.

If an incident may threaten the health or safety of the surrounding community, the public will be informed and, if necessary, evacuated from the area. The EC or his designee will inform the proper agencies, if necessary. Emergency contact telephone numbers are listed in **Table 9-3**.

Places of refuge will be established prior to the commencement of activities. These areas must be identified for the following incidents:

- Chemical release
- Fire/explosion
- Power loss
- Medical emergency
- Hazardous weather

In general, evacuation will be made to the crew trailers unless the EC determines otherwise. It is the responsibility of the EC to determine when it is necessary to evacuate personnel to off-site locations. In the event of an emergency evacuation, employees will gather at the entrance to the site until a head count establishes that all are present and accounted for. No one is to leave the site without notifying the EC.

9.5 Evacuation Routes and Procedures

Emergencies require prompt and deliberate action. In the event of an emergency, it will be necessary to follow an established set of procedures. Such established procedures will be followed as closely as possible. However, in specific emergency situations the EC may deviate from the procedures to provide a more effective plan for bringing the situation under control. The EC is responsible for determining which situations require site evacuation.

9.5.1 Evacuation Signals and Routes

An air horn will be used to notify employees of the necessity to evacuate an area or building involved in a release/spill of a hazardous material. Total site evacuation will be initiated only by the EC; however, in his absence, decision to preserve the health and safety of employees will take precedence and may be initiated by the PSO, SS, foreman or other supervisor. Evacuation routes will be posted in each outside work area. Signs inside buildings will be posted on walls or other structural elements of a building. Periodic drills will be conducted to familiarize each employee with the proper routes and procedures.

9.5.2 Evacuation Procedures

In the event evacuation is necessary, the following actions will be taken:

- The emergency signal will be activated.
- No further entry of visitors, contractors, or trucks will be permitted. Vehicle traffic within the site will cease in order to allow safe exit of personnel and movement of emergency equipment.
- Shut off all machinery if safe to do so.
- On-site personnel, visitors, and contractors in the site area will assemble at the entrance to the site for a head count and await further instruction from the EC.
- Persons in the site area will be accounted for by their immediate crew leaders (e.g., foreman). Leaders will determine the safest exits for employees and will also choose an alternate exit if the first choice is inaccessible.
- During exit, the crew leader should try to keep the group together. Immediately upon exit, the crew leader will account for the employees in his crew.
- Upon completion of the head count, the crew leader will provide the information to the EC.
- Contract personnel and visitors will also be accounted for.
- The names of emergency response team members involved will be reported to the emergency spill control coordinator.
- A final tally of persons will be made by the EC or designee. No attempt to find persons not accounted for will involve endangering lives of Shaw or other employees by re-entry to emergency areas.
- In all questions of accountability, immediate crew leaders will be held responsible for those persons reporting to them. Visitors will be the responsibility of those employees they are visiting. Contractors and truck drivers are the responsibility of the SS. The security guard will aid in accounting for visitors, contractors, and truckers by reference to sign-in sheets available field office trailer.
- Personnel will be assigned by the EC to be available at the main gate to direct and brief emergency responders.
- Re-entry into the site will be made only after clearance is given by the EC. At his direction, a signal or other notification will be given for re-entry into the facility.

- Drills will be held periodically to practice all of these procedures and will be treated with the same seriousness as an actual emergency.

9.6 Emergency Spill Response Procedures and Equipment

In the event of an emergency involving a hazardous material spill or release, the following general procedures will be used for rapid and safe response and control of the situation. Emergency contacts found in **Table 9-3** provide a quick reference guide in the event of a major spill.

9.6.1 Notification Procedures

If an employee discovers a chemical spill or process upset resulting in a vapor or material release, he or she will immediately notify the on-site EC and the Marshall Fire Department. Report details of a release upon discovery to the Marshall Fire Department at phone number (903) 935-4580.

The on-site EC will obtain the following information:

- The material spilled or released
- Location of the release or spillage of hazardous material
- An estimate of quantity released and the rate at which it is being released
- The direction in which the spill, vapor, or smoke release is heading
- Injuries involved
- Fire and/or explosion or possibility of these events
- The area and materials involved and the intensity of the fire or explosion

This information will help the on-site EC to assess the magnitude and potential seriousness of the spill or release.

9.6.2 Procedure for Containing/Collecting Spills

The initial response to any spill or discharge will be to protect human health and safety, and then the environment. Identification, containment, treatment, and disposal assessment will be the secondary response.

If a chemical spill is not contained within a dike or sump area, an area of isolation will be established around the spill. The size of the area will generally depend on the size of the spill and the materials involved. If the spill is large (greater than 55 gallons) and involves a tank or pipeline rupture, an initial isolation of at least 100 feet in all directions will be used. Small spills (less than or equal to 55 gallons) or leaks from a tank or pipe will require evacuation of at least 50 feet in all directions to allow cleanup and repair, and to prevent exposure. When spill occurs, only those persons involved in overseeing or performing emergency operations will be allowed

within the designated hazard area. If possible, the area will be roped or otherwise blocked off. If the spill results in the formation of a toxic vapor cloud (by reaction with surrounding materials or by outbreak of fire) and its release (due to high vapor pressures under ambient conditions), further evacuation will be enforced. In general, an area at least 500 feet wide and 1,000 feet long will be evacuated downwind if volatile materials are spilled. (Consult the North American Emergency Response Guide for isolation distances for listed hazardous materials.)

If an incident may threaten the health or safety of the surrounding community, the public will be informed and possibly evacuated from the area. The on-site EC will inform the local Fire Department who will, in turn, inform the proper agencies in the event this is necessary (refer to **Table 9-3**).

As called for in regulations developed under the Comprehensive Environmental Response, Compensation, and Liability Act (Superfund), Shaw's practice is to report a spill of a pound or more of any hazardous material for which a reportable quantity has not been established and which is listed under the Solid Waste Disposal Act, Clean Air Act, Clean Water Act, or Toxic Substances Control Act. Shaw also follows the same practice for any substances not listed in the Acts noted above but which can be classified as a hazardous waste under the Resource Conservation and Recovery Act.

Cleanup personnel will take the following measures:

- Verify all unnecessary persons are removed from the hazard area.
- Put on protective clothing and equipment.
- If a flammable material is involved, remove all ignition sources and use spark and explosion-proof equipment for recovery of material.
- Remove all surrounding materials that could be especially reactive with materials in the waste. Determine the major components in the waste at the time of the spill.
- If wastes reach a storm sewer, try to dam the outfall by using sand, earth, sandbags, etc. If this is done, pump this material out into a temporary holding tank or drums as soon as possible.
- Place all small quantities of recovered liquid wastes (55 gallons or less) and contaminated soil into drums for incineration or removal to an approved disposal site.
- Spray the spill area with foam, if available, if volatile emissions may occur.
- Apply appropriate spill control media (e.g., clay, sand, lime, etc.) to absorb discharged liquids.

- For large spills, establish diking around leading edge of spill using booms, sand, clay, or other appropriate material. If possible, use a diaphragm pump to transfer discharged liquid to drums or holding tank.

9.6.3 Emergency Response Equipment

The following equipment will be staged in the site area and throughout the site, as needed, to provide for safety and first aid during emergency responses:

- ABC-type fire extinguisher
- First aid kit, industrial size
- Eyewash/safety shower
- Emergency signal horn

9.6.4 Personal Protective Equipment

Emergency response personnel will have respirators available for use with cartridge selection determined by the PSO, based on the results of direct reading instruments. Emergency response personnel will also be provided with protective clothing as warranted by the nature of the hazardous material and as directed by the PSO.

9.6.5 Emergency Spill Response Cleanup Materials and Equipment

A sufficient supply of appropriate emergency response cleanup and PPE will be inventoried and inspected visually on a weekly basis. The materials will be kept on-site for spill control depending on the types of hazardous materials present on-site. The majority of this material will be located in the supply trailer, or storage area.

Contaminated soils, absorbent materials, solvents, and other materials resulting from the cleanup of spilled or discharged substances shall be properly stored, labeled, and disposed off site.

9.7 Emergency Response Contingency Plan

This section details the contingency measures Shaw will take to prepare for and respond to fires, explosions, spills, and releases of hazardous materials, hazardous weather, and medical emergencies.

The procedures listed below will be used to respond to medical emergencies. The PSO will contact the local hospital and inform them of the site hazards and potential emergency situations. A minimum of two First Aid/cardiopulmonary resuscitation (CPR)-trained personnel will be retained on site.

Response

The nearest workers will immediately assist a person who shows signs of medical distress or who is involved in an accident. The crew foreman will be summoned. The crew foreman will immediately make radio contact with the on-site EC to alert him of a medical emergency situation. The foreman will relay the following information:

- Location of the victim at the work site
- Nature of the emergency
- Whether the victim is conscious
- Specific conditions contributing to the emergency, if known

The EC will notify the PSO. The following actions will then be taken depending on the severity of the incident:

- Life-Threatening Incident – If an apparent life-threatening condition exists, the crew foreman will call (903) 935-4580 and the Marshall Fire Department will send a rescue truck with EMS personnel. Additionally, the crew foreman will inform the EC. An on-site person will be appointed to meet the rescue truck and direct the truck to the victim. Shaw personnel will evacuate any injured person within the site to a clean area for treatment by EMS personnel arriving with the rescue truck.

- Non Life-Threatening Incident – If it is determined that no threat to life is present, the PSO will direct the injured person through decontamination procedures (see below) appropriate to the nature of the illness or accident. Appropriate first aid or medical attention will then be administered. Injuries will be reported to the USACE Inspector or, in his absence, the Technical Manager.

  Note: The area surrounding an accident site must not be disturbed until the scene has been cleared by the PSO.

Any personnel requiring emergency medical attention will be evacuated from the site if doing so would not endanger the life of the injured person or otherwise aggravate the injury. Personnel will not enter the area to attempt a rescue if their own lives would be threatened.

The decision whether or not to decontaminate a victim prior to evacuation is based on the type and severity of the illness or injury and the nature of the contaminant. For some emergency victims, immediate decontamination may be an essential part of life-saving first aid. For others, decontamination may aggravate the injury or delay life-saving first aid. Decontamination will be performed if it does not interfere with essential treatment.

If decontamination can be performed, observe the following procedures:

- Wash external clothing and cut it away.

If decontamination cannot be performed, observe the following procedures:

- Wrap the victim in blankets or plastic to reduce contamination of other personnel.
- Alert emergency and off-site medical personnel to potential contamination, and instruct them about specific decontamination procedures.
- Send site personnel familiar with the incident and chemical safety information such as MSDSs, with the affected person.

Any injuries, no matter how small, will be reported to the PSO or SS. An accident/injury/illness report will be completely and properly filled out and submitted to the Program HSM/Project CIH, in accordance with Shaw's reporting procedures.

A list of emergency telephone numbers is given in **Table 9-3**.

Notification

The following personnel/agencies will be notified in the event of a medical emergency:

- Local Fire Department or EMS
- On-site EC
- Workers in the affected areas
- USACE Representative

Directions to Hospital

Written directions (see **Figure 9-1**) to the hospital are as follows: exit base, head southwest on Hwy 449. Hwy 449 will turn into Hwy 43 (Karnack Hwy). Turn left on Hwy 59. Turn right on E. Travis Street. Turn left on S. Washington Avenue. Marshall Regional Medical Center is located at 811 S. Washington Avenue.

For non emergencies:

Longview Occupational Medicine
950 N 4th Street
Longview, Texas 75601
903-757-0577

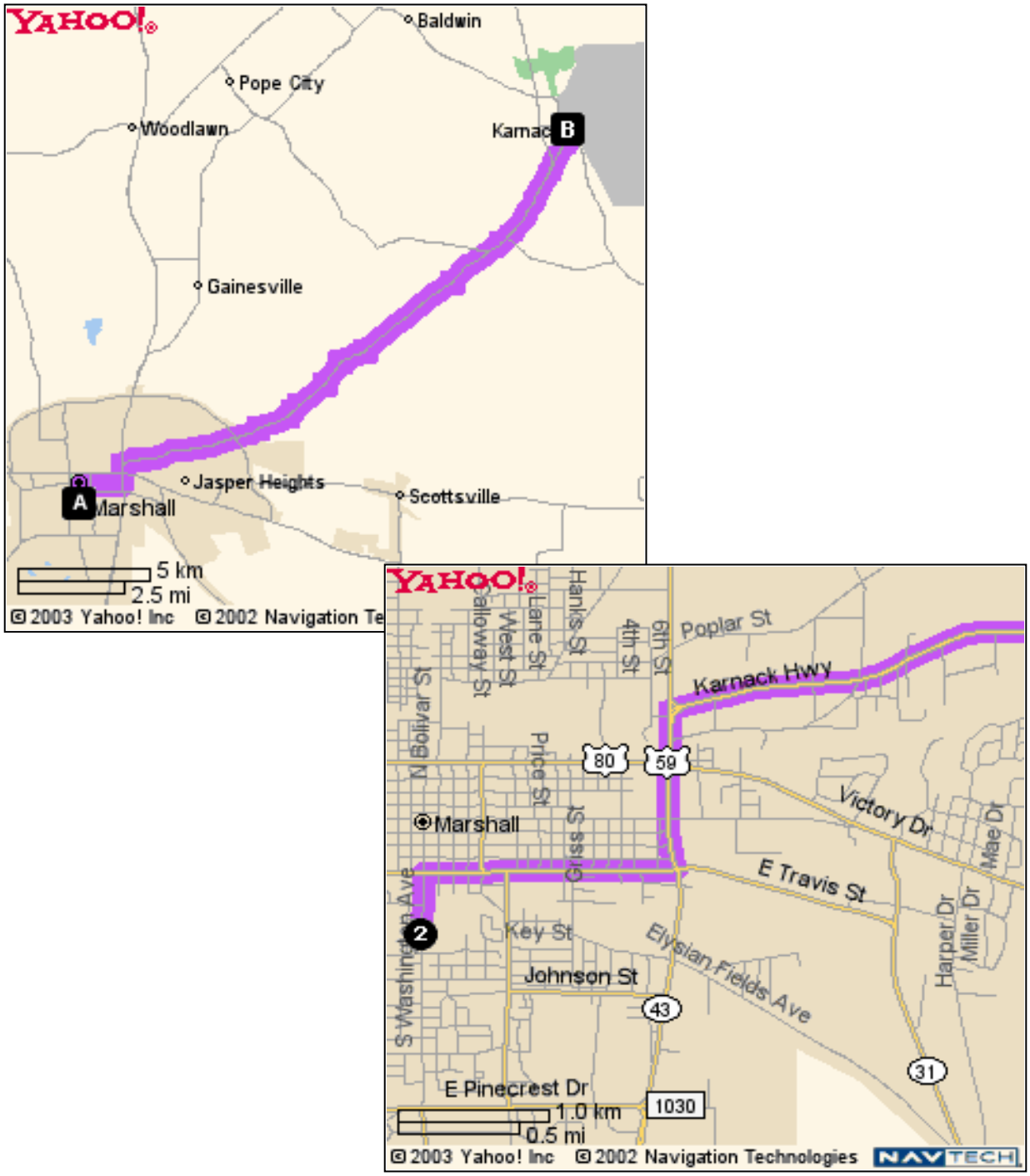


Figure 9-1
Route to Hospital – Marshall Regional Medical Center, 811 S. Washington Avenue

9.8 Fire Contingency Measures

Shaw personnel and subcontractors are not trained professional firefighters. Therefore, if there is any doubt that a fire cannot be quickly contained and extinguished, personnel will notify the EC and vacate the structure or area. The EC will immediately notify the local fire department.

The following procedures will be used to prevent the possibility of fires and resulting injuries:

- Sources of ignition will be distant from areas where flammable materials are handled or stored.
- The air will be monitored for explosivity before and during hot work and periodically where flammable materials are present. Hot work permits will be required for all such work.
- "No Smoking" signs will be conspicuously posted in areas where flammable materials are present.
- Fire extinguishers will be placed in areas where a fire hazard may exist.
- Before workers begin operations in an area, the foreman will give instructions on egress procedures and assembly points. Egress routes will be posted in work areas and exit points clearly marked.

The following procedures will be used in the event of a fire:

- Anyone who sees a fire will notify his supervisor, who will then contact the EC by radio. The EC will activate the emergency air horns and contact the local Fire Department.
- When the emergency siren sounds, workers will disconnect electrical equipment in use (if possible) and proceed to the nearest fire exit.
- Work crews will be comprised of pairs of workers (buddy system) who join each other immediately after hearing the fire alarm and remain together throughout the emergency. Workers will assemble at a predetermined rally point for a head count.
- When a small fire has been extinguished by a worker, the EC will be notified.

9.9 Hazardous Weather Contingency Measures

Operations will not be started or continued when the following hazardous weather conditions are present:

- Lightning
- Heavy rains/snow
- High winds

9.9.1 Response

In the event contingency measures are put into effect, the following response(s) will be implemented:

- Excavation/soil stockpiles will be covered with a plastic liner.
- Equipment will be shut down and secured to prevent damage.
- Personnel will be moved to safe refuge. The EC will determine when it is necessary to evacuate personnel to off-site locations and will coordinate efforts with fire, police, and other agencies.

9.9.2 Notification

The EC will be responsible for assessing hazardous weather conditions and notifying personnel of specific contingency measures. Notifications will include the following:

- Shaw employees and subcontractors
- Client representative
- Local civil defense organization

9.9.3 Lightning Safety

As per recommendations of the National Lightning Safety Institute (NLSI), lightning safety should be practiced during thunderstorms. Measuring lightning's distance is useful. Using the flash/bang (F/B) technique, for every five seconds (from the time of seeing the lightning flash to hearing the associated thunder), lightning is 1 mile away. A F/B of 10 seconds equals 2 miles; a F/B of 20 seconds equals 4 miles, etc. The span of a lightning strike can be as much as 6 to 8 miles from the same point of origin. The NLSI recommends the 30/30 rule: suspend activities at the F/B of 30 (6 miles) or when first hearing thunder. Outdoor activities should not be resumed until 30 minutes have passed from the last observable thunder or lightning. If you are suddenly exposed to nearby lightning, adopt the so-called Lightning Safety Position (LSP). LSP means stay away from other people, take off all metal objects, crouch with feet together and head bowed, and place hands on ears to reduce acoustic shock from nearby thunder. When lightning threatens, standard safety measures should include: avoid water and all metal objects; get off the high ground including rooftop, platforms, and heavy equipment; avoid solitary trees; stay off the telephone**.**

9.10 Spill/Release Contingency Measures

In the event of release or spill of a hazardous material, the following measures will be taken.

- A person observing a spill or release will act to remove and/or protect injured/contaminated persons from any life-threatening situation. First aid and/or decontamination procedures will be implemented as appropriate
- First aid will be administered to injured/contaminated personnel. Unsuspecting persons/vehicles will be warned of the hazard. Personnel will act to prevent any unsuspecting persons from coming in contact with spilled materials by alerting other nearby persons of the spill hazard. Without taking unnecessary risks, personnel will attempt to stop the spill at the source. This may involve activities such as uprighting a drum, closing a valve, or temporarily sealing a hole with a plug
- The EC will be notified of the spill/release, including information on material spilled, quantity, personnel injuries, and immediate life-threatening hazards. Air monitoring will be implemented by the EC and PSO to determine the potential impact on the surrounding community. Notification procedures will be followed to inform on-site personnel and off-site agencies. The EC will make a rapid assessment of the spill/release and direct confinement, containment, and control measures

Depending upon the nature of the spill, measures may include the following:

- Construction of a temporary containment berm utilizing on-site clay absorbent earth
- Digging a sump, installing a polyethylene liner, and diverting the spill material into the sump
- Placing drums under the leak to collect the spilling material before it flows over the ground
- Transferring the material from its original container to another container

The EC will notify the designated Emergency Response Coordinator of the spill and of the steps taken to institute cleanup. Emergency response personnel will clean up all spills in accordance with the spill cleanup plan developed by the EC. Supplies necessary to clean up a spill will be immediately available on site. Such items may include, but are not limited to, the following:

- Shovel, rake
- Clay absorbent
- Polyethylene liner
- PPE
- Steel drums
- Pumps and miscellaneous hand tools

The major supply of material and equipment will be located in the site area. Smaller supplies will be kept at active work locations. The EC will inspect the spill site to determine if the spill has been cleaned up to the satisfaction of the designated Emergency Response Coordinator. If necessary, soil, water, or air samples may be taken and analyzed to demonstrate the effectiveness of the spill cleanup effort. The EC will determine the cause of the spill and determine remedial steps to ensure that recurrence is prevented. The EC will review the cause with the designated Emergency Response Coordinator and obtain his concurrence with the interim remedial action plan.

10.0 Training Requirements

As a requirement for work at this site, in a hazardous waste work area all field personnel will have completed a 40-hour HAZWOPER training class prior to job assignment. This training must cover the requirements in 29 CFR 1910.120, entitled Hazardous Waste Operations and Emergency Response, which includes PPE, toxicological effects of various chemicals, hazard communication, blood borne pathogens, handling of unknown tanks and drums, confined-space entry procedures, electrical safety, etc. In addition, all personnel must receive annual 8-hour refresher training and 3-day on-site training under a trained, experienced supervisor. Supervisory personnel shall have received an additional 8-hour training in handling hazardous waste operations.

All personnel entering the EZ will be trained in the provisions of this site safety plan and be required to sign the Site Safety Plan Acknowledgment in **Attachment 1** of this HASP.

Site-specific safety and health training for this project will be held at the site location by the SS and PSO before any site work activities begin, and will include potential site contaminants, site physical and environmental hazards, emergency response and evacuation procedures, and emergency telephone numbers.

Outlines of the orientation for Shaw/subcontract personnel and visitors are presented in **Table 10-1**.

Table 10-1
Safety Orientation

Shaw/Subcontractors	Visitor Orientation
• HASP sign off • Sign in/out procedures • Site background • Chain of command • Rules and regulations • Hours of work • Equipment • Emergency information • Emergency signal • Gathering point • Responsibilities/roles • Emergency phone numbers • Work zones • Contaminants and material safety data sheets (Hazard Communication Program) • Activity hazard analyses • Incident reporting • Safe Driver Training HS800	• Sign in/out procedures • Review of site map • Work zones in progress • Hazard communication • Emergency plan/signals • Training/medical requirements • Zones/areas open to visitors

10.1 Daily and Periodic Safety Training

Daily "Tailgate" safety meetings will be held prior to each shift where health and safety problems and issues are discussed. "Phase Safety" briefings will be held prior to the commencement of a new task where task-specific risks and precautions are discussed. Attendance is mandatory and will be documented.

10.2 Motor Vehicle Operation: General Requirements

All employees who drive rented, leased, or company-owned vehicles or who may drive on company business must be familiar with the requirements of *Health & Safety Program, Volumes I & II*, HS800 (Shaw, 2003).

Each employee will complete Attachments 2 and 3 of HS 800, and return them to the PSO and/or SS **prior** to operating a vehicle at this site. The PSO and/or SS will ensure this documentation is thoroughly checked before such operations. Any associate who fails to comply will be subject to the disciplinary procedures detailed in HR207.

11.0 Medical Surveillance Program

Shaw personnel participate in a medical and health monitoring program. This program is initiated when the employee starts work with a complete physical and medical history and is continued on a regular basis. A listing of Shaw's worker medical profile is shown below. This program was developed in conjunction with a consultant toxicologist and Shaw's occupational health physician. Other medical consultants are retained when additional expertise is required. The medical surveillance program meets the requirements of the OSHA Standard 29 CFR 1910.120/1926.65(f).

Worker Medical Profile

Item	Initial	Annual
Medical History	✓	✓
Work History	✓	✓
Visual Acuity and Tonometry	✓	✓
Pulmonary Function Tests	✓	✓
Physical Examination	✓	✓
Audiometry Tests	✓	✓
Chest X-Ray	✓	Biennial age 35-45 years Every 5th yr 18-35 years Annual 45 years plus
Complete Blood Count	✓	✓
Blood Chem. (SMAC-23 or equivalent)	✓	✓
Urinalysis	✓	✓
Dermatology Examination	✓	✓
EKG	✓	Annual 35 years plus

The following information is provided in the event that medical attention is necessary.

The Shaw Medical Director is:

Dr. Jerry H. Berke, MD
Health Resources
800 350-4511 (toll free)
781 935-8581 (direct)

The Shaw Medical Director and the Program CIH will be immediately notified of any suspected exposures to hazardous materials/wastes.

Active remediation employees are examined initially upon start of employment, annually thereafter, and may be examined upon termination of employment. Unscheduled medical examinations are conducted under the following conditions:

- At employee request after known or suspected exposure to toxic or hazardous materials
- At the discretion of the client, HSM, CIH, PSO, or occupational physician after known or suspected exposure to toxic or hazardous materials
- At the discretion of the occupational physician

Non-scheduled medical examinations will include, as a minimum, all items specified above for period surveillance, with the exception of the chest X-ray, which will be conducted at the discretion of the occupational physician performing the examination.

12.0 Shaw Health & Safety Program, Volumes I & II

This section discusses *Health & Safety Program, Volumes I & II* (Shaw, 2003), that, at a minimum, must be implemented during the project activities. *Health & Safety Program, Volumes I & II* will be on site during all remediation activities. **Figure 12-1** is a copy of the manual's Table of Contents.

TABLE OF CONTENTS
HEALTH & SAFETY PROCEDURES HS001-HS823

PRO. NO.	PROCEDURE NAME	ISSUE DATE	REV. DATE
HS001	Safety Policy	9/24/96	05/21/02
HS003	Philosophy for Corporate Procedures	08/31/95	04/24/02
HS010	Employee Health and Safety Manual	05/13/99	04/24/02
HS011	Policy: Contractor Safety and Health Rules Attachment 2: General Rules for Contractors	04/01/97	04/24/02
HS012	Chemical Hygiene Plan	08/07/96	04/24/02
HS013	Health and Safety Procedure Variance	06/08/90	04/24/02
HS018	Safety Councils	01/20/99	04/24/02
HS019	Injury and Illness Prevention Program	04/15/96	04/24/02
HS020	Accident Prevention Program: Reporting, Investigation, and Review	05/13/99	06/09/03
HS021	Accident Prevention Program: Management Safety Inspections	02/09/99	04/24/02
HS022	Accident Prevention Program: Review of New Proposals, Projects, Operations, Construction, and Jobs by Health and Safety	09/09/91	04/24/02
HS023	Accident Prevention Program: Safety Incentive Award Program	04/09/99	04/24/02
HS024	Prevention of Repetitive Motion Injuries (applies to California only)	04/24/02	04/24/02
HS040	Stop Work Authority	05/31/91	04/24/02
HS041	Embryo-Fetus Protection Program	03/12/97	04/24/02
HS045	Job Safety Analysis	01/07/03	01/07/03
HS050	Training Requirements	08/07/96	04/24/02
HS051	Tailgate Safety Meetings	04/09/99	04/24/02
HS052	Health and Safety Plans	03/10/95	04/24/02
HS060	Hazard Communication Program	01/21/99	04/24/02
HS090	OSHA Regulatory Inspections	04/01/97	04/24/02
HS091	Reporting of Fatality or Multiple Hospitalization Incidents	08/31/95	04/24/02
HS100	Medical Policies and Procedures	09/29/97	04/24/02
HS101	Drug and Alcohol Testing	04/19/99	04/24/02
HS102	Management of Associate Exposure and Medical Records	06/18/98	04/24/02
HS104	Employee Notification of Industrial Hygiene Monitoring Results	09/27/99	04/24/02

Figure 12-1
Shaw Health and Safety Program Table of Contents

PRO. NO.	PROCEDURE NAME	ISSUE DATE	REV. DATE
HS105	Occupational Injury/Illness Procedures and Return to Work Following a Non-Occupational Medical Absence	06/18/98	04/24/02
HS106	First Aid Kits	04/23/93	09/26/02
HS300	Confined Spaces	04/09/99	04/25/02
HS301	Fall Protection	04/24/02	04/24/02
HS302	Ladder Safety	01/21/99	09/26/02
HS303	Pressurized Water Cleaning and Cutting Equipment	12/10/95	04/25/02
HS304	Compressed Gas Cylinders	05/01/97	04/25/02
HS306	Handling Compressed Gas Cylinders with Unknown Contents	08/16/99	04/25/02
HS307	Excavation and Trenching	09/27/99	04/25/02
HS308	Underground/Overhead Utility Contact Prevention	04/25/02	05/05/05
HS309	Underground Storage Tank removal	08/31/95	04/25/02
HS314	Hot Work in Hazardous Locations	05/13/99	04/25/02
HS315	Control of Hazardous Energy Sources	11/22/93	04/25/02
HS316	Drill Rig Operations	03/10/95	04/25/02
HS317	Unexploded Ordnance (UXO)	03/10/95	04/25/02
HS400	Working in Hot Environments	05/13/99	04/25/02
HS401	Cold Stress	06/19/98	04/25/02
HS402	Hearing Conservation Program	05/13/99	04/25/02
HS500	OSHA Regulated Toxic and Hazardous Substances	11/01/95	04/25/02
HS501	Cadmium Compliance Plan	05/05/96	04/25/02
HS512	Handling of Blood of Other Potentially Infectious Material	06/14/93	04/25/02
HS600	Personal Protective Equipment	12/16/96	09/26/02
HS601	Respiratory Protection Program	04/09/99	04/25/02
HS700	Radiation Protection Program	05/15/94	04/25/02
HS800	Motor Vehicle Operation: General Requirements	08/16/99	03/15/04
HS810	Commercial Motor Vehicle Operation and Maintenance	08/31/95	04/25/02
HS811	Department of Transportation (DOT) 24-Hour Emergency Number	05/13/99	04/25/02
HS820	Forklift Operation	06/30/99	04/25/02
HS822	Crane Operations	03/31/96	04/25/02
HS823	Rigging & Lifting	07/18/02	07/18/02

Figure 12-1 (*Continued)*
Shaw Health and Safety Program Table of Contents

13.0 References

National Institute for Occupational Safety and Health (NIOSH)/U.S. Coast Guard/U.S. Environmental Protection Agency/U.S. Occupational Safety and Health Administration, 1985, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, DHAS/NIOSH Publication Number 85-115, Washington, D.C.

Shaw Environmental, Inc., 2003, *Health & Safety Program, Volumes I & II.*

U.S. Army Corps of Engineers, 2003a, *Safety and Health Requirements Manual*, EM-385-1-1, Washington, D.C.

U.S. Environmental Protection Agency, 1998, *Standard Operating Safety Guidelines,* Washington, D.C.

Attachment 1
Site Safety and Health Plan Worker Acknowledgment

WORKER ACKNOWLEDGMENT TO HEALTH AND SAFETY PLAN

I HAVE BEEN TRAINED ON THE SAFETY PLAN FOR THIS SITE AND FULLY UNDERSTAND ITS CONTENTS.

NAME	SIGNATURE	EMP. No.	DATE

Attachment 2
Health and Safety Forms

HEALTH AND SAFETY FORMS

The following forms from HS020 and the Health & Safety Procedures Manual will be available in the field:

CASE Trac Forms
Supervisor's Employee Injury Report
Accident/Injury Investigation
Accident Review Board
Vehicle Accident Report
General Liability, Property Damage, & Loss Report
Shaw Safety Rules
Daily Safety Meeting Log
Instrument Calibration Logs
Air Monitoring Instrument (Direct Reading) Logs
Heavy Equipment Inspection Forms
Fire Extinguisher Checklist/Inventory Form
PM Safety Inspection Report (Monthly)
Site Safety Inspection Checklist (Weekly)
PSO Daily Report
Air Sampling Data Sheet
Chain-of-Custody Record
Motor Vehicle Operations (HS800)

Attachment 3
Health and Safety Plan Amendments

Site-Specific Health and Safety Plan
Amendment Documentation

Project Name:_____ **Project No.:**_____

Amendment No.:_____ **Date:**_____

Amendment Revises: Page:_____ **Section:**_____

Task(s) Amendment Affects*:_____

_____

***(Attach new/revised Activity Hazard Analysis)**

Reason for Amendment:

_____

_____

_____

_____

Amendment:
(Attach a separate sheet(s), as necessary)

_____

_____

_____

_____

_____

_____

_____

Completed by:_____ **Approved by:**_____

Attachment 4
Material Safety Data Sheets

Ammonium Perchlorate
Acetone
Methylene Chloride
Trichloroethylene
Hydrochloric Acid
Nitric Acid
Sulfuric Acid
2,4,6 Trinitrotoluene (TNT)
Lead
Mercury

New Jersey Department of Health and Senior Services

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **AMMONIUM PERCHLORATE**

CAS Number: 7790-98-9
DOT Number: UN 1442

RTK Substance number: 0109
Date: March 2000

HAZARD SUMMARY

* **Ammonium Perchlorate** can affect you when breathed in.
* Contact can irritate the skin and eyes.
* Breathing **Ammonium Perchlorate** can irritate the nose and throat causing coughing and wheezing.
* High levels can interfere with the ability of the blood to carry *Oxygen* causing headache, fatigue, dizziness, and a blue color to the skin and lips (*methemoglobinemia*). Higher levels can cause trouble breathing, collapse and even death.
* **Ammonium Perchlorate** may affect the kidneys.
* **Ammonium Perchlorate** is a HIGHLY REACTIVE CHEMICAL and a DANGEROUS EXPLOSION HAZARD.

IDENTIFICATION

Ammonium Perchlorate is an odorless, white, sand-like powder. It is used in analytical chemistry and as an etching and engraving agent. It is also used as an animal fattening agent and in explosives.

REASON FOR CITATION

* **Ammonium Perchlorate** is on the Hazardous Substance List because it is cited by DOT and NFPA.
* This chemical is on the Special Health Hazard Substance List because it is **REACTIVE**.
* Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard, 1910.1200, requires private employers to provide similar training and information to their employees.

* Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under OSHA 1910.1020.
* If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

WORKPLACE EXPOSURE LIMITS

No occupational exposure limits have been established for **Ammonium Perchlorate**. This does not mean that this substance is not harmful. Safe work practices should always be followed.

WAYS OF REDUCING EXPOSURE

* Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
* Wear protective work clothing.
* Wash thoroughly immediately after exposure to **Ammonium Perchlorate**.
* Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **Ammonium Perchlorate** to potentially exposed workers.

This Fact Sheet is a summary source of information of all potential and most severe health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

HEALTH HAZARD INFORMATION

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Ammonium Perchlorate**:

* Contact can irritate the skin and eyes.
* Breathing **Ammonium Perchlorate** can irritate the nose and throat causing coughing and wheezing.
* High levels can interfere with the ability of the blood to carry *Oxygen* causing headache, fatigue, dizziness, and a blue color to the skin and lips (*methemoglobinemia*). Higher levels can cause trouble breathing, collapse and even death.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Ammonium Perchlorate** and can last for months or years:

Cancer Hazard

* According to the information presently available to the New Jersey Department of Health and Senior Services, **Ammonium Perchlorate** has not been tested for its ability to cause cancer in animals.

Reproductive Hazard

* According to the information presently available to the New Jersey Department of Health and Senior Services, **Ammonium Perchlorate** has not been tested for its ability to affect reproduction.

Other Long-Term Effects

* **Ammonium Perchlorate** may affect the kidneys.

MEDICAL

Medical Testing

If symptoms develop or overexposure is suspected, the following are recommended:

* Kidney function tests.
* Blood methemoglobin level.

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under OSHA 1910.1020.

WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, **ENGINEERING CONTROLS** are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following controls are recommended:

* Where possible, automatically transfer **Ammonium Perchlorate** from drums or other storage containers to process containers.
* Before entering a confined space where **Ammonium Perchlorate** may be present, check to make sure that an explosive concentration does not exist.

Good **WORK PRACTICES** can help to reduce hazardous exposures. The following work practices are recommended:

* Workers whose clothing has been contaminated by **Ammonium Perchlorate** should change into clean clothing promptly.
* Do not take contaminated work clothes home. Family members could be exposed.
* Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **Ammonium Perchlorate.**
* Eye wash fountains should be provided in the immediate work area for emergency use.
* If there is the possibility of skin exposure, emergency shower facilities should be provided.
* On skin contact with **Ammonium Perchlorate,** immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted **Ammonium Perchlorate,** whether or not known skin contact has occurred.
* Do not eat, smoke, or drink where **Ammonium Perchlorate** is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, smoking, or using the toilet.
* Use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

OSHA 1910.132 requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Clothing

* Avoid skin contact with **Ammonium Perchlorate**. Wear protective gloves and clothing. Safety equipment suppliers/ manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
* All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

* Wear impact resistant eye protection with side shields or goggles.
* Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

* NIOSH has established new testing and certification requirements for negative pressure, air purifying, particulate filter and filtering facepiece respirators. The filter classifications of dust/mist/fume, paint spray or pesticide prefilters, and filters for radon daughters, have been replaced with the N, R, and P series. Each series has three levels of filtering efficiency: 95%, 99%, and 99.9%. Check with your safety equipment supplier or your respirator manufacturer to determine which respirator is appropriate for your facility.
* If while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Ammonium Perchlorate**, or if while wearing particulate filters abnormal resistance to breathing is experienced, or eye irritation occurs while wearing a full facepiece respirator, leave the area immediately. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
* Be sure to consider all potential exposures in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
* Where the potential for high exposure exists, use a MSHA/NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.

HANDLING AND STORAGE

* Prior to working with **Ammonium Perchlorate** you should be trained on its proper handling and storage.
* **Ammonium Perchlorate** is a *strong oxidizer*; and mixtures with SULFUR, ORGANIC MATERIALS, and FINELY DIVIDED METALS are explosive and friction and shock sensitive.
* **Ammonium Perchlorate** must be stored to avoid contact with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) since violent reactions occur.
* **Ammonium Perchlorate** is not compatible with STRONG REDUCING AGENTS; STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); METALS (such as ALUMINUM, COPPER, and POTASSIUM); METAL OXIDES; PHOSPHOROUS; and COMBUSTIBLES.
* Store in tightly closed containers in a cool, well-ventilated area away from HEAT and SHOCK.
* Wherever **Ammonium Perchlorate** is used, handled, manufactured, or stored, use explosion-proof electrical equipment and fittings.

QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?

A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?

A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?

A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?
A: Conditions which increase risk of exposure include dust releasing operations (grinding, mixing, blasting, dumping, etc.), other physical and mechanical processes (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and "confined space" exposures (working inside vats, reactors, boilers, small rooms, etc.).

Q: Is the risk of getting sick higher for workers than for community residents?
A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. This may be a problem for children or people who are already ill.

The following information is available from:

New Jersey Department of Health and Senior Services
Occupational Health Service
PO Box 360
Trenton, NJ 08625-0360
(609) 984-1863
(609) 292-5677 (fax)

Web address: http://www.state.nj.us/health/eoh/odisweb/

Industrial Hygiene Information
Industrial hygienists are available to answer your questions regarding the control of chemical exposures using exhaust ventilation, special work practices, good housekeeping, good hygiene practices, and personal protective equipment including respirators. In addition, they can help to interpret the results of industrial hygiene survey data.

Medical Evaluation
If you think you are becoming sick because of exposure to chemicals at your workplace, you may call personnel at the Department of Health and Senior Services, Occupational Health Service, who can help you find the information you need.

Public Presentations
Presentations and educational programs on occupational health or the Right to Know Act can be organized for labor unions, trade associations and other groups.

Right to Know Information Resources
The Right to Know Infoline (609) 984-2202 can answer questions about the identity and potential health effects of chemicals, list of educational materials in occupational health, references used to prepare the Fact Sheets, preparation of the Right to Know survey, education and training programs, labeling requirements, and general information regarding the Right to Know Act. Violations of the law should be reported to (609) 984-2202.

DEFINITIONS

ACGIH is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is assigned by the Chemical Abstracts Service to identify a specific chemical.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes irreversible damage to human tissue or containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

HHAG is the Human Health Assessment Group of the federal EPA.

IARC is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

MSHA is the Mine Safety and Health Administration, the federal agency that regulates mining. It also evaluates and approves respirators.

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NAERG is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

NCI is the National Cancer Institute, a federal agency that determines the cancer-causing potential of chemicals.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the Public Employees Occupational Safety and Health Act, a state law which sets PELs for New Jersey public employees.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

>>>>>>>>>>>>>>>>> EMERGENCY INFORMATION <<<<<<<<<<<<<<<<<

Common Name: **AMMONIUM PERCHLORATE**
DOT Number: **UN 1442**
NAERG Code: **143**
CAS Number: **7790-98-9**

Hazard rating	NJDHSS	NFPA
FLAMMABILITY	-	0
REACTIVITY	-	4
REACTIVE POISONOUS GASES ARE PRODUCED IN FIRE CONTAINERS MAY EXPLODE IN FIRE		

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

FIRE HAZARDS

* **Ammonium Perchlorate** does not burn but will accelerate burning and may decompose explosively in fire conditions.
* Only use water to extinguish fires.
* POISONOUS GASES ARE PRODUCED IN FIRE, including *Ammonia, Chlorine,* and *Nitrogen Oxides*.
* CONTAINERS MAY EXPLODE IN FIRE.
* Use water spray to keep fire-exposed containers cool.
* **Ammonium Perchlorate** may ignite combustibles (wood, paper, oil, etc.).
* If employees are expected to fight fires, they must be trained and equipped as stated in OSHA 1910.156.

SPILLS AND EMERGENCIES

If **Ammonium Perchlorate** is spilled, take the following steps:

* Evacuate persons not wearing protective equipment from area of spill until clean-up is complete.
* Remove all ignition sources.
* Cover with dry lime, sand or soda ash, and place in covered containers for disposal.
* Ventilate and wash area after clean-up is complete.
* Keep **Ammonium Perchlorate** out of a confined space, such as a sewer, because of the possibility of an explosion, unless the sewer is designed to prevent the build-up of explosive concentrations.
* It may be necessary to contain and dispose of **Ammonium Perchlorate** as a HAZARDOUS WASTE. Contact your Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.
* If employees are required to clean-up spills, they must be properly trained and equipped. OSHA 1910.120(q) may be applicable.

FOR LARGE SPILLS AND FIRES immediately call your fire department. You can request emergency information from the following:

CHEMTREC: (800) 424-9300
NJDEP HOTLINE: (609) 292-7172

HANDLING AND STORAGE (See page 3)

FIRST AID

In NJ, for POISON INFORMATION call 1-800-764-7661

Eye Contact
* Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids.

Skin Contact
* Remove contaminated clothing. Wash contaminated skin with soap and water.

Breathing
* Remove the person from exposure.
* Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
* Transfer promptly to a medical facility.

PHYSICAL DATA

Water Solubility: Soluble

OTHER COMMONLY USED NAMES

Chemical Name:
Perchloric Acid, Ammonium Salt
Other Names:
PKHA

Not intended to be copied and sold for commercial purposes.

NEW JERSEY DEPARTMENT OF HEALTH AND SENIOR SERVICES
Right to Know Program
PO Box 368, Trenton, NJ 08625-0368
(609) 984-2202

MSDS Number: **A0446** * * * * * *Effective Date:* ***05/20/04*** * * * * * *Supercedes:* ***02/12/04***

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

ACETONE

1. Product Identification

Synonyms: Dimethylketone; 2-propanone; dimethylketal
CAS No.: 67-64-1
Molecular Weight: 58.08
Chemical Formula: (CH3)2CO
Product Codes:
J.T. Baker: 5008, 5018, 5356, 5580, 9001, 9002, 9003, 9004, 9005, 9006, 9007, 9008, 9009, 9010, 9015, 9024, 9036, 9125, 9254, 9271, A134, V655
Mallinckrodt: 0018, 2432, 2435, 2437, 2438, 2440, 2443, 2445, 2850, H451, H580, H981

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Acetone	67-64-1	99 - 100%	Yes

3. Hazards Identification

Emergency Overview

DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate
Flammability Rating: 3 - Severe (Flammable)
Reactivity Rating: 0 - None
Contact Rating: 3 - Severe
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES; CLASS B EXTINGUISHER
Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:
Inhalation of vapors irritates the respiratory tract. May cause coughing, dizziness, dullness, and headache. Higher concentrations can produce central nervous system depression, narcosis, and unconsciousness.
Ingestion:
Swallowing small amounts is not likely to produce harmful effects. Ingestion of larger amounts may produce abdominal pain, nausea and vomiting. Aspiration into lungs can produce severe lung damage and is a medical emergency. Other symptoms are expected to parallel inhalation.
Skin Contact:
Irritating due to defatting action on skin. Causes redness, pain, drying and cracking of the skin.
Eye Contact:
Vapors are irritating to the eyes. Splashes may cause severe irritation, with stinging, tearing, redness and pain.
Chronic Exposure:
Prolonged or repeated skin contact may produce severe irritation or dermatitis.
Aggravation of Pre-existing Conditions:
Use of alcoholic beverages enhances toxic effects. Exposure may increase the toxic potential of chlorinated hydrocarbons, such as chloroform, trichloroethane.

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4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Ingestion:
Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT

INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately.

Skin Contact:

Immediately flush skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting upper and lower eyelids occasionally. Get medical attention.

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5. Fire Fighting Measures

Fire:

Flash point: -20C (-4F) CC
Autoignition temperature: 465C (869F)
Flammable limits in air % by volume:
lel: 2.5; uel: 12.8
Extremely Flammable Liquid and Vapor! Vapor may cause flash fire.

Explosion:

Above flash point, vapor-air mixtures are explosive within flammable limits noted above. Vapors can flow along surfaces to distant ignition source and flash back. Contact with strong oxidizers may cause fire. Sealed containers may rupture when heated. This material may produce a floating fire hazard. Sensitive to static discharge.

Fire Extinguishing Media:

Dry chemical, alcohol foam or carbon dioxide. Water may be ineffective. Water spray may be used to keep fire exposed containers cool, dilute spills to nonflammable mixtures, protect personnel attempting to stop leak and disperse vapors.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

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6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! If a leak or spill has not ignited, use water spray to disperse the vapors, to protect personnel attempting to stop leak, and to flush spills away from exposures. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker SOLUSORB® solvent adsorbent is recommended for spills of this product.

7. Handling and Storage

Protect against physical damage. Store in a cool, dry well-ventilated location, away from any area where the fire hazard may be acute. Outside or detached storage is preferred. Separate from incompatibles. Containers should be bonded and grounded for transfers to avoid static sparks. Storage and use areas should be No Smoking areas. Use non-sparking type tools and equipment, including explosion proof ventilation. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
Acetone:
-OSHA Permissible Exposure Limit (PEL):
1000 ppm (TWA)

-ACGIH Threshold Limit Value (TLV):
500 ppm (TWA), 750 ppm (STEL) A4 - not classifiable as a human carcinogen
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a half-face organic vapor respirator may be worn for up to ten times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece organic vapor respirator may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Clear, colorless, volatile liquid.
Odor:
Fragrant, mint-like
Solubility:
Miscible in all proportions in water.
Specific Gravity:
0.79 @ 20C/4C
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
56.5C (133F) @ 760 mm Hg
Melting Point:
-95C (-139F)
Vapor Density (Air=1):
2.0
Vapor Pressure (mm Hg):
400 @ 39.5C (104F)
Evaporation Rate (BuAc=1):
ca. 7.7

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10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
Carbon dioxide and carbon monoxide may form when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Concentrated nitric and sulfuric acid mixtures, oxidizing materials, chloroform, alkalis, chlorine compounds, acids, potassium t-butoxide.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

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11. Toxicological Information

Oral rat LD50: 5800 mg/kg; Inhalation rat LC50: 50,100mg/m3; Irritation eye rabbit, Standard Draize, 20 mg severe; investigated as a tumorigen, mutagen, reproductive effector.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Acetone (67-64-1)	No	No	None

12. Ecological Information

Environmental Fate:
When released into the soil, this material is expected to readily biodegrade. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into water, this material is expected to readily biodegrade. When released to water, this material is expected to quickly evaporate. This material has a log octanol-water partition coefficient of less than 3.0. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material may be moderately degraded by photolysis. When released into the air, this material is expected to be readily removed from the atmosphere by wet deposition.
Environmental Toxicity:
This material is not expected to be toxic to aquatic life. The LC50/96-hour values for fish are over 100 mg/l.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: ACETONE
Hazard Class: 3
UN/NA: UN1090
Packing Group: II
Information reported for product/size: 188L

International (Water, I.M.O.)

Proper Shipping Name: ACETONE
Hazard Class: 3
UN/NA: UN1090
Packing Group: II
Information reported for product/size: 188L

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------

Ingredient	TSCA	EC	Japan	Australia
Acetone (67-64-1)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\---------------------------------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Acetone (67-64-1)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Acetone (67-64-1)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\----------------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Acetone (67-64-1)	5000	U002	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: Yes
SARA 311/312: Acute: Yes Chronic: No Fire: Yes Pressure: No
Reactivity: No (Pure / Liquid)

Australian Hazchem Code: 2[Y]E
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **1** Flammability: **3** Reactivity: **0**
Label Hazard Warning:
DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR MAY CAUSE FLASH FIRE. HARMFUL IF SWALLOWED OR INHALED. CAUSES

IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. AFFECTS CENTRAL NERVOUS SYSTEM.

Label Precautions:

Keep away from heat, sparks and flame.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Avoid breathing vapor.
Avoid contact with eyes, skin and clothing.

Label First Aid:

Aspiration hazard. If swallowed, vomiting may occur spontaneously, but DO NOT INDUCE. If vomiting occurs, keep head below hips to prevent aspiration into lungs. Never give anything by mouth to an unconscious person. Call a physician immediately. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.

Product Use:

Laboratory Reagent.

Revision Information:

No Changes.

Disclaimer:

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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

MSDS Number: **M4420** * * * * * *Effective Date: **10/06/05** * * * * * *Supercedes: **05/14/03***

MSDS **Material Safety Data Sheet**

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

J.T.Baker®

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300
National Response in Canada
CANUTEC: 613-996-6666
Outside U.S. And Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

METHYLENE CHLORIDE

1. Product Identification

Synonyms: MC; Dichloromethane (DCM); Methylene dichloride; Methylene bichloride; Methane dichloride
CAS No.: 75-09-2
Molecular Weight: 84.93
Chemical Formula: CH2Cl2
Product Codes: 9235, 9264, 9266, 9295, 9315, 9324, 9329, 9330, 9348, 9350, 9965, Q480

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Methylene Chloride	75-09-2	> 99%	Yes

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED

THROUGH SKIN. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER, CARDIOVASCULAR SYSTEM, AND BLOOD. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Cancer Causing)
Flammability Rating: 1 - Slight
Reactivity Rating: 2 - Moderate
Contact Rating: 3 - Severe
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:
Causes irritation to respiratory tract. Has a strong narcotic effect with symptoms of mental confusion, light-headedness, fatigue, nausea, vomiting and headache. Causes formation of carbon monoxide in blood which affects cardiovascular system and central nervous system. Continued exposure may cause increased light-headedness, staggering, unconsciousness, and even death. Exposure may make the symptoms of angina (chest pains) worse.

Ingestion:
May cause irritation of the gastrointestinal tract with vomiting. If vomiting results in aspiration, chemical pneumonia could follow. Absorption through gastrointestinal tract may produce symptoms of central nervous system depression ranging from light headedness to unconsciousness.

Skin Contact:
Causes irritation, redness and pain. Prolonged contact can cause burns. Liquid degreases the skin. May be absorbed through skin.

Eye Contact:
Vapors can cause eye irritation. Contact can produce pain, inflammation and temporal eye damage.

Chronic Exposure:
Can cause headache, mental confusion, depression, liver effects, kidney effects, bronchitis, loss of appetite, nausea, lack of balance, and visual disturbances. Can cause dermatitis upon prolonged skin contact. Methylene chloride may cause cancer in humans.

Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders, eye problems, impaired liver, kidney, respiratory or cardiovascular function may be more susceptible to the effects of this substance.

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4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Ingestion:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

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5. Fire Fighting Measures

Fire:
Autoignition temperature: 556C (1033F)
Flammable limits in air % by volume:
lel: 12; uel: 23
Forms flammable vapor-air mixtures above 100C (212F).
Explosion:
Concentrated can be ignited by a high intensity ignition source. Vapor may form flammable mixture in atmosphere that contains a high percentage of oxygen. Sealed containers may rupture when heated.
Fire Extinguishing Media:
Dry chemical, foam or carbon dioxide. Water spray may be used to keep fire exposed containers cool.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Combustion by-products include phosgene and hydrogen chloride gases. Structural firefighters' clothing provides only limited protection to the combustion products of this material.

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6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from any source of heat or ignition. Outside or detached storage is recommended. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product. To minimize decomposition, all storage containers should be galvanized or lined with a phenolic coating. This material may corrode plastic and rubber. Wear special protective equipment (Sec. 8) for maintenance break-in or where exposures may exceed established exposure levels. Wash hands, face, forearms and neck when exiting restricted areas. Shower, dispose of outer clothing, change to clean garments at the end of the day. Avoid cross-contamination of street clothes. Wash hands before eating and do not eat, drink, or smoke in workplace. Odor Threshold: 205 - 307 ppm. The odor threshold only serves as a warning of exposure; not smelling it does not mean you are not being exposed.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
Methylene Chloride (Dichloromethane):
- OSHA Permissible Exposure Limit (PEL) -
25 ppm (TWA), 125 ppm (STEL), 12.5 ppm (8-hour TWA - Action Level)
- ACGIH Threshold Limit Value (TLV) -
50 ppm (TWA), A3 - suspected human carcinogen.

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. The cartridges recommended for this material have a predicted service of less than 30 minutes at concentrations of ten times (10x) the exposure limits. Actual service life will vary considerbly, depending on concentration levels, temperature, humidity, and work rate. This substance has poor warning properties.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact. Neoprene is a recommended material for personal protective equipment. Natural rubber and polyvinyl chloride ARE NOT recommended materials for personal protective equipment.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

Other Control Measures:
Do not use closed circuit rebreathing system employing soda lime or other carbon dioxide absorber because of formation of toxic compounds capable of producing cranial nerve paralysis. See OSHA Standard for medical surveillance, record keeping, and reporting requirements for methylene chloride (29 CFR 1910.1052).

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9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.
Odor:
Chloroform-like odor.
Solubility:
1.32 gm/100 gm water @ 20C.
Specific Gravity:
1.318 @ 25C
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
39.8C (104F)
Melting Point:
-97C (-143F)
Vapor Density (Air=1):
2.9
Vapor Pressure (mm Hg):
350 @ 20C (68F)
Evaporation Rate (BuAc=1):
27.5

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10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
Emits highly toxic fumes of phosgene when heated to decomposition. Decomposes in a flame or hot surface to form toxic gas phosgene and corrosive mists of hydrochloric acid. Carbon dioxide and carbon monoxide may form when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong oxidizers, strong caustics, plastics, rubber, nitric acid, water + heat, and chemically active metals, such as aluminum and magnesium powder, sodium, potassium, and lithium. Avoid contact with open flames and electrical arcs. Liquid methylene chloride will attack some forms of plastics, rubber, and coatings.

Conditions to Avoid:
Moisture, heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Toxicological Data:
Dichloromethane: Oral rat LD50: 1600 mg/kg; inhalation rat LC50: 52 gm/m3; investigated as a tumorigen, mutagen, reproductive effector.
Reproductive Toxicity:
Dichloromethane has been linked to spontaneous abortions in humans.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Methylene Chloride (75-09-2)	No	Yes	2B

12. Ecological Information

Environmental Fate:
When released into the soil, this material may leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into water, this material may biodegrade to a moderate extent. When released to water, this material is expected to quickly evaporate. This material has a log octanol-water partition coefficient of less than 3.0. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life of greater than 30 days. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition.
Environmental Toxicity:
The LC50/96-hour values for fish are over 100 mg/l. This material is not expected to be toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: RQ, DICHLOROMETHANE
Hazard Class: 6.1
UN/NA: UN1593
Packing Group: III
Information reported for product/size: 1000L

International (Water, I.M.O.)

Proper Shipping Name: RQ, DICHLOROMETHANE
Hazard Class: 6.1
UN/NA: UN1593
Packing Group: III
Information reported for product/size: 1000L

International (Air, I.C.A.O.)

Proper Shipping Name: RQ, DICHLOROMETHANE
Hazard Class: 6.1
UN/NA: UN1593
Packing Group: III
Information reported for product/size: 1000L

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15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------

Ingredient	TSCA	EC	Japan	Australia
Methylene Chloride (75-09-2)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\---------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Methylene Chloride (75-09-2)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Methylene Chloride (75-09-2)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\----------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Methylene Chloride (75-09-2)	1000	U080	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Liquid)

WARNING:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: 2Z
Poison Schedule: S5
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

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16. Other Information

NFPA Ratings: Health: **2** Flammability: **1** Reactivity: **0**
Label Hazard Warning:
WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER, CARDIOVASCULAR SYSTEM, AND BLOOD. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.
Label Precautions:
Do not breathe vapor.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Keep away from heat and flame.
Do not get in eyes, on skin, or on clothing.
Label First Aid:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 14.
Disclaimer:
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Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information

must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.
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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

New Jersey Department of Health and Senior Services

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **METHYLENE CHLORIDE**

CAS Number: 75-09-2
DOT Number: UN 1593

RTK Substance number: 1255
Date: November 1995 Revision: May 2001

HAZARD SUMMARY

* **Methylene Chloride** can affect you when breathed in and by passing through your skin.
* **Methylene Chloride** should be handled as a CARCINOGEN—WITH EXTREME CAUTION.
* Contact can irritate and burn the skin and eyes with possible eye damage.
* Breathing **Methylene Chloride** can irritate the nose, throat and lungs causing coughing, wheezing and/or shortness of breath.
* **Methylene Chloride** may damage the liver and affect the kidneys and brain.

IDENTIFICATION

Methylene Chloride is a colorless liquid with a pleasant *Chloroform*-like odor. It is used in food, furniture and plastics processing, and as a paint remover.

REASON FOR CITATION

* **Methylene Chloride** is on the Hazardous Substance List because it is regulated by OSHA and cited by ACGIH, DOT, NIOSH, NTP, DEP, IARC, HHAG, NFPA and EPA.
* This chemical is on the Special Health Hazard Substance List because it is a **CARCINOGEN, MUTAGEN** and **TERATOGEN.**
* Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard, 1910.1200, requires private employers to provide similar training and information to their employees.

* Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under OSHA 1910.1020.
* If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

WORKPLACE EXPOSURE LIMITS

OSHA: The legal airborne permissible exposure limit (PEL) is **25 ppm** averaged over an 8-hour workshift and **125 ppm**, not to be exceeded during any 15 minute work period.

NIOSH: Recommends that exposure to occupational carcinogens be limited to the lowest feasible concentration.

ACGIH: The recommended airborne exposure limit is **50 ppm** averaged over an 8-hour workshift.

* **Methylene Chloride** may be a CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.
* The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

WAYS OF REDUCING EXPOSURE

* Enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
* A regulated, marked area should be established where **Methylene Chloride** is handled, used, or stored as required by the OSHA Standard 29 CFR 1910.1052.
* Wear protective work clothing.
* Wash thoroughly immediately after exposure to **Methylene Chloride** and at the end of the workshift.
* Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **Methylene Chloride** to potentially exposed workers.

This Fact Sheet is a summary source of information of all potential and most severe health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

HEALTH HAZARD INFORMATION

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Methylene Chloride**:

* Contact can irritate and burn the skin and eyes with possible eye damage.
* Breathing **Methylene Chloride** can irritate the nose, throat and lungs causing coughing, wheezing and/or shortness of breath.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Methylene Chloride** and can last for months or years:

Cancer Hazard

* **Methylene Chloride** may be a CARCINOGEN in humans since it has been shown to cause liver and lung cancer in animals.
* Many scientists believe there is no safe level of exposure to a carcinogen. Such substances may also have the potential for causing reproductive damage in humans.

Reproductive Hazard

* There is limited evidence that **Methylene Chloride** causes spontaneous abortions.

Other Long-Term Effects

* **Methylene Chloride** can irritate the lungs. Repeated exposure may cause bronchitis to develop with cough, phlegm, and/or shortness of breath.
* **Methylene Chloride** may damage the liver and affect the kidneys.
* Long term exposure may affect the brain, causing memory loss, poor coordination, and reduced thinking ability.

MEDICAL

Medical Testing

For those with frequent or potentially high exposure (half the PEL or greater, or significant skin contact), the following are recommended before beginning work and at regular times after that:

* Lung function tests.
* Liver and kidney function tests.
* Exam of the nervous system.
* Evaluate for brain effects such as changes in memory, concentration, sleeping patterns and mood (especially irritability and social withdrawal), as well as headaches and fatigue. Consider evaluations of the cerebellar, autonomic and peripheral nervous systems. Positive and borderline individuals should be referred for neuropsychological testing.

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under OSHA 1910.1020.

Mixed Exposures

* Because more than light alcohol consumption can cause liver damage, drinking alcohol can increase the liver damage caused by **Methylene Chloride**.

WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, **ENGINEERING CONTROLS** are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following control are recommended:

* Where possible, automatically pump liquid **Methylene Chloride** from drums or other storage containers to process containers.
* Specific engineering controls are required for this chemical by OSHA. Refer to the OSHA Standard: 29 CFR 1910.1052.

Good **WORK PRACTICES** can help to reduce hazardous exposures. The following work practices are recommended:

* Workers whose clothing has been contaminated by **Methylene Chloride** should change into clean clothing promptly.
* Do not take contaminated work clothes home. Family members could be exposed.

* Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **Methylene Chloride**.
* Eye wash fountains should be provided in the immediate work area for emergency use.
* If there is the possibility of skin exposure, emergency shower facilities should be provided.
* On skin contact with **Methylene Chloride**, immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted **Methylene Chloride**, whether or not known skin contact has occurred.
* Do not eat, smoke, or drink where **Methylene Chloride** is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, smoking, or using the toilet.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

OSHA 1910.132 requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Clothing

* Avoid skin contact with **Methylene Chloride**. Wear solvent-resistant gloves and clothing. Safety equipment suppliers/ manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
* All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.
* ACGIH recommends *Polyvinyl Alcohol* as a protective material.

Eye Protection

* Wear indirect-vent, impact and splash resistant goggles when working with liquids.
* Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

* Where the potential exists for exposure over **25 ppm**, use a MSHA/NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.

QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?

A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?

A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?

A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?

A: Conditions which increase risk of exposure include physical and mechanical processes (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and "confined space" exposures (working inside vats, reactors, boilers, small rooms, etc.).

Q: Is the risk of getting sick higher for workers than for community residents?

A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. This may be a problem for children or people who are already ill.

Q: Don't all chemicals cause cancer?

A: No. Most chemicals tested by scientists are not cancer-causing.

Q: Should I be concerned if a chemical causes cancer in animals?

A: Yes. Most scientists agree that a chemical that causes cancer in animals should be treated as a suspected human carcinogen unless proven otherwise.

Q: But don't they test animals using much higher levels of a chemical than people usually are exposed to?
A: Yes. That's so effects can be seen more clearly using fewer animals. But high doses alone don't cause cancer unless it's a cancer agent. In fact, a chemical that causes cancer in animals at high doses could cause cancer in humans exposed to low doses.

Q: Can men as well as women be affected by chemicals that cause reproductive system damage?
A: Yes. Some chemicals reduce potency or fertility in both men and women. Some damage sperm and eggs, possibly leading to birth defects.

Q: Who is at the greatest risk from reproductive hazards?
A: Pregnant women are at greatest risk from chemicals that harm the developing fetus. However, chemicals may affect the ability to have children, so both men and women of childbearing age are at high risk.

Q: Should I be concerned if a chemical is a teratogen in animals?
A: Yes. Although some chemicals may affect humans differently than they affect animals, damage to animals suggests that similar damage can occur in humans.

Q: What are the likely health problems from chemicals which cause mutations?
A: There are two primary health concerns associated with mutagens: (1) cancers can result from changes induced in cells and, (2) adverse reproductive and developmental outcomes can result from damage to the egg and sperm cells.

The following information is available from:

New Jersey Department of Health and Senior Services
Occupational Health Service
PO Box 360
Trenton, NJ 08625-0360
(609) 984-1863
(609) 292-5677 (fax)

Web address: http://www.state.nj.us/health/eoh/odisweb/

Industrial Hygiene Information

Industrial hygienists are available to answer your questions regarding the control of chemical exposures using exhaust ventilation, special work practices, good housekeeping, good hygiene practices, and personal protective equipment including respirators. In addition, they can help to interpret the results of industrial hygiene survey data.

Medical Evaluation

If you think you are becoming sick because of exposure to chemicals at your workplace, you may call personnel at the Department of Health and Senior Services, Occupational Health Service, who can help you find the information you need.

Public Presentations

Presentations and educational programs on occupational health or the Right to Know Act can be organized for labor unions, trade associations and other groups.

Right to Know Information Resources

The Right to Know Infoline (609) 984-2202 can answer questions about the identity and potential health effects of chemicals, list of educational materials in occupational health, references used to prepare the Fact Sheets, preparation of the Right to Know Survey, education and training programs, labeling requirements, and general information regarding the Right to Know Act. Violations of the law should be reported to (609) 984-2202.

DEFINITIONS

ACGIH is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is assigned by the Chemical Abstracts Service to identify a specific chemical.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes irreversible damage to human tissue or containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

HHAG is the Human Health Assessment Group of the federal EPA.

IARC is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

MSHA is the Mine Safety and Health Administration, the federal agency that regulates mining. It also evaluates and approves respirators.

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NAERG is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

NCI is the National Cancer Institute, a federal agency that determines the cancer-causing potential of chemicals.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the Public Employees Occupational Safety and Health Act, a state law which sets PELs for New Jersey public employees.

PIH is a DOT designation for chemicals which are Poison Inhalation Hazards.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

>>>>>>>>>>>>>>>>> EMERGENCY INFORMATION <<<<<<<<<<<<<<<<<

Common Name: **METHYLENE CHLORIDE**
DOT Number: **UN 1593**
NAERG Code: **160**
CAS Number: **75-09-2**

Hazard rating	NJDHSS	NFPA
FLAMMABILITY	-	1
REACTIVITY	-	0
CARCINOGEN POISONOUS GASES ARE PRODUCED IN FIRE CONTAINERS MAY EXPLODE IN FIRE		

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

FIRE HAZARDS

* Extinguish fire using an agent suitable for type of surrounding fire. **Methylene Chloride** itself does not burn.
* POISONOUS GASES ARE PRODUCED IN FIRE, including *Hydrogen Chloride* and *Phosgene*.
* CONTAINERS MAY EXPLODE IN FIRE.
* Use water spray to keep fire-exposed containers cool.
* If employees are expected to fight fires, they must be trained and equipped as stated in OSHA 1910.156.

SPILLS AND EMERGENCIES

If **Methylene Chloride** is spilled or leaked, take the following steps:

* Evacuate persons not wearing protective equipment from area of spill or leak until clean-up is complete.
* Absorb liquids in vermiculite, dry sand, earth, or a similar material and deposit in sealed containers.
* Ventilate and wash area after clean-up is complete.
* It may be necessary to contain and dispose of **Methylene Chloride** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.
* If employees are required to clean-up spills, they must be properly trained and equipped. OSHA 1910.120(q) may be applicable.

FOR LARGE SPILLS AND FIRES immediately call your fire department. You can request emergency information from the following:

CHEMTREC: (800) 424-9300
NJDEP HOTLINE: 1-877-WARN-DEP

HANDLING AND STORAGE

* Prior to working with **Methylene Chloride** you should be trained on its proper handling and storage.
* **Methylene Chloride** is not compatible with ALKALI METALS; ALUMINUM; LITHIUM; NITRIC ACID; OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); and CHEMICALLY ACTIVE METALS (such as POTASSIUM, SODIUM, MAGNESIUM and ZINC).
* Store in tightly closed containers in a cool, dry, well-ventilated area away from MOISTURE, AIR and HEAT.

FIRST AID

In NJ, for POISON INFORMATION call 1-800-764-7661

Eye Contact

* Immediately flush with large amounts of water. Continue without stopping for at least 30 minutes, occasionally lifting upper and lower lids. Seek medical attention immediately.

Skin Contact

* Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Breathing

* Remove the person from exposure.
* Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
* Transfer promptly to a medical facility.

PHYSICAL DATA

Vapor Pressure: 350 mm Hg at 68°F (20°C)
Water Solubility: Slightly soluble

OTHER COMMONLY USED NAMES

Chemical Name:
Methane, Dichloro-
Other Names:
Methylene Dichloride; Aerothene MM

Not intended to be copied and sold for commercial purposes.

NEW JERSEY DEPARTMENT OF HEALTH AND SENIOR SERVICES
Right to Know Program
PO Box 368, Trenton, NJ 08625-0368
(609) 984-2202 H4985

MSDS Number: **T4940** * * * * * *Effective Date: **08/01/05** * * * * * Supercedes: **05/08/03***

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS

J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

TRICHLOROETHYLENE

1. Product Identification

Synonyms: Trichloroethene; TCE; acetylene trichloride; Ethinyl trichloride
CAS No.: 79-01-6
Molecular Weight: 131.39
Chemical Formula: C2HCl3
Product Codes:
J.T. Baker: 5376, 9454, 9458, 9464, 9473
Mallinckrodt: 8600, 8633

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Trichloroethylene	79-01-6	100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED OR INHALED. AFFECTS HEART, CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. CAUSES SEVERE SKIN IRRITATION. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate (Poison)
Flammability Rating: 1 - Slight
Reactivity Rating: 1 - Slight
Contact Rating: 3 - Severe
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:
Vapors can irritate the respiratory tract. Causes depression of the central nervous system with symptoms of visual disturbances and mental confusion, incoordination, headache, nausea, euphoria, and dizziness. Inhalation of high concentrations could cause unconsciousness, heart effects, liver effects, kidney effects, and death.

Ingestion:
Cases irritation to gastrointestinal tract. May also cause effects similar to inhalation. May cause coughing, abdominal pain, diarrhea, dizziness, pulmonary edema, unconsciousness. Kidney failure can result in severe cases. Estimated fatal dose is 3-5 ml/kg.

Skin Contact:
Cause irritation, redness and pain. Can cause blistering. Continued skin contact has a defatting action and can produce rough, dry, red skin resulting in secondary infection.

Eye Contact:
Vapors may cause severe irritation with redness and pain. Splashes may cause eye damage.

Chronic Exposure:
Chronic exposures may cause liver, kidney, central nervous system, and peripheral nervous system effects. Workers chronically exposed may exhibit central nervous system depression, intolerance to alcohol, and increased cardiac output. This material is linked to mutagenic effects in humans. This material is also a suspect carcinogen.

Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders, cardiovascular disorders, impaired liver or kidney or respiratory function, or central or peripheral nervous system disorders may be more susceptible to the effects of the substance.

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4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give

oxygen. Call a physician.
Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Call a physician.
Skin Contact:
Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:
Do not administer adrenaline or epinephrine to a victim of chlorinated solvent poisoning.

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5. Fire Fighting Measures

Fire:
Autoignition temperature: 420C (788F)
Flammable limits in air % by volume:
lel: 8; uel: 12.5
Explosion:
A strong ignition source, e. g., a welding torch, can produce ignition. Sealed containers may rupture when heated.
Fire Extinguishing Media:
Use water spray to keep fire exposed containers cool. If substance does ignite, use CO2, dry chemical or foam.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Combustion by-products include phosgene and hydrogen chloride gases. Structural firefighters' clothing provides only limited protection to the combustion products of this material.

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6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from any source of heat or ignition. Isolate from incompatible substances. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
Trichloroethylene:
-OSHA Permissible Exposure Limit (PEL):
100 ppm (TWA), 200 ppm (Ceiling),
300 ppm/5min/2hr (Max)

-ACGIH Threshold Limit Value (TLV):
50 ppm (TWA) 100 ppm (STEL);
listed as A5, not suspected as a human carcinogen.

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134). This substance has poor warning properties. Where respirators are required, you must have a written program covering the basic requirements in the OSHA respirator standard. These include training, fit testing, medical approval, cleaning, maintenance, cartridge change schedules, etc. See 29CFR1910.134 for details.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact. Neoprene is a recommended material for personal protective equipment.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.
Odor:
Chloroform-like odor.
Solubility:
Practically insoluble in water. Readily miscible in organic solvents.
Specific Gravity:
1.47 @ 20C/4C
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
87C (189F)
Melting Point:
-73C (-99F)
Vapor Density (Air=1):
4.5
Vapor Pressure (mm Hg):
57.8 @ 20C (68F)
Evaporation Rate (BuAc=1):
No information found.

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10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Will slowly decompose to hydrochloric acid when exposed to light and moisture.
Hazardous Decomposition Products:
May produce carbon monoxide, carbon dioxide, hydrogen chloride and phosgene when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong caustics and alkalis, strong oxidizers, chemically active metals, such as barium, lithium, sodium, magnesium, titanium and beryllium, liquid oxygen.
Conditions to Avoid:
Heat, flame, ignition sources, light, moisture, incompatibles

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11. Toxicological Information

Toxicological Data:
Trichloroethylene: Oral rat LD50: 5650 mg/kg; investigated as a tumorigen, mutagen, reproductive effector.
Reproductive Toxicity:
This material has been linked to mutagenic effects in humans.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Trichloroethylene (79-01-6)	No	Yes	2A

12. Ecological Information

Environmental Fate:
When released into the soil, this material may leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released to water, this material is expected to quickly evaporate. This material has an experimentally-determined bioconcentration factor (BCF) of less than 100. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life between 1 and 10 days.
Environmental Toxicity:
The LC50/96-hour values for fish are between 10 and 100 mg/l. This material is expected to be slightly toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: TRICHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1710
Packing Group: III
Information reported for product/size: 4L

International (Water, I.M.O.)

Proper Shipping Name: TRICHLOROETHYLENE
Hazard Class: 6.1
UN/NA: UN1710

Packing Group: III
Information reported for product/size: 4L

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\----------

Ingredient	TSCA	EC	Japan	Australia
Trichloroethylene (79-01-6)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\----------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Trichloroethylene (79-01-6)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Trichloroethylene (79-01-6)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\----------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Trichloroethylene (79-01-6)	100	U228	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Liquid)

WARNING:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: None allocated.
Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **2** Flammability: **1** Reactivity: **0**
Label Hazard Warning:
WARNING! HARMFUL IF SWALLOWED OR INHALED. AFFECTS HEART, CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. CAUSES SEVERE SKIN IRRITATION. CAUSES IRRITATION TO EYES AND RESPIRATORY TRACT.

SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.

Label Precautions:

Do not get in eyes, on skin, or on clothing.
Do not breathe vapor.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Keep away from heat and flame.

Label First Aid:

If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases call a physician. Note to physician: Do not administer adrenaline or epinephrine to a victim of chlorinated solvent poisoning.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 3.

Disclaimer:

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Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

MSDS Number: **H3880** * * * * * *Effective Date: 09/24/04* * * * * *Supercedes: 05/07/03*

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS J.T.Baker

24-Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1 800 582-2537) for assistance.

HYDROCHLORIC ACID, 33 - 40%

1. Product Identification

Synonyms: Muriatic acid; hydrogen chloride, aqueous
CAS No.: 7647-01-0
Molecular Weight: 36.46
Chemical Formula: HCl
Product Codes:
J.T. Baker: 5367, 5537, 5575, 5800, 5814, 5821, 5839, 5861, 5862, 5894, 5962, 5972, 5994, 6900, 7831, 9529, 9530, 9534, 9535, 9536, 9537, 9538, 9539, 9540, 9544, 9548
Mallinckrodt: 2062, 2515, 2612, 2624, 2626, 3861, 5583, 5587, H611, H613, H987, H992, H999, V078, V628

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Hydrogen Chloride	7647-01-0	33 - 40%	Yes
Water	7732-18-5	60 - 67%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE LUNG DAMAGE.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 2 - Moderate
Contact Rating: 4 - Extreme (Corrosive)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: White (Corrosive)

Potential Health Effects

Inhalation:
Corrosive! Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death.
Ingestion:
Corrosive! Swallowing hydrochloric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract. May cause nausea, vomiting, and diarrhea. Swallowing may be fatal.
Skin Contact:
Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and discolor skin.
Eye Contact:
Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.

Chronic Exposure:
Long-term exposure to concentrated vapors may cause erosion of teeth. Long term exposures seldom occur due to the corrosive properties of the acid.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye disease may be more susceptible to the effects of this substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
Ingestion:
DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:
Extreme heat or contact with metals can release flammable hydrogen gas.
Explosion:
Not considered to be an explosion hazard.
Fire Extinguishing Media:
If involved in a fire, use water spray. Neutralize with soda ash or slaked lime.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Structural firefighter's protective clothing is ineffective for fires involving hydrochloric acid. Stay away from ends of tanks. Cool tanks with water spray until well after fire is out.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker NEUTRASORB® or TEAM® 'Low Na+' acid neutralizers are recommended for spills of this product.

7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, the acid should always be added slowly to water and in small amounts. Never use hot water and never add water to the acid. Water added to acid can cause uncontrolled boiling and splashing. When opening metal containers, use non-sparking tools because of the possibility of hydrogen gas being present. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
For Hydrochloric acid:
- OSHA Permissible Exposure Limit (PEL):
5 ppm (Ceiling)
- ACGIH Threshold Limit Value (TLV):
2 ppm (Ceiling), A4 Not classifiable as a human carcinogen
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, a full facepiece respirator with an acid gas cartridge may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:
Rubber or neoprene gloves and additional protection including impervious boots, apron, or coveralls, as needed in areas of unusual exposure to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Colorless, fuming liquid.
Odor:
Pungent odor of hydrogen chloride.
Solubility:
Infinite in water with slight evolution of heat.
Density:
1.18
pH:
For HCL solutions: 0.1 (1.0 N), 1.1 (0.1 N), 2.02 (0.01 N)
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
53C (127F) Azeotrope (20.2%) boils at 109C (228F)
Melting Point:
-74C (-101F)
Vapor Density (Air=1):
No information found.
Vapor Pressure (mm Hg):
190 @ 25C (77F)
Evaporation Rate (BuAc=1):
No information found.

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Containers may burst when heated.
Hazardous Decomposition Products:
When heated to decomposition, emits toxic hydrogen chloride fumes and will react with water or steam to produce heat and toxic and corrosive fumes. Thermal oxidative decomposition produces toxic chlorine fumes and explosive hydrogen gas.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
A strong mineral acid, concentrated hydrochloric acid is incompatible with many substances and highly reactive with strong bases, metals, metal oxides, hydroxides, amines, carbonates and other alkaline materials. Incompatible with materials such as cyanides, sulfides, sulfites, and formaldehyde.
Conditions to Avoid:
Heat, direct sunlight.

11. Toxicological Information

Inhalation rat LC50: 3124 ppm/1H; oral rabbit LD50: 900 mg/kg (Hydrochloric acid concentrated); investigated as a tumorigen, mutagen, reproductive effector.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Hydrogen Chloride (7647-01-0)	No	No	3
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:
When released into the soil, this material is not expected to biodegrade. When released into the soil, this material may leach into groundwater.
Environmental Toxicity:
This material is expected to be toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations.

Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: HYDROCHLORIC ACID
Hazard Class: 8
UN/NA: UN1789
Packing Group: II
Information reported for product/size: 475LB

International (Water, I.M.O.)

Proper Shipping Name: HYDROCHLORIC ACID
Hazard Class: 8
UN/NA: UN1789
Packing Group: II
Information reported for product/size: 475LB

15. Regulatory Information

Risk and Safety Phrases:
Symbol: C
Risk: 34-37
Safety: (1/2-)26-45

--------\Chemical Inventory Status - Part 1\----------

Ingredient	TSCA	EC	Japan	Australia
Hydrogen Chloride (7647-01-0)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\----------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Hydrogen Chloride (7647-01-0)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------

Ingredient	-SARA 302- RQ	TPQ	List	------SARA 313------ Chemical Catg.
Hydrogen Chloride (7647-01-0)	5000	500*	Yes	No
Water (7732-18-5)	No	No	No	No

--------\Federal, State & International Regulations - Part 2\----------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Hydrogen Chloride (7647-01-0)	5000	No	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: Yes
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Mixture / Liquid)

Australian Hazchem Code: 2R
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **0**
Label Hazard Warning:
POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE LUNG DAMAGE.
Label Precautions:

Do not get in eyes, on skin, or on clothing.
Do not breathe vapor or mist.
Use only with adequate ventilation.
Wash thoroughly after handling.
Store in a tightly closed container.
Remove and wash contaminated clothing promptly.

Label First Aid:
In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In all cases get medical attention immediately.

Product Use:
Laboratory Reagent.

Revision Information:
MSDS Section(s) changed since last revision of document include: 3.

Disclaimer:
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Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.
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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

MSDS Number: **N3660** * * * * * *Effective Date:* ***05/06/05*** * * * * * *Supercedes:* ***07/02/02***

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS

J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

NITRIC ACID, 50-70%

1. Product Identification

Synonyms: Aqua Fortis; Azotic Acid; Nitric Acid 50%; Nitric Acid 65%; nitric acid 69-70%
CAS No.: 7697-37-2
Molecular Weight: 63.01
Chemical Formula: HNO3
Product Codes:
J.T. Baker: 411D, 412D, 5371, 5796, 5801, 5826, 5856, 5876, 5896, 9597, 9598, 9600, 9601, 9602, 9603, 9604, 9606, 9607, 9608, 9610, 9616, 9617, 9670
Mallinckrodt: 1409, 2704, 2716, 6623, H862, H988, H993, H998, V077, V633, V650

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Nitric Acid	7697-37-2	50 - 70%	Yes
Water	7732-18-5	30 - 50%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 4 - Extreme (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 3 - Severe (Oxidizer)
Contact Rating: 4 - Extreme (Corrosive)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: White (Corrosive)

Potential Health Effects

Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison.

Inhalation:
Corrosive! Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract.
Ingestion:
Corrosive! Swallowing nitric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract.
Skin Contact:
Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color.
Eye Contact:
Corrosive! Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Chronic Exposure:
Long-term exposure to concentrated vapors may cause erosion of teeth and lung damage. Long-term exposures seldom occur due to the corrosive properties of the acid.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders, eye disease, or cardiopulmonary diseases may be more susceptible to the effects of this substance.

---

4. First Aid Measures

Immediate first aid treatment reduces the health effects of this substance.
Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give

oxygen. Call a physician.

Ingestion:

DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

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5. Fire Fighting Measures

Fire:

Not combustible, but substance is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition. Can react with metals to release flammable hydrogen gas.

Explosion:

Reacts explosively with combustible organic or readily oxidizable materials such as: alcohols, turpentine, charcoal, organic refuse, metal powder, hydrogen sulfide, etc. Reacts with most metals to release hydrogen gas which can form explosive mixtures with air.

Fire Extinguishing Media:

Water spray may be used to keep fire exposed containers cool. Do not get water inside container.

Special Information:

Increases the flammability of combustible, organic and readily oxidizable materials. In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

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6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker NEUTRASORB® or TEAM® 'Low Na+' acid neutralizers are recommended for spills of this product.

7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, the acid should always be added slowly to water and in small amounts. Never use hot water and never add water to the acid. Water added to acid can cause uncontrolled boiling and splashing. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
2 ppm (TWA), 4 ppm (STEL)
-ACGIH Threshold Limit Value (TLV):
2 ppm (TWA); 4 ppm (STEL)

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Nitric acid is an oxidizer and should not come in contact with cartridges and canisters that contain oxidizable materials, such as activated charcoal. Canister-type respirators using sorbents are ineffective.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Colorless to yellowish liquid.
Odor:
Suffocating, acrid.

Solubility:
Infinitely soluble.
Specific Gravity:
1.41
pH:
1.0 (0.1M solution)
% Volatiles by volume @ 21C (70F):
100 (as water and acid)
Boiling Point:
122C (252F)
Melting Point:
-42C (-44F)
Vapor Density (Air=1):
2-3
Vapor Pressure (mm Hg):
48 @ 20C (68F)
Evaporation Rate (BuAc=1):
No information found.

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10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Containers may burst when heated.
Hazardous Decomposition Products:
When heated to decomposition, emits toxic nitrogen oxides fumes and hydrogen nitrate. Will react with water or steam to produce heat and toxic and corrosive fumes.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
A dangerously powerful oxidizing agent, concentrated nitric acid is incompatible with most substances, especially strong bases, metallic powders, carbides, hydrogen sulfide, turpentine, and combustible organics.
Conditions to Avoid:
Light and heat.

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11. Toxicological Information

Nitric acid: Inhalation rat LC50: 244 ppm (NO2)/30M; Investigated as a mutagen, reproductive effector. Oral (human) LDLo: 430 mg/kg.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Nitric Acid (7697-37-2)	No	No	None
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:
No information found.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: NITRIC ACID (WITH NOT MORE THAN 70% NITRIC ACID)

Hazard Class: 8
UN/NA: UN2031
Packing Group: II
Information reported for product/size: 6.5GL

International (Water, I.M.O.)

Proper Shipping Name: NITRIC ACID
Hazard Class: 8
UN/NA: UN2031
Packing Group: II
Information reported for product/size: 6.5GL

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\---------------------------------

Ingredient	TSCA	EC	Japan	Australia

Ingredient	Korea	Canada DSL	Canada NDSL	Canada Phil.
Nitric Acid (7697-37-2)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

Ingredient	-SARA 302- RQ	-SARA 302- TPQ	SARA 313 List	SARA 313 Chemical Catg.
Nitric Acid (7697-37-2)	1000	1000	Yes	No
Water (7732-18-5)	No	No	No	No

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Nitric Acid (7697-37-2)	1000	No	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No
Reactivity: No (Mixture / Liquid)

Australian Hazchem Code: 2PE
Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

---

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **0** Other: **Oxidizer**
Label Hazard Warning:
POISON! DANGER! STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR INHALED. INHALATION MAY CAUSE LUNG AND TOOTH DAMAGE.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe vapor or mist.
Use only with adequate ventilation.
Wash thoroughly after handling.
Keep from contact with clothing and other combustible materials.
Do not store near combustible materials.

Store in a tightly closed container.
Remove and wash contaminated clothing promptly.

Label First Aid:

In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In all cases get medical attention immediately.

Product Use:

Laboratory Reagent.

Revision Information:

No Changes.

Disclaimer:

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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

00040067

SULFURIC ACID, 52 - 100 %

MSDS Number: S8234 --- *Effective Date: 09/14/00*

1. Product Identification

Synonyms: Oil of vitriol; Babcock acid; sulphuric acid
CAS No.: 7664-93-9
Molecular Weight: 98.08
Chemical Formula: H2SO4 in H2O
Product Codes:
J.T. Baker: 5030, 5137, 5374, 5802, 5815, 5889, 5960, 5961, 5971, 6902, 9673, 9674, 9675, 9676, 9679, 9680, 9681, 9682, 9684, 9687, 9691, 9693, 9694
Mallinckrodt: 2468, 2876, 2878, 2900, 2904, 3780, 4222, 5524, 5557, H644, H976, H996, V344, V651

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Sulfuric Acid	7664-93-9	52 - 100%	Yes
Water	7732-18-5	0 - 48%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR CONTACTED WITH SKIN. HARMFUL IF INHALED. AFFECTS TEETH. WATER REACTIVE. CANCER HAZARD. STRONG INORGANIC ACID MISTS CONTAINING SULFURIC ACID CAN CAUSE CANCER. Risk of cancer depends on duration and level of exposure.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 3 - Severe (Water Reactive)
Contact Rating: 4 - Extreme (Corrosive)
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: White (Corrosive)

Potential Health Effects

Inhalation:
Inhalation produces damaging effects on the mucous membranes and upper respiratory tract. Symptoms may include irritation of the nose and throat, and labored breathing. May cause lung edema, a medical emergency.
Ingestion:
Corrosive. Swallowing can cause severe burns of the mouth, throat, and stomach, leading to death. Can cause sore throat, vomiting, diarrhea. Circulatory collapse with clammy skin, weak and rapid pulse, shallow respirations, and scanty urine may follow ingestion or skin contact. Circulatory shock is often the immediate cause of death.
Skin Contact:
Corrosive. Symptoms of redness, pain, and severe burn can occur. Circulatory collapse with clammy skin, weak and rapid pulse, shallow respirations, and scanty urine may follow skin contact or ingestion. Circulatory shock is often the immediate cause of death.
Eye Contact:
Corrosive. Contact can cause blurred vision, redness, pain and severe tissue burns. Can cause blindness.
Chronic Exposure:
Long-term exposure to mist or vapors may cause damage to teeth. Chronic exposure to mists containing sulfuric acid is a cancer hazard.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems or impaired respiratory function may be more susceptible to the effects of the substance.

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4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician immediately.
Ingestion:
DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Call a physician immediately.
Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Excess acid on skin can be neutralized with a 2% solution of bicarbonate of soda. Call a physician immediately.

Eye Contact:
Immediately flush eyes with gentle but large stream of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Call a physician immediately.

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5. Fire Fighting Measures

Fire:
Concentrated material is a strong dehydrating agent. Reacts with organic materials and may cause ignition of finely divided materials on contact.
Explosion:
Contact with most metals causes formation of flammable and explosive hydrogen gas.
Fire Extinguishing Media:
Dry chemical, foam or carbon dioxide. Do not use water on material. However, water spray may be used to keep fire exposed containers cool.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Structural firefighter's protective clothing is ineffective for fires involving this material. Stay away from sealed containers.

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6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Neutralize with alkaline material (soda ash, lime), then absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker NEUTRASORB(R) or TEAM(R) 'Low Na+' acid neutralizers are recommended for spills of this product.

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7. Handling and Storage

Store in a cool, dry, ventilated storage area with acid resistant floors and good drainage. Protect from physical damage. Keep out of direct sunlight and away from heat, water, and incompatible materials. Do not wash out container and use it for other purposes. When diluting, always add the acid to water; never add water to the acid. When opening metal containers, use non-sparking tools because of the possibility of hydrogen gas being present. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
For Sulfuric Acid:
- OSHA Permissible Exposure Limit (PEL) -
1 mg/m3 (TWA)
- ACGIH Threshold Limit Value (TLV) -
1 mg/m3(TWA), 3 mg/m3 (STEL), A2 - suspected human carcinogen for sulfuric acid contained in strong inorganic acid mists.

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a full facepiece respirator with an acid gas cartridge and particulate filter (NIOSH type N100 filter) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P particulate filter. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres. Where respirators are required, you must have a written program covering the basic requirements in the OSHA respirator standard. These include training, fit testing, medical approval, cleaning, maintenance, cartridge change schedules, etc. See 29CFR1910.134 for details.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Clear oily liquid.

Odor:
Odorless.

Solubility:
Miscible with water, liberates much heat.

Specific Gravity:
1.84 (98%), 1.40 (50%), 1.07 (10%)

pH:
1 N solution (ca. 5% w/w) = 0.3; 0.1 N solution (ca. 0.5% w/w) = 1.2; 0.01 N solution (ca.

0.05% w/w) = 2.1.
% Volatiles by volume @ 21C (70F):
No information found.
Boiling Point:
ca. 290C (ca. 554F) (decomposes at 340C)
Melting Point:
3C (100%), -32C (93%), -38C (78%), -64C (65%).
Vapor Density (Air=1):
3.4
Vapor Pressure (mm Hg):
1 @ 145.8C (295F)
Evaporation Rate (BuAc=1):
No information found.

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10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage. Concentrated solutions react violently with water, spattering and liberating heat.
Hazardous Decomposition Products:
Toxic fumes of oxides of sulfur when heated to decomposition. Will react with water or steam to produce toxic and corrosive fumes. Reacts with carbonates to generate carbon dioxide gas, and with cyanides and sulfides to form poisonous hydrogen cyanide and hydrogen sulfide respectively.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Water, potassium chlorate, potassium perchlorate, potassium permanganate, sodium, lithium, bases, organic material, halogens, metal acetylides, oxides and hydrides, metals (yields hydrogen gas), strong oxidizing and reducing agents and many other reactive substances.
Conditions to Avoid:
Heat, moisture, incompatibles.

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11. Toxicological Information

Toxicological Data:
Oral rat LD50: 2140 mg/kg; inhalation rat LC50: 510 mg/m3/2H; standard Draize, eye rabbit, 250 ug (severe); investigated as a tumorigen, mutagen, reproductive effector.
Carcinogenicity:
Cancer Status: The International Agency for Research on Cancer (IARC) has classified "strong inorganic acid mists containing sulfuric acid" as a known human carcinogen, (IARC category 1). This classification applies only to mists containing sulfuric acid and not to sulfuric acid or sulfuric acid solutions.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Sulfuric Acid (7664-93-9)	No	No	None
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:
When released into the soil, this material may leach into groundwater. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition. When released into the air, this material may be removed from the atmosphere to a moderate extent by dry deposition.
Environmental Toxicity:
LC50 Flounder 100 to 330 mg/l/48 hr aerated water/Conditions of bioassay not specified; LC50 Shrimp 80 to 90 mg/l/48 hr aerated water /Conditions of bioassay not specified; LC50 Prawn 42.5 ppm/48 hr salt water /Conditions of bioassay not specified.
This material may be toxic to aquatic life.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: SULFURIC ACID (WITH MORE THAN 51% ACID)
Hazard Class: 8
UN/NA: UN1830
Packing Group: II
Information reported for product/size: 440LB

International (Water, I.M.O.)

Proper Shipping Name: SULPHURIC ACID (WITH MORE THAN 51% ACID)
Hazard Class: 8
UN/NA: UN1830
Packing Group: II

Information reported for product/size: 440LB

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\----------

Ingredient	TSCA	EC	Japan	Australia
Sulfuric Acid (7664-93-9)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\----------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Sulfuric Acid (7664-93-9)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Sulfuric Acid (7664-93-9)	1000	1000	Yes	No
Water (7732-18-5)	No	No	No	No

--------\Federal, State & International Regulations - Part 2\----------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Sulfuric Acid (7664-93-9)	1000	No	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: Yes
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: Yes (Pure / Liquid)

Australian Hazchem Code: 2P
Poison Schedule: No information found.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **2** Other: **Water reactive**
Label Hazard Warning:
POISON! DANGER! CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED OR CONTACTED WITH

SKIN. HARMFUL IF INHALED. AFFECTS TEETH. WATER REACTIVE. CANCER HAZARD. STRONG INORGANIC ACID MISTS CONTAINING SULFURIC ACID CAN CAUSE CANCER. Risk of cancer depends on duration and level of exposure.

Label Precautions:

Do not get in eyes, on skin, or on clothing.
Do not breathe mist.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Do not contact with water.

Label First Aid:

In all cases call a physician immediately. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before re-use. Excess acid on skin can be neutralized with a 2% bicarbonate of soda solution. If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 8.

Disclaimer:

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Prepared by: Strategic Services Division
Phone Number: (314) 539-1600 (U.S.A.)

00040075

BESTON CHEMICAL
TNT Revised: 04/30/1997

MSDS Contents

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SPILL OR LEAK PROCEDURES
SPECIAL PROTECTION INFORMATION
SPECIAL PRECAUTIONS
STORAGE CONDITIONS
SHIPPING INFORMATION

BSI

BESTON CHEMICAL CORPORATION
P.O. BOX 2826
CONROE, TEXAS 77305-2826
PHONE: (409) 856-1431
FAX: (409) 856-3163

MATERIAL SAFETY DATA SHEET
(MSDS-TNT)

PRODUCT IDENTIFICATION

PRODUCT NAME
TNT

DESCRIPTION
HIGH EXPLOSIVES

TRADE NAMES AND SYNONYMS
2,4,6 TRINITROTOLUENE

MANUFACTURER/DISTRIBUTOR
CHINA NORTH CHEMICAL INDUSTRIES CORP.

TRANSPORTATION EMERGENCY
800-255-3924 (24 HRS - CHEM-TEL)

PREVENTION OF ACCIDENTS IN THE USE OF EXPLOSIVES

THE PREVENTION OF ACCIDENTS IN THE USE OF EXPLOSIVES IS A RESULT OF CAREFUL PLANNING AND OBSERVANCE OF THE BEST KNOWN PRACTICES. THE EXPLOSIVES USER MUST REMEMBER THAT HE IS DEALING WITH A POWERFUL FORCE AND THAT VARIOUS DEVICES AND METHODS HAVE BEEN DEVELOPED TO ASSIST HIM IN DIRECTING THIS FORCE. HE SHOULD REALIZE THAT THIS FORCE, IF MISDIRECTED, MAY EITHER KILL OR INJURE BOTH HIM AND HIS FELLOW WORKERS.

WARNING

ALL EXPLOSIVES ARE DANGEROUS AND MUST BE CAREFULLY HANDLED AND USED FOLLOWING APPROVED SAFETY PROCEDURES EITHER BY OR UNDER THE DIRECTION OF COMPETENT, EXPERIENCED PERSONS IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL LAWS, REGULATIONS, OR ORDINANCES. IF YOU HAVE ANY QUESTIONS OR DOUBTS AS TO HOW TO USE ANY EXPLOSIVE PRODUCT, DO NOT USE IT BEFORE CONSULTING WITH YOUR SUPERVISOR, OR THE MANUFACTURER, IF YOU DO NOT HAVE A SUPERVISOR. IF YOUR SUPERVISOR HAS ANY QUESTIONS OR DOUBTS, HE SHOULD CONSULT THE MANUFACTURER BEFORE USE.

HAZARDOUS COMPONENTS

MATERIAL OR COMPONENT
TNT (TRINITROTOLUENE)

CAS NO.
38082-89-2

TLV
1.5 MG/M3

PEL
0.5 MG/M3

N/A = NOT ASSIGNED
N/E = NOT ESTABLISHED

PHYSICAL DATA

BOILING POINT
464 DEG. F

VAPOR PRESSURE
0.057 MPa @ 179 DEG. F

VAPOR DENSITY
N/A

SOLUBILITY IN WATER
INSOLUBLE

SPECIFIC GRAVITY
1.5 - 1.6

MELTING POINT
176 DEG. F

EVAPORATION RATE
N/A

APPEARANCE AND ODOR
YELLOW FLAKES, WITH BITTER ALMOND ODOR

HAZARDOUS REACTIVITY

INSTABILITY
STABLE

INCOMPATIBILITY
NO DATA APPLICABLE

HAZARDOUS DECOMPOSITION
NITROUS OXIDE

POLYMERIZATION
POLYMERIZATION WILL NOT OCCUR

FIRE AND EXPLOSION DATA

FLASHPOINT
NOT APPLICABLE

EXTINGUISHING MEDIA
NONE

UNUSUAL FIRE AND EXPLOSIVE HAZARDS
WILL DETONATE IF SUITABLY PRIMED BY HEAT OR FLAME. HAZARDOUS GASES PRODUCED IN FIRE ARE NITROGEN OXIDES.

SPECIAL FIRE FIGHTING PROCEDURES
SEE BELOW

AUTO IGNITION TEMPERATURE
570 DEG. F

ALL EXPLOSIVES:
DO NOT FIGHT EXPLOSIVES FIRES. TRY TO KEEP FIRE FROM REACHING EXPLOSIVES. ISOLATE AREA AND EVACUATE PERSONNEL TO A SAFE PLACE. GUARD AGAINST INTRUDERS.

DIVISION 1.1 EXPLOSIVES:
EVACUATE THE AREA FOR 5,000 FEET (1 MILES). CONSULT NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK GUIDE NUMBER 112 FOR FURTHER DETAILS.

HEALTH HAZARDS

GENERAL
TNT IS A DIVISION 1.1 EXPLOSIVE, AND DETONATION MAY CAUSE SEVERE PHYSICAL INJURY, INCLUDING DEATH. ALL EXPLOSIVES ARE DANGEROUS AND MUST BE HANDLED CAREFULLY AND USED FOLLOWING APPROVED SAFETY PROCEDURES UNDER THE DIRECTION OF COMPETENT, EXPERIENCED PERSONS IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE AND LOCAL LAWS, REGULATIONS AND ORDINANCES.

INHALATION OF EXPLOSIVES POWDERS MAY CAUSE NERVOUS SYSTEM IRREGULARITIES, INCLUDING HEADACHE AND DIZZINESS.

NITROGEN OXIDES GENERATED DURING USE ARE SKIN, EYE AND RESPIRATORY TRACT

IRRITANTS.

CARCINOGENICITY
NONE OF THE COMPONENTS OF TNT ARE LISTED AS A CARCINOGEN BY NTP, IARC OR OSHA.

FIRST AID

INHALATION
IF DETONATION FUMES ARE INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION, PREFERABLY MOUTH-TO-MOUTH. IF BREATHING IS DIFFICULT, GIVE OXYGEN AND CALL A PHYSICIAN.

EYE AND SKIN CONTACT
FLUSH EYES WITH WATER. WASH SKIN WITH SOAP AND WATER.

INGESTION
INDUCE VOMITING IMMEDIATELY BY GIVING TWO GLASSES OF WATER AND STICKING FINGER DOWN THROAT.

INJURY FROM DETONATION
SEEK PROMPT MEDICAL ATTENTION.

SPILL OR LEAK PROCEDURES

SPILL/LEAK RESPONSE
REVIEW FIRE AND EXPLOSION HAZARDS BEFORE PROCEEDING WITH CLEAN UP. REMOVE ALL IGNITION SOURCES. WEAR PROTECTIVE EQUIPMENT DURING CLEAN UP. MOP UP WITH WATER.

WASTE DISPOSAL
DISPOSE OF IN COMPLIANCE WITH FEDERAL REGULATIONS UNDER THE AUTHORITY OF THE RESOURCE CONSERVATION AND RECOVERY ACT (40 CFR PARTS 260-271).

SPECIAL PROTECTION INFORMATION

VENTILATION RESPIRATORY
GENERAL VENTILATION WITH LOCAL EXHAUST IN OPERATION AREA. WEAR FITTED NIOSH APPROVED RESPIRATOR, AVOID DUSTING BY KEEPING WET WHEN POSSIBLE.

EYE
CHEMICAL GOGGLES.

GLOVES
COTTON OR LEATHER GLOVES.

OTHER
FLAME PROOF COVERALLS AND CONDUCTIVE BOOTS.

SPECIAL PRECAUTIONS

REFER TO MANUFACTURER'S INSTRUCTIONS AND WARNINGS SUPPLIED WITH PRODUCT

STORAGE CONDITIONS

STORE IN ACCORDANCE WITH THE REQUIREMENTS OF SUBPART K, ATF: EXPLOSIVES LAW AND REGULATIONS (27 CFR 55.201-55.219).

SHIPPING INFORMATION

PROPER SHIPPING NAME
TNT

HAZARD CLASS
1.1D

UN NUMBER
UN0209 (1.1D)

DOT LABEL & PLACARD
DOT LABEL EXPLOSIVE 1.1D
DOT PLACARD EXPLOSIVES 1.1

THE INFORMATION CONTAINED IN THIS MATERIAL SAFETY DATA SHEET IS BASED UPON AVAILABLE DATA AND BELIEVED TO BE CORRECT; HOWEVER, AS SUCH AS BEEN OBTAINED FROM VARIOUS SOURCES, INCLUDING THE MANUFACTURER AND INDEPENDENT LABORATORIES, IT IS GIVEN WITHOUT WARRANTY OR REPRESENTATION THAT IT IS COMPLETE, ACCURATE, AND CAN BE RELIED UPON. BESTON CHEMICAL CORPORATION, INC. HAS NOT ATTEMPTED TO CONCEAL IN ANY MANNER THE DELETERIOUS ASPECTS OF THE PRODUCT LISTED HEREIN, BUT MAKES NO WARRANTY AS TO SUCH. FURTHER, BESTON CHEMICAL CORPORATION, INC. CANNOT ANTICIPATE NOR CONTROL THE MANY SITUATIONS IN WHICH THE PRODUCT OR THIS INFORMATION MAY BE USED; THERE IS NO GUARANTEE THAT THE HEALTH AND SAFETY PRECAUTIONS SUGGESTED WILL BE PROPER UNDER ALL CONDITIONS. IT IS THE SOLE RESPONSIBILITY OF EACH USER OF THE PRODUCT TO DETERMINE AND COMPLY WITH THE REQUIREMENTS OF ALL APPLICABLE LAWS AND REGULATIONS REGARDING ITS USE. THIS INFORMATION IS GIVEN SOLELY FOR THE PURPOSES OF SAFETY TO PERSONS AND PROPERTY. ANY OTHER USE OF THIS INFORMATION IS EXPRESSLY PROHIBITED.

FOR FURTHER INFORMATION CONTACT:
MICHAEL E. POTTER OR FRANCIS X. COLLIGAN
P.O. BOX 2826
CONROE, TEXAS 77305-2826
TELEPHONE NUMBER: 409-856-1431
FAX NUMBER: 409-856-3163

MSDS PREPARED BY:
OWEN COMPLIANCE SERVICES, INC.
ORIGINAL PUBLICATION DATE: 4/30/97
REVISION DATE NA

MSDS Number: **L2347** * * * * * *Effective Date:* ***08/10/04*** * * * * * *Supercedes:* ***11/02/01***

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS | J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

LEAD METAL

1. Product Identification

Synonyms: Granular lead, pigment metal; C.I. 77575
CAS No.: 7439-92-1
Molecular Weight: 207.19
Chemical Formula: Pb
Product Codes:
J.T. Baker: 2256, 2266
Mallinckrodt: 5668

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Lead	7439-92-1	95 - 100%	Yes

3. Hazards Identification

Emergency Overview

POISON! DANGER! MAY BE FATAL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. NEUROTOXIN. AFFECTS THE GUM TISSUE, CENTRAL NERVOUS SYSTEM, KIDNEYS, BLOOD AND REPRODUCTIVE SYSTEM. POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Life)
Flammability Rating: 0 - None
Reactivity Rating: 0 - None
Contact Rating: 1 - Slight
Lab Protective Equip: GOGGLES; LAB COAT; PROPER GLOVES
Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:

Lead can be absorbed through the respiratory system. Local irritation of bronchia and lungs can occur and, in cases of acute exposure, symptoms such as metallic taste, chest and abdominal pain, and increased lead blood levels may follow. See also Ingestion.

Ingestion:

POISON! The symptoms of lead poisoning include abdominal pain and spasms, nausea, vomiting, headache. Acute poisoning can lead to muscle weakness, "lead line" on the gums, metallic taste, definite loss of appetite, insomnia, dizziness, high lead levels in blood and urine with shock, coma and death in extreme cases.

Skin Contact:

Lead and lead compounds may be absorbed through the skin on prolonged exposure; the symptoms of lead poisoning described for ingestion exposure may occur. Contact over short periods may cause local irritation, redness and pain.

Eye Contact:

Absorption can occur through eye tissues but the more common hazards are local irritation or abrasion.

Chronic Exposure:

Lead is a cumulative poison and exposure even to small amounts can raise the body's content to toxic levels. The symptoms of chronic exposure are like those of ingestion poisoning; restlessness, irritability, visual disturbances, hypertension and gray facial color may also be noted.

Aggravation of Pre-existing Conditions:

Persons with pre-existing kidney, nerve or circulatory disorders or with skin or eye problems may be more susceptible to the effects of this substance.

---

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention.
Skin Contact:
Immediately flush skin with plenty of soap and water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard. Powder/dust is flammable when heated or exposed to flame.
Explosion:
Not considered to be an explosion hazard.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire. Do not allow water runoff to enter sewers or waterways.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Can produce toxic lead fumes at elevated temperatures and also react with oxidizing materials.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Sweep up and containerize for reclamation or disposal. Vacuuming or wet sweeping may be used to avoid dust dispersal. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from incompatible substances. Areas in which exposure to lead

metal or lead compounds may occur should be identified by signs or appropriate means, and access to the area should be limited to authorized persons. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

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8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
For lead, metal and inorganic dusts and fumes, as Pb:
-OSHA Permissible Exposure Limit (PEL): 0.05 mg/m3 (TWA)
For lead, elemental and inorganic compounds, as Pb:
-ACGIH Threshold Limit Value (TLV): 0.05 mg/m3 (TWA), A3 animal carcinogen
ACGIH Biological Exposure Indices (BEI): 30 ug/100ml, notation B (see actual Indices for more information).
For lead, inorganic:
-NIOSH Recommended Exposure Limit (REL): 0.1 mg/m3 (TWA)
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a half-face high efficiency particulate respirator (NIOSH type N100 filter) may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece high efficiency particulate respirator (NIOSH type N100 filter) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P filter. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.
Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.
Eye Protection:
Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.
Other Control Measures:
Eating, drinking, and smoking should not be permitted in areas where solids or liquids containing lead compounds are handled, processed, or stored. See OSHA substance-specific standard for more information on personal protective equipment, engineering and work practice controls, medical surveillance, record keeping, and reporting requirements. (29 CFR 1910.1025).

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9. Physical and Chemical Properties

Appearance:
Small, white to blue-gray metallic shot or granules.
Odor:
Odorless.
Solubility:
Insoluble in water.
Density:
11.34
pH:
No information found.
% Volatiles by volume @ 21C (70F):
0
Boiling Point:
1740C (3164F)
Melting Point:
327.5C (622F)
Vapor Density (Air=1):
No information found.
Vapor Pressure (mm Hg):
1.77 @ 1000C (1832F)
Evaporation Rate (BuAc=1):
No information found.

---

10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
Does not decompose but toxic lead or lead oxide fumes may form at elevated temperatures.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Ammonium nitrate, chlorine trifluoride, hydrogen peroxide, sodium azide, zirconium, disodium acetylide, sodium acetylide and oxidants.
Conditions to Avoid:
Heat, flames, ignition sources and incompatibles.

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11. Toxicological Information

Toxicological Data:
Investigated as a tumorigen, mutagen, reproductive effector.
Reproductive Toxicity:
Lead and other smelter emissions are human reproductive hazards. (Chemical Council on

Environmental Quality; Chemical Hazards to Human Reproduction, 1981).
Carcinogenicity:
EPA / IRIS classification: Group B2 - Probable human carcinogen, sufficient animal evidence.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Lead (7439-92-1)	No	No	2B

12. Ecological Information

Environmental Fate:
When released into the soil, this material is not expected to leach into groundwater. This material may bioaccumulate to some extent.
Environmental Toxicity:
No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\----------

Ingredient	TSCA	EC	Japan	Australia
Lead (7439-92-1)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\----------

	--Canada--

Ingredient	Korea	DSL	NDSL	Phil.
Lead (7439-92-1)	Yes	Yes	No	Yes

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Lead (7439-92-1)	No	No	Yes	No

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Lead (7439-92-1)	10	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Solid)

WARNING:
THIS PRODUCT CONTAINS CHEMICALS KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

Australian Hazchem Code: None allocated.
Poison Schedule: S6
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

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16. Other Information

NFPA Ratings: Health: **3** Flammability: **1** Reactivity: **0**
Label Hazard Warning:
POISON! DANGER! MAY BE FATAL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. NEUROTOXIN. AFFECTS THE GUM TISSUE, CENTRAL NERVOUS SYSTEM, KIDNEYS, BLOOD AND REPRODUCTIVE SYSTEM. POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure.
Label Precautions:
Do not get in eyes, on skin, or on clothing.
Do not breathe dust.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Label First Aid:
If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not

breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.

Product Use:
Laboratory Reagent.

Revision Information:
No Changes.

Disclaimer:
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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

00040088

HIGH-PURITY STANDARDS
P.O. Box 41727
Charleston, SC 29423

Phone: (843) 767-7900
Fax: (843) 767-7906

MATERIAL SAFETY DATA SHEET

Mercury
Cat. No. 100033-1

Issue Date: 9-9-03

SECTION I - Product Identification/Hazardous Ingredients

Formula: Hg Concentration: 1000 µg/mL Molecular Weight: 200.59

TSCA: YES CAS NO: 7697-37-2/7439-97-6

Component: Hg metal in 2% HNO_3 + 98% H_2O TLV/TWA: 8 h Not Estab. 5 mg/m^3

STEL: N/A PEL: N/A Toxicity: N/A

Internet copy

SECTION II - Physical/Chemical Characteristics

Boiling Point: 100°C Vapor Pressure (mm): N/A Vapor Density (air+1): N/A

Freezing Point: N/A Specific Gravity (H_20 = 1): 1.0119 Solubility in H_20: Complete

SECTION III - Fire and Explosion Hazard Data

Flash Point: N/A Auto Ignition Temperature: N/A Lower Explosion Level: N/A

NFPA - Rating: N/A Extinguishing Media: Use appropriate

Special fire-fighting Procedures: Firefighters should wear proper protective equipment and self-contained breathing apparatus with full face piece operated in positive pressure mode.

Unusual Fires Explosion Hazards: N/A

Toxic Gases Produced: NO_X, Hg

Hg in 2% HNO_3

SECTION IV - Reacting Data

Unstable : () Stable: (X)

Conditions to Avoid: Metals, hydroxides, carbonates, cyanides

Incompatibles: Strong reducing agents

Hazardous Decomposition: NO_X, Hg

SECTION V - Health Hazard Data

Routes of Entry: Inhalation, eye contact, skin contact

Signs and Symptoms of Exposure: Liquid may cause burns to skin and eyes.

Medical Conditions Generally Aggravated by Exposure: None identified

Carcinogenicity: NTP: No IARC: No ZLIST: No OSHA reg: No

Emergency First Aid Procedures: CALL A PHYSICIAN; If swallowed, do not induce vomiting. If conscious, give water, milk. In case of contact, flush eyes or skin with plenty of water.

Internet copy

SECTION VI - Precautions for Safe Handling and Use

Special Precautions: Keep container tightly closed

In Case of Spill or Discharge: Remove source of ignition if hydrogen is a hazard. Provide optimum ventilation. Flush to holding area for neutralization.

Disposal Procedures: Follow Federal, State and Local regulations for acid waste.

EPA Hazardous Waste #: N/A

SECTION VII - Protective Equipment

Respiratory Protection: NIOSH approved respirator

Ventilation: Local Exhaust (X) Mechanical ()

Protective Gloves: Proper gloves

Eye Protection: Safety glasses with side shields

Other: Lab coat/apron; vent hood

NOTICE

The data and information as stated was furnished by the manufacturer of the product. HPS products are intended for laboratory use only. All products should be handled and used by trained professional personnel only. The responsibility for the safe handling and use of these products rest solely with the buyer and/or user. Theodore C. Rains, Ph.D. 9-9-03.

MSDS Number: **M1599** * * * * * *Effective Date:* ***08/10/04*** * * * * * *Supercedes:* ***11/02/01***

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

Mallinckrodt CHEMICALS J.T.Baker

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

MERCURY

1. Product Identification

Synonyms: Quicksilver; hydrargyrum; Liquid Silver
CAS No.: 7439-97-6
Molecular Weight: 200.59
Chemical Formula: Hg
Product Codes:
J.T. Baker: 2564, 2567, 2569
Mallinckrodt: 1278, 1280, 1288

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Mercury	7439-97-6	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

DANGER! CORROSIVE. CAUSES BURNS TO SKIN, EYES, AND RESPIRATORY TRACT. MAY BE FATAL IF SWALLOWED OR INHALED. HARMFUL IF ABSORBED THROUGH SKIN. AFFECTS THE KIDNEYS AND CENTRAL NERVOUS SYSTEM. MAY CAUSE ALLERGIC SKIN REACTION.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 4 - Extreme (Poison)
Flammability Rating: 0 - None
Reactivity Rating: 1 - Slight
Contact Rating: 3 - Severe (Life)
Lab Protective Equip: GOGGLES; LAB COAT; PROPER GLOVES
Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:
Mercury vapor is highly toxic via this route. Causes severe respiratory tract damage. Symptoms include sore throat, coughing, pain, tightness in chest, breathing difficulties, shortness of breath, headache, muscle weakness, anorexia, gastrointestinal disturbance, ringing in the ear, liver changes, fever, bronchitis and pneumonitis. Can be absorbed through inhalation with symptoms similar to ingestion.

Ingestion:
May cause burning of the mouth and pharynx, abdominal pain, vomiting, corrosive ulceration, bloody diarrhea. May be followed by a rapid and weak pulse, shallow breathing, paleness, exhaustion, tremors and collapse. Delayed death may occur from renal failure. Gastrointenstinal uptake of mercury is less than 5% but its ability to penetrate tissues presents some hazard. Initial symptoms may be thirst, possible abdominal discomfort.

Skin Contact:
Causes irritaton and burns to skin. Symptoms include redness and pain. May cause skin allergy and sensitization. Can be absorbed through the skin with symptoms to parallel ingestion.

Eye Contact:
Causes irritation and burns to eyes. Symptoms include redness, pain, blurred vision; may cause serious and permanent eye damage.

Chronic Exposure:
Chronic exposure through any route can produce central nervous system damage. May cause muscle tremors, personality and behavior changes, memory loss, metallic taste, loosening of the teeth, digestive disorders, skin rashes, brain damage and kidney damage. Can cause skin allergies and accumulate in the body. Repeated skin contact can cause the skin to turn gray in color. A suspected reproductive hazard; may damage the developing fetus and decrease fertility in males and females.

Aggravation of Pre-existing Conditions:
Persons with nervous disorders, or impaired kidney or respiratory function, or a history of allergies or a known sensitization to mercury may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

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5. Fire Fighting Measures

Fire:
Not considered to be a fire hazard.
Explosion:
Not considered to be an explosion hazard.
Fire Extinguishing Media:
Use any means suitable for extinguishing surrounding fire. Do not allow water runoff to enter sewers or waterways.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Undergoes hazardous reactions in the presence of heat and sparks or ignition. Smoke may contain toxic mercury or mercuric oxide. Smoke may contain toxic mercury or mercuric oxide.

---

6. Accidental Release Measures

Ventilate area of leak or spill. Clean-up personnel require protective clothing and respiratory protection from vapor.

Spills: Pick up and place in a suitable container for reclamation or disposal in a method that does not generate misting. Sprinkle area with sulfur or calcium polysulfide to suppress mercury. Do not flush to sewer. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker CINNASORB® and RESISORB® are recommended for spills of this product.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from any source of heat or ignition. Do not use or store on porous work surfaces (wood, unsealed concrete, etc.). Follow strict hygiene practices. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
- OSHA Acceptable Ceiling Concentration:
mercury and mercury compounds: 0.1 mg/m3 (TWA), skin
- ACGIH Threshold Limit Value (TLV):
inorganic and metallic mercury, as Hg: 0.025 mg/m3 (TWA) skin, A4 Not classifiable as a human carcinogen.
- ACGIH Biological Exposure Indices:
total inorganic mercury in urine (preshift): 35 ug/g creatinine;
total inorganic mercury in blood (end of shift): 15 ug/l.

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a half-face respirator with a mercury vapor or chlorine gas cartridge may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece respirator with a mercury vapor or chlorine gas cartridge may be worn up to 50 times the exposure limit, or the maximum use concentraiton specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator.
WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:
Silver-white, heavy, mobile, liquid metal.
Odor:
Odorless.
Solubility:
Insoluble in water.
Density:
13.55
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
356.7C (675F)
Melting Point:
-38.87C (-38F)
Vapor Density (Air=1):
7.0
Vapor Pressure (mm Hg):
0.0018 @ 25C (77F)
Evaporation Rate (BuAc=1):
4

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10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
At high temperatures, vaporizes to form extremely toxic fumes.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Acetylenes, ammonia, ethylene oxide, chlorine dioxide, azides, metal oxides, methyl silane, lithium, rubidium, oxygen, strong oxidants, metal carbonyls.
Conditions to Avoid:
Heat, flames, ignition sources, metal surfaces and incompatibles.

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11. Toxicological Information

Toxicological Data:
Investigated as a tumorigen, mutagen, reproductive effector.
Reproductive Toxicity:
All forms of mercury can cross the placenta to the fetus, but most of what is known has

been learned from experimental animals. See Chronic Health Hazards.
Carcinogenicity:
EPA / IRIS classification: Group D1 - Not classifiable as a human carcinogen.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Mercury (7439-97-6)	No	No	3

12. Ecological Information

Environmental Fate:
This material has an experimentally-determined bioconcentration factor (BCF) of greater than 100. This material is expected to significantly bioaccumulate.
Environmental Toxicity:
This material is expected to be toxic to aquatic life. The LC50/96-hour values for fish are less than 1 mg/l.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: RQ, MERCURY
Hazard Class: 8
UN/NA: UN2809
Packing Group: III
Information reported for product/size: 1LB

International (Water, I.M.O.)

Proper Shipping Name: MERCURY
Hazard Class: 8
UN/NA: UN2809
Packing Group: III
Information reported for product/size: 1LB

15. Regulatory Information

--------\Chemical Inventory Status - Part 1\--------------------------------

Ingredient	TSCA	EC	Japan	Australia
Mercury (7439-97-6)	Yes	Yes	No	Yes

--------\Chemical Inventory Status - Part 2\--------------------------------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Mercury (7439-97-6)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Mercury (7439-97-6)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\----------------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Mercury (7439-97-6)	1	U151	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Liquid)

WARNING:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

Australian Hazchem Code: 2Z
Poison Schedule: S7
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **0**
Label Hazard Warning:
DANGER! CORROSIVE. CAUSES BURNS TO SKIN, EYES, AND RESPIRATORY TRACT. MAY BE FATAL IF SWALLOWED OR INHALED. HARMFUL IF ABSORBED THROUGH SKIN. AFFECTS THE KIDNEYS AND CENTRAL NERVOUS SYSTEM. MAY CAUSE ALLERGIC SKIN REACTION.
Label Precautions:

Do not get in eyes, on skin, or on clothing.
Do not breathe vapor.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.

Label First Aid:

If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases get medical attention immediately.

Product Use:

Laboratory Reagent.

Revision Information:

No Changes.

Disclaimer:

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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

Attachment 5
Activity Hazard Analysis Table

ACTIVITY HAZARD ANALYSIS FOR MOBILIZATION/SITE PREPARATION				
Principle Steps	**Potential Safety/Health Hazards**	**Hazard Control Measures**	**Personal Protective Equipment**	**Monitoring Devices**
Mobilization/site setup and survey/ layout	Slips, trips, falls	• Clear walkways, work areas of equipment, tools, vegetation, excavated material and debris • Mark, identify, or barricade other obstructions • Ensure footing. Look before you step	—	—
	Electrical shock	• De-energize or shut off utility lines at their source before work begins • Use double insulated or properly grounded electric power-operated tools • Maintain tools in a safe condition • Provide an equipment-grounding conductor program or employ ground-fault circuit interrupters • Use qualified electricians to hook up electrical circuits • Inspect extension cords daily for structural integrity, ground continuity, and damaged insulation • Cover or elevate electric wire or flexible cord passing through work areas to protect from damage • Keep all plugs and receptacles out of water • Use approved waterproof, weather-proof equipment if exposure to moisture is likely • Inspect electrical power circuits prior to commencing work • Follow lockout-tagout procedures in accordance with Shaw Health & Safety Program, Volumes I & II, HS315	—	—
	Handling heavy objects	• Observe proper lifting techniques • Obey sensible lifting limits (60 lb maximum per person manual lifting) • Use mechanical lifting equipment (hand carts, trucks) to move large, awkward loads	—	—
	Sharp objects	• Wear cut-resistant work gloves when the possibility of lacerations or other injury may be caused by sharp edges or objects • Maintain hand and power tools in a safe condition • Keep guards in place during use	Leather gloves with reinforced palm	—

ACTIVITY HAZARD ANALYSIS FOR MOBILIZATION/SITE PREPARATION				
Principle Steps	**Potential Safety/Health Hazards**	**Hazard Control Measures**	**Personal Protective Equipment**	**Monitoring Devices**
Mobilization/site setup and survey/ layout (*cont*.)	High noise levels	• Use hearing protection when exposed to excessive noise levels (greater than 85 decibels, A-scale (dBA) over an 8-hour work period)	Ear plugs	—
	High/low ambient temperature	• Monitor for heat/cold stress in accordance with Shaw Health & Safety Program, Volumes I & II, HS400 / HS 401 • Provide fluids to prevent worker dehydration	Insulated clothing (subject to ambient temperature)	Meteorological equipment

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Hand tools	• Daily heavy equipment inspections • Small equipment as specified by operations manual	• Review Site Safety and Health Plan (HASP) • Review site-specific Activity Hazard Analysis (AHA) with all task personnel. • Review equipment safety operations manual • Safe driver's training (HS800)

ACTIVITY HAZARD ANALYSIS FOR WELL INSTALLATION, DEVELOPMENT, AND GROUNDWATER/SOIL SAMPLING				
Task Breakdown	**Potential Hazards**	**Hazard Control Measures**	**Personal Protective Equipment**	**Monitoring Devices**
Well installation, development, and abandonment	Struck by/against flying particles, protruding objects	• Wear hard hats, safety glasses with side shields and steel-toe safety boots at all times • Wear splash shields and safety goggles when cleaning, decontaminating drilling equipment	Hard hat, safety glasses	—
	Handling heavy objects	• Observe proper lifting techniques • Obey sensible lifting limits (60 lb maximum per person manual lifting) • Use mechanical lifting equipment (hand carts, trucks) to move large, awkward loads	—	—
	Caught in/between moving parts	• Identify and understand parts of equipment which may cause crushing, pinching, rotating or similar injuries • Assure guards are in place to protect from these parts of equipment during operation • Provide and use proper work gloves when the possibility of pinching, or other injury may be caused by moving/ handling large or heavy objects • Maintain all equipment in a safe condition • Keep all guards in place during use • De-energize and lock-out machinery before maintenance or service	—	—
	Sharp objects	• Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by sharp edges or objects • Maintain all tools in a safe condition • Keep guards in place during use	Leather gloves, with reinforced palm	—
	Inhalation and contact with hazardous substances	• Provide workers proper skin, eye and respiratory protection based on the exposure hazards present • Review hazardous properties of site contaminants before starting work	Tyvek® coveralls, nitrile gloves	LEL/O_2, photoionization detector (PID)
	High noise levels	• Use hearing protection when exposed to excessive noise levels (greater than 85 dBA over an 8-hour work period) • Assess noise level with sound level meter if possibility exists that level may exceed 85 dBA time-weighted average (TWA)	Ear plugs	Sound level meter

ACTIVITY HAZARD ANALYSIS FOR WELL INSTALLATION, DEVELOPMENT, AND GROUNDWATER/SOIL SAMPLING				
Task Breakdown	**Potential Hazards**	**Hazard Control Measures**	**Personal Protective Equipment**	**Monitoring Devices**
Well installation, development, and abandonment *(cont.)*	Fire/explosion	• Test atmosphere with combustible gas meter • Eliminate sources of ignition from the work area • Prohibit smoking in well drilling area • Provide ABC (or equivalent) fire extinguishers for all work and flammable storage areas, fuel powered generators and compressors • Store flammable liquids in well ventilated areas • Prohibit storage, transfer of flammable liquids in plastic containers • Post "NO SMOKING" signs • Store combustible materials away from flammables • Store all compressed gas cylinders upright, caps in place when not in use • Separate flammables and oxidizers by 20 feet minimum	—	LEL/O_2
Groundwater/soil sampling	Inhalation and contact with hazardous substances	• Provide workers proper skin, eye and respiratory protection based on the exposure hazards present • Review hazardous properties of site contaminants with workers before sampling operations begin	Latex inner gloves, Tyvek® coveralls, nitrile gloves	LEL/O_2, PID
	Flammable, explosive atmospheres	• Test well head atmosphere for flammable/toxic vapors • Wear proper level of PPE for the type of atmospheric contaminants • Eliminate sources of ignition from the work area • Prohibit smoking in development area	Tyvek® coveralls, nitrile gloves	LEL/O_2, PID
	Struck by/against flying particles, protruding objects, liquid splash	• Wear Hard hats, safety glasses with side shields and steel-toe safety boots at all times • Wear splash shields and safety goggles when sampling, cleaning, decontaminating test equipment	Hard hat, safety glasses	—
	Handling heavy objects	• Observe proper lifting techniques • Obey sensible lifting limits (60 lb maximum per person manual lifting) • Use mechanical lifting equipment (hand carts, trucks) to move large, awkward loads	—	—
	Sharp objects	• Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by sharp edges or objects • Maintain all tools in a safe condition • Keep guards in place during use	Cut resistant gloves	—

ACTIVITY HAZARD ANALYSIS FOR WELL INSTALLATION, DEVELOPMENT, AND GROUNDWATER/SOIL SAMPLING				
Task Breakdown	**Potential Hazards**	**Hazard Control Measures**	**Personal Protective Equipment**	**Monitoring Devices**
Groundwater sampling *(cont.)*	High/low ambient temperature	• Monitor for heat/cold stress in accordance with Shaw Health & Safety Program, Volumes I & II, HS400 / HS 401 • Provide fluids to prevent worker dehydration	Insulated clothing (subject to ambient temperature)	Meteorological equipment

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Drill rig • Hand tools	• Daily heavy equipment inspections • Daily drill rig Inspections • Small equipment as specified by operations manual	• 40 hour Hazardous Waste Training • Review HASP • Review site-specific AHA with all task personnel. • Review equipment safety operations manual • Safe driver's training (HS800)

ACTIVITY HAZARD ANALYSIS FOR SOIL EXCAVATION				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
Excavation of Soil & Backfill	Overhead Utilities	• Maintain at least 10 feet from overhead power lines, up to 50 kV • For voltages over 50 kV, add 0.4 inches per kV to obtain the safe distance between equipment and power lines • If voltage is unknown, remain at least 20 feet from overhead power lines. • Do not drive the drill rig from hole to hole with the mast in the raised position. Before raising the mast, check for overhead obstructions.		
	Underground Utilities	• Identify all underground and overhead utilities around the excavation site before work commences • Use manual excavation within 3 feet of known utilities • Cease work immediately if unknown utility markers are uncovered		
	Struck By/ Against Heavy Equipment	• Wear reflective warning vests when exposed to vehicular traffic • Isolate equipment swing areas • Make eye contact with operators before approaching equipment • Understand and review hand signals	Warning vests, hard hat, safety glasses, steel toe work boots	
	Handling Heavy Objects	• Observe proper lifting techniques • Obey sensible lifting limits (60 lb. maximum per person manual lifting) • Use mechanical lifting equipment (hand carts, trucks) to move large, awkward loads		
	Sharp Objects	• Wear cut resistant work gloves when the possibility of lacerations or other injury may be caused by sharp edges or objects • Maintain all hand and power tools in a safe condition • Keep guards in place during use	Leather gloves	
	Strains and Sprains	• Maintain a safe stance and body position operating pressurized equipment • Avoid rushing		
	Awkward Motion and Position	• Take breaks to reduce repetitive strain. • Avoid awkward positions and intense stretching. • Alternate hands periodically. • Do not overexert yourself in any way. • To not provide a forced-grip for prolonged periods of time. • Stretch hands and arms every 30 to 60 minutes		

ACTIVITY HAZARD ANALYSIS FOR SOIL EXCAVATION				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
Excavation of Soil & Backfill (*cont.*)	Excavation Wall Collapse	• Construct diversion ditches or dikes to prevent surface water from entering excavation • Provide good drainage of area adjacent to excavation • Collect ground water/rain water from excavation and dispose of properly • Store excavated material at least 2 feet from the edge of the excavation; prevent excessive loading of the excavation face • Provide sufficient stairs, ladders, or ramps when workers enter excavations over 4 feet in depth • Place ladders no more than 25 feet apart laterally • Treat excavations over 4 feet deep as confined spaces • Complete confined space permit entry procedure • Monitor atmosphere for flammable/toxic vapors, and oxygen deficiency • Slope, bench, shore, or sheet excavations over 5 feet deep if worker entry is required • Assign a competent person to inspect, decide soil classification, proper sloping, the correct shoring, or sheeting • Inspect excavations (when personnel entry is required) daily, any time conditions change • Provide at least two means of exit for personnel working in excavations	Hard hat, safety glasses, steel toe work boots	
	High Noise Levels	• Use hearing protection when exposed to excessive noise levels (greater than 85 dBA over an 8-hour work period) • Assess noise level with sound level meter if possibility exists that level may exceed 85dBA TWA	Ear plugs	
	Slips, Trips, Falls	• Clear walkways, work areas of equipment, vegetation, excavated material, tools, and debris • Mark, identify, or barricade other obstructions • Evaluate fall hazards above 4 ft.; use fall protection equipment (harness/lanyard), standard guardrails or other fall protection systems when working on elevated platforms above 6 ft. • Use heavy duty industrial (type IA) ladders • Install and inspect scaffolds according to manufacturers requirements • Only trained operators are permitted to use aerial lifts • Tie-off all straight/extension ladders or manually hold by co-worker at base • Anchorage points for fall arrest systems must support at least 5,400 pounds for each worker		

ACTIVITY HAZARD ANALYSIS FOR SOIL EXCAVATION				
Task Breakdown	**Potential Hazards**	**Critical Safety Practices**	**Personal Protective Clothing and Equipment**	**Monitoring Devices**
Excavation of Soil & Backfill (*cont.*)	Inhalation and Contact with Hazardous Substances	• Provide workers proper skin, eye and respiratory protection based on the any chemical exposure hazards present • Review hazardous properties of site contaminants with workers before operations begin • Monitor breathing zone air to determine levels of contaminants • Dampen soil using light water spray to prevent fugitive dust emissions • Cover stockpiled soil with plastic sheeting to prevent fugitive dust emissions • Conduct air monitoring / sampling to determine exposure levels		
	High/Low Ambient Temperature	• Monitor for Heat/Cold stress in accordance with it E&I Health and Safety Procedures # HS400, HS401 • Provide fluids to prevent worker dehydration • Follow work/rest schedule in the HASP	Insulated Clothing (subject to ambient temperature)	Meteorological Equipment

EQUIPMENT REQUIRED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Excavator • Shovels, probes • LEL/O2	• Daily equipment inspections as per manufacturers requirements • Excavation inspection/permit for employee entry • Confined space permit (potential) • Inspection of all emergency equipment (i.e.: first aid kits, fire extinguishers)	• Review AHA and daily JSA with all task personnel • Review health and safety plan • Review operations/safety manuals for all equipment utilized • Review site specific chemical hazards • Excavation Competent Person • Fall Protection

ACTIVITY HAZARD ANALYSIS FOR SAMPLING				
Task Breakdown	**Potential Hazards**	**Hazard Control Measures**	**Personal Protective Equipment**	**Monitoring Devices**
Surface water and sediment sampling	Inhalation and contact with hazardous substances	• Provide workers proper skin, eye and respiratory protection based on the exposure hazards present • Review hazardous properties of site contaminants with workers before sampling operations begin	Latex inner gloves, Tyvek® coveralls, nitrile gloves	LEL/O_2, PID
	Flammable, explosive atmospheres	• Test atmosphere for flammable/toxic vapors • Wear proper level of personal protective equipment for the type of atmospheric contaminants • Eliminate sources of ignition from the work area • Prohibit smoking in development area	Tyvek® coveralls, nitrile gloves	LEL/O_2, PID
	Struck by/against flying particles, protruding objects, liquid splash	• Wear hard hats, safety glasses with side shields, and steel-toe safety boots at all times • Wear splash shields and safety goggles when sampling, cleaning, decontaminating test equipment	Hard hat, safety glasses	—
	Handling heavy objects	• Observe proper lifting techniques • Obey sensible lifting limits (60 lb maximum per person manual lifting) • Use mechanical lifting equipment (hand carts, trucks) to move large, awkward loads	—	—
	Sharp objects	• Wear cut-resistant work gloves when the possibility of lacerations or other injury may be caused by sharp edges or objects • Maintain all tools in a safe condition • Keep guards in place during use	Leather gloves, with reinforced palms	—
	High/low ambient temperature	• Monitor for heat/cold stress in accordance with Shaw Health & Safety Program, Volumes I & II, HS400/HS 401 • Provide fluids to prevent worker dehydration	Insulated clothing (subject to ambient temperature)	Meteorological equipment
	Underground hazards	• Before beginning intrusive activities, the field supervisor shall ensure that underground utilities are located • Look at underground drawings if available • When underground utilities are exposed, they shall be protected to avoid damage • Personnel on the ground will assist in probing the soils to find the exact location of the lines and will use hand shovels to carefully remove the soil adjacent to the lines • Identify the work area to be sampled	—	—

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Hand tools • Monitoring equipment	• Daily heavy equipment inspections • Daily drill rig Inspections • Small equipment as specified by operations manual	• 40-hour Hazardous Waste Training • Review HASP • Review site-specific AHA with all task personnel. • Review equipment safety operations manual • Safe driver training (HS 800)

ACTIVITY HAZARD ANALYSIS FOR SITE RESTORATION				
Principal Steps	**Potential Safety/Health Hazards**	**Hazard Control Measures**	**Personal Protective Equipment**	**Monitoring Devices**
Site restoration and demobilization	Struck by/against heavy equipment, protruding objects	• Use reflective warning vests when exposed to vehicular traffic • Avoid equipment swing areas • Make eye contact with operators before approaching equipment • Wear hard hats, safety glasses with side shields, or splash/face shields and goggles, and steel-toe safety boots at all times • Understand and review hand signals	Warning vests, hard hat, safety glasses	—
	Slips, trips, falls	• Clear, walkways of equipment, tools, debris, other materials • Mark, identify, or barricade other obstructions • Look before you step, ensure safe and secure footing	—	—
	High noise levels	• Use hearing protection when exposed to excessive noise levels (greater than 85 dBA over an 8-hour work period)	Ear plugs	—
	Handling heavy objects	• Observe proper lifting techniques • Obey sensible lifting limits (60 lb per person for manual lifting) • Use mechanical lifting equipment (hand carts, trucks) to move large, awkward loads	—	—
	Contact dermatitis	• Wear PPE to avoid skin contact with contaminated soil, plants, or other skin irritants • Identify and review poisonous plants with workers	Tyvek® coveralls, duct tape bottom of coveralls to boots or latex boot covers	—
	High/low ambient temperature	• Monitor for heat/cold stress in accordance with Shaw Health & Safety Program, Volumes I & II, HS400/HS401 • Provide fluids to prevent worker dehydration	Insulated clothing (subject to ambient temperature)	—

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Hand tools	• Daily equipment documented inspections	• Review AHA with task personnel • Review equipment safe operating manual • Safe driver's training (HS 800)

Appendix B

Contractor Quality Control Plan

APPENDIX B
CONTRACTOR QUALITY CONTROL PLAN

FINAL
INSTALLATION-WIDE WORK PLAN
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.
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Houston, Texas 77042

Contract Number W912QR-04-D-0027
Task Order No. DS02

January 2006

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Acronyms and Abbreviations

CDAP	Chemical Data Acquisition Plan
CQC	contractor quality control
CQCP	Contractor Quality Control Plan
CQCSM	Contractor Quality Control System Manager
GPS	Global Positioning System
LHAAP	Longhorn Army Ammunition Plant
OSHA	Occupational Safety and Health Administration
PPE	personal protection equipment
QAR	quality assurance representative
QC	quality control
Shaw	Shaw Environmental, Inc.
HASP	Health and Safety Plan
SSO	Site Safety Officer
MARC	Multiple Award Remediation Contract
TO	task order
USACE	U.S. Army Corps of Engineers

1.0 Introduction

The U.S. Army Corps of Engineers (USACE), Tulsa District, contracted Shaw Environmental, Inc. (Shaw), under the Louisville District's Multiple Award Remediation Contract (MARC) No. W912QR-04-D0027, Task Order (TO) No. DS02, to perform closure of multiple environmental sites at Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas. TO DS02 is being administered by the Tulsa District of USACE.

LHAAP is located in central-east Texas, in Harrison County, between State Highway 43 at Karnack, Texas, and Caddo Lake. Work Plan Figure 1-1 shows the location of LHAAP and surrounding communities.

The objective of this TO is to perform investigations, collect data, perform remediation activities at multiple sites on an expedited basis to achieve site closures and bring as many sites as possible into the long-term management/long-term operation stage as early as possible. This Contractor Quality Control Plan (CQCP) documents quality control (QC) requirements that will be implemented during investigation and remediation of the multiple sites. This CQCP will be supplemented as needed to address site-specific issues and specialized technologies.

2.0 Contractor Quality Control Plan Purpose and Scope

2.1 Contractor Quality Control Plan Purpose

This CQCP establishes procedures that enable common project field activities to be completed successfully and documents QC requirements for services provided by Shaw and its subcontractors during various project activities at multiple sites at Longhorn. This plan describes requirements for organizing, planning, performing, reviewing, documenting, and reporting activities that may affect the quality of the work. This CQCP applies the specific requirements of Shaw's Contractor Quality Control (CQC) System to this project by establishing controls for:

- QC staff organization and authority
- Workmanship
- Construction activities for major definable features of work
- Records
- Inspections and tests
- Documentation
- Audits
- Subcontractor performance

This plan references standard field procedures, policies, regulations, and practices required to implement the work. A controlled copy of applicable Field Procedures (**Appendix D**) will be available as a reference document.

2.2 Contractor Quality Control Plan Scope

This CQCP is applicable to work required by the contract including the major definable features of site work (or major project tasks) identified below:

Task 1 – Mobilization and Site Setup
Task 2 – Monitoring Well/Compliance Well Installation
Task 3 – Survey of Monitoring Well Locations
Task 4 – Groundwater Sampling
Task 5 – Soil Sampling
Task 6 – Surface Water/Sediment Sampling
Task 7 – Investigation-Derived Waste Management
Task 8 – Soil Excavation and Disposal
Task 9 – Monitoring Well Abandonment

2.3 Acceptance of Contractor Quality Control Plan

Work within the scope of this plan will not be started prior to providing this CQCP to USACE, unless otherwise permitted by USACE. Any proposed changes to this CQCP will require notification to USACE in writing. Proposed changes are subject to the approval of USACE.

3.0 Organization and Responsibilities

3.1 Personnel and Structure

The Contractor Quality Control System Manager (CQCSM) coordinates implementation of this CQCP with the Site Superintendent, Remediation Manager, and the Project Manager.

3.2 Duties and Responsibilities

The duties and responsibilities of personnel with regard to the CQC program are briefly outlined below. Duties and responsibilities of health and safety personnel are presented in Appendix A, Health and Safety Plan (HASP).

Project Manager: The Project Manager is responsible for all activities on the project, and directs and monitors the Site Superintendent in planning, coordinating, and controlling the work. The Project Manager has overall responsibility for establishing the CQCP and for its implementation, and he has the authority to access the required resources throughout Shaw to ensure compliance with the contract requirements.

Remediation Manager: The Remediation Manager will direct investigation and remediation activities and will be responsible for the overall preparation of submittals related to investigation and remediation activities. This individual will direct the technical staff during daily operations. He/she will coordinate and supervise human health/ecological risk assessment activities, feasibility studies, and decision documents and will ensure that regulatory requirements are met and will support the Project Manager with regulatory interaction. Other responsibilities include overseeing drilling, geologic interpretation, and required modeling.

Project Hydrogeologist: The Project Hydrogeologist reports to the Remediation Manager and is responsible for site investigation technical assurance. This individual will oversee the site investigation activities. The project hydrogeologist has the following duties and authorities:

- Plan and oversee site drilling and monitoring well installation
- Select the well screening intervals
- Perform and/or oversee the purging and sampling of newly installed monitoring wells and existing monitoring wells
- Perform and/or oversee the preservation, packaging, and shipping of samples to an off-site, fixed laboratory for environmental analyses
- Ensure documentation accuracy, completeness, and consistency among field team members

- Stop work that deviates from the contract documents or is otherwise nonconforming or unsafe.

CQCSM: The CQCSM is responsible for the overall management of the project CQC program during field activities. Depending on the extent of on-going field work, the CQCSM may perform dual roles of CQC management and site safety management. When serving as CQCSM/Site Safety Officer (SSO), this individual receives administrative and day-to-day direction from the Remediation Manager. This individual is responsible to the Shaw Program QC Manager for direction on matters that may affect the QC requirements for the project and to the Shaw Program Health and Safety Manager for safety-related matters. The CQCSM/SSO is assigned the following duties:

- Monitor and verify that the work is performed in accordance with the contract requirements
- Review and verify the disposition of discrepancy and corrective action reports
- Perform QC inspections and surveillance, and report daily on project QC
- Monitor project submittals in accordance with submittal register requirements
- Submit QC reports to the USACE Field Representative/Quality Assurance Representative on a daily basis, unless other arrangements are agreed to by the USACE

The CQCSM has the authority to reject materials and workmanship that do not comply with project requirements, and to stop nonconforming work activities (see **Figure 3-1**). This individual will also verify conformance with the HASP.

Site Superintendent: The Site Superintendent is responsible to the Remediation Manager and the Project Manager for day-to-day supervision of the on-site remedial activities. The Site Superintendent's involvement in QC includes communicating the necessity of quality workmanship in all remedial activities to the on-site project staff.

Program QC Manager: The Program QC Manager is responsible to review, monitor, and report the conformance to QC requirements set forth in the CQCP. He may also advise the CQCSM on QC methods and practices. He will maintain a record of his quality monitoring activities and will inform the CQCSM of his monitoring activities. He shall also be responsible for performing periodic internal audits, and reporting his findings to the CQCSM.

Subcontractors: Shaw assumes overall responsibility for conformance to the quality requirements for the subcontracted items and services. Subcontractors are responsible to the Project Manager and Remediation Manager for completing the portion of work assigned to them,

and to the CQCSM for CQCP activities. They shall verify that their construction and materials comply with the requirements of the contract plans and specifications. Subcontractors include organizations supplying quality-related items or services to the project.

3.3 Qualification of Personnel

Shaw personnel assigned to the project are qualified to perform the tasks to which they are assigned. The Project Manager and the Remediation Manager will appraise the qualification of professional and/or technical personnel assigned to the project. The appraisal will include the comparison of the requirements of the job assignment with the relevant experience and training of the prospective assignee.

Shaw Environmental, Inc.
3010 Briarpark, Suite 4N
Houston, Texas 77042

To:	To Be Determined
From:	John W. Patin, QC Manager
Date:	November 15, 2005
Subject:	Contractor Quality Control System Manager, Letter of Authority U.S. Army Corps of Engineers, Tulsa District MARC Contract No. W912QR-04-D0027, Task Order No. DS02

This letter describes the responsibilities and authority delegated to you in your capacity as the Contractor Quality Control System Manager for Site Closure of Multiple Sites at Longhorn Army Ammunition Plant, Karnack, Texas.

In this position, you are responsible for the implementation and enforcement of the CQCP and site specific addenda. You will use the plan to verify that the quality of materials, workmanship, operations, and safety monitoring conforms to the Work Plan, its appendices, and addenda.

Your responsibilities include identifying and reporting quality problems, rejecting nonconforming materials, initiating corrective actions, and requesting solutions for nonconforming activities. You have the authority to control or stop project activities until satisfactory disposition and implementation of corrective actions are achieved. Detailed responsibilities and guidelines are given in the Work Plan, its appendices, and addenda.

Figure 3-1
Letter of Authority

4.0 Contractor Quality Control Systems

4.1 Control Measures

The CQCP provides measures to verify and document that the work performed complies with the requirements specified in the contract documents. These measures include:

- CQC inspections
- Document control
- Submittals
- Completion inspection
- Records

Procedures for implementing the above measures are included throughout the CQCP. The CQCP may be supplemented by additional guidelines or instructions for implementing the work and/or verifying compliance with the contract requirements.

4.2 Quality Control Monitoring

The project CQC program is monitored to verify that the program is in compliance with the CQCP. Monitoring activities are performed by the Shaw Program QC Manager, or his representative, and include the review of daily QC reporting and instructions, or directions given to the CQCSM on QC matters. If required, an assessment of the project's CQC system is performed. If performed, the assessment includes the following items:

- Subcontractor performance
- Field operation and records
- CQC and health and safety inspections, testing, and records
- Document control
- Training records

4.3 Quality Control Testing

As applicable, the CQCSM monitors the equipment/materials testing firm and/or analytical laboratory activities to verify the following:

- Execution of required tests
- Location of tests
- Timely and accurate reporting of test results
- Correct frequency of tests
- Completeness of documentation

5.0 Inspection Plan

QC inspections include inspection of equipment, materials, testing procedures, documentation/submittals, and workmanship before, during, and after each definable feature of work. QC inspections are performed by the CQCSM in accordance with the Three-Phase Contractor Quality Control System. The CQCSM gives the USACE Quality Assurance Representative advance notification (at least 24 hours) of formal inspections.

Definable features of site work (or major work tasks) for which QC inspections will be performed are addressed below.

Definable Features of Site Work:

Task 1 – Mobilization and Site Setup
Task 2 – Monitoring Well/Compliance Well Installation
Task 3 – Surveying of Monitoring Well Locations
Task 4 – Groundwater Sampling
Task 5 – Soil Sampling
Task 6 – Surface Water/Sediment Sampling
Task 7 – Investigation-Derived Waste Management
Task 8 – Soil Excavation and Disposal
Task 9 – Monitoring Well Abandonment

Other site remediation activities that constitute definable features of site work will be defined within site-specific addenda to the work plan. Those addenda will also identify related QC inspection requirements.

5.1 Task 1 – Mobilization and Site Setup

Following approval of the Work Plan, Shaw will mobilize the necessary personnel and equipment to prepare the site for investigation activities. Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Site personnel have the necessary Occupational Safety and Health Administration (OSHA) training and medical surveillance statements/certifications
- Heavy equipment (e.g., drilling rig) has undergone safety and preventive maintenance checks, and is suitable for the task for which it will be used.
- Measuring and test equipment has undergone calibration and/or calibration checks to assure accuracy and precision.
- The project team understands the investigation/remediation requirements.

- Site personnel have received a HASP by the SSO and have acknowledged this review by signing the HASP acknowledgment form.
- Installed government property plan (when applicable) is reviewed and implemented for the equipment to be installed on site.
- Work zones and decontamination facilities are established in accordance with the HASP.
- Material storage areas are kept orderly.
- Site security measures are adequately maintained to prevent unauthorized access.
- Work zones are clearly demarcated using temporary barricading or fencing as required.

Once the site is mobilized and set up, field activities will commence.

5.2 Task 2 – Monitoring Well/Compliance Well Installation

Groundwater monitoring well construction materials and specifications are provided in the Work Plan and in Appendix D. The specifications conform to the following:

- Engineering and Design – *Monitoring Well Design, Installation, and Documentation at Hazardous, Toxic, and Radioactive Waste Sites*, EM 1110-1-4000 (USACE, 1998)
- Technical Requirements – *Locations and Standards of Completion for Wells*, Texas Administrative Code Title 16, Part 4, Chapter 76, Section 76.1000 (State of Texas, 2001)
- Monitor-Well Construction Specifications, Texas Administrative Code Title 30, Part 1, Chapter 330, Subchapter I, Section 330.242 (State of Texas, 1993)

Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Drilling locations are marked/staked in the field and verified against those in the approved drawings prior to well drilling.
- Underground utilities that transect the sites are located and marked, and their depths are known, so as to avoid damaging them during drilling activities.
- Digging permits (when applicable) are obtained prior to the start of work.
- Qualified drilling firms are procured to perform this task.
- The driller is licensed by the Texas Department of Licensing and Regulation and maintains a current license, in good standing.

- Personnel associated with this task have applicable OSHA training and medical surveillance certifications.
- The CQCSM/SSO has briefed personnel on task-specific hazards and the appropriate personal protection equipment (PPE) to be worn and performed a job safety analysis for well drilling and installation.
- Drilling personnel have reviewed the HASP and signed the acknowledgement form.
- Task crews undergo preparatory briefing to verify their understanding of the scope of work and health and safety issues.
- Drilling team leader (i.e., Shaw Hydrogeologist) instructs the drilling crew of the depth of the well and its construction, and documents those instructions in the field notes.
- Drilling team leader documents the suitability of the construction materials.
- Construction materials meet specifications, are contaminant-free, and shipped/ received in good order.
- Well construction details are properly logged on forms and in the site logbook.
- Incomplete construction is protected from surface-water infiltration.
- Completed construction conforms to work plan requirements, specifications and drawings for well installation and surface completion.
- Generated soil cuttings, decontamination fluids, and contaminated PPE are handled and disposed of in accordance with the waste disposal requirements described in Section 3.7 of the Installation-Wide Work Plan and Attachment 10 of Appendix D, and state and federal regulations.
- Adjacent ground surfaces are protected from spillage during drilling operations.
- Well filter pack, bentonite, and grout volumes are calculated and documented in the field log book.
- Bentonite seal and grout is allowed to hydrate/cure sufficiently prior to beginning well development.
- Monitoring well development equipment, methods, and stabilization measurements are performed in accordance with the Work Plan and Chemical Data Acquisition Plan (CDAP).
- Well development fluids are handled, characterized, and disposed of in accordance with the requirements addressed in Task 7 of the Work Plan, and state and federal regulations. Field screening requirements are listed in **Section 5.8.1** of this CQCP. Additional information on field screening procedures is found in Appendix D, Attachment 1.

- Disturbance of property surrounding drilling site is minimized.

Ground water sampling will commence following monitoring well installation and development.

5.3 Task 3 – Surveying

Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- A qualified land surveyor licensed by the State of Texas is employed to perform well surveying.
- Survey datum (vertical and horizontal) used is consistent with the work plan requirements and/or historical datum.
- Survey team undergoes preparatory meeting to verify their understanding of the scope of work.
- Surveying equipment is operative and properly calibrated.
- Instrument calibration is performed per manufacturer instructions.
- Survey points are clearly marked or labeled (e.g., notch in the top of casing and/or brass surveying marker embedded in surface pad).
- Field documentation is legible, accurate, and complete.
- Worker protection is adequate for the associated task hazards.

For identifying locations of soil samples and limits of excavation, a Global Positioning System (GPS) may be used in lieu of land surveying. Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Survey team undergoes preparatory meeting to verify their understanding of the scope of work.
- Surveying equipment is operative and properly calibrated.
- Instrument calibration is performed per manufacturer instructions.
- Survey points are clearly marked or labeled
- Field documentation is legible, accurate, and complete.
- Worker protection is adequate for the associated task hazards.

5.4 Task 4 – Groundwater Sampling

Following the installation of groundwater monitoring wells, Shaw will collect groundwater samples for laboratory analyses. Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Sampling personnel have reviewed the CDAP and Work Plan and understand the scope of work.
- The CQCSM/SSO has briefed sampling personnel on task hazards and the appropriate PPE level before sampling begins.
- A sampling equipment checklist is developed for this task and is reviewed with sampling personnel before sampling begins.
- Well depth and depth-to-water measurements are performed consistently from a common location at top-of-well casing (e.g., notch in top of casing or northern lip of casing).
- Well water volume is calculated accurately using well measurements.
- Well is purged of the required quantity of well water and water quality is stabilized as defined by the CDAP prior to sample collection.
- Purged water is contained in drums and managed in accordance with Work Plan waste handling requirements. Field screening procedures is found in Appendix D, Attachment 1.
- The specified sampling equipment and materials are used for sample collection.
- The sampling team leader (i.e., Shaw Hydrogeologist) has instructed samplers on the sampling procedures and protocols and has assigned specific duties and responsibilities to each team member.
- Sampling equipment decontamination procedures are performed according to the CDAP.
- Sampling documentation procedures in the CDAP are followed and field documentation is legible, accurate, and complete.
- Quality assurance and QC samples are collected at prescribed frequencies in accordance with CDAP protocols and procedures.
- Sample labels, custody seals, and chain-of-custody forms contain pertinent sampling and analytical information before samples are packaged and shipped off site for laboratory analysis.
- Sampling and analytical records are maintained in the project file (in secured area).

- All field instruments are calibrated at the start of the testing day.

5.5 Task 5 – Soil Sampling

Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Sampling personnel have reviewed the CDAP, Work Plan, and any related documents regarding the scope of work.
- The CQCSM/SSO has briefed sampling personnel on task hazards and the appropriate PPE level before sampling begins.
- A sampling equipment checklist is developed for this task and is reviewed with sampling personnel before sampling begins.
- The specified sampling equipment and materials are used for sample collection.
- Sampling equipment decontamination procedures are performed according to the CDAP.
- Sampling documentation procedures in the CDAP are followed and field documentation is legible, accurate, and complete.
- Quality assurance and QC samples are collected at prescribed frequencies in accordance with CDAP protocols and procedures.
- Sample labels, custody seals, and chain-of-custody forms contain pertinent sampling and analytical information before samples are packaged and shipped off site for laboratory analysis.
- Sampling and analytical records are maintained in the project file (in secured area).
- All field instruments are calibrated at the start of the testing day.

5.6 Task 6 – Surface Water/Sediment Sampling

Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Sampling personnel have reviewed the CDAP, Work Plan, and any related documents regarding the scope of work.
- The CQCSM/SSO has briefed sampling personnel on task hazards and the appropriate PPE level before sampling begins.
- A sampling equipment checklist is developed for this task and is reviewed with sampling personnel before sampling begins.
- The specified sampling equipment and materials are used for sample collection.

- The sampling team leader (i.e., Shaw Hydrogeologist or Sample Technologist) has instructed samplers on the sampling procedures and protocols and has assigned specific duties and responsibilities to each team member.
- Sampling equipment decontamination procedures are performed according to the CDAP.
- Sampling documentation procedures in the CDAP are followed and field documentation is legible, accurate, and complete.
- Quality assurance and QC samples are collected at prescribed frequencies in accordance with CDAP protocols and procedures.
- Sample labels, custody seals, and chain-of-custody forms contain pertinent sampling and analytical information before samples are packaged and shipped off site for laboratory analysis.
- Sampling and analytical records are maintained in the project file (in secured area).
- Field instruments are calibrated at the start of the testing day.

5.7 Task 7 – Investigation-Derived Waste Management

Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Waste generated during the project activities will be segregated by type (e.g., soil cuttings, PPE, well development and purging liquids, trash/debris) and stored in approved 55-gallon drums or other containers.
- Waste containers are labeled with a waterproof marker according to the Work Plan, indicating the content, accumulation date, waste code(s) (if known) and pertinent analytical information.
- Waste handling activities are documented in the field logbook and a tracking log is prepared that indicates waste type, point of waste generation (i.e., well number) container size and type, accumulation date, storage location, disposal destination, transporter name, shipping paper/manifest number, and transportation and disposal dates.
- Waste containers are leak proof and stored in a secure storage area.
- Waste storage area is clearly demarcated using barricade tape and/or temporary barricade fencing, as required.
- Waste container and storage area inspections are performed on a weekly basis (at a minimum) and documented in the field logbook and/or in a standard inspection form.

5.8 Task 8 – Soil Excavation and Disposal

Soil samples will also be collected from excavations for confirmation sampling. Contaminated soils will be excavated, removed and disposed off site. Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Underground utilities are marked and digging permits are obtained prior to excavation activities.
- Preparatory meetings are held with work crews to discuss the scope of work for excavation and removal of contaminated soil.
- Personnel associated with this task have applicable OSHA training and medical surveillance certifications.
- Worker protection is adequate for the associated task hazards.
- The excavations boundaries are marked in the field for each location and the proposed depths of excavations are confirmed prior to excavation activity.
- Field documentation is legible, accurate, and complete.
- Confirmation samples are screened using properly calibrated field instruments and selected samples are sent to off site laboratory for confirmation analysis.
- Following confirmation sampling, the excavated areas are backfilled, compacted and tested the degree of compaction.
- The contaminated soils are staged at a designated place pending waste characterization and subsequent disposal.
- The excavation boundaries are surveyed by a surveyor licensed in the State of Texas.

Shaw will restore the sites to their original grade and condition as necessary.

5.8.1 Field Screening

The soil and groundwater samples will be screened in the field for confirmation and will be sent to a laboratory for confirmation analyses. Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Sampling personnel have reviewed the CDAP and understand the scope of work.
- The CQCSM/SSO has briefed sampling personnel on task hazards and the appropriate PPE level before sampling screening begins.
- A sampling equipment checklist is developed for this task and is reviewed with sampling personnel before sampling begins.

- Field screening instrumentation is calibrated before the start of the work and at the end of the sampling day.
- Calibrated equipment will be uniquely identified by using either the manufacturer's serial number or other means.

Calibration records traceable to the equipment will be readily available for reference. In addition, the results of calibrations and records of repairs will be recorded in a logbook.

5.9 Task 9 – Monitoring Well Abandonment

Shaw will abandon monitoring wells that were installed during any investigation and remediation activities as needed. Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Preparatory meetings are held with work crews to discuss the regulatory requirements for well abandonment.
- Personnel associated with this task have applicable OSHA training and medical surveillance certifications.
- Worker protection is adequate for the associated task hazards.
- Abandonment activities will employ a well driller licensed in the state of Texas.
- Well abandonment materials and equipment are suitable and approved for use prior to starting the work.
- Well locations and top of casing elevations are verified and recorded in a logbook prior to abandonment.
- Required agency permits and/or notifications are completed prior to starting abandonment activities.
- Waste generated during abandonment activities is handled and disposed according to the waste management plan.
- Quantity and depth measurements are made and recorded accurately the amount of grout used, depth below ground surface of the top of the grout once the grout has settled and hardened, and the amount of cover soil placed and compacted above the top of the grout to re-establish a level ground surface.
- A multi-purpose completion report and/or well abandonment log is accurately completed for each abandoned well and submitted to the State of Texas. Copies are maintained in the project file until submitted to the USACE with the final report.

5.10 Other Site Remediation Tasks

Shaw will perform various site remedial activities to include optimizing the existing on site groundwater treatment plant, soil/groundwater flushing, and instituting bioremedial solutions where applicable. Using the Three-Phase CQC system, the CQCSM will monitor these tasks as appropriate. Specific QC requirements for these tasks will be identified in site-specific addenda to the work plan.

6.0 Document Control

6.1 Documentation

The CQCSM maintains current records of QC activities and tests performed, including those of suppliers and subcontractors. The records will be maintained as evidence that required control measures and tests have been performed, and indicate the results of the activities. Photographic documentation is also maintained for this project in accordance with **Section 6.4** of this plan.

6.2 Daily CQC Report

A Daily CQC Report is completed and maintained by the CQCSM using a standard form. The form is provided in **Attachment 1**. As applicable, standard forms used to document safety, technical, and operations aspects of daily field activities will be attached to the Daily CQC Report.

6.3 Daily Weather Conditions/Lost Time Report

A Daily Weather Conditions/Lost Time Report is prepared daily by the CQCSM. A report form is provided at the end of this section. Lost time will be logged into the report in increments of 25% (in other words, 0%, 25%, 50%, 75% or 100%). The amount of lost time incurred will be agreed upon and initialed by the CQCSM and the Corps of Engineers' quality assurance representative (QAR) or Technical Manager overseeing the project work. Upon completion of the report for the specified period of time, one copy of the report should be submitted to the QAR/Technical Manager once each month during fieldwork and an extra copy should be maintained by the CQCSM for future reference.

6.4 Photographs

The CQCSM will photograph the project activities. Photographs will be taken on a regular basis during the course of the project to document the work, events, and equipment used. The frequency and number of pictures taken will depend upon the activities occurring and the amount of documentation needed. The Project Manager or Remediation manager will use judgment to determine the frequency and number of pictures taken; however, a sufficient quantity of pictures will be taken to effectively document the TO.

Pictures will be taken using 35mm film or digital medium (using a digital camera or video camera). Photos will be documented on a project log (see standard form in **Attachment 1**), which includes the photo number, date, time, description of the task depicted, and the view direction (e.g., facing northwest). A copy of the photo log, pictures, slides/videos, and digital media will be maintained in Project Files.

6.5 Review of Vendor Submittals

Vendors and subcontractors are required to expeditiously submit items such as drawings, test data, and specifications to Shaw for review to enable timely submittals to USACE. Shaw technical and CQC personnel review each submittal for compliance with contract documents. If acceptable, the item is stamped or indicated as such, and forwarded to USACE for review and acceptance.

If unacceptable, errors or deficiencies are identified and returned to the vendor or subcontractor for correction. The corrected document is resubmitted to Shaw for review until it meets contract requirements.

6.6 Government Property Accounting and Control

If applicable, Shaw will acquire, manage, and dispose of government property. At the completion of the project, all real property (removed and/or installed) will be listed on a Property Inventory Sheet.

6.7 Submittals

The Project Manager, Remediation Manager, the Program Controls Engineer, and the CQCSM are responsible for project submittals. A submittal register prepared for this project is given in **Figure 6-1**.

SUBMITTAL REGISTER																							DACA56-94-D-0020 TO No. 0109
TITLE AND LOCATION: Longhorn Army Ammunition Plant – Closure of Multiple Sites														CONTRACTOR: Shaw Environmental Inc.									
				TYPE OF SUBMITTAL									CLASSI-FICATION			CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVT. ACTION		
TRANSMITTAL NO a.	ITEM NO b.	SPEC PARA NO c.	DESCRIPTION OF ITEM SUBMITTED d.	DATA e.	DRAWINGS f.	INSTRUCTIONS g.	SCHEDULES h.	STATEMENTS i.	REPORTS j.	CERTIFICATES k.	SAMPLES l.	RECORDS m.	INFO ONLY n.	GOVT. APPROVED o.	REVIEWER p.	SUBMIT q.	APPROVAL NEEDED BY r.	MAT'L NEEDED BY s.	CODE t.	DATE u.	SUBMIT TO GOVT v.	CODE w.	DATE x.	REMARKS
			Project Work Plan (and Appendices)		X	X	X							X		Per Project Schedule							
			Cost/Schedule Reports										X			Monthly							
			Site Personnel OSHA Medical & Training Certificates							X		X	X			Prior to start of work							
			CQC and Safety Reports						X				X			Daily							
			Well Construction Methods/Specifications	X	X								X			Per Work Plan							
			Transporter ID, Insurance Cert							X			X			Prior to subcontract award							
			Manifests/Shipping Papers									X	X			Prior to shipment							
			Disposal Facility ID	X									X			Prior to subcontract award							
			Environmental Inspection Sheets									X	X			Per Work Plan							
			Groundwater Sampling Results	X					X				X			Upon data evaluation and with Background Groundwater Report							
			Survey Drawings (As-built)		X									X		Upon completion							
			Well Construction Completion Forms									X		X		To State of Texas within 30 days of construction completion and with Background Groundwater Report							
			Well Abandonment Forms									X		X		To the State of Texas within 30 days of construction completion							
			Drilling Logs & Groundwater Sampling Forms									X				With Daily QC Reports and Background Groundwater Report							
			Background Groundwater Report	X	X				X			X		X		Per Project Schedule							

Figure 6-1
Submittal Register

7.0 Subcontractor Quality Control

Subcontractors for this project are responsible for compliance with the QC requirements of their respective subcontract. Subcontractors include organizations supplying quality related items or services to the project. Shaw assumes overall responsibility for conformance to the quality requirements for the subcontracted items and services.

Subcontract documents should include the requirements for personnel qualifications, technical performance levels, QC procedures, acceptability criteria, and documentation. The CQCSM, or his designee, reviews the subcontract procurement documents to verify that the QC requirements are communicated to the subcontractor.

Each subcontractor is required to identify an adequately qualified individual within the organization to perform QC duties. The qualifications of this individual are submitted to the CQCSM for review and approval. The CQCSM coordinates the QC functions with the designated subcontractor QC representative. The Project Manager, or his authorized designee, assists the CQCSM in managing subcontractor QC.

The CQCSM is responsible for the performance of inspections, surveillance, document reviews, audits, and other QC functions to verify compliance with the subcontract requirements. These activities are documented on inspection reports, checklists, audit reports, field logs, or other forms appropriate to the function performed.

For field operations, the CQCSM performs QC inspections before, during, and after the subcontractor activities, to the extent required, to verify that the subcontractor is in compliance with the QC requirements of the contract and the applicable subcontract documents.

Audits of subcontractor activities are conducted by the CQCSM as necessary to verify compliance with the CQCP. Objective evidence of conformance to the subcontract documents is reviewed during the audits.

8.0 References

Shaw Environmental and Infrastructure, Inc. (Shaw), 2005, *Standard Operating Procedures* (Intranet), (Headquarters) Baton Rouge, Louisiana, November 9.

State of Texas, 2001, Administrative Code Title 16, Part 4, Chapter 76, Section 76.1000, *Technical Requirements – Locations and Standards of Completion for Wells,* Austin, Texas.

State of Texas, 1993, Texas Administrative Code Title 30, Part 1, Chapter 330, Subchapter I, Section 330.242, *Monitor-Well Construction Specifications,* Austin, Texas.

U.S. Army Corps of Engineers, 1998, *Engineering and Design – Monitoring Well Design, Installation, and Documentation at Hazardous, Toxic, and Radioactive Waste Sites*, EM 1110-1-4000.

Attachment 1

Field Forms

- Preparatory Inspection Check List
- Initial/Follow-Up Inspection Form
- Final Inspection Form(s)
- Daily Contractor Quality Control Report
- Daily Weather Conditions/Lost Time Report
- Photo Log Form
- Corrective Action Report

PREPARATORY INSPECTION CHECKLIST

Shaw Environmental, Inc.
1430 Enclave Parkway
Houston, Texas 77077

Project Name:_____
Project Location_____
Project No.:_____

Plan or Specification Title/Section:_____ **Drawing Nos.:**_____

A. Personnel present *(use back of form to list additional personnel)*

Name	Position	Company

B. Submittals involved: *(use back of form to list additional submittals)*

Number and Type	Description	Indicate Contractor of Government Approval

C. Are all materials on hand and in accordance with approvals: ☐ Yes ☐ No
List all deficiencies:

D. Test required: (list/reference all quality control tests with their required frequencies):

E. Accident prevention preplanning (list all health and safety items discussed):

CQCSM: _____

INITIAL/FOLLOW-UP INSPECTION FORM

Shaw Environmental, Inc.
1430 Enclave Parkway
Houston, Texas 77077

Project Name:_____
Project Location_____
Project No.:_____

(check one)

INITIAL PHASE CHECK LIST ☐ OR
FOLLOW-UP PHASE CHECK LIST ☐

Plan or Specification Section:_____ Drawing Nos.:_____

A. Personnel present:

Name	Position	Company

B. Materials are in strict conformance with contract specifications: ☐ Yes ☐ No
If no, explain:

C. Work being performed is in strict conformance with contract specifications: ☐ Yes ☐ No
If no, explain:

D. Workmanship is acceptable: ☐ Yes ☐ No
If improvement is needed, explain:

CQCSM: _____

FINAL INSPECTION FORM

Shaw Environmental, Inc.
1430 Enclave Parkway
Houston, Texas 77077

Project Name:_____
Project Location_____
Shaw Project No.:_____

FINAL INSPECTION FORM

Plan or Specification Title/Section:_____Drawing Nos.:_____

Inspected Work (list feature(s) of work inspected):

1. 6.
2. 7.
3. 8.
4. 9.
5. 10.

Performance Specification by Contract Delivery Order Reference	Status of Inspection

On behalf of Shaw, I certify that the work inspected is complete and meets the performance specifications cited above and that all material and equipment used and work performed was completed in accordance with approved plans and work instructions and meets contract delivery order requirements.

CQCSM _____ Date_____/_____/_____

Site Manager_____ **Date_____/_____/_____**

DAILY CONTRACTOR QUALITY CONTROL REPORT

Shaw Environmental, Inc.
1430 Enclave Parkway
Houston, Texas 77077

Project Name:_____
Project Location:_____
Shaw Report No.:_____

WEATHER: ( ) Clear ( ) P. Cloudy ( ) Cloudy
Wind_____
Temperature: High_____ Low_____
Precipitation: Today_____ Previous Period (i.e., weekend)_____
Site Conditions:_____
Lost Time Due to Inclement Weather: _____%

PRIME CONTRACTOR/SUBCONTRACTORS AND AREAS OF RESPONSIBILITY/LABOR COUNT:
(Include number, trade, hours, employer, location, and description of work.)
a.

b.

c.

d.

e.

f.

WORK PERFORMED: (Include location and description of work performed including equipment used. Refer to work performed by prime and/or subcontractors as previously designated by letter above. Attached subcontractor daily activity reports when applicable):

MATERIALS AND/OR EQUIPMENT DELIVERED: (Include a description of materials and/or equipment, quantity, date/hours used, date of safety check, and supplier)

RESULTS OF SURVEILLANCE: (Include satisfactory work completed or deficiencies with action to be taken.)
a. Preparatory Inspection: (Attach Minutes)

b. Initial Inspection: (Attach Minutes)

c. Follow-up Inspection: (List results of inspection compared to specification requirements.)

d. Safety Inspection: (Include safety violations and corrective actions taken.)

OFF-SITE SURVEILLANCE ACTIVITIES: (Include action taken.)

QC TESTS PERFORMED AND RESULTS: (As required by plans and/or specifications.)

VERBAL INSTRUCTIONS RECEIVED OR GIVEN: (List any instructions received from government personnel or given by Shaw on construction deficiencies identified, required retesting, etc., and the corresponding action to be taken.)

CHANGED CONDITIONS/DELAYS/CONFLICTS ENCOUNTERED: (List any conflicts with the delivery order [i.e., Scope of Work and/or drawings], delays to the project attributable to site, and weather conditions, etc.)

SUBMITTALS REVIEWED: (Include submittal number, specification reference, and name of submitter.)

MEETINGS: (List the meetings, i.e., Health and Safety, Site Operations, Cost/Schedule, etc.)

VISITORS:

REMARKS: (Any additional information pertinent to the project not defined by the previous entries.)

CONTRACTOR'S VERIFICATION: The above report is complete and correct. All material and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications except as noted above.

Shaw CQCSM (or designee) _____/_____/_____ Date

DAILY WEATHER CONDITIONS/LOST TIME REPORT

DAILY WEATHER CONDITIONS/LOST TIME REPORT FOR WEEK/MONTH OF_____

Contract No.:_____ Delivery Order No.:_____ Project:_____

Contractor:_____

DAY	DATE	W/C. L/T	% LOST	ACTIVITY DELAYED	REMARKS	CONCUR	
						CQCR	QAR
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							

Weather Conditions (W/C): R - Precipitation, C - Extreme Temperature, M - Muddy Site Conditions W - Extreme Winds
Other Lost Time Conditions (L/T): D - Demobilized, S - Standby

Representative of the Contractor_____

Representative of the Government_____

PHOTO LOG FORM

PROJECT PHOTO LOG

Project Name:_____ Project Location:_____ Project No.:_____

Photo No.	Date	Time	Task and Description	View Direction

CORRECTIVE ACTION REPORT

Shaw Environmental, Inc.
1430 Enclave Parkway
Houston, Texas 77077

Project Name:_____
Project Location:_____
Report No.:_____

DESCRIPTION OF PROBLEM:_____

PERSONNEL RESPONSIBLE FOR INVESTIGATIVE PROCESS:_____

RECOMMENDED CORRECTIVE ACTIONS:_____

PERSONNEL RESPONSIBLE FOR IMPLEMENTATION OF CORRECTIVE ACTIONS:_____

RESULTING ACTIONS AND EFFECTIVENESS OF THOSE ACTIONS:_____

PERSONNEL RESPONSIBLE FOR MONITORING EFFECTIVENESS OF CORRECTIVE ACTIONS:_____

FINAL DISPOSITION APPROVED BY:

Name:_____ Title:_____

Date:_____

Name:_____ Title:_____

Date:_____

COPIES TO:

Appendix C

Chemical Data Acquisition Plan

APPENDIX C
CHEMICAL DATA ACQUISITION PLAN

FINAL
INSTALLATION-WIDE WORK PLAN
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.
3010 Briarpark Drive, Suite 4N
Houston, Texas 77042

Contract Number W912QR-04-D-0027
Task Order No. DS02

January 2006

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Acronyms and Abbreviations

^{o}C	degrees centigrade
CAR	Corrective Action Report
CDAP	Chemical Data Acquisition Plan
COC	chain-of-custody
CQCSM	Contractor Quality Control System Manager
EDT	Electronic Data Transfer
GC	gas chromatography
GC/MS	gas chromatography/mass spectrometer
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LHAAP	Longhorn Army Ammunition Plant
LQMP	Laboratory Quality Management Plan
mL	milliliter
MS	matrix spike
MSD	matrix spike duplicate
PARCC	precision, accuracy, representativeness, comparability & completeness
PID	photoionization detector
ppb	parts per billion
ppm	parts per million
PWS	Project Work Statement
QA	quality assurance
QC	quality control
RPD	relative percent difference
Shaw	Shaw Environmental, Inc.
SQCR	Sample Quality Control Report
MARC	Multiple Award Remediation Contract
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound

1.0 Introduction

The U.S. Army Corps of Engineers (USACE), Tulsa District, contracted Shaw Environmental, Inc. (Shaw), under the USACE Louisville District's Multiple Award Remediation Contract (MARC) No. W912QR-04-D-0027, Task Order No. DS02, to conduct investigations and remedial activities at Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas. This Chemical Data Acquisition Plan (CDAP) describes the analytical and field activities, as well as the quality assurance (QA)/quality control (QC) protocols associated with the site investigations, remediation, and site restoration activities. The figures referenced in this CDAP are included at the end of each respective section.

The ultimate accuracy of any data generation begins with a sampling and measurement procedure that is fully conceived and implemented. This CDAP is designed to delineate the methods that will be used to accomplish the chemical data quality objectives. Data quality objectives include the data quality indicators of precision, accuracy, and completeness addressed in **Section 7.1**. A conscious effort has been made to provide relevant information with minimal duplication of information that is discussed in detail in other project planning documents.

Sampling and analytical activities will be documented in accordance with this plan. Analytical methods and constituents of potential concern and their detection limits are provided in **Attachment 1**. ShawView database will be utilized for data management and to produce data summary tables. **Attachment 2** contains the ShawView Electronic Data Transfer (EDT) format specifications for laboratory data.

2.0 Project Description

2.1 Site Description

LHAAP is located in central-east Texas, in Harrison County, between State Highway 43 at Karnack, Texas, and Caddo Lake. Figure 1-1 of the Work Plan shows the location of LHAAP and surrounding communities.

The installation-wide work activities planned at the LHAAP facility encompasses the following sites that will be addressed through investigation, remediation, or document reviews: LHAAP-02, -03, -04, -06, -07, -08, -12, -16, -17, -18/24, -23, -29, -35, -36, -37, -46, -47, -49, -50, -51, -55, -58, -60, -64, -66, -67, -68, and the Pistol Range.

2.2 Project Objective

The objective of this installation-wide project is to focus on an expedited path toward site closure and bring as many sites to closure or, where needed, into a long term monitoring or long term operation stage as early as possible. In order to accomplish these objectives, more investigations are needed to delineate the nature and extent of contamination and initiate the appropriate remediation at designated sites.

3.0 Project Organization and Responsibility

The project management organization is based on specific project requirements. The key project team members and their responsibilities are listed in **Section 3.1** below.

The Project Manager is the primary focal point for control of project activities. The Project Manager will be supported by the program management support team, which will provide reviews, guidance, and technical advice on project execution issues. The Project Manager is to be supported by a supervisory, safety and health, and QA/QC staff to ensure that the project is executed in compliance with all applicable laws, regulations, statutes, and industry codes.

3.1 Responsibilities of Key Personnel

3.1.1 Project Manager

The Project Manager is responsible for the overall direction of this project, which is executed under his supervision. The Project Manager is ultimately accountable for all work activities undertaken on this project and provides the managerial and administrative skills to ensure resource allocations, planning, execution, and reporting to meet contract requirements. The individual responsibilities of the Project Manager include, but are not limited to, the following:

- Participation in project QA reviews
- General supervision of the project
- Approval, as required, of project specific QA documents
- Approval of procurement documents
- Stopping work on a project, if necessary, because the project cannot be completed to the required quality levels, safety specifications, the schedule, or budget to permit successful completion
- Communication to the project staff of project-specific client and regulatory requirements
- Identification and documentation (and notification to the contracting officer and project staff) of changes in scope of work, regulatory requirements, or QA practices

3.1.2 Remediation Manager

The Remediation Manager will direct investigation and remediation activities and will be responsible for the overall preparation of submittals related to investigation and remediation activities. This individual will direct the technical staff during daily operations. He/she will

coordinate and supervise human health/ecological risk assessment activities, feasibility studies, and decision documents and will ensure that regulatory requirements are met and will support the Project Manager with regulatory interaction. Other responsibilities include overseeing drilling, geologic interpretation, and required modeling.

3.1.3 Site Superintendent

The Site Superintendent will be the on-site operational manager of the project and is responsible for its day-to-day operation. He is in charge of the on-site operational and technical staff. He is responsible for maintaining clear, effective, up-to-date communications with the Contracting Officer concerning project scoping and planning. Responsibilities include coordination of subcontractors, including their compliance with Shaw policies and procedures and contractual requirements, implementing and maintaining all site-specific plans, health and safety, and controlling cost and schedule aspects of all site activities. Some of the quality-related responsibilities for the Site Superintendent include:

- Notifying the Remediation Manager and Project Manager if the project cannot be completed with regard to quality, schedule, health and safety, or cost.
- Determining that changes, revisions, and reworks are required of the CDAP, and documenting changes.
- Serving as a reviewer prior to release of project information to the client.

3.1.4 Project Contractor Quality Control System Manager

The Project Contractor Quality Control System Manager (CQCSM) will serve as the on-site QC officer. This individual will monitor field personnel engaged in chemical data acquisition. Some of the quality related responsibilities include:

- Determining that changes, revisions, and reworks are required of the Work Plan and CDAP.
- Serving as the final reviewer prior to release of project information to the client.
- Monitor the field investigation activities for compliance with contract documents.
- Stopping work that is nonconforming or deficient.

3.1.5 Project Safety Officer

The Project Safety Officer will be primarily responsible for:

- Assessing the potential health and safety hazards at the site

- Developing/implementing site-specific safety and health plans
- Performing daily safety checks

3.1.6 Project Chemist

A Project Chemist will be assigned to this project. However, the Project Chemist will not be stationed on site, but will be stationed in the Houston, Texas office. He/she, or his/her designee, will be responsible for the following:

- Manage production and quality of data generated from sampling and analytical activities
- Verify that the CDAP quality objectives are met
- Review data prior to release to site
- Provide for contact between site and the subcontract analytical laboratory

3.1.7 Field Sampling Personnel

The Field Chemist and Sample Technicians report to the Site Superintendent and are responsible for the following:

- Obtain samples and document sampling tasks
- Package and ship samples to the off-site laboratory

3.2 Qualifications of Personnel

Shaw team personnel assigned to this project will be qualified to perform the task to which they are assigned. All members of the team are qualified to perform work on this task order. The Project Manager will make appraisal of the qualifications of additional personnel assigned to the project.

3.3 Analytical Laboratory

Shaw will select an analytical laboratory, from among its alliance laboratories, to provide subcontract analytical services for this task order. The laboratory will be USACE validated to perform project analyses. USACE Chemistry and Industrial Hygiene Section, Louisville District, will be notified upon the procurement of the analytical services laboratory.

A copy of the Laboratory Quality Management Plan (LQMP) from the lab will be supplied to USACE as a submittal prior to execution of task order. The selected laboratory will be provided a copy of the final CDAP for their reference.

4.0 Sampling and Analysis

Samples expected to be collected for this project include groundwater, soil, surface water, sediment, and waste characterization samples. Sampling procedures are addressed in Appendix D, Field Procedures.

4.1 Types of Sampling

In general, two basic types of sampling techniques are recognized for solid media (soil and sediments): composite samples and grab samples.

4.1.1 Composite Sampling

Composite samples are a combination of more than one subsample collected at various sampling locations and/or different points in time. Area composite samples are composited from individual grab samples that are collected on an area or cross-sectional basis. Area composites will be made up of equal volumes of grab samples; each grab sample will be collected in an identical manner.

Analysis of composites yields an average value. In certain instances, a composite can be used as an alternative to analyzing a number of individual grab samples and calculating an average value. However, compositing of samples can mask problems by diluting isolated concentrations of some hazardous compounds to below detection limits. Also, a small sample size may be removed for analysis, and if the composite is not homogeneous, an error in reporting results may occur. When compositing for trace organics and/or metals, only stainless steel, glass, or Teflon bowls and spatulas will be used for sampling. Samples for volatile analysis will not be composited in the field, due to potential for analyte loss during the compositing process.

4.1.2 Grab Samples

A grab sample is defined as a single sample that is collected all at once and is representative of the specific location in the sample medium at a given point in time. The representativeness of such samples is defined by the nature of the materials being sampled. In general, as sources vary over time and distance, the representativeness of grab samples decreases.

4.2 Soil/Sediment Sampling

Soil sampling may involve collection of surface soil and subsurface soil samples. Sediment samples may be collected from the creeks within the installation. Procedures for surface and subsurface soil and sediment sampling are provided in Appendix D. Soil and sediment samples will be collected from locations related to sites covered under the Project Work Statement (PWS).

4.3 Surface Water Sampling

Surface water samples may be collected from the creeks within the installation as it relates to sites under the PWS. Procedures for surface water sampling are provided in Appendix D.

4.4 Groundwater Monitoring Well Sampling

Groundwater samples will be collected from newly installed monitoring wells and existing monitoring wells of various depths and construction as it relates to sites under the PWS as discussed in the Work Plan.

4.4.1 Water Level Measurement

Before samples are collected, the static water level will be measured to the nearest 0.01 foot using a battery operated electronic water level probe. Static water level measurements will be recorded on the Field Sampling Report **(Figure 4-1)** or equivalent. Immiscible layers are not anticipated but, if present, an interface probe will be used to measure the level of the immiscible surface and apparent thickness. A sample will also be collected using a transparent, disposable bailer to visually confirm the immiscible layer.

4.4.2 Monitoring Well Purging

Well sampling will be accomplished using the low flow sampling method. In the event the low flow sampling method is not used due to insufficient well recharge, wells will be purged before groundwater samples are collected. Appendix D provides the groundwater sampling procedure for this project.

4.4.3 Groundwater Sample Collection

Wells will be sampled using a submersible bladder pump as discussed in the previous section. Only in extreme cases will a bailer be used where a slow recharging well had to be purged dry. In such a case, after a bailer will be lowered gently into the well and sample collected, as soon as sufficient recovery has occurred. Pre-cleaned sample containers will be filled directly from the pump outflow port or bailer. Preservatives will be added to the sample bottle by the laboratory before the containers are shipped to the site. Groundwater sampling analytical parameters and methods are given in **Table 4-1** of the plan. Individual analytical constituents and associated detection limits are given in **Attachment 1**. The appropriate sample containers, preservation methods, and holding times for all project aqueous samples are given in **Table 4-2**.

QC sample types and minimum sampling frequencies are as follows:

- 10 percent QC replicates
- One trip blank set for each cooler containing volatile organic compounds (VOC) samples.

QA sampling and analysis will be performed when requested by the USACE:

Additional information on groundwater sampling and handling is found in Appendix D, Field Procedures.

4.5 Contaminated Soil in Drums or Roll-off Boxes for Disposal Sampling

Drill cuttings will be staged in drums or roll-off boxes for subsequent disposal analysis. At the completion of the drilling, the drill cuttings will be sampled and sent to the subcontract analytical laboratory for analysis of disposal parameters as listed in **Table 4-1**. The sample technician shall note the drum or roll-off number in the sample logbook.

The procedure for collecting a sample from a drum or roll-off box is summarized below:

- Decontaminate equipment:
  - Stainless steel spatula
  - Trowel or trier
  - Stainless steel bowl
- Don a clean pair of sample gloves.
- Remove drum lid.
- Insert trowel into material and remove sample. For roll-off box use a trier and position the trier at the corner of the roll-off and at an angle (i.e., 30 degrees) and push the trier into the soil as far as possible.
- Begin sampling with the acquisition of grab samples for VOCs, conducting sampling with as little disturbance as possible to the media. The sample container shall be filled with no headspace.
- Collect a five point composite sample for all parameters other than VOCs.
- Thoroughly mix the soil in a stainless steel bowl and fill the remaining containers.
- Label the sample container with the appropriate sample label.
- Place the sample containers in a cooler containing ice.
- Complete all chain-of-custody (COC) documents and record in field logbook.

4.6 Sampling and Analytical Requirements

Table 4-1 summarizes the sampling and analytical requirements for the site. **Table 4-2** summarizes the preservation methods, holding times, and sample size/containers for the required analysis. A complete list of the parameters and methods is provided in **Attachment 1**. Ten

percent of the field samples collected at the site will be QC Samples. The approximate number of QC samples to be collected is also shown in **Table 4-1**.

4.7 Equipment Decontamination

Sampling equipment (core samplers, trowels, triers, and stainless-steel bowls) will be decontaminated prior to the collection of each sample. The electronic interface probe, used to measure depth to groundwater in monitoring wells and pump(s) used for well development and purging, will be decontaminated prior to use at each well. The equipment will be decontaminated using a non-phosphate detergent (such as Alconox, Liquinox, or equivalent), followed by two potable water rinses, one deionized water rinse, and air dried. Decontamination fluids will be containerized for subsequent disposal. Further information and instructions on decontamination procedures are given in Appendix D, Field Procedures.

Drilling rigs will be brought onto the installation in a clean condition with no mud on the undercarriage or vehicle. The drilling rig and equipment, including augers, bits, and drilling and sampling rods, will be steam-cleaned or hot water pressure-cleaned prior to use at each borehole or monitoring well construction site. Well construction materials will be brought to the site in their original packaging and will remain in the factory-sealed containers until use. If these materials contact the ground during assembly, they will be cleaned with low-sudsing soap and potable water prior to use. A decontamination pad will be established for the washing of drilling equipment. Wash waters from decontamination activities will be contained in the decontamination pad and transferred to containers for proper disposal.

4.8 Sample Handling

4.8.1 Field Documentation

The field geologist (and/or sample technologist) will maintain daily field notes on sampling activities. Items that must be included are sampling protocol, any changes to the procedures, meetings, instructions, safety precautions, level of personnel protection, and other activities pertaining to the samples. The person taking notes must be knowledgeable enough about these activities to know which details are important.

Repetition of information recorded in other pertinent logs should be avoided, but enough information should be recorded to present a clear and accurate picture of technical activities. Should a question arise later concerning a specific event or procedure used, it will be answered from these notes. Some items that would be considered noteworthy are as follows:

- Termination of a sample point or parameter and reasons (i.e., terminating a well drilling due to encountering water)
- Unusual appearance or odor of a sample

- Lithologic description of soil samples
- Measurements, volumes of flow, temperature, and weather conditions
- Additional samples and reasons for obtaining them
- Levels of protection (with justification)
- Details concerning any samples split with another party (i.e., USACE)
- Details of QA/QC samples obtained

These notes must be dated and signed (each page) for validity in a court of law. All logbook entries will be made with blue or black waterproof ink and legibly written. Field notes will be entered into a hardbound logbook and the pages will be consecutively numbered. All entries will be in chronological order. The language will be factual and objective. In addition, field sketches may be made in the field logbooks when appropriate, with reference points tied to existing permanent structures in the area (i.e., trees, fence posts, benchmarks, facilities). No erasures will be allowed. If an incorrect entry is made, the information will be crossed out with a single strike-mark and the change initialed and dated by the team member initiating the change. Each page in the field logbook will be signed and dated at the bottom by all persons making entries on that page. Field logbooks will be identified by a project-specific number (i.e., Logbook Number 1 for Project Number 117591, etc.) and stored in the field project files when not in use. At the completion of the field activities, the logbooks will be maintained in the permanent project file.

Information on all samples will be entered in the logbook and associated field data collection sheets. The following information items are standard for all projects, recorded on the Field Sampling Report **(Figure 4-1)** or equivalent and entered in a column format where possible:

1. DATE – date sample was obtained
2. SAMPLE NUMBER – consecutive series of numbers assigned to every sample
3. LOCATION – description of area sampled
4. TIME – (military) time sampled (i.e., 24-hour format)
5. SAMPLERS – full name and initials of persons obtaining sample (usually two persons with at least one witnessing, if not involved in the actual sampling task)
6. TYPE OF SAMPLE – water, sediment, sludge, etc.
7. DESCRIPTION OF SAMPLE – physical description of sample (e.g., clear, cloudy, etc.)

8. ANALYSIS – the name of the analytical test or series of analytical tests to be performed on the collected environmental sample
9. WEIGHT OR VOLUME – size of sample (500 milliliters [mL], 32 oz)
10. PRESERVATIVES – preservatives used or included by lab, including cooling to 4 degrees centigrade (°C)
11. LABORATORY – off-site laboratory who performed analytical work
12. FIELD RESULTS – on-site or field analysis will vary according to project requirements; should be in consistent units (i.e., parts per million [ppm], parts per billion [ppb], etc.)
13. CHAIN-OF-CUSTODY NUMBER – for samples sent to the subcontract laboratory
14. ADDITIONAL COMMENTS – space reserved for any other information concerning a particular sample or special procedure or analysis
15. DATE SAMPLES SENT – date samples were sent to subcontract laboratory
16. OVERNIGHT CARRIER AIRBILL NUMBER

4.8.2 Sample Identification and Labeling

A coding system will be used to identify each sample collected during the sampling program. The Shaw Sample Technologist will maintain a listing of the project and sample identification numbers. Pre-printed sample labels will include the monitoring well location and a sample number unique to ShawView. The sample name will use the following format:

Sample Name: ShawView number-well identification - cc

Where:

ShawView number = L0001

L0001 = Longhorn Army Ammunition Plant and sequential number

Well identification, for example

35AWW03 = site 35A, water well number 03

Disposal samples will be identified as AAAxxx

Where AAA = source of sample:

RO = Roll-off box

DML = Drummed Liquid Sample

DMS = Drummed Soil Sample

TK = Tank

xxx = identification number of the drum or roll-off.

cc = QC sample indicator:

QC = QC (Quality Control) Replicate

QA = QA (Quality Assurance) Replicate

Trip blanks will be coded separately in sequence as follows:

Sample Name: TB – mmyy - xx

Where:

TB = Trip Blank
mmyy = month/year
xx = sequential number

The following are examples of the sample identification scheme for various samples:

L0002-04WW01-QC	A QC replicate of a monitoring well sample collected from LHAAP-04 monitoring well WW01.
DMS005	A soil sample taken from drum number 5.

Environmental samples are identified by a sample label attached to the sample container. Included on the label are the following items:

1. PROJECT # 117591
2. PROJECT NAME (Longhorn Multiple Site)
3. LOCATION (Site identification)
4. SAMPLER (Sampler initials, cross referenced to full names in the field logbook).
5. WITNESS (Witness initials, cross referenced to full names in the field logbook).
6. PRESERVATIVE (Whenever applicable)
7. ShawView identification code
8. SAMPLE location
9. DATE (DD-MM-YYYY)
10. TIME (24-hour format)
11. ANALYSES (Analytical parameters and methods; i.e., VOC-8260B)

The information described above will be printed neatly using a waterproof marker. After the sample is taken and the label is securely attached, the sample will be logged into the sample logbook. An example of a completed label for VOC analysis is included as **Figure 4-2**.

4.8.3 Custody Seals

Custody seals are narrow strips of adhesive paper or glass fiber used to demonstrate that no tampering of the sample container, equipment and sample cooler has occurred. The custody seal will be signed and dated by the Sample Technician and placed across the opening of the lid and body of the sample transport container (e.g., cooler) on one side and the front (cover the custody seal with wide, clear tape). A custody seal should also be placed from one side, across the top (lid), and to the other side of the sample container. A sample Custody Seal is shown on **Figure 4-3**.

4.9 Chain-of-Custody Procedures

Because of the evidentiary nature of samples collected, the possession of samples must be traceable from the time the samples are collected until they are introduced as evidence in legal proceedings, if necessary. To maintain and document sample possession, COC procedures are followed as described below.

The Shaw COC is printed with a unique control number in the upper right-hand corner. The COC form will be signed by each individual who has the samples in his or her possession. The COC forms will be completed in the field by the person collecting the samples. Each sample number, time of sampling, description, requested analysis name and method number, and turn-around-time shall be entered on the COC form. When samples are shipped to the subcontract analytical laboratory, the courier name, and waybill (or airbill) number should be noted on the COC form prior to sealing the cooler.

Upon arrival at the subcontract analytical laboratory, the person accepting delivery will sign the COC form(s) with a date, time, and initials. Next, the samples in the cooler will be checked against the COC forms for sample number, description, time and date of sampling, and analysis. Any samples in question will be segregated and the field personnel will be notified immediately. The person responsible for checking the samples in the cooler against the COC form shall also complete and sign a cooler receipt form. The COC and cooler receipt forms will be provided in the final data package.

If a fast turn-around-time is required for some samples, these samples will be submitted to the subcontract analytical laboratory with a separate COC. In the lower right-hand section of the COC form labeled “remarks”, write the word “**RUSH**” using large letters and underline. The next day, contact the subcontract analytical laboratory and confirm that the samples were received and are processed for the rapid turn-around-time.

A sample is under your custody if any of the following conditions is met:

1. It is in your actual possession.
2. It is in your view, after being in your physical possession.
3. It was in your physical possession and they/you lock it up to prevent tampering.
4. It is in a designated secure area.

It is very important that the information on the COC record form match the information on the sample container label; especially sample number, time taken, description and analysis requested. A COC is shown in **Figure 4-4**.

4.10 Shipment of Samples

Samples will be shipped via an overnight carrier to the subcontract laboratory. COCs will be prepared accordingly and are organized by sampling events and matrix; soil samples separate from water samples. All field samples will be placed in appropriately labeled, pre-cleaned sample containers, and enclosed within a plastic sealable bag. The bottom of the shipping cooler will be lined with absorbent material. A sufficient quantity of ice will then be placed on the absorbent material to cover the bottom of the cooler. All ice utilized inside the cooler will be containerized within two plastic freezer bags of 1 quart or larger size. All four sides of the cooler will then be lined with ice packs. Each sample container will be wrapped with bubble pack material to prevent breakage. The wrapped sample container will then be placed in a plastic, sealable bag and sealed. The bagged sample containers will then be placed in the space created by placement of the ice. Any remaining void space will then be filled with bubble pack, styrofoam peanuts, or absorbent material to prevent movement of the sample containers during transport. Once the samples are secured, ice will be placed on top of the sample containers, thereby completely surrounding the sample containers with ice packs. The remaining headspace in the cooler, if any, will be filled with bubble pack, Styrofoam peanuts, or absorbent material.

THE SHIPPING INSTRUCTIONS ARE AS FOLLOWS.

1. Samples must be shipped in strong outer packaging (a plastic cooler is acceptable).

2. Both Shaw and the subcontract Laboratory's addresses must appear on the container.

3. The following information must be printed on the container: "FRAGILE" (if glass containers are shipped) with "This Side Up" arrows on two sides of the cooler.

4. A typical Shaw shipping label, which also includes Shaw and the subcontract analytical laboratory's addresses, must be attached to top of cooler.

5. Inner packages cannot exceed 1 gallon each, and the entire shipment (cooler, samples, absorbent) cannot exceed 66 pounds.

6. Coolers must be packed with absorbent.

7. 40-mL vials with reagent water will be used as temperature blanks. Temperature conditions will be checked and reported in the Cooler Receipt Form upon arrival at the laboratory.

8. Inner containers should have their lids secured with tape or wire.

9. Prior to sealing the cooler with Custody Seal and Tape, a Shaw Shipment Checklist will be completed and reviewed. A sample Shipment Checklist is shown in **Figure 4-5**.

10. A standard airbill is completed to the satisfaction of the selected shipping company.

The completed COC forms shall be enclosed in plastic, sealable bags and taped to the underside of the lid of the cooler. The drain of the cooler will be taped shut. On the day of shipment, fresh ice will be added to the coolers to ensure the preservation criteria are met, the lid will be taped shut using strapping tape (filament type), and a minimum of two custody seals or evidence tape will be fixed to the coolers. The coolers will then be sent to the subcontract laboratory. For liquid samples, a "**THIS SIDE UP**" placard is required.

Table 4-1
Sampling and Analytical Requirements

Matrix	Parameter	Method	Turnaround Time
Groundwater	VOCs	SW-846 8260B	14 Days
Groundwater	Perchlorate	EPA 314	14 Days
Groundwater	Explosives	SW-846 8330	14 Days
Groundwater	Thallium	SW-846 7841 or 6020	14 Days
Groundwater	Metals	SW-846 6020	14 Days
Groundwater	Dioxin/Furans	SW-846 8290	14 Days
Soil	VOCs	SW-846 8260B	14 Days
Soil	Perchlorate	EPA 314	14 Days
Soil	Explosives	SW-846 8330	14 Days
Soil	Metals	EPA 6010B/7470A	14 Days

Type	Matrix	Parameter	Method	Turnaround Time
Disposal	Soil	TCLP VOCs TCLP SVOC TCLP metals Reactivity Corrosivity Ignitability	SW-846 8260B EPA 314 SW-846 8330 SW-846 7.3 SW-846 9045C 1010	14 Days
Disposal	Water	TCLP VOCs TCLP SVOC TCLP metals Reactivity Corrosivity Ignitability	SW-846 8260B EPA 314 SW-846 8330 SW-846 7.3 SW-846 9040B 1010	14 Days

Notes and Abbreviations:

[1] *United States Environmental Protection Agency (USEPA), 1997.* Test Methods for Evaluating Solid Waste, Physical Chemical Methods (SW-846)*, Update III. Office of Solid Waste and Emergency Response, Washington, D.C.*

[2] *USEPA, 1983. Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020. Environmental Monitoring and Support Laboratory, Office of Research and Development, Cincinnati, Ohio.*

SVOC *semivolatile organic compound*
TBD *to be determined based on volume of material collected in the field*
TCLP *toxicity characteristic leaching procedure*
VOC *volatile organic compound*

Table 4-2
Sample Volume, Preservation, Holding Times

Parameter	Minimum Sample Volume	Holding Time	Preservation
Water (Groundwater, Surface Water Rinse Blanks)			
Volatiles	3 X 40 mL vial with PTFE septa cap	14 days	HCl to pH < 2 4 °C no headspace
Explosives	2 X 1L AG	7 days to extraction 40 days to analysis	4 °C
Metals	1 X 500 mL HDPE bottle	6 months except mercury, 28 days	HNO_3 to pH < 2 4 ºC
Perchlorate	250 mL HPDE bottle	28 days	4 °C
Dioxin/Furans	2 X 1L AG	30 days to extraction 45 days to analysis	4 °C
TCLP Semivolatiles	1L AG	7 days to extraction 40 days to analysis	4 °C
TCLP Volatiles	2 X 40 mL vial with PTFE septa cap	14 days	4 °C
TCLP Metals	1 L HDPE bottle	6 months except mercury, 28 days	4 °C
Reactivity, Corrosivity, (pH), Ignitability	1 L HDPE bottle	28 days except pH, immediate	4 °C
Soil/Sediments			
Volatiles	2- or 4-ounce CWM (or 5g – Encore)	2 days to extraction 14 days to analysis	4 °C
Perchlorate	1 X 8-ounce CWM with Teflon-lined cap	180 days to analysis	4 °C
Explosives	1 X 4-ounce CWM with Teflon-lined cap	14 days to extraction 40 days to analysis	4 °C
Metals	1 X 4-ounce CWM with Teflon-lined cap	180 days to analysis (EPA Method 6010B) 28 days to analysis (EPA Method 7471A)	4 °C
TCLP Volatiles	4-ounce CWM with PTFE septa cap	14 days to analysis	4 °C no headspace
TCLP Semivolatiles	8-ounce CWM jar	14 days to extraction 40 days to analysis	4 °C
TCLP Metals	4-ounce CWM jar	6 months to analysis except mercury, 28 days	4 °C
Reactivity, Corrosivity, (pH), Ignitability	4-ounce CWM jar	28 days except pH, immediate	4 °C

Notes and Abbreviations:

The above listed volumes provide an adequate quantity of sample to analyze a matrix spike (MS) and matrix spike duplicate (MSD). Multiple analytes, except volatiles may be combined into one 8-ounce jar for soils.

AG	*amber glass jug*	*HNO_3*	*nitric acid*
°C	*degrees centigrade*	*L*	*liter*
CWM	*clear wide mouth jar*	*mL*	*milliliter*
EPA	*U.S. Environmental Protection Agency*	*pH*	*potential hydrogen*
HCl	*hydrochloric acid*	*PTFE*	*polytetrafluoroethylene*
HDPE	*high-density polyethylene*	*TCLP*	*toxicity characteristic leaching procedure*

FIELD SAMPLING REPORT

LOCATION: _____ PROJECT: _____

SITE: _____

SAMPLE INFORMATION

MATRIX _____ SAMPLE ID: _____

SAMPLING METHOD _____ DUP/REP OF: _____

BEGINNING DEPTH _____ MATRIX SPIKE/MATRIX SPIKE DUPLICATE
YES ( ) NO ( )

END DEPTH _____

GRAB ( ) COMPOSITE ( ) DATE: _____ TIME _____

CONTAINER SIZE/TYPE #		PRESERVATIVE/ PREPARATION	EXTRACTION METHOD	ANALYTICAL METHOD	ANALYSIS

NOTABLE OBSERVATIONS
SAMPLE CHARACTERISTICS

PID READINGS		MISCELLANEOUS
1st	COLOR:	
2nd	ODOR:	
	OTHER:	

pH _____ Temperature _____ Dissolved oxygen _____ Specific Conductivity _____ Turbidity _____

GENERAL INFORMATION

WEATHER: SUN/CLEAR _____ OVERCAST/RAIN _____ WIND DIRECTION _____
AMBIENT TEMP: _____

SHIPMENT VIA: FED-X _____ HAND DELIVER _____ COURIER _____ OTHER _____

SHIPPED TO: _____

COMMENTS:

Figure 4-1
Field Sampling Report

PROJECT #: 117591	SAMPLE NO: L0002-04WW01
PROJECT NAME: LONGHORN AAP	DATE: 16-FEB-2004
LOCATION: LHAAP-04 WW01	TIME: 1415
SAMPLER: RBW	ANALYSIS: SW8260B
WITNESS: JTR	
PRESERVATIVE: ICE	

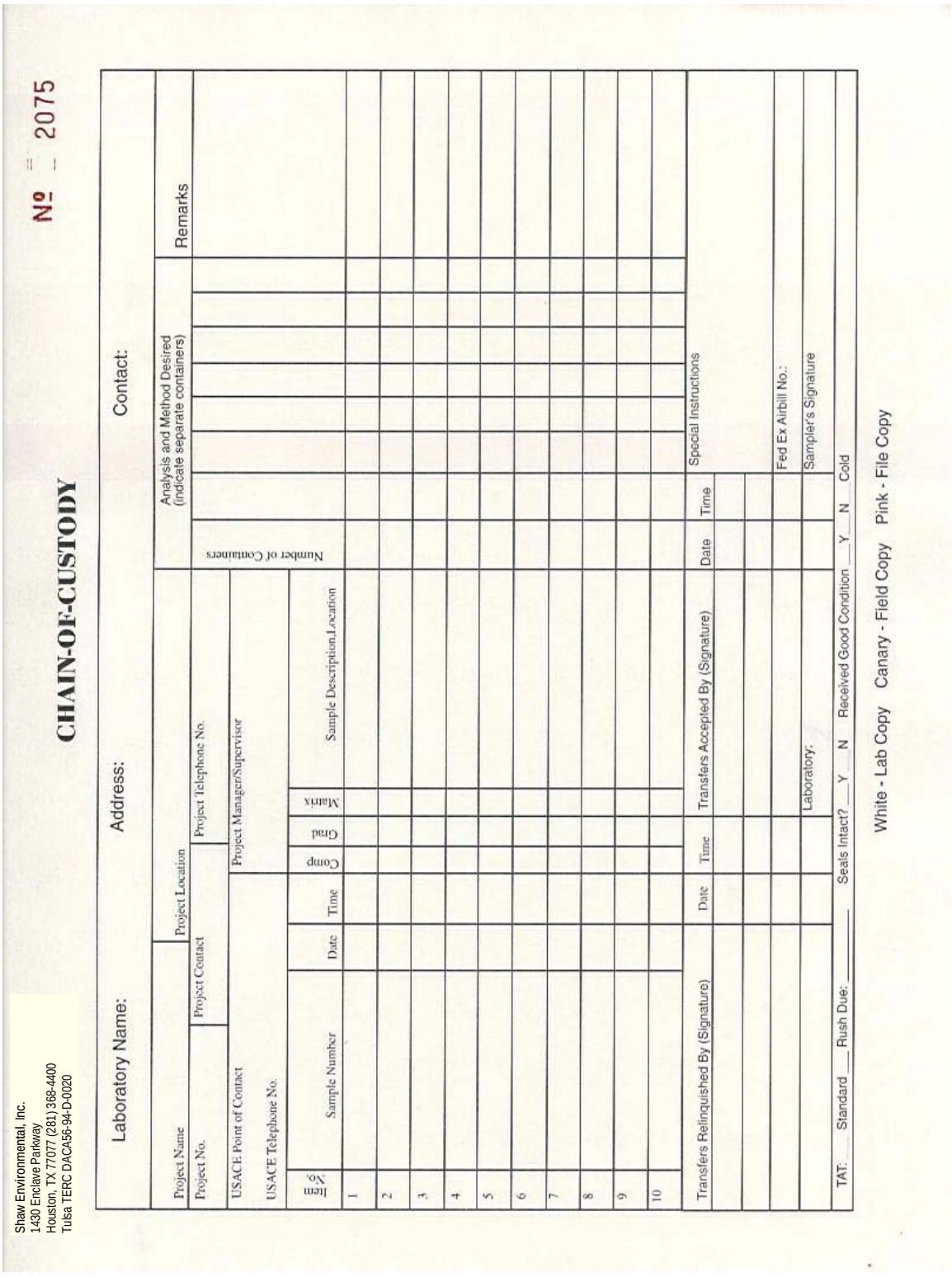
Figure 4-2
Sample Label

CUSTODY SEAL

PERSON COLLECTING SAMPLE BW	SAMPLE # L002-04WW01
DATE COLLECTED 16-FEB-2004	TIME COLLECTED 1415

NOTE: The "Sample #" and "Time Collected" blocks would not be filled in when placing Custody Seals on the outside of the shipping container.

Figure 4-3
Sample Custody Seal



Shaw Environmental, Inc.
1430 Enclave Parkway
Houston, TX 77077 (281) 368-4400
Tulsa TERC DACA56-94-D-0020

CHAIN-OF-CUSTODY

№ 2075

Laboratory Name: Address: Contact:

Project Name | Project Location
Project No. | Project Contact | Project Telephone No.
USACE Point of Contact | Project Manager/Supervisor
USACE Telephone No.

Item No.	Sample Number	Date	Time	Comp	Grad	Matrix	Sample Description/Location	Number of Containers	Analysis and Method Desired (indicate separate containers)							Remarks
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																

Transfers Relinquished By (Signature)	Date	Time	Transfers Accepted By (Signature)	Date	Time	Special Instructions
						Fed Ex Airbill No.:
			Laboratory:			Sampler's Signature

TAT: ___ Standard ___ Rush Due: _____ Seals Intact? ___ Y ___ N Received Good Condition ___ Y ___ N Cold

White - Lab Copy Canary - Field Copy Pink - File Copy

Figure 4-4
Chain-of-Custody

SHIPMENT CHECKLIST

Project Name _____ Project No. _____
Street Address _____ Date: _____ Time: _____
City/State/Zip _____
Phone Number (xxx) _____ Fax Number (xxx) _____

SAMPLE CHECKLIST

	Yes	No	Comments
Sample lids are tight and custody seals in place?	☐	☐	_____
Are sample numbers, dates, times and other label information legible and complete?	☐	☐	_____
Have all sample numbers, dates, times and other sample data been logged into sample logbook?	☐	☐	_____
Do sample numbers and sample description on the labels match with those on the Chain-of-Custody (COC)?	☐	☐	_____
Have the samples been properly preserved?	☐	☐	_____
Have the COCs been filled out completely and correctly?	☐	☐	_____
Are the labels filled out in the indelible ink and/or label taped over with clear tape?	☐	☐	_____
Have the COCs been properly signed in the transfer section?	☐	☐	_____

PACKAGING CHECKLIST

Has each sample been placed into an individual plastic bag?	☐	☐	_____
Has the drain plug of the cooler been taped closed with waterproof tape from the inside?	☐	☐	_____
Has the cooler been adequately lined with cushioning absorbent pads?	☐	☐	_____
Have all the samples been placed into the cooler in an upright position?	☐	☐	_____
Is there adequate spacing of samples so that they will not touch during shipment?	☐	☐	_____
Have an adequate number of blue ice packs been placed around and on top of samples?	☐	☐	_____
Has the COC been placed in a plastic sealable bag and taped to the inside of the lid of the cooler?	☐	☐	_____
Is an analytical request form needed and is it in a plastic sealable bag under the lid of the cooler?	☐	☐	_____
Have custody seals been placed over the lid?	☐	☐	_____
Has the cooler been properly labeled with correct address and proper certification?	☐	☐	_____
Has the laboratory performing the analysis been notified of the shipment of samples?	☐	☐	_____

PROBLEMS/RESOLUTIONS

Prepared by: _____ Signature:_____

Figure 4-5
Shipment Checklist

5.0 Field Screening Methods

Several field screening methods will be utilized based on site-specific objectives and soil collection methods. During the collection of soil samples from surface soils and subsurface (drilling) soils, basic field screening methods using an organic vapor analyzer (OVA) or photoionization detector (PID) will be employed. The samples will be collected using a clean trowel, trier, or shovel and scooping the appropriate quantity of soil or sediment into a stainless steel bowl. A sufficient quantity of soil will be collected for both the field and laboratory sample requirements. Each sample will be composited and the sample for field analysis will be removed. If the field results indicate that a sample should be submitted to the laboratory for confirmatory analysis, the remaining composited soil will be used for the analyses. For samples requiring VOC analysis, a discrete grab sample will be collected from each of the sample locations. The remaining composited soil will be disposed with the excavated soil. Additional information is found in Appendix D, Attachment 1, Field Screening Methods and Attachment 12, Screening Level Metals Analysis Using a Portable X-Ray Fluorescence Instrument.

Excavation sampling, while using the same or similar screening equipment and basic procedures as described above, may require the use of other screening tools or field sampling kits. By guiding the excavation limits at certain sites with the use of these screening tools, soil excavation limits can be delineated horizontally and vertically. If the field analysis results indicate that concentrations of chemicals of interest exceed the cleanup criteria, excavation will continue in the direction from where the sample was collected until exceedances are not detected. When the four sidewall samples and the center "floor" sample(s) do not exceed the cleanup criteria, the excavation will be considered temporarily complete pending the results of the laboratory confirmation results.

Should subsequent laboratory analysis indicate that the concentrations of chemicals of interest in a sample are less than the cleanup criteria, then the excavation from which that sample was collected will be back-filled. Should the sample indicate a concentration greater than or equal to the cleanup criteria, then excavation in the area will recommence and the sample program for that area will proceed from there. If applicable, multi-incremental sampling will be used to delineate compliance with closure criteria.

Sampling devices will be inspected prior to use to ensure that there is no corrosion or wear that would increase the likelihood of contaminant sorption to the sampling equipment. Reusable sample equipment will be thoroughly decontaminated between uses. See Appendix D, Attachment 9, Decontamination Procedures.

Table 5-1 summarizes the field screening method for this sampling project. Health and safety screening methods are described in the Site Safety and Health Plan.

Table 5-1
Field Screening Procedures

Parameter	Techniques	Field Method
Volatile Organic Compounds	Photoionization Detector	Portable, real-time meter. Operate according to manufacturer instructions.
Groundwater Quality Parameters: pH, temperature, conductivity, and turbidity	Electronic sensors	Portable, real-time meters. Operate according to manufacturer instructions.
Soil Screening and Delineation Parameters: Metals	X-Ray Fluorescence Instrument	Portable, real-time meters. Operate according to manufacturer instructions.

6.0 Off-Site Laboratory

Shaw will notify USACE of the selected laboratory prior to starting the sampling program. The analytical tables in **Attachment 1** summarize the analytical methods, analytes, and detection limits for off-site analysis.

The laboratory will be required to input all applicable laboratory data into ShawView format. **Attachment 2** contains ShawView EDT format specifications for laboratory data.

6.1 Data Quality Objectives

The following sections summarize the data quality objectives for the analytical laboratory procedures that can be found in **Attachment 1**. Detection limits for these analytes shall be as stated in either the subcontract analytical laboratory's LQMP or **Attachment 1**, whichever are/is more stringent as compared to the listed groundwater standards.

6.1.1 Method Blanks

The method blank is used to document contamination resulting from the analytical process. As stated in SW-846, Chapter One, Section 5.0, 1994 Edition of *Methods for Chemical Analysis of Water and Wastes*, and U.S. Environmental Protection Agency (USEPA) 600 Methods, for a method blank to be acceptable for use with this site's samples, the concentration in the blank of any analyte of concern should not be higher than the highest of either:

- The method detection limit, or
- 5 percent of the regulatory limit for that analyte, or
- 5 percent of the measured concentration in the sample

A method blank shall be analyzed with each batch of samples that are analyzed from this site by matrix

6.1.2 Matrix Spikes

A matrix spike (MS) is defined as an aliquot of sample spike with a known concentration of target analytes. The spiking occurs prior to sample preparation and analysis. MSs are used to document the precision and bias of a method in a given sample matrix.

The acceptable criteria (control limits) for use with this site's samples shall be provided in the subcontract analytical laboratory's LQMP, and shall be provided with each set of data and final report. A MS and matrix spike duplicate (MSD) shall be analyzed with each batch of samples analyzed from this site. Site samples must be utilized for an MS/MSD analysis at a minimum of once each 20 samples received by the laboratory, by matrix.

The laboratory is directed by appropriate sections of SW-846 and other USEPA methodologies on the procedure to establish QC limits for each target analyte of interest. These QC control limits shall be provided with all laboratory data, regardless of the turn-around-time requested, for each target analyte requested.

6.1.3 Laboratory Control Sample

A Laboratory Control Sample (LCS) is a volume of reagent water or inert solid spiked with known concentrations of analytes and carried through the preparation and analysis procedure as a sample. The purpose of the LCS is to monitor method loss and recovery data on a sample with no matrix effects. An LCS shall be analyzed with each batch of samples by matrix. NOTE: If there is not a sufficient quantity of sample to perform an MS/MSD, an LCS/Laboratory Control Sample Duplicate (LCSD) analysis shall be analyzed to provide QC data.

The laboratory is directed by appropriate sections of SW-846 and other USEPA methodologies on the procedure to establish QC limits for the LCS for each target analyte of interest in reagent water. These QC control limits shall be provided with all laboratory data, regardless of the turn-around-time requested, for each target analyte requested.

6.1.4 Surrogate Compounds (Organic Methods)

A surrogate compound is an organic compound which is similar to the target analytes in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. Surrogate compounds are added to monitor the extraction process and method efficiency. Surrogates are to be added to gas chromatography/mass spectrometer (GC/MS) methods and those GC methods that specifically require surrogate compound(s).

In the case of SW-846 GC/MS methods, surrogate QC acceptance recoveries for each compound are established and provided in the method. The subcontract analytical laboratory must meet these surrogate QC acceptance criteria. If the GC/MS and/or GC surrogate QC acceptance criteria is not provided in the method, the laboratory shall establish surrogate QC acceptance criteria as described in the MS section above **(Section 6.1.2)**.

6.1.5 Laboratory Duplicates

Laboratory duplicates are two aliquots of the same sample taken through the whole sample preparation and analysis process in the same manner. The purpose is to monitor system performance and sample homogeneity.

Laboratory duplicates are normally specified for metals and water quality parameters. The QC acceptance criteria shall be within 20 percent relative percent difference (RPD).

6.2 Method Quality Control

All calibration and instrument tuning will follow SW-846, EPA 600, or manufacturer's specifications when this is not available. Laboratory blanks, spikes (LCS, LCSD, MS, MSD), duplicates and standard reference materials analyses that are required by the method will be reported.

6.3 Sample Quality Control

Subcontract analytical laboratory's LQMP will be provided to USACE upon request. The LQMP covers QC functions, including, but not limited to:

- Tuning
- Internal Standards
- Surrogate spikes
- Detection limit study
- Analyte identification and tentatively identified compounds
- Serial dilutions
- Duplicate injections
- Post digestion spikes
- Sample dilution
- Method blank
- LCS

The above-mentioned items are also covered in the pertinent methods manual.

7.0 Quality Control Parameters

The quality of analytical data will be assessed in terms of its precision, accuracy, representativeness, comparability, and completeness (PARCC) parameters. Because accuracy and precision information may be expressed in several ways, data obtained from this project will be carefully reviewed and evaluated by either an analytical chemist or a statistician. The application of PARCC parameters is described in the following sections.

7.1 PARCC Parameters

7.1.1 Precision

Precision will be assessed by comparing the analytical results between MS and MSD. The RPD between the MS and MSD (or LCS and LCSD) will be calculated using **Equation 7-1**. This information will be used to determine whether the analytical results received provide equal or greater precision data generated by the applicable method validation on similar matrices.

$$\text{RPD} = \frac{\text{MS Result} - \text{MSD Result}}{(\text{MS Result} + \text{MSD Result})/2} \times 100 \qquad \textbf{Equation (7-1)}$$

The precision of the field sample and the QC field sample will be considered to be outside QC limits under the following circumstances: (1) if at least one of the results exceed the analysis detection limit by a factor of five or greater, and (2) if the ratio of the results (field sample/QC sample or QC sample/field sample) exceed a factor of 2.0 for water samples or 5.0 for soil samples. A major disagreement is apparent when concentration ratios exceed 5.0 for water and 10 for soil. The ratios do not apply when both the QC sample and field sample results are less than 5 times the analytical detection limit.

If there is not a sufficient quantity of sample available to conduct an MS and MSD spike analyses, LCS and LCSD analyses must be completed to provide required QC data.

7.1.2 Accuracy

The accuracy of the measured data is evaluated by the comparison of the percent recovery of QC reference materials of known or established concentrations, independent of the routine calibration. Statistically based control limits are established for each method of analysis and sample matrix.

Accuracy is determined by the analysis of method spikes (blank spike, LCS) and MS/MSD samples. A blank spike is prepared in the laboratory using an inert matrix such as deionized

water or certified clean, inert sand which is spiked with target analytes. When one of the samples in the batch has two additional aliquots prepared and spiked with target analytes, these two aliquots are referred to as the MS and MSD. Spiked samples are routinely analyzed on each batch of up to 20 samples. Note that a batch may also contain less than 20 samples. Recoveries are assessed to determine method efficiency and any matrix interference effects. Analytical accuracy is expressed as the percent recovery of the spike added. **Equation 7-2** is used to calculate the percent recovery.

$$\text{Percent} = \frac{\text{Spike Sample Results} - \text{Sample Results}}{\text{Amount of Spike Added}} \times 100 \qquad \textbf{Equation (7-2)}$$

7.1.3 Completeness

Completeness is defined as the percentage of measurement taken for analysis in order to make site decisions compared to the total valid results available. **Equation 7-3** defines completeness. The highest percentage possible (minimum of 90 percent) will be achieved between the number of samples in control compared to the total number of samples received by the subcontract analytical laboratory. The results will be calculated following data reduction, review, and assessment.

$$\text{Completeness} = \frac{\text{Valid Data Obtained}}{\text{Total Data Planned}} \times 100 \qquad \textbf{Equation (7-3)}$$

A value of 90 percent or higher is the goal. For values less than 90 percent, problems in the sampling or analytical procedures should be examined and explained.

7.1.4 Representativeness

Unlike accuracy, precision, and completeness that can be expressed in quantitative terms, representativeness is a qualitative parameter. Representativeness is the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is address throughout this CDAP and the Design/Work Plan by describing the rational for sample locations, collection methods, frequency of sampling, and QA/QC procedures. **Table 4-1** summarizes analytical methods and turnaround times. **Table 4-2** summarizes analytical sample volume, holding times, and preservation method. **Table 7-1** presents field QA/QC requirements.

QC considerations including method blank results, sample holding times, sample preservation and sample conditions (i.e., during shipment and upon arrival at the lab) play an important role in sample representativeness. Sample results are not to be corrected for blank contamination. Samples may be rejected before analyzing if preservation requirements are not met, causing

undue resampling in the field. If sample holding times are exceeded and samples are received in poor condition at the laboratory, the USACE must be notified immediately for problem resolution.

7.2 Sensitivity / Detection Limits

The detection limits for each test listed in **Table 4-1** are outlined in **Attachment 1** and are covered in subcontract analytical laboratory's LQMP. The more stringent detection limits shall apply.

7.3 Field Quality Control

Field QC samples will be collected and analyzed throughout the field phases of this Task Order. The number and type of field QA/QC samples, as a minimum, are shown in **Table 7-1**.

7.3.1 Trip Blanks

Blanks, which are collected in the field, are an important link in the QC data chain for each set of samples. The analytical data derived from these blanks are necessary to assess quality of field sampling operations. Blanks are used to verify that sample containers, preserving reagents, and equipment are contaminant-free prior to and between different sampling points. Blanks are also used as a check for potential on-site environmental contamination, to evaluate personnel expertise in sample collection, and to reveal problems that may occur in sample storage and transport.

Therefore, the field QC blanks will not be isolated from actual samples. They must be considered as samples and treated identically (preserved with the same reagents, stored and transported in the same containers as the samples, etc.)

PURPOSE: The trip blank will be used when water samples, and soils in Septa jars, are being requested for volatile contaminants. Trip blanks will be analyzed for VOCs to ensure the integrity of the collection and shipping process.

PROCEDURE: Trip blanks will be prepared prior to the sampling event by the subcontract analytical laboratory, which is responsible for the initial preparation of sample containers. The water will be free of volatile organic contaminants. Any appropriate preservatives will be added at the time that the blanks are prepared. The sample containers (vials) will be sealed (custody seal), labeled appropriately, and transported to the site in the same sampling kits as the sample vials. These blanks will <u>not</u> be opened in the field. The trip blank remains with the corresponding field samples at all times during the collection, handling, and shipping of field samples.

FREQUENCY: A set of trip blanks will accompany the storage and transport of all field water samples, and soils collected in Septa jars being requested to be analyzed for volatile contaminants. One set of trip blanks will be placed into every cooler that contains water samples and soils in Septa jars for volatile analysis.

7.3.2 QC Replicate Samples

PURPOSE: QC samples are collected by the Sample Technologist and are used to verify the reproducibility of the subcontract laboratory data. The purpose of the samples is to provide site specific field originated checks that the data generated by the subcontract laboratory are of suitable quality.

Groundwater QC samples will be collected as a single sample using an acceptable sampling device and poured/pumped into separate but identical containers. Volatile samples will be collected first. One sample will be labeled as the field sample and the other sample will be labeled as the QC sample. The QC samples will be contained, preserved, and transported in the same manner as the samples of interest. QC samples will be analyzed for the same parameter groups as the associated field samples of interest.

FREQUENCY: One QC sample will be collected for every 10 or less field samples (for each sample matrix) collected at the site.

The precision of the field sample and the QC field sample will be considered to be outside QC limits under the following circumstances: (1) if at least one of the results exceed the analysis detection limit by a factor of five or greater, and (2) if the ratio of the results (field sample/QC sample or QC sample/field sample) exceed a factor of 2 for water samples or 5 for soil samples. A major disagreement is apparent when concentration ratios exceed 5 for water and 10 for soil. The ratios do not apply when both the QC sample and field sample results are less than 5 times the analytical detection limit.

7.3.3 QA Replicate Samples

PURPOSE: QA samples are used by the USACE to evaluate the performance of the subcontract laboratory.

Groundwater QC samples will be collected as a single sample using an acceptable sampling device and poured/pumped into separate but identical containers. Volatile samples will be collected first. One sample will be labeled as the field sample, one sample will be labeled as the QC sample, and the other sample will be labeled as the QA sample. The QA samples will be contained, preserved, and transported in the same manner as the samples of interest. QA samples will be analyzed for the same parameter groups as the associated field samples of interest.

FREQUENCY: One QA sample will be collected for every 10 or less field samples (for each sample matrix) collected at the site.

7.3.4 Field Measurement Duplicates

PURPOSE: Field measurement duplicate samples (photoionization detector [PID] readings) are used to verify reproducibility of data on field instruments.

PROCEDURE: Field measurement duplicate readings will be collected every ten samples.

FREQUENCY: One QA sample will be collected for every 10 or less field samples (for each sample matrix) collected at the site.

7.4 Sample Quality Control Report

To supplement the information recorded in the field logbook, Sample Quality Control Reports (SQCRs) will also be maintained for every sampling location. An example of the SQCR to be used at the site is shown in **Figure 7-1**. SQCRs will be maintained by the Sample Technologist and cross-checked for completeness at the end of each day by the CQCSM. Each form will be signed and dated by individuals making entries and initialed by the CQCSM upon completion. Copies of the SQCR will be attached to the Daily Quality Control Report and forwarded to USACE.

Table 7-1
Field QA/QC Samples

Quality Control	Frequency of Occurrence	Percent Objective	Minimum Number
Trip Blank	1 per cooler containing waters and soils (in jars with PTFE septa caps) for volatile analysis	100	1
QA Replicate Samples	As requested by the USACE	100	1
QC Replicate Samples	1 per 10 or fewer field samples	100	1

Abbreviations:

PTFE polytetrafluoroethylene
QA quality assurance
QC quality control

Shaw Environmental, Inc.
1430 Enclave Parkway
Houston, Texas 77077

	Date						
	Day	S	M	T	W	TH	F	S
	Weather	Bright Sun	Clear		Overcast	Rain		Snow
USACE Project Manager	**Temp**	<32	32-50		50-70	70-85		>85
Project	**Wind**	Still	Moderate		High	Report #		
Project #	**Humidity**	Dry	Moderate		Humid			
Contract #								

Subcontractors on Site:
.
Equipment on Site:
Visitors on Site:
Shaw Personnel on Site:
Work Performed (including sampling):
Quality Control Activities (including field calibrations:
Health and Safety Levels and Activities:
Problems Encountered/Corrective Actions Taken:
Downtime/Standby:
Special Notes:
By: Title:

Figure 7-1
Sample Quality Control Report Form

8.0 Data Analysis Reporting

8.1 Field Instrument Data Reduction

The Sample Technician will be responsible for the proper use and calibration of the PID instruments used in the field to collect chemical data. All raw data collected for the field survey instruments will be entered into the logbook for the site.

8.2 Field Data Reduction

8.2.1 Responsibilities of the Analyst-Sample Technician

Each analyst will be responsible for converting raw data into reportable values. These specific duties include:

- Proper identification of the analyte
- Checking calibrations to ensure support of data
- Ensuring QA/QC checks are supportive of data
- Ensuring documentation is complete and accurate in respective logbooks

8.2.2 Analytical Records from On-Site Field Analytical

The Sample Technician will maintain a bound, numbered logbook for all PID samples analyzed. The following column headings will be entered, as applicable, for each item of sample information:

- Date – Date sample was collected
- Sample Number
- Location – Description of area sampled (abbreviated form if sampled twice or more - log explaining locations and abbreviations should be attached to or written in front of the logbook).
- Time – Time sample was collected
- Samplers – Persons collecting sample (always two-one at least witnessing even if not involved in the actual act)
- Type of Sample – Water, Soil, Air, etc.
- Analysis by – Person who performed analytical work
- Additional Comments – Space reserved for any other information concerning a particular sample or special procedure or analysis and COC of samples that leave the site

8.3 Field Data Verification

All field equipment will be checked and calibrated prior to use. Each instrument calibration is recorded in the field instrument calibration notebook. Field personnel using the equipment (sample technician, safety and health personnel, project hydrogeologist) are responsible for the following information:

- Internal calibration, complete and accurate
- Field data integrity
- All documentation is complete and accurate in a logbook
- Acknowledging historical data

8.4 Project Data Review

All data produced for the project will be given to the CQCSM and the Remediation Manager for final data review. All logbooks, COC, laboratory reports, etc. are reviewed to ensure all QC protocols have been met. All information will be archived for data storage.

8.5 Data Reporting by Contract Laboratory

8.5.1 Original Laboratory Report

Once the data have been reviewed, it is ready for report production. The report will typically contain the following information:

- Narrative discussing QC problems encountered by analytical method and matrix
- Shaw Project Number
- Original COC forms
- Cooler Receipt Form
- Description of sample types
- Tests performed and method number
- Date sampled
- Date received
- Date extracted
- Date analyzed
- Analytical results
- Dilution factor
- Percent solids (if applicable)
- Moisture content (soils)
- Field identification number and corresponding lab identification number
- Actual laboratory detection limit
- QC information
  - Blanks analyzed

  - Matrix spikes (MS/MSD)
  - Method spike (LCS, blank spike)
  - Surrogates, when applicable
  - Percent recovery
  - Control limits
  - RPD
  - any other special QC information
- Methodology
- Table cross-referencing field sample numbers and lab identification numbers, when these numbers are not included on each individual lab report form
- Table cross-referencing field samples to the associated method blanks, blank spike, MS, and MSD when more than one batch is included in the lab report package

The hard copy report will be checked by the off-site Project Chemist/Laboratory Coordinator, Remediation Manager and QC Manager before it is released. The original copy of the laboratory report, including the COC and cooler receipt form, will be provided to USACE as an integral part of the final submittal after all review comments have been resolved. A copy of each final laboratory report will be placed in the project file for future reference.

8.5.2 Diskette Deliverable

The analytical laboratory will also provide all project analytical data in an electronic data format. The file structure will comply with the ShawView format as described in **Attachment 2**. The laboratory will complete the files by downloading the appropriate analytical results and data. The ShawView files will be added to a database that can be used to produce analytical results tables.

8.6 Shaw Review of Diskette Deliverable

Upon receipt of the laboratory ShawView diskette deliverable listed in **Section 8.5.2**, the diskette will be reviewed by Shaw technical personnel. The review will consist of reviewing the format and files to ensure that they also comply with the ShawView format. The review will also consist of a review of the diskette contents for completeness; all analytical data has been entered correctly. If problems are encountered in the analytical data, the diskette will be returned to the analytical lab for a correction.

8.7 Data Storage and Deliverables

All documentation used and generated will be given to the Project Manager at the completion of the project. All logbooks, laboratory reports, and support documentation will be submitted to USACE. When available, the data will also be uploaded on the project specific portal provided by Shaw. This information will be accessible to both the Army and regulators for their use.

Deliverables to the Army will be in a format compatible with the ERIS and AEDB-R databases in accordance with the terms of the PWS (USACE, 2005) and PMP (Shaw, 2005).

9.0 Assessments and Response Actions

9.1 Site Audits

Under this task, the CQCSM, or his designee, will conduct a field audit to check the implementation of this CDAP. Site audits will assess the following:

- Personnel performance
- Sampling methods and techniques
- Decontamination methods and techniques
- QC program
- Data review program
- Recordkeeping procedures
- Document control system
- Data storage
- Corrective action responses

Upon completion of the site audit, the CQCSM will generate a report citing the deficiencies found as well as the progress achieved since the last site audit. Any deficiencies will be promptly corrected. Copies of the audit report will be given to the Project Chemist, Remediation Manager, and Project Manager. One copy will also be placed in the project files for reference

9.2 Data Review System

9.2.1 Laboratory Analyst's Data Review Responsibilities

The laboratory analyst at the subcontract analytical laboratory is responsible for the initial review of the project data. Any errors, or deficiencies, will be addressed at this time.

9.2.2 Laboratory QA Officer Data Review Responsibilities

The QA Officer at subcontract analytical laboratory will be responsible for the final data review prior to sending the initial and final report to Shaw. Any errors, or deficiencies, will be addressed at this time.

9.2.3 Project Chemist Data Review Responsibilities

The Project Chemist is responsible for the initial Shaw review of the data from the subcontract analytical laboratory. This review shall include the following:

- Verify that all requested data are reported (indicate any data gaps)
- Verify that samples are analyzed according to the contract specified methods
- Verify that the holding times have not been exceeded

- Verify that MS, MSD, method spike (LCS or blank spike), and surrogate recoveries fall within the laboratory's, or method, acceptable criteria
- Review blank data for gross, or unacceptable, contamination
- Review laboratory corrective actions discussed in narrative
- Provide a comparison of the field and QC sample results
- Provide an evaluation of data acceptability and usability for each sampling episode
- Verify receipt of QC validated ShawView data diskette

The Project Chemist will be responsible for informing the Project Manager and CQCSM of any laboratory and/or sampling deficiencies or issues. The Project Chemist will immediately inform the Project Manager, and/or CQCSM, of any data that do not fall within clean-up or closure criteria. The USACE will make the final decision regarding data acceptability and usability based on review of the data.

9.3 Corrective Action Reports

The Corrective Action Report (CAR) should include, but not limited to, the following:

- A description of the problem, deficiency, or issue
- Proposed resolution
- Resulting action

Depending on the issues, this report may be generated by the laboratory, Project Chemist, or Sample Technician. Copies of the CAR will be given to the Project Chemist, Remediation Manager, Project Manager, CQCSM, and USACE point-of-contact. A copy will also be placed in the project file for future reference. A sample CAR is shown in **Figure 9-1**.

Shaw® Shaw Environmental, Inc.

CORRECTIVE ACTION REPORT

TO:
FROM:
PC:
DATE:
PROJECT: **PROJECT NUMBER:**

NATURE OF EVENT:

RECOMMENDED CORRECTIVE ACTION:

CORRECTIVE ACTION TAKEN:

DATE: _____ TIME: _____ CORRECTIVE ACTION TAKEN: _____

SIGNATURE of person implementing corrective action: _____

Figure 9-1
Corrective Action Report Form

10.0 References

Shaw Environmental, Inc., 2005, *Draft Project Management Plan for Site Closure of Multiple Sites, Longhorn Army Ammunition Plant, Karnack, Texas*, Houston, Texas.

U. S. Army Corps of Engineers (USACE), 2001, *Engineering and Design - Requirements for the Preparation of Sampling and Analysis Plans*, Document EM-200-1-3.

USACE, 2005, *Performance Work Statement (PWS), Longhorn Army Ammunition Plant*, July 22.

Attachment 1

Analytical Methods and Constituent/Detection Limits

Comparison of Typical Laboratory Detection Limits to Screening Levels of Aqueous Samples
Volatile Organic Compounds – Method 8260B
Longhorn Army Ammunition Plant, Karnack, Texas

Analyte	Units	Reporting Limit[1]	Groundwater Standard (MCL)[2]
1,1,1,2-Tetrachloroethane	mg/L	0.0005	0.00328
1,1,1-Trichloroethane	mg/L	0.0008	0.2
1,1,2,2-Tetrachloroethane	mg/L	0.0004	0.000426
1,1,2-Trichloroethane	mg/L	0.001	0.005
1,1-Dichloroethane	mg/L	0.0004	0.365
1,1-Dichloroethylene	mg/L	0.0012	0.007
1,1-Dichloropropene	mg/L	0.001	0.000852
1,2,3-Trichlorobenzene	mg/L	0.0003	0.011
1,2,3-Trichloropropane	mg/L	0.0032	0.0000122
1,2,4-Trichlorobenzene	mg/L	0.0004	0.07
1,2-Dibromoethane	mg/L	0.0006	0.00005
1,2-Dichlorobenzene	mg/L	0.0003	0.6
1,2-Dichloroethane	mg/L	0.0006	0.005
1,2-Dichloropropane	mg/L	0.0004	0.005
1,3-Dichlorobenzene	mg/L	0.0012	0.11
1,3-Dichloropropane	mg/L	0.0004	0.000852
1,4-Dichlorobenzene	mg/L	0.0003	0.075
1,4-Dioxane	mg/L	–	0.00774
2,2-Dichloropropane	mg/L	0.0035	–
2-Hexanone	mg/L	0.005	0.219
Acetone	mg/L	0.005	0.365
Acrolein	mg/L	0.0004	0.018
Benzene	mg/L	0.0004	0.005
Benzene, 1,2,4-trimethyl	mg/L	0.0013	0.183
Benzene, 1,3,5-trimethyl	mg/L	0.0005	0.183
Benzene, 1-methylethyl	mg/L	–	0.365
Bromobenzene	mg/L	0.0003	0.073
Bromodichloromethane	mg/L	0.0008	0.1
Bromoform	mg/L	0.0012	0.1
Carbon tetrachloride	mg/L	0.0021	0.005
Carbondisulfide	mg/L	0.005	0.365
Chlorobenzene	mg/L	0.0004	0.1
Chlorobromomethane	mg/L	0.0004	0.146
Chlorodibromomethane	mg/L	0.0005	0.1
Chloroethane	mg/L	0.001	1.46

Comparison of Typical Laboratory Detection Limits to Screening Levels of Aqueous Samples
Volatile Organic Compounds – Method 8260B
Longhorn Army Ammunition Plant, Karnack, Texas
(continued)

Analyte	Units	Reporting Limit[1]	Groundwater Standard (MCL)[2]
Chloroform	mg/L	0.001	0.1
cis-1,2-Dichloroethene	mg/L	0.0012	0.07
cis-1,3-Dichloropropene	mg/L	0.001	0.000158
Dichlorodifluoromethane	mg/L	0.001	0.73
Ethylbenzene	mg/L	0.0006	0.7
Hexachlorobutadiene	mg/L	0.0011	0.00073
Isobutyl Alcohol	mg/L	–	1.1
Methyl chloride	mg/L	–	0.00655
Methyl ethyl ketone	mg/L	0.005	2.19
Methyl iodide	mg/L	0.001	0.00511
Methyl isobutylketone (MIBK)	mg/L	0.0015	0.292
Methyl tert-butyl ether	mg/L	0.001	0.015
Methylene bromide	mg/L	0.001	0.0114
Methylene chloride	mg/L	0.0003	0.005
Naphthalene	mg/L	0.0004	0.073
n-Butylbenzene	mg/L	0.0011	0.146
n-Propylbenzene	mg/L	0.0004	0.146
o-Chlorotoluene	mg/L	0.0004	0.073
p-Chlorotoluene	mg/L	0.0006	0.073
p-Cymene	mg/L	–	0.365
sec-Butylbenzene	mg/L	0.0013	0.146
Styrene	mg/L	0.0004	0.1
tert-Butylbenzene	mg/L	0.0014	0.146
Tetrachloroethylene	mg/L	0.0014	0.005
Toluene	mg/L	0.0011	1
trans-1,2-Dichloroethene	mg/L	0.0005	--
trans-1,3-Dichloropropene	mg/L	0.001	0.000852
Trichloroethylene	mg/L	0.001	0.005
Trichlorofluoromethane	mg/L	0.0008	1.1
Vinyl Acetate	mg/L	0.0075	0.107
Vinyl chloride	mg/L	0.0011	0.002
Xylene (total)	mg/L	0.003	8.93

Note:
[1]Reporting limits are laboratory-specific and will vary. The laboratory will be instructed to report to the method detection limit, which is a laboratory-specific limit less than the reporting limit, in an attempt to meet the groundwater risk standard.
[2]Safe Drinking Water Act, 40 CFR 141 and 30 Texas Administrative Code 290

Comparison of Typical Laboratory Detection Limits to Screening Levels of Aqueous Samples
Explosives – Method 8260
Longhorn Army Ammunition Plant, Karnack, Texas

Analyte	Units	Reporting Limit[1]	Groundwater Risk Standard
2,4-Dinitrotoluene	mg/L	0.001	0.000125
2,6-Dinitrotoluene	mg/L	0.001	0.000125
2-Amino-4,6-dinitrotoluene	mg/L	0.001	0.000608
4-Amino-2,6-dinitrotoluene	mg/L	0.001	0.000608
HMX	mg/L	0.001	0.183
m-Dinitrobenzene	mg/L	0.001	0.000365
m-Nitrotoluene	mg/L	0.001	0.0365
Nitrobenzene	mg/L	0.001	0.00183
o-Nitrotoluene	mg/L	0.001	0.0365
p-Nitrotoluene	mg/L	0.001	0.0365
RDX	mg/L	0.001	0.000774
sym-Trinitrobenzene	mg/L	0.001	0.11
Tetryl	mg/L	0.001	0.0365
Trinitrotoluene, 2,4,6- (TNT)	mg/L	0.001	0.00183

Note:

[1] Reporting limits are laboratory-specific and will vary. The laboratory will be instructed to report to the method detection limit, which is a laboratory-specific limit less than the reporting limit, in an attempt to meet the groundwater risk standard.

Comparison of Typical Laboratory Detection Limits to Screening Levels of Aqueous Samples
Perchlorate – Method 314
Longhorn Army Ammunition Plant, Karnack, Texas

Analyte	Units	Reporting Limit[1]	Groundwater Standard
Perchlorate	mg/L	0.005	0.004[2]

Note:

[1] Reporting limits are laboratory-specific and will vary. The laboratory will be instructed to report to the method detection limit, which is a laboratory-specific limit less than the reporting limit, in an attempt to meet the groundwater risk standard.

[2] 30 Texas Administrative Code 290. Texas has promulgated the federal secondary maximum contaminant levels into Texas Administrative Code

Comparison of Typical Laboratory Detection Limits to Screening Levels of Aqueous Samples
Metals – Method 7841 or 6020
Longhorn Army Ammunition Plant, Karnack, Texas

Analyte	Units	Reporting Limit[1]	Groundwater Risk Standard
Thallium	mg/L	0.002	0.002[2]

Note:

[1] Reporting limits are laboratory-specific and will vary. The laboratory will be instructed to report to the method detection limit, which is a laboratory-specific limit less than the reporting limit, in an attempt to meet the groundwater risk standard.

[2] Safe Drinking Water Act, 40 CFR 141 and 30 Texas Administrative Code 290

Attachment 2

ShawView EDT Format Specifications

File Structure: ShawView uses a standard file format for transmitting analytical data. Each file should be in standard ASCII format and consist of:

- A variable number of records containing analytical data
- A trailer record containing three dollar signs (i.e., $$$) followed by 358 blanks

Each individual analytical record must be 361 bytes long, contain only ASCII characters, and be terminated by a carriage return. ShawView identifies the information included in each record by position. Each value should be left-justified within the defined column. **All information requested in the format specification is required, except when not available or applicable**. The format is as follows:

Position	Field Length	Content	Blank Allowed	Comments
1-20	20	Project Sample Number	N	a
21-28	8	Sample Date (as MMDDYYYY)	N	b
29-33	5	Sample Time (as HH24:MI)	N	b
34-48	15	Sample Delivery Group	Y	
49-58	10	Lab Matrix	N	
59-78	20	Lab Sample No	N	
79-83	5	Laboratory Identification Code	N	c
84-91	8	Analysis Date (as MMDDYYYY)	N	
92-96	5	Analysis Time (as HH24:MI)	N	
97-116	20	QC Batch Number	Y	
117-120	4	Result Type	N	
121-131	11	CAS Number	N	
132-141	10	Result	N	
142-148	7	Result Qualifier	Y	d
149-158	10	2-Sigma Error (for Radiological results only)	Y	
159-168	10	Units of Measure	N	
169-176	8	Retention Time	Y/N	e
177-236	60	Parameter Name	N	
237-246	10	Detection Limit	N	f
247-256	10	Method Detection Limit	Y	g
257-263	7	Dilution Factor	N	h
264-269	6	Extraction Method Code	Y	i
270-271	2	Result Classification Code	Y	i
272-285	14	Expected Result	Y	i
286-295	10	Analytical Method Code	Y	i
296-299	4	Sample Purpose	Y	b
300-303	4	Sample Prep Code	N	j
304-311	8	Sample Leachate Date (as MMDDYYYY)	Y	
312-319	8	Extraction Date (as MMDDYYYY)	N	j
320-324	5	Extraction Time (as HH24:MI)	Y	
325-359	35	Lab Method	N	
360	1	Sample Filtered	N	k
361	1	Re-extraction Number	N	l

Comments:

Valid value tables are provided.
If no valid CAS registry number exists, use code assigned by Shaw.

a. The lab should enter the lab sample number in both the project and lab sample number fields when the sample is a laboratory QC sample.
b. The sample date and time are required for all samples. Additionally, sample purpose is required for laboratory QC samples.
c. The code reported by the lab is assigned by Shaw.
d. Results for all spike samples should be reported in units of percent recovery.

e. A blank qualifier is assumed to be a positive detect. A list of default qualifiers is provided in **Table 2**. This list can be superseded by the Contractor Quality Control Plan (CQCP).
f. Retention time is required for tentatively identified compounds only. For target compounds and surrogates, leave this field blank.
g. The detection limit reported in this field should be the reporting limit as specified in the CQCP. The value should be adjusted for moisture and dilution as necessary.
h. The detection limit reported in this field is the limit for the method as reported in the literature.
i. If sample is not diluted, report a value of 1.
j. Sample Prep Code and Extraction Date are required fields.
k. Valid entries are Y/N.
l. Valid entries are 0 - 9.

Table 1. Result Types

Result Type	Category	Description
TRG	NF	Target parameter for analysis
TIC	NF	Tentatively identified compound
IS	LQ	Internal standard added to the sample by the laboratory
SUR	LQ	Surrogate compound added to the sample by the laboratory

Table 2. Result Qualifiers

Qualifier	Qualifier Category	Nondetect Qualifier	Description
U	O	Y	Compound was analyzed for but was not detected ("Non-detect")
J	O	N	Estimated value less than the CRDL
C	O	N	Pesticides only. Presence confirmed by GC/MS
B	O	N	Analyte found in both sample and associated blank
E	O	N	Estimate: result outside linear range of instrument
D	O	N	Dilution run. Initial run outside linear range of instrument
A	O	N	Indicates that the TIC is a suspected aldol condensation product
X	O	N	Indicates manual modification of result or EPA qualifier
JX	O	N	Result is less than SQL that would have been displayed for "U"
B	I	N	Value less than the CRDL but greater than or equal to the IDL
E	I	N	Value estimated due to interference
M	I	N	Duplicate inject precision did not agree (GFAA)
N	I	N	Spiked sample recovery not within control limits
S	I	N	Reported value determined by Method of Standard Additions (MSA)
W	I	N	Post-digestion spike out of control limits (GFAA)
*	I	N	Duplicate analysis not within control limits
+	I	N	Correlation coefficient for the MSA is less than 0.995
P	I	N	Method qualifier - ICP
A	I	N	Method qualifier - Flame AA
F	I	N	Method qualifier - Furnace AA
CV	I	N	Method qualifier- Manual cold vapor
AV	I	N	Method qualifier - Automated cold vapor
NR	I	N	Method qualifier - Analyte was not required
C	I	N	Method qualifier - Manual spectrophotometric

Table 3. Sample Purpose

Sample Purpose	Category	Description
BKS	LQ	Blank spike
BLK	LQ	Blank
BSD	LQ	Blank spike duplicate
CB	LQ	Calibration blank
LCS	LQ	Laboratory control sample
LR	LQ	Laboratory replicate
MB	LQ	Method blank
MS	LQ	Matrix spike
MSD	LQ	Matrix spike duplicate
REG	NF	Regular environmental field sample
AB	FQ	Ambient condition blank (HAZWRAP definition)
ER	FQ	Equipment rinsate
FB	FQ	Field blank (USEPA definition)
FD	FQ	Field duplicate
RD	FQ	Regulatory duplicate collected in the field by a regulator
SMQC	FQ	Source material quality control
SPLT	FQ	Regular sample split in two; each half is sent to a different lab
TB	FQ	Trip blank

Table 4. Sample Prep Codes

Prep Code	Description
1310	Leachate Method SW1310
1311	Leachate Method SW1311
1312	Leachate Method SW1312
CIT	Waste extraction test using sodium citrate
CON1	Confirmation Analysis - First
CON2	Confirmation Analysis - Second
DION	Waste extraction test using deionized water
NORM	Normal preparation associated with analytical method used

Appendix D

Field Procedures

APPENDIX D
FIELD PROCEDURES

FINAL
INSTALLATION-WIDE WORK PLAN
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Prepared for

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Tulsa District
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Contract Number W912QR-04-D-0027
Task Order No. DS02

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List of Attachments

Attachment 1 Collection and Field Screening of Soil Samples
Attachment 2 Groundwater Sampling
Attachment 3 Well Development
Attachment 4 Groundwater Level Measurements
Attachment 5 Subsurface Soil Sampling
Attachment 6 Surface Soil Sampling
Attachment 7 Surface Water Sampling
Attachment 8 Non-Hazardous Sample Handling, Packaging and Shipping
Attachment 9 Field Equipment Decontamination
Attachment 10 Investigation Derived Waste
Attachment 11 Monitoring Well and Borehole Abandonment
Attachment 12 Screening Level Metals Analysis Using a Portable X-Ray Fluorescence Instrument
Attachment 13 Monitoring Well Installation Procedures

SHAW STANDARD OPERATING PROJECT PROCEDURE

LONGHORN ARMY AMMUNITION PLANT

ATTACHMENT 1

Subject: COLLECTION AND FIELD SCREENING OF SOIL SAMPLES

1.0 PURPOSE AND SUMMARY

This Standard Operating Project Procedure (SOPP) establishes guidelines and procedures for use by field personnel in collection and field screening of hand-augered, grab, and sleeve-lined split-spoon soil samples from surface or subsurface soils, or sediments.

The use of field screening methods for hand-augered, grab, or sleeve-lined split-spoon samples allows field teams to develop a general understanding of contaminant profiles with the objective of optimizing confirmation sampling activities. Consistent sampling procedures help to ensure uniformity of results and to reduce either false positives or negatives.

2.0 TABLE OF CONTENTS

1.0 Purpose and Scope
2.0 Table of Contents
3.0 Responsibility Matrix
  3.1 Site Manager
  3.2 Field Team
3.1 Site Contractor Quality Control Systems Manager (CQCSM)
4.0 Definitions
5.0 Text
  5.1 Required Records and Forms
  5.2 Required Material, Equipment, or Supplies
  5.3 General Requirements
  5.4 Specific Requirements for Hand Augering
  5.5 Specific Requirements for Split-Spoon Sampling
  5.6 Records
6.0 Exception Provision
7.0 Cross Reference
8.0 Tables
9.0 Attachments

3.0 RESPONSIBILITY MATRIX

3.1 Site Manager

The Site Manager or Field Team Leader, is responsible for ensuring that field activities are completed to meet the project objectives, are conducted in accordance with the project plans and requirements, and all activities are performed according to the respective procedures. This will be accomplished by staff training, by maintaining quality assurance/quality control (QA/QC), and proper documentation.

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3.2 Field Team

All members of the field team (samplers, technicians, field geologists, engineers, etc.) are responsible for understanding and implementing this field procedure as well as ensuring all team members also perform work in accordance with this procedure.

3.3 Site Contractor Quality Control Systems Manager (CQCSM)

The site CQCSM is responsible for ensuring that this procedure is correctly implemented and that data collected meet the requirements of the project work plan.

4.0 DEFINITIONS

En Core® Sampler. A disposable volumetric sampling device used for collecting, storing and delivery of a soil sample.

Hand Auger. A hand-operated device used for collecting shallow subsurface soil samples. Several types of hand augers are available: screw-type augers, barrel augers, tube type augers, and hand-held power augers. The basic operation of a hand auger involves turning the auger repeatedly while applying pressure so that it goes down into the soil. Soil samples are collected either from the cuttings (screw-type) or the barrel (barrel or tube-type) of the auger.

Split Spoon Sampler. The split-spoon sampler consists of two split-barrel halves, a drive shoe, and a sampler head containing a ball 'n check valve, all of which are threaded together. The sampler is commonly 2 to 3 inches in outside diameter and 2-feet in length. The sampler is threaded to a driving rod and either pushed or hammered into the ground to obtain a soil sample.

5.0 TEXT

5.1 Required Records And Forms

1. Field Activity Daily Log (FADL)
2. Sample labels and chain-of-custody forms
3. Sample collection log (SCL)
4. Material safety and data sheets (MSDS).

5.2 Required Materials, Equipment, Or Supplies

1. Indelible black-ink pens and markers
2. Personal protective clothing and gear
3. Gloves, nitrile
4. Keys for locking well caps
5. Paper towels
6. Radio, two-way, hand held or cellular phone
7. Safety glasses with side shields
8. Hard hat
9. Aluminum Foil
10. Portable organic vapor detector (i.e., photoionization detector [PID] or flame ionization detector [FID])
11. Clean stainless steel spoon or spatula

12. Certified clean glass sample container or zip-top type bags
13. End caps, and Teflon® tape
14. Stainless steel, brass, Lexan® or Teflon® inserts (liners) for split-spoons. Liners must be sized appropriately for the diameter of the split spoon used.

5.3 General Requirements

The collection of field-screening samples can be accomplished by several types/sizes of sampling devices (e.g., hand auger, Geoprobe sampler system, or split-spoon samplers). However, the greater the number of analyses to be performed in the field, the greater the volume of soil that will be required for on-site and potential off-site laboratory analyses. The following procedures outline the collection methods from three of the most common sample retrieval devices that allow for both on-site and off-site analyses.

1. Verify that all personnel have read and understood the approved site-specific health and safety plan and have the proper training and certifications required under OSHA.

2. Sample locations are to be marked and proper utility clearances obtained prior to sampling event.

3. Verify the site location by existing maps and surface features. Mark off the boundaries of the work site with flagging or other means to prohibit access to unauthorized personnel.

4. Check to see that all the necessary equipment (including PPE) is available at the site, is in good working condition, and has been properly decontaminated.

5. Check that all monitoring equipment is properly calibrated and operating.

6. The use of biochemical field devices (e.g., immunoassay kits) may be used to augment the field screening for total petroleum hydrocarbons and specific VOCs.

7. Dispose of the soils/sediment and containers as stated in the Work Plan and Attachment 10 of Appendix D, Investigation Derived Waste.

5.4 Specific Requirements for Hand Augering

1. Follow the general procedures for collection of subsurface soil samples as defined Attachment 5 of Appendix D, Subsurface Soil Sampling.

2. Using gloved hands and spatula/spoon, fill either a clean container or zip-top bag approximately one-half to two-thirds full with soil/sediment and tightly seal the zip-top type bag or tightly cap the clean container with a piece of aluminum foil.

3. Properly identify the sample.

4. Allow the sample to set for approximately 15 min in a warm environment (e.g., the sun or a heated car).

5. Pierce the aluminum foil or the zip-tip type bag with the sample probe of the organic vapor detector and record the highest initial reading from the container's headspace on the FADL.

5.5 Specific Requirements for Split-Spoon Sampler (24-inch or 5-foot [CME])

1. Follow the general procedures for collection of subsurface soil samples as defined in Attachment 5. The split-spoon sampler may be used when a large volume of soil is needed for samples or an extra liner is needed for lithologic description.

2. Place the liners in the split spoon as illustrated in the attached diagram (**Figure 1**). Prepare labels, or label the liners, with all pertinent sampling information and liner designations.

3. Collect soil sample following Attachment 5.

4. Take appropriate hand-held meter measurements (PID or FID) from the ends of liners and record on the FADL.

5. If all liners have approximately the same PID/FID readings, seal liners C1 and C2 (see Fig. 1) with Teflon tape and end caps. If a particular liner section has a significantly higher PID/FID reading, this liner should be selected as the off-site VOC sample.

6. Extrude total petroleum hydrocarbons (TPH) sample from liner B for on-site laboratory analysis, if necessary. If there is no TPH analysis, proceed to next step.

7. Collect additional sample volume for other on-site analyses [e.g., metals or semivolatile organic compounds (SVOCs)] from liner D and place in the appropriate container for shipping to the on-site laboratory. Cap liners A, B, and D with Teflon tape and end caps. Liner A, the topmost liner, may contain slough from the previous sample run's drilling activities. Use liner A only if there is insufficient sample volume and collect from the bottom of the liner first. Place liners A, B, and D and C2 in plastic bags and store on ice in coolers.

8. Field-screening analysis must be completed before a decision can be made on whether the stored liners (i.e., A, B, D, and C2) are to be sent to the off-site laboratory for analysis, archived for future use, or discarded. The decision to send samples to the off-site laboratory must be consistent with the decision criteria set forth in the SFSP and the samples must arrive at the laboratory at least 5 working days before the holding times expire.

9. If samples are to be sent to the off-site laboratory, remove the necessary sample volume from liners A, B, and D, composite the samples, and place in appropriate

containers for shipment to laboratory. Ensure each sample is clearly labeled. A liner from which on-site samples were collected will not be shipped.

10. If samples are to be archived or discarded, procedures must be consistent with those set forth in the SFSP or work plan.

5.6 Records

All information will be recorded in the FADL for the subject site. The FADL entries will be recorded chronologically and the time of the entry recorded first. All FADL continuation pages will be sequentially numbered and the last page recorded for the day will be signed and dated by the recording technician.

Records generated as a result of this SOPP will be controlled and maintained in the project record files.

6.0 EXCEPTION PROVISIONS

Headspace analysis is limited by potential loss of volatile organic compounds during method execution.

7.0 CROSS REFERENCE

Attachment 5 - Subsurface Soil Sampling
Attachment 9 - Field Equipment Decontamination

Annual Book of ASTM Standards, *Standard Guide for Soil Gas Monitoring in the Vadose Zone*, D5314.

HAZWRAP, 1996. *Document No. DOE/HWP-100, Standard Operating Procedure 2A and 2B, Collection and Field Screening of Hand-Augered and Grab Samples and Sampling and Field Screening of Sleeved Soil Samples.*

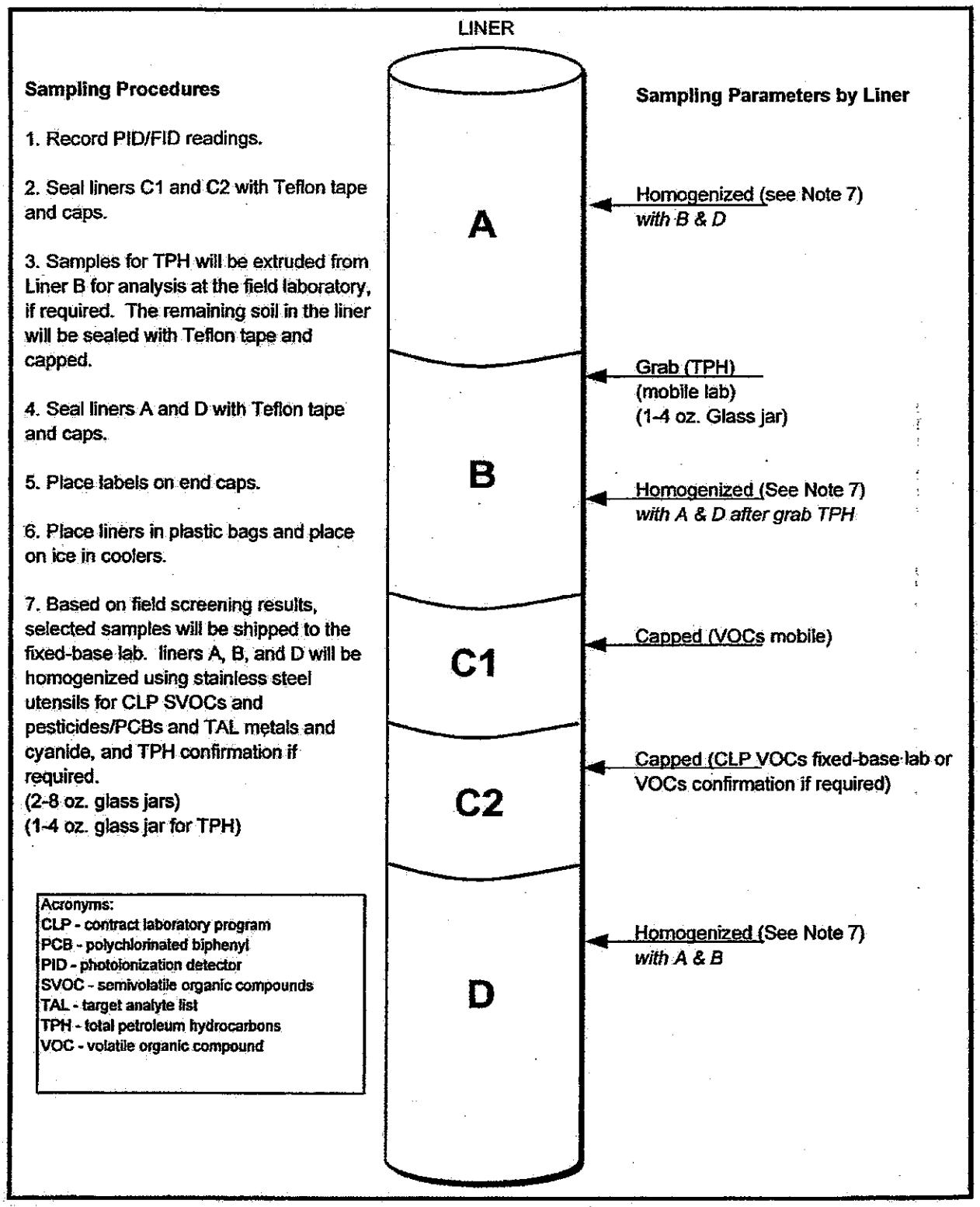
8.0 TABLES

None

9.0 ATTACHMENTS

Figure 1 - Lining the Split-Spoon Sampler
Figure 2 – Field Activity Daily Log

Figure 1


LINER
Sampling Procedures
1. Record PID/FID readings.
2. Seal liners C1 and C2 with Teflon tape and caps.
3. Samples for TPH will be extruded from Liner B for analysis at the field laboratory, if required. The remaining soil in the liner will be sealed with Teflon tape and capped.
4. Seal liners A and D with Teflon tape and caps.
5. Place labels on end caps.
6. Place liners in plastic bags and place on ice in coolers.
7. Based on field screening results, selected samples will be shipped to the fixed-base lab. liners A, B, and D will be homogenized using stainless steel utensils for CLP SVOCs and pesticides/PCBs and TAL metals and cyanide, and TPH confirmation if required.
(2-8 oz. glass jars)
(1-4 oz. glass jar for TPH)
Acronyms:
CLP - contract laboratory program
PCB - polychlorinated biphenyl
PID - photoionization detector
SVOC - semivolatile organic compounds
TAL - target analyte list
TPH - total petroleum hydrocarbons
VOC - volatile organic compound
A
B
C1
C2
D
Sampling Parameters by Liner
Homogenized (see Note 7)
with B & D
Grab (TPH)
(mobile lab)
(1-4 oz. Glass jar)
Homogenized (See Note 7)
with A & D after grab TPH
Capped (VOCs mobile)
Capped (CLP VOCs fixed-base lab or VOCs confirmation if required)
Homogenized (See Note 7)
with A & B

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Figure 2

Shaw
Shaw Environmental & Infrastructure, Inc.

DAILY LOG	DATE:
	NO.
	SHEET OF

FIELD ACTIVITY DAILY LOG

PROJECT NAME	PROJECT NO.
FIELD ACTIVITY SUBJECT:	
DESCRIPTION OF DAILY ACTIVITIES AND EVENTS:	

SHAW STANDARD OPERATING PROJECT PROCEDURE

LONGHORN ARMY AMMUNITION PLANT

ATTACHMENT 2

Subject: GROUNDWATER SAMPLING

1.0 PURPOSE AND SUMMARY

This Standard Operating Project Procedure (SOPP) establishes guidelines and procedures for use by field personnel in sampling monitoring well groundwater.

A consistently implemented groundwater sampling procedure will help ensure data comparability between different sampling events and between sites. One of the following methods shall be used to collect groundwater samples. The method to be used shall depend upon the site conditions or requirements of the work plan. The low-flow method shall be used unless other methods are specified or approved for special circumstances.

(a) Low-flow purge and sample using a submersible bladder pump.
The method involves purging the well at low-flow rates until water quality parameters stabilize or are within acceptable ranges, and collecting the sample at the same low flow rates. This method should be used by default unless the site conditions or the work plan require using a different method. A bladder pump is preferred for low flow sampling; however, other pumps (e.g., peristaltic pump) may be acceptable depending upon the objective of the sampling.

(b) Volume purge and sample using a bailer or submersible pump.
The method involves purging a fixed number of well volumes using a bailer or submersible pump. Purging is continued until at least 3 well volumes are purged and the parameters have stabilized. This method shall be used in lieu of the low-flow method, only if warranted by the site conditions (e.g., exceptionally low recharge rate). A bailer may be used for collecting sample from a well that goes dry even at the slowest pumping rate during low-flow purging. In such a case, the well is pumped dry and sample is collected with a bailer within 24 hours. This method shall be used only if specified in the work plan or approved by a task manager or the technical lead.

The low-flow purge and sample method shall be used as a default method for collecting groundwater samples for chemical analysis. The use of method (b) will be restricted only to special circumstances, either if specified in the work plan or if warranted by site conditions. If site conditions warrant the use of method (b), prior approval from the technical lead is required and the approving person must be identified in the sample collection log.

1.1 Low-Flow Purge and Sample

Introduction. The low-flow (minimum drawdown, micropurging) sampling method is based upon the premise that a pump located within the screened interval of a well and pumping at a rate corresponding to the hydraulic conductivity of the formation, will rapidly establish a horizontal laminar flow of groundwater and withdraw fresh

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formation water without significant mixing or dewatering of the stagnant casing water in the well (U.S. Army Corps of Engineers, 1995). The low flow method aims to minimize well water turbidity which may be caused by resuspension of well sediments or additional development of the formation during high speed pumping.

Establishment of a low flow regime will be ensured by carefully monitoring the drawdown because excessive drawdown indicates that the pump is withdrawing stagnant casing water. The maximum drawdown allowed will be 0.3 feet (4 inches). During purging, the flow rate will typically be maintained within the range of 0.1-0.5 liter/minute (L/min). The flow rate will be decreased further if the drawdown exceeds 0.3 feet. Flow rates up to 1 L/min may be used in purging some high yielding residuum aquifers, if the drawdown remains within the allowable limit of 0.3 feet. Flow rates greater than 1 L/min may be allowed in bedrock wells where the well may be screened across a cavity, with the limitation of the maximum drawdown. However, the flow rate in all cases must be slowed down to 0.1 to 0.3 L/min during sampling to prevent turbulence and aeration of water.

If excessive drawdown is noted using the lowest possible pump rate, then the low-flow method is not applicable. In such a case, the well will be pumped dry once and sample will be collected with a bailer as soon as adequate quantity of water for samples is available.

2.0 RESPONSIBILITY MATRIX

2.1 Site Manager

The Site Manager or Field Team Leader, is responsible for ensuring that field activities are completed to meet the project objectives, that they are conducted in accordance with the project plans and requirements, and that all activities are performed according to the respective procedures. The Site Manager is responsible for ensuring that all site personnel are trained in the procedures, that the procedures are adhered to, and that all activities are documented.

2.2 Field Team

All members of the field team (samplers, technicians, field geologists, engineers, etc.) are responsible for understanding and implementing this field procedure as well as ensuring that all team members also perform work in accordance with this procedure.

3.0 DEFINITIONS

Bailer. A bailer is an enclosed cylindrical tube containing a floating ball check-valve at the bottom. Lowering the bailer into water causes the ball to float allowing water to enter the cylinder. Raising the bailer through the water causes the ball to settle, creating a seal to trap the water so that it can be brought to the surface.

Bladder Pump. A bladder pump is an enclosed cylindrical tube containing a flexible membrane bladder. Well water enters the bladder through a one-way check-valve at the bottom. Gas is forced into the annular space (positive displacement) surrounding the bladder through a gas supply line. The gas displaces the well water through a one-way check-value at

the top. The water is brought to the surface through a water discharge line. The gas (air or nitrogen) is provided by compressors or compressed gas cylinders.

Peristaltic Pump. A peristaltic pump is a self-priming, low volume pump consisting of a rotor and ball bearing rollers. Tubing placed around the rotors is squeezed by the rotors as they revolve. The squeezing produces a wavelike contractual movement which causes water to be drawn through the tubing. The peristaltic pump is limited to sampling at depths of less than 25 feet.

Purging. The process of evacuation of the static water in the monitoring well to allow formation water to flow into the well. The aim of purging a well before sampling is to obtain a sample that is representative of the groundwater in the soil or rock formation. Purging can be accomplished either by utilizing low-flow purge or volume purge methods. In the low-flow purge method, water is pumped at a slow rate to establish a horizontal laminar flow to draw water from the formation without drawing in the stagnant casing water. Volume purge involves evacuating 3-5 well volumes of water to ensure that all stagnant water has been removed from the well.

Water Quality Parameters. Chemical and physical properties of groundwater measured during purging and sampling to ensure that a representative groundwater sample has been collected and to document the ambient subsurface conditions at the time of sampling. The parameters normally measured include pH, Eh, temperature, dissolved oxygen, conductivity, and turbidity. The measurements are made at specified intervals and documented in appropriate sample collection logs completed in the field.

4.0 PROCEDURE

4.1 Required Records And Forms

1. Groundwater Sampling Log (Attachment 1.0)
2. Chain-of-Custody Form
3. Sampling and Analysis Plan
4. Material Safety Data Sheets (MSDS)
5. Field Activity Daily Log (FADL).

4.2 Required Materials, Equipment, Or Supplies

The following supplies are required for low-flow purge and sample method. Other supplies as needed in addition or in-lieu of those listed below are specified in respective sections.

1. Personal protective equipment (PPE) as required by the site-specific health and safety plan
2. Calculator
3. Decontamination solutions; nonphosphate detergent, rinse water, deionized water
4. Compressor, air
5. Container, 1-gal clear glass
6. Controller Box
7. Cooler with ice and packing materials
8. Cylinder, graduated, 2-liter

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9. Drum, 55-gallon
10. Filters, high capacity, in-line sample filter, 0.45 micron
11. Filtration units, (disposable) and hand-operated vacuum pump (if needed in-lieu of in-line filtration)
12. Flow-through cell or equivalent
13. Gasoline
14. Gloves, nitrile or latex
15. Keys for locking well caps
16. Labels, sample bottles
17. Litmus paper or pH indicator strips
18. Paper towels
19. Pens, waterproof
20. Pipettes
21. Pump, bladder
22. Radio, two-way, hand-held or cellular phone
23. Safety glasses with side shields
24. Sample containers
25. Sheeting, polyethylene
26. Steel tape, weighted
27. Stop watch
28. Thermometer
29. Photoionization Detector (PID)
30. Trash bags, large plastic
31. Trash can, 32-gallon plastic
32. Tubing, Teflon®-lined polyethylene discharge bundled with polyethylene air tube
33. Water Level Indicator.

4.3 General Requirements

Decontamination:

1. All field sampling equipment (pump, bailer, water discharge tubing, support cables, water level indicator, flow-through cells, etc) likely to come in contact with the sampled groundwater shall be decontaminated before and after each use or between wells. The pump shall be initially dissembled and decontaminated. Refer to the decontamination SOPP for complete procedures.

2. The water discharge tubing shall then be attached and the pump used to twice circulate detergent solution followed by potable water and deionized water rinses. Only Teflon® or Teflon®-lined tubing shall be reused after decontamination. Polyethylene or tygon tubing shall be discarded after each use and shall not be decontaminated for reuse.

Other Requirements

3. Provide shade for the spooled tube when a sampling event occurs during summer months in full sun. Otherwise, the tube may act as an effective heater, warming the groundwater sample and creating a potential for volatilization.

4. The portable generator/compressors shall be placed downwind from the well being sampled.

5. Store field parameter measurement "instruments" in shade during transportation and at the sampling site. The instruments may give inaccurate readings if left under full sun.

6. To the extent possible, groundwater sampling shall be conducted so as to sample upgradient, presumably "clean" wells first.

7. All personnel involved in sampling shall wear appropriate health and safety clothing and gear, including clean nitrile gloves, in accordance with the site-specific health and safety plan.

8. In order to minimize turbidity in the well, pump and tubing assemblages shall be lowered into the well as slowly as possible to minimize turbidity.

4.4 Specific Requirements for Low-Flow Sampling

Follow steps given below:

Pump Installation

1. Measure the static water level and the total well depth with an electric water level indicator.

2. Based on the well design information, subsurface geology, and the measured water level, determine the location of the pump intake using the guidelines given below:

   a. If a zone with a relatively high hydraulic conductivity (K) is present in the screened interval, place the pump intake within this zone. A high K zone may be a sandy or gravel unit within an overall clayey unit or a fracture zone within the bedrock. If the high K zone is near the bottom of the screen, the pump intake should be as much above the well bottom as possible.

   b. If a high K zone is not present and the screen is completely submerged, place the pump intake near the middle or slightly above the middle of the screen.

   c. If a high K zone is not present and if the water level is below the top of the screen, place the pump near the middle of the water column. The pump intake should be as much above the well bottom as possible.

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3. Connect the safety cable, discharge tube, and air tube to the bladder pump. The discharge tube will be Teflon®-lined polyethylene and its length will be appropriate for the well being sampled. For example, a 100-foot long tube may not be used in sampling a 30-foot deep well; instead a 50-foot length will be used.

   Using an appropriate length of tube will minimize the amount of decontamination fluids generated and lessen the opportunity for chemical and physical changes in the water due to contact with the spooled tube.

4. Gently lower the pump to the appropriate sampling depth so as to minimize mixing of stagnant casing water with the screen water and resuspension of bottom sediments. Secure the pump at the desired depth by clamping the support cable to the 4-inch non-locking well cap.

5. Lower an electric water level indicator (with an audio and visual alarm) again into the well, measure and record the water level. The water level may be temporarily elevated because of the insertion of the pump into the well. Wait for a few minutes until the water level returns to the static level.

6. Make proper connections for the pump. Attach the air supply line to the pump controller. Connect the pump discharge tube to a "T" insert with a valve. Connect two sections of Teflon® -lined tube to the two remaining ends of the "T". Connect one tube to the flow through cell of the water quality meter and place the discharge from the flow cell into the purge water container. The third tube from the "T" will be used for sample collection.

7. Calibrate water quality meters and place probes into the flow through cell.

8. Measure the water level in the well. Secure the water level probe 0.3 foot (4 inches) below the water level and keep the instrument on.

9. Start the pump at the lowest setting. Gradually increase the flow rate.

10. Constantly monitor the drawdown as the flow rate is increased. If the drawdown exceeds 0.3 foot, indicated by visual or audio alarms on the water level indicator, decrease the flow rate appropriately.

11. Monitor the pump flow rate in mL/min using a stop watch and a graduated measuring cylinder. The targe flow rate is 100 to 500 mL/min (0.1 to 0.5 L/min), which may be increased in the case of a rapid recharging well to 1 L/min (residuum well) or greater (bedrock well), with the maximum drawdown limitation of 0.3 foot.

12. Measure water quality indicator parameters every 3 to 5 minutes. The parameters and their tolerance limits are provided in **Table 1** and discussed further in a subsequent section. The measurements shall be recorded on the groundwater

sampling form. All measurements shall be recorded in units shown on the form. If measurements are made in different units, these units must be clearly shown on the form.

13. Once water quality indicator parameters stabilize (four consecutive readings within acceptable variability), turn the valve at the "T" junction so that the water is diverted from the flow cell to the tube designated for sample collection. Collect samples at 100 to 500 mL/min purging rate.

    A bailer should be used for sampling in the case where a well is extremely slow to recharge (i.e., the recovery rate is below the minimum possible pump rate) and has to be pumped dry. Follow the procedures given below under these circumstances.

14. If the recharge rate of a well fails to sustain the lowest possible flow rate of the pump, causing an excessive drawdown, purge the well dry once. Remove the pump from the well and allow the well to recover until adequate water for samples is available.

15. Use a bailer to collect samples within 24 hours. Collect samples for different parameters as the water becomes available, in the order specified in section 4.8. This is especially important for wells that have historically yielded turbid samples. Up to 24 hours may elapse between purge dry and sample collection to allow silt to settle out.

4.5 Specific Requirements for Volume Purge and Sampling Using a Bailer or Submersible Pump

The following procedures shall be applicable to the volume purge and sampling of a well. The volume purge method shall be used only under special circumstances. However, prior approval from the technical lead or the remediation manager shall be obtained and documented on the sample collection form before using this method.

1. Prepare and decontaminate equipment as per general procedures.

2. Measure the static water level and the total well depth with an electric water level indicator.

Bailer

3. Use Teflon® bailers, if the bailers are to be decontaminated between wells and reused, or disposable bailers.

4. Use disposable twine with the bailer. Do not decontaminate and reuse plastic twine. Only Teflon®-covered steel cable may be decontaminated and reused at another well.

5. To start purging, gently lower and raise the bailer in the water column.

Submersible Pump

6. Lower the pump gently to the bottom of the well.

7. Complete power connections and begin purging.

8. Record water quality parameters at least twice for each well volume evacuated.

9. Purge until at least 3 well volumes have been evacuated and the well parameters have stabilized or the well is bailed dry. Proceed with sample collection once parameter stabilization and low turbidity values (**Table 1**) have been achieved. If the well is bailed dry, wait until adequate water is available in the well and proceed with sample collection.

10. Collect the samples in the analyte order provided in a subsequent section.

11. If collecting a filtered sample, use a disposable filtration unit with a hand-operated vacuum pump. Alternatively, send an unpreserved (no nitric acid added) sample to the laboratory. The sample will be filtered in the laboratory before analysis.

12. Record all pertinent information on the groundwater sampling form, identifying the sampling method used (i.e., volume purge and sample with a bailer) in the "Comments" field. Any fields in the form not applicable to the method used shall be marked "NA."

4.6 Disposal of Purge Water

The water purged from the well is considered investigation-derived waste (IDW). All purge water shall be containerized and handled according to the work plan.

4.7 Specific Requirements for Water Quality Parameter Measurements

Water quality parameters to be monitored during the purge process shall include pH, temperature, conductivity, redox potential (Eh), dissolved oxygen (DO), and turbidity. Measurements shall be made at intervals required by the specific method used. If using a pump, a flow-through cell will be used to measure field parameters at the discharge from the pump at a frequency specified in the sample collection log. If using a bailer for purging, field parameters shall be measured at least twice per well volume evacuated.

The goal of the purging process is to obtain a groundwater sample that is representative of the surrounding aquifer. Field parameters are the simplest indicators for determining when the formation water is being removed. The normal ranges of field parameters are indicated in **Table 1**. Stabilization of parameters is required for before analytical samples may be collected, irrespective of the method used. Field parameter stabilization is defined as four consecutive readings within the criteria presented in **Table 1**.

Professional judgment should be used in evaluating field measurements. For example, if DO readings are in the 5 to 7 milligrams per liter (mg/L0 range, then 10

percent is a reasonable fluctuation. But if DO is in the o.5 to 1 mg/L range, then fluctuations within 10 percent are perhaps overly stringent and 20-50 percent variations may be allowed. The same is true for conductivity and the 10 mV goal for redox. If after 3 well volumes have been purged, all but one or two parameters have stabilized, but are relatively close to their respective target bounds, then this may be an adequate indication that formation water is being removed and sample may be collected. Rationale for samples collected when field parameters are outside of the target fluctuations will be documented on the sample collection logs.

Under low-flow sampling conditions, no minimum volume of water is required to be removed from a well prior to sampling. Under volume purge techniques (pump or bailer), at least 3 well volumes of water should be purged before sampling. Up to 5 well volumes may be purged if parameters do not stabilize after purging 3 volumes and there is an indication that the parameters may stabilize with further purging. However, if field measurements have not stabilized after 5 well volumes have been removed, then the task manager or technical lead shall be contacted to determine whether collecting a sample is appropriate.

Turbidity measurements should be treated differently for different situations. When the analytical program specifies metals (total or unfiltered) for laboratory analysis, then the target turbidity shall be less than 10 NTU, and consecutive turbidity readings less than 10 NTU will be considered equivalent. When metals are not an analytical parameter, then turbidity is not as great a concern, and the target shall be less than 20 NTU. However, in both cases, these goals may not be attainable due to silty or clayey sections of the aquifer matrix. If each parameter has stabilized, but turbidity is still above the target NTU value, then purging shall continue in an effort to attain the target NTU. Decisions to continue purging will be based on how far out of compliance the values are (e.g., 15 versus 100 NTU), and will be made by the technical lead on a case-by-case basis.

During purging, the field parameter values shall be periodically compared to the normal parameter ranges (**Table 1**). Parameters outside the normal range may indicate a problem with instrument calibration or a faulty well construction. The accuracy of certain instruments tends to drift with time and such instruments may require frequent calibration. An example of a faulty well construction is the presence of cement grout in the screen interval due to a poor bentonite seal. The cement grout causes the pH of the groundwater to be abnormally high (11-13 range). If the parameters are observed to be outside the normal range, the instruments shall be recalibrated and the measurement repeated. If the parameters are still outside the normal range for 4 consecutive readings during purging, the well construction may be faulty and the task manager or technical lead must be contacted for further direction. No samples shall be collected from a well with questionable construction until further direction.

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4.8 Sample Collection

Regardless of the purging technique used, samples shall be collected at flow rates in the range 0.1-0.5 L/min or poured gently to avoid aeration, bubble formation, or turbulent filling of sample bottles.

Samples shall be collected in the following order of target analytes, if adequate amount of water is available in the well:

- Volatile organic compounds (VOC)
- Semivolatile organic compounds (SVOC)
- Turbidity
- Major water quality cations and anions
- Carbonate/bicarbonate
- Total suspended solids
- Total dissolved solids
- Kjeldahl nitrogen
- Total metals
- Dissolved metals
- Total petroleum hydrocarbons
- Cyanide
- Ammonia, nitrogen.

Samples for any target analytes not listed above shall be collected in the order of decreasing volatility within the framework of this list. If the amount of water available in the well is low, minimum volume requirements provided in **Table 2** should be implemented or certain target analytes may be omitted, upon approval from the task manager and project chemist.

Filtered Samples. Filtered groundwater samples are normally not needed if a successful low-flow sampling program is implemented. However, if specified in the work plan, filtered groundwater samples will be collected according to the following procedures:

1. If using a flow cell, connect an inline, disposable 0.45 µm filter to the discharge flow tube attached to the "T" junction upstream from the flow cell. If a flow cell is not being used, connect the filter to the discharge tube of the pump. Collect the water discharging from the filter in the sample container.

2. If the low rate is too slow to allow filtration through an in-line filter or if samples are collected by a bailer, an alternative filtration method may be required. A disposable filtration unit and a hand-operated vacuum pump will be used to filter the sample in the field.

3. If filtration can not be accomplished in the field, an unpreserved sample (no nitric acid added) cooled to 4°C shall be shipped to the laboratory along with the preserved sample for unfiltered analysis. The unpreserved sample shall be filtered

upon receipt and the filtrate preserved with nitric acid. The data from the laboratory filtered sample will be reported as "dissolved metals."

4.9 Records

For each monitoring well purged, the technician shall complete a groundwater sampling form (Attachment A). This form prompts the technician to identify and record information such as: site ID, well ID, sample number, depth of well, depth to water, and well diameter. The technician can then use the information on the form to perform a well casing volume calculation. The form also includes spaces to record the field parameters that are measured during purging and any comments and observations. This form also prompts the technician to record the sample number, collection date, and time, sample containers, and associated QC sample information.

All well purging and sampling data and information shall be recorded in the Field Activity Data Log (FADL) for the site sampled. The FADL entries shall be recorded chronologically and the time of the entry recorded first. All FADL continuation pages shall be sequentially numbered and the last page recorded for the day shall be signed and dated by the recording technician.

5.0 CROSS REFERENCE

U.S. Environmental Protection Agency (USEPA), 1986, *Resource Conservation and Recovery Act (RCRA) Groundwater Monitoring Technical Enforcement Guidance Document,* OSWER-9950.1, September.

U.S. Army Corps of Engineers (USACE), 1994, *Requirements for the Preparation of Sampling and Analysis Plans*, EM 200-1-3, September.

U.S. Environmental Protection Agency (USEPA), 1996, *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*, Region 4, May.

U.S. Environmental Protection Agency (USEPA), 1995, *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures, Groundwater Issue*, EPA/540/S-95/504, December.

6.0 TABLES

Table 1 - Water Quality Indicator Parameters
Table 2 - Water Sample Volume Requirements

7.0 FIGURES

Figure 1 - Groundwater Sampling Form
Figure 2 – Water Sample Field Collection Report

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Table 1
Water Quality Indicator Parameters

Measurement	Normal Range	Acceptable Variability[a]
PH	4.6 to 8.5	± 0.1
Temperature (°C)	10 to 18	± 10%
Specific Conductivity (µS/cm)	10 to 8,000	± 3%
Redox (mV)	+400 to -300	± 10
Dissolved oxygen (mg/L)	<10	± 10%
Turbidity (NTU)	variable	± 10%[b]

Notes and Abbreviations:

[a] acceptable variability for four consecutive readings
[b] values of less than 10 NTU are considered to be equivalent

°C degrees celsius
µS/cm micro siemens per centimeter
mV millivolt
mg/L milligrams per liter
NTU nephelometric turbidity unit

Table 2
Water Sample Volume Requirements

Analysis	Standard Volume (mL)	Minimum Volume (mL)*	Minimum Volume Option*
Volatile organics	120	40	X
Semivolatile organics	1000	1000	
Pesticides/PCBs	1000	1000	
Herbicides	1000	1000	
Metals – Total	500	125	X
Metals – Dissolved	500	125	X
Mercury – Total Mercury – Dissolved	Included with metals (100)	Included with metals (100)	
Cyanide	500	125	X
Anions	250	100	X
Nitrate-nitrite	100	50	X
Total suspended solids and total dissolved solids (TSS and TDS)	500	200	X
Total organic carbon (TOC) RCRA 4/well	4 x 25	4 x 25	
Total organic halides (TOX) RCRA 4/well	4 x 100	4 x 100	
Total petroleum hydrocarbon (TPH)	1000	1000	X
Gasoline range organics (GRO)	80	40	X
Diesel range organics (DRO)	1000	1000	

Notes:

* Quantitation limits (detection levels) may be affected when operating with minimum sample volumes. If volumes are lowered below the minimum sample volumes, quantitation limits will be raised.

Figure 1

Water Level Measurement/Groundwater Sampling Log Form

Well No. _____ Date _____

Sample ID No. _____

Project ID _____ Measured/Sampled By: _____

Time: Start _____ End: _____

Measuring Point Elevation: _____ Ft. Well Construction Material: _____

Well Depth Ft: 1) _____ 2) _____ 3) _____ 4) _____

Avg. _____ (of valid measurements*)

Water Depth Ft: 1) _____ 2) _____ 3) _____ 4) _____

Avg. _____ (of valid measurements*)

(*Minimum of three measurements, last two within 0.01 feet.)

Well Internal Diameter: _____ Ft.

Riser Above/Below Pad Elevation Marker: _____ Ft.

Pad Elevation: _____ Ft.

Sampling Equipment Used:

_____

_____

Equipment Numbers:

pH Meter _____ EC Meter _____ Turbidity Meter _____ Thermometer _____

Casing Volume Information:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

Purging Information:

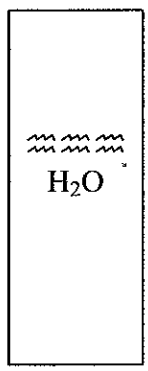
Measured Well Depth (B): _____ Ft.

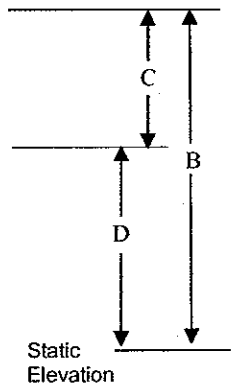
Measured Water Level Depth (C): _____ Ft.

Length of Static Water Column (D) : (B) - (C) = _____ ft.

Casing Water Volume (E): (A) x (D) = _____ gal.

Total Purge Volume = _____ (gal) (minimum of three casing volumes)





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Figure 1 (*continued*)

Water Level Measurement/Groundwater Sampling Log Form (Continued)

Field Indicator Parameter Measurements During Purging:

pH _____ _____ _____ _____

Temp.°C _____ _____ _____ _____

Specific Conductance: µmhos/cm _____ _____ _____ _____

Turbidity: NTU _____ _____ _____ _____

Visual Appearance of Water: _____ _____ _____ _____

Comments:

Field Indicator Parameter Measurements After Sampling:

pH _____ _____ _____ _____

Temp.°C _____ _____ _____ _____

Specific Conductance: µmhos/cm _____ _____ _____ _____

Turbidity: NTU _____ _____ _____ _____

Visual Appearance of Water:

Comments:

Laboratory Analysis Requested:

Sample ID No.	Parameter	Method	Preservation	Duplicate	No. of Containers

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Figure 2

Shaw Environmental & Infrastructure, Inc.	WATER SAMPLE FIELD COLLECTION REPORT	Project Number: _____ Project Name: _____ Site Location: _____

Sample ID Number	_____	Date Collected	_____
Sample Location[7]	_____	Time Collected	_____
Diameter of Well	_____ (in.)	Sampler	I.D. #_____
Depth to Bottom of Well	_____ (ft.)	Casing Stick Up	_____
Static Water Level	_____ (ft.)	Measured From[1]	_____ (ft.)
Well Volumes Purged	_____	Purging Method[2]	_____
Type of Sample[3]	_____	Sampling Method[4]	_____
Depth of Sample	_____ (ft.)	Measured From[1]	_____
Sample Collection Order			

FIELD SCREENING AND TEST RESULTS

Water Temperature _____ °C pH _____ Units

Specific Conductance _____ umho/cm at _____ °C

OVA ☐ HNU PID ☐ Reading _____ PPM

Photovac GC (P/GC) Probable Compound _____ Reading_____PPM

METER CALIBRATION

pH STD	METER READING	SP. COND. STD	METER READING	_____/STD (8)	METER READING

SAMPLE TYPES COLLECTED

CONTAINER #	TYPE (5)	CONTAINER TYPE		VOLUME	FILTERED			
_____		P ☐	G ☐	_____	Y ☐	N ☐	Y _____	N ☐
_____		P ☐	G ☐	_____	Y ☐	N ☐	Y _____	N ☐
_____		P ☐	G ☐	_____	Y ☐	N ☐	Y _____	N ☐
_____		P ☐	G ☐	_____	Y ☐	N ☐	Y _____	N ☐
		P ☐	G ☐		Y ☐	N ☐	Y	N ☐

WEATHER CONDITIONS: TEMP._____ °F CLEAR ☐ CLOUDY ☐ RAIN ☐ SNOW ☐ WINDY ☐

(1) T.O.C. = Top of Protective Casing; T.O.W. = Top of Well Casing; G.S. = Ground Surface
(2) Bailed, Pumped, Air Lift, Etc.
(3) Stream, Pond, Spring, Well, Seep, Supply, Etc.
(4) Bailer, Kemmerer, Grab, Pump, Etc.
(5) General Chem., Metal, VOA, Organics, Etc.
(6) HNO^3, NaOH, H^2SO^4, $Na^2O^3S^2$, Etc.
(7) If Well, give Well I.D. Number.
(8) OVA, PID, P/GC or Other.

SHAW STANDARD OPERATING PROJECT PROCEDURE

LONGHORN ARMY AMMUNITION PLANT

ATTACHMENT 3

Subject: WELL DEVELOPMENT

1.0 PURPOSE AND SUMMARY

The objective of this Standard Operating Project Procedure (SOPP) is to define the procedural requirements for developing monitoring wells.

Monitoring wells are developed to create an effective filter pack around the well screen; to repair damage to the formation caused by drilling; to remove the "skin" from the borehole wall; to claim liquids introduced during drilling; and to remove fine-grained particles from the filter pack and the adjacent formation. When a cement-bentonite grout is used to seal the annular space, wells shall not be developed for a minimum of 48 hours (hr) after grouting. Further, the development shall be initiated within 7 days after the final grouting of the well. Timely development of a well is essential to remove fine-grained silt and clay particles that may become permanently lodged in the filter pack with time. Further, the borehole wall "skin" may also become more difficult to remove with time.

Depending upon the amount of water in a monitoring well, well development may be accomplished during an initial attempt or may have to be completed in multiple stages over several months. Specific cases and required procedures are addressed in subsequent sections. A successful well development requires an active participation of the task manager or designate in following the well development process. As addressed in the following sections, wells with an inadequate amount of water to accomplish full development during the initial attempt would have to be redeveloped if the water level rises in the well during the next wet season. The task manager or designate shall schedule water level measurements in the *wet season* in wells that are candidates for redevelopment, so that a decision regarding a redevelopment effort may be made.

There are many well development methods currently in use within the industry:

- Pumping
- Overpumping
- Surging and pumping
- Bailing
- Mechanical surging using a surge block
- Backwashing
- Airlifting (not recommended when the well will be sampled for volatile organic compounds within 7 days of development).

The well development method to be used for this project is a modified surging and pumping method. Water quality indicator parameters of the produced water should be monitored to assist in the proper development of monitoring wells. The indicator parameters monitored

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should include pH, specific conductance, temperature, and turbidity.

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3.0 RESPONSIBILITY MATRIX

3.1 Site Manager

The Site Manager or Field Team Leader, is responsible for ensuring that field activities are completed to meet the project objectives, that they are conducted in accordance with the project plans and requirements, and that all activities are performed according to the respective procedures. The Site Manager is responsible for ensuring that all site personnel are trained in the procedures, that the procedures are adhered to, and that all activities are documented.

3.2 Field Team

All members of the field team (samplers, technicians, field geologists, engineers, etc.) are responsible for understanding and implementing this field procedure as well as ensuring that all team members perform work in accordance with this procedure. The team members are responsible for communication with the task manager and technical lead to address issues or key decision points.

3.3 Site Contractor Quality Control Systems Manager (CQCSM)

The Site CQCSM is responsible for ensuring that this procedure is correctly implemented and that the quantity and quality of well development activities meet the requirements of the project.

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4.0 DEFINITIONS

Bailer. A long, narrow tubular device with an open top and a check valve at the bottom that is used to remove water and sediment from a borehole or well.

Drilling Fluid. A fluid introduced into the borehole in the well drilling operation to remove cuttings from the borehole, to clean and cool the bit, to reduce friction between the drill string and the sides of the borehole and to hold the borehole open during the drilling operation.

Formation Damage. Reduction of formation hydraulic conductivity at the borehole wall caused by the drilling process. May consist of compaction, clay smearing, clogging of pores with drilling mud filtrate, or other drilling-related damage.

Indicator Parameters. Chemical parameters, including pH, specific conductance, temperature and dissolved oxygen content, which are used to determine when formation water is entering a monitoring well.

Monitoring Well. A well that is constructed by one of a variety of techniques that may serve a variety of purposes: (1) extracting ground water for physical, chemical, or biological testing; (2) measuring water levels; (3) measuring formation fluid chemical or physical parameters.

Surge Block. A plunger-like tool consisting of disks of flexible material (for example, neoprene) sandwiched between rigid (for example, metal) disks that may be solid or valved, and that is used in well development. The surge block should have a vent hole to let the air escape as the block is lowered. See surging.

Surging. A well-development technique in which a surge block is alternately raised and lowered within the well casing or screen, or both, to create a strong inward and outward movement of water through the well screen.

Turbidity. Cloudiness in water due to suspended and colloidal material; measured in nephelometric turbidity units (NTU).

Well Development. The act of repairing damage to the borehole caused by the drilling process and removing fine-grained materials or drilling fluids, or both, from formation materials so that natural hydraulic conditions are restored and well yields are enhanced.

5.0 TEXT

5.1 Required Records And Forms

1. Well development Log (**Figure 1**)
2. Field Activity Daily Log (FADL)

5.2 Required Materials, Equipment, Or Supplies

The following equipment is needed to develop a monitoring well:

1. bailer
2. surge block

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3. pump, bottom filling (bladder) or peristaltic (Note: All pumps used should have check valves to prevent backflow.)
4. controller
5. pump tubing
6. Teflon®-coated stainless-steel wire
7. power source (e.g., generator), if required
8. water-level meter
9. temperature, specific conductivity, Eh, DO, and pH meters
10. turbidity meter
11. container or flow-through cell to measure field parameters
12. personal protective equipment (PPE) as specified in the site-specific health and safety plan
13. decontamination supplies, if required on-site
14. disposal drums to contain produced water.

5.3 General Requirements

Well development procedures will vary depending upon the amount of water available in the monitoring well. Scenarios likely to be encountered and required procedures are as follows:

1. The screen is 80-100 percent submerged. Proceed with well development in accordance with procedures provided in Sections 5.4 and 5.5.

2. The height of the water column in the well is between 2 feet and 80 percent of screen length (8 feet for a 10-foot screen, and 4 feet for a 5-foot screen). Proceed with well development in accordance with procedures provided in Sections 5.4 and 5.5. Measure the water level in the well again during the wet season. Redevelop the well if the water level is significantly higher than the level at the time of the initial development. The task manager or the technical lead will evaluate the benefit of a redevelopment effort and instruct the field staff accordingly.

3. The height of the water column in the well is less than 2 feet. The well shall not be surged. A minimum 2 feet of water is necessary for the surge operation to be effective. Sections 5.4 and 5.6 provide the procedure to be followed when less than 2 feet of water is present in the well. Measure the water level in the well again during the wet season. Redevelop the well if the water level is significantly higher than the level at the time of the initial development. The task manager or the technical lead will evaluate the benefit of redevelopment and instruct the field staff accordingly.

5.4 General Requirements for Developing Wells

The following steps shall be followed when developing wells:

1. Don PPE as specified in the site-specific health and safety plan.

2. Calibrate all meters in accordance with standard operating procedures and manufacturer's guidelines.

3. Open, check, and note the condition of the wellhead, including the condition of the surveyed reference mark.

4. Decontaminate and prepare the necessary equipment for developing the well.

5. Using a decontaminated electric water level indicator, determine the static water level and depth to the bottom of the well (from the surveyed reference mark). Record on the appropriate field forms. Compare measured total depth to reported total depth and document the accumulation of silt at the well bottom, if any.

6. Compare the depth to water with depths to the top and bottom of the screen. Determine the applicable scenario from those listed above based on the height of the water column in the well. Follow the steps given in Section 5.5 if Scenarios 1 or 2 are applicable. For Scenario 3 (water column less than 2 feet), follow procedures given in Section 5.6.

5.5 Specific Requirements for Well Development by Surge and Pump

The intent of this procedure is to effectively develop the well through mechanical surging and removal of settleable fines while minimizing overall volume of water removed from the well.

1. Slowly lower a bottom-check valve bailer into the well and remove a bailer full of water from mid-screen. Empty the contents into a vessel large enough to contain the well probes. Measure and record water quality parameters (T, SC, pH, turbidity, DO, Eh).

2. Evacuate any sediment present at the well bottom using a bottom intake pump or bailer. If the well is shallow, a peristaltic pump may be used to evacuate sediments. Minimize the water volume removed.

3. Measure static water level after removing sediment; allow equalization if water level drops within screened interval.

4. Insert the surge block so that it is within the screen interval of the well. Surge the water column gently with 2 feet strokes working towards the bottom of the screen. Remove the surge block and rods from the well slowly.

5. Using a bailer or submersible pump, evaluate the turbid water. Periodically measure and record water quality parameters.

6. Repeat steps 1 through 5 until water quality parameters stabilize and are within the normal range of values observed for the site. The criteria for parameter stabilization are the normal ranges of values provided in **Table 1**. If the well

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dewaters before desired parameter values are reached, allow time to recharge and continue.

7. Water quality parameters are considered stabilized if they are within the ranges provided in **Table 1** for 4 consecutive measurements.

8. Periodically, compare the parameter readings with the normal range of values (**Table 1**). If the parameters are significantly outside the normal range, the field crew shall recalibrate the instruments and repeat the measurement. If the readings are consistently outside the range for 4 consecutive measurements, a faulty well construction may be the cause (e.g., grout in the filter pack). Contact the technical lead for further instructions.

9. Following a minimum of 3 surge and pump cycles, a minimum of one well volume should be removed. At least 3 well volumes should be removed and (depending upon depth and static water level) upon direction of the task manager or technical lead.

10. Collect 0.5 liters of the last batch of water evacuated from the well and place it into a clean jar. The jar should be labeled with development date and well number. Each sample should be individually agitated and immediately photographed with a 35-mm camera in a backlit setting so that the clarity of the water is visible. The photographs will be a minimum 5 inch x 7 inch in size, and will be individually identified with the project name, well number, and photo date. The photograph will become a part of the well development documentation and will be included in the report along with the development log.

11. Record pertinent data in the FADL and well development log form (Well Development, **Figure 1**).

12. Remove the development equipment from the well, decontaminate (as required), and clean up the site. Lock the well cover before leaving. Dispose of produced water as required by the project work plan.

5.6 Specific Requirements for Minimal Well Development

This procedure is applicable to situations where the height of the water column in the well is less than 2 feet. The surging operation is not considered effective under these conditions and the development process would essentially involve using a pump to evacuate sediments and extremely turbid water near the well bottom. Follow the steps given below:

1. Using a bailer remove a small quantity of water from the well. Empty contents into a container and measure water quality parameters.

2. Lower a bottom-filling pump into the well and evacuate the sediments and turbid water. If possible, maintain the pumping at a rate that would not cause the well to run dry. If the well goes dry even at the lowest possible pumping rate, allow it to

recharge and repeat pumping. A bailer may also be used for sediment evacuation.

3. Measure water quality parameters every 3 to 5 minutes during pumping, preferably using a flow-through cell if a pump is used.

4. Record pertinent data in a well development form (**Figure 1**) and a FADL.

5. Collect the 0.5-liter of the last batch of water evacuated from the well and place it into a clear jar. The jar should be labeled with development date and well number. Each sample should be individually agitated and immediately photographed with a 35-mm in a backlit setting so that the clarity of the water is visible. The photographs will be a minimum 5-inch x 7-inch in size and will be individually identified with project name, well number and photo date. The photograph will be become a part of the well development documentation and will be included in the report along with the development log.

6. Remove the development equipment from the well, decontaminate (as required), and clean up the site. Lock the well cover before leaving. Dispose of produced water as required by the project work plan.

7. Water level shall be measured in the well during the following wet season. The well shall be redeveloped if the water level appears to have risen significantly. The task manager or technical lead will evaluate the benefit of redevelopment and instruct the field staff accordingly.

5.7 Well Volume Calculation

The well's volume must be calculated to estimate how many drums or other containers may be required and how many well volumes were removed.

$$Well\ Volume = A + B$$

Where:

$$A\ (Riser\ \ Volume\ ) = \left(H \times r^2 \times \pi\right) \times 7.4805$$

Where:

H = static water column (total depth - depth to water) (in feet)
R = radius of riser or screen (in feet)
$\pi = 3.1416$

and

$$B\ (Sand\ Pack\ Volume) = 0.25 \times \left(\left(\left(R^2 \times \pi \times L\right) - \left(r^2 \times \pi \times L\right)\right) \times 7.4805\right)$$

Where:

R = Borehole radius (in feet)
$\pi = 3.1416$
L = Filter pack length (in feet)
R = radius of riser or screen (in feet)

Porosity is assumed to be 25 percent. Record these data and calculations in the FADL or well development form (Well Development Attachment 1).

5.8 Development and Sampling Break

A period of at least 14 days will be allowed between well development and sampling. The intent of this hiatus is to allow the newly installed and developed well to equilibrate to the ambient conditions, thus enabling the collection of a representative sample.

5.9 Restrictions/Limitations

Where flammable light, nonaqueous phase liquid (LNAPL) or emulsified LNAPL is expected or known to exist on or in groundwater, use only intrinsically safe electrical devices and place portable power sources (e.g., generators) 50 feet (or more) from the wellhead and disposal drums. Effort should be made to remove LNAPL (bailer) prior to surging to prevent spreading/dispensing of product into sand pack/screen interval.

6.0 EXCEPTION PROVISIONS

This SOPP implements a modified surge-and-pump method that emphasizes the removal of sediments from the well in an efficient manner and is not driven by evacuation of a specified volume of water that may or may not remove all the sediments from the well.

7.0 CROSS REFERENCE

American Society for Testing of Materials (ASTM), 1994. *Standard Guide for Development of Ground-Water Monitoring Wells in Granular Aquifers*, ASTM D5521-94.

U.S. Army Corps of Engineers (USACE), 1990, *Monitor Well Installation at Hazardous and Toxic Waste Sites*, EM 1110-7-XX(FR) (Draft), November.

U.S. Army Corps of Engineers (USACE), 1998, *Monitoring Well Design, Installation, and Documentation at Hazardous, Toxic and Radioactive Waste Sites*, EM 1110-1-4000, November.

U.S. Environmental Protection Agency (EPA), 1996, *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual,* Region 4, May.

U.S. Environmental Protection Agency (EPA), 1986, *Resource Conservation and Recovery Act (RCRA) Groundwater Monitoring Technical Enforcement Guidance Document*, OSWER-9950.1, September.

8.0 TABLES

Table 1 - Water Quality Indicator Parameters

9.0 FIGURES

Figure 1 - Well Development Log Form

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Table 1
Water Quality Indicator Parameters

Measurement	Normal Range	Acceptable Variability[a]
PH	4.6 to 8.5	± 0.1
Temperature (°C)	10 to 18	± 10%
Specific Conductivity (µS/cm)	10 to 8,000	± 3%
Redox (mV)	+400 to -300	± 10
Dissolved oxygen (mg/L)	<10	± 10%
Turbidity (NTU)	Variable	±10%[b]

[a] Acceptable variability for four consecutive readings.
[b] Values of less than 10 NTU are considered to be equivalent.

°C - Degrees Celsius.
µS/cm - MicroSiemens per centimeter
mV - Millivolt
mg/L - Milligrams per liter.
NTU - Nephelometric turbidity unit

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Figure 1

WELL DEVELOPMENT RECORD

WELL/PIEZOMETER ID_____
SHEET _____ OF _____

PROJECT NAME: _____ PROJECT NO.: _____ DATE: _____

LOCATION: _____ DATE INSTALLED: _____

TOTAL DEPTH (FTOC) _____ CASING DIAMETER _____

METHODS OF DEVELOPMENT

☐ Swabbing ☐ Bailing ☐ Pumping ☐

Describe_____

Equipment decontaminated prior to development ☐ Yes ☐ No

Describe_____

EQUIPMENT NUMBERS

pH Meter _____ EC Meter _____ Turbidity Meter _____ Thermometer _____

CASING VOLUME INFORMATION:

Casing ID (inch)	1.0	1.5	2.0	2.2	3.0	4.0	4.3	5.0	6.0	7.0	8.0
Unit Casing Volume (A) (gal/ft)	0.04	0.09	0.16	0.2	0.37	0.65	0.75	1.0	1.5	2.0	2.6

PURGING INFORMATION

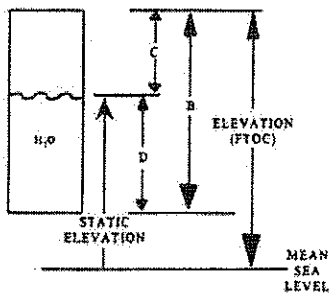
Measured Well Depth B _____ ft.

Measured Water Level Depth (C) _____ ft.

Length of Static Water Column (D) _____ (B) - _____ (C) = _____

Casing Water Volume (E) _____ (A) x _____ (D) = _____

Total Purge Volume = _____ gal



Date	Time	Water Level (FTOC)	Volume Removed (gal)	pH	EC	Temperature F or C	Turbidity/ Sand (ppm)	Comments

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SHAW STANDARD OPERATING PROJECT PROCEDURE

LONGHORN ARMY AMMUNITION PLANT

ATTACHMENT 4

Subject: GROUNDWATER LEVEL MEASUREMENTS

1.0 PURPOSE AND SUMMARY

This Standard Operating Project Procedure (SOPP) establishes guidelines and procedures for use by field personnel in determining the groundwater level in monitoring wells.

Proper recording procedures are necessary to assure the quality and integrity of all groundwater level measurements. Prior to collecting groundwater levels, a strategy should be developed based on the objectives of the investigation.

The measurement of the ground water level in a well is frequently conducted in conjunction with ground water sampling to determine the "free" water surface. This potentiometric surface measurement can be used to establish ground water flow direction and gradients. Total well depth and ground water level measurements are needed to determine the volume of water in the well casing prior to purging the well for sampling purposes.

All ground water level and total depth measurements should be made relative to an established reference point on the well casing and should be documented in the field records. To be useful for establishing ground water gradient, the reference point should be tied in with the NGVD (National Geodetic Vertical Datum) or a local datum.

When measuring wells for water table or potentiometric surface analysis, and if the contaminant history is known for each of the wells, it is advisable to monitor water levels beginning with the least contaminated wells first and progressing to the most contaminated wells last, where practical.

Documents other than those required by the contract and consulted in the preparation of this SOPP are listed under "Cross Reference."

The details within this SOPP should be used in conjunction with the Work Plan which will generally provide the following information:

- Data collection objectives;
- Locations for data collection;
- Types of data to be collected; and
- Specific quality control (QC) procedures required.

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3.0 RESPONSIBILITY MATRIX

3.1 Site Manager

The Site Manager or Field Team Leader, is responsible for ensuring field activities are completed to meet the project objectives, are conducted in accordance with the project plans and requirements, and all activities are performed according to the respective procedures. The Site Manager is responsible for ensuring all site personnel are trained in the procedures, the procedures are adhered to, and all activities are documented.

3.2 Field Team

All members of the field team (samplers, technicians, field geologists, engineers, etc.) are responsible for understanding and implementing this field procedure as well as ensuring all team members also perform work in accordance with this procedure.

3.3 Site Contractor Quality Control Systems Manager (CQCSM)

The Site CQCSM is responsible for ensuring that this procedure is correctly implemented and that data collected meet the requirements of the Project Work Plan.

4.0 DEFINITIONS

Electronic Water Level Indicator. This instrument consists of a spool of dual wire, a probe attached to the end, and an indicator. When the probe comes in contact with the water, the circuit is closed and a meter light and/or buzzer attached to the spool will signal the contact. Penlight or 9-volt batteries are normally used as a power source. Measurements should be made and recorded to the nearest 0.01 foot.

5.0 TEXT

5.1 Required Records And Forms

1. Field Activity Daily Log (FADL)
2. Instrument operation manual.

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5.2 Required Materials, Equipment, Or Supplies

1. Indelible black-ink pens and markers
2. Personal protective clothing and gear
3. Gloves, nitrile
4. Keys for locking well caps
5. Paper towels
6. Radio, two-way, hand held or cellular phone
7. Safety glasses
8. Appropriate equipment and meters for obtaining field measurements as specified in the Work Plan (i.e., water quality)
9. Linear measuring device (e.g., tape measure)
10. Electronic water indicator (appropriate length)
11. Organic vapor analyzer (FID/PID).

The equipment must be capable of recording a measurement to the accuracy required by the Work Plan. Project data quality objectives and site characteristics must be taken into account when determining the groundwater level measurement equipment to use. The total number of wells to be measured, weather, tidal influences, pumping, and construction can all affect water level measurements.

5.3 General Requirements

Operation manuals provide operation and calibration procedures to be followed. Several standard steps should be taken before beginning any depth measurement of groundwater level measurement activity is performed.

1. Verify that all personnel have read and understood the approved site-specific health and safety plan and have the proper training and certifications required under OSHA.

2. Verify the site location by existing maps and surface features. Mark off the boundaries of the work site with flagging or other means to prohibit access to unauthorized personnel.

3. Check to see that all the necessary equipment (including PPE) is available at the site, is in good working condition, and has been properly decontaminated.

4. Check that all monitoring equipment is properly calibrated and operating. Measuring tapes should be checked a minimum of every six months against a surveyor's tape to determine if shrinking or stretching has occurred.

5. Visually inspect the well to ensure that it is undamaged, properly labeled and secured. Any damage or problems with the well head should be noted on the FADL and the site manager notified for repair or replacement of the equipment.

6. Uncap the well and monitor the air space for organic vapors immediately above the open casing with an FID/PID. (Observe if any air is flowing into or out of the casing. In the event such conditions are observed, they should be noted on the

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FADL. If air is observed to be entering or flowing out of the casing, the sounder should not be placed inside the well until the air flow stops and pressure equalizes.

5.4 Specific Requirements

The specific procedure for determining groundwater level using an electronic water level indicator is described below.

1. Lower the electronic water level indicator into the well until the water surface is encountered as indicated by an audible (beep) or visual (light) signal.

2. When the water surface is reached, give the tape a short, sharp jerk to ensure that the probe is not responding to condensation along the well casing.

3. Measure the distance from the water surface to the permanent reference point. For aboveground "stickup" completions, the reference point is usually a groove cut into the north side of the casing. If no permanent reference point is available for an aboveground completion, measure from another permanently fixed structure or from ground level. The point of measurement should then be noted on the FADL and the appropriate form on which the water level is recorded. For flush mount completions, such as street boxes, the groundwater level measurement should be referenced to a steel grate placed across the rim of the street box and over the casing. Any aboveground completions without permanent reference points or marks should be brought to the attention of the appropriate supervisory personnel.

4. Collect measurements until two consecutive measurements are identical or within the specified tolerance (usually 0.01 ft). Record all appropriate information on the FADL. At a minimum, the following information must be recorded:

   - project name and number;
   - unique well identification number;
   - date and time of measurement collection;
   - depth to water to the specified tolerance;
   - weather conditions; and any problems encountered.

5. Once the water level measurement is completed, turn the device in the off position and slowly lower the probe to the bottom of the well to sound the depth. Record the depth to the bottom of the well to the nearest 0.01 feet and document the bottom condition (i.e., soft, silty, hard).

6. Cap and relock the well.

7. Perform all equipment decontamination procedures as specified in the field procedures in Attachment 9 of Appendix D. Measuring **equipment must be decontaminated** prior to utilizing for well measurements.

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5.5 Records

All information will be recorded on a FADL for the subject site. The FADL entries will be recorded chronologically and the time of the entry recorded first. All FADL continuation pages will be sequentially numbered and the last page recorded for the day will be signed and dated by the recording technician. Records generated as a result of this SOPP will be controlled and maintained in the project record files.

6.0 EXCEPTION PROVISIONS

None.

7.0 CROSS REFERENCE

Annual Book of ASTM Standards, 1987 *Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well)*, D4750.

EPA, 1996, *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*, Region 4, Athens, GA.

EPA, 1986, *RCRA Groundwater Monitoring Technical Enforcement Guidance Document*, OSWER-9950.1, U.S. Government Printing Office, Washington, D.C.

U.S. Army Corp of Engineers, 1998, *Monitoring Well Design, Installation, and Documentation at Hazardous, Toxic, and Radioactive Waste Sites,* EM 1110-1-4000.

8.0 TABLES

None

9.0 ATTACHMENTS

None.

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SHAW STANDARD OPERATING PROJECT PROCEDURE

LONGHORN ARMY AMMUNITION PLAN

ATTACHMENT 5

Subject: SUBSURFACE SOIL SAMPLING

1.0 PURPOSE AND SUMMARY

The objective of this Standard Operating Project Procedure (SOPP) is to establish guidelines and procedures for use by field personnel in the collection and documentation of subsurface soil samples for physical and chemical analysis. Techniques include use of hand augers, Shelby tubes, and split-spoon samplers. Proper collection procedures are necessary to assure the quality and integrity of all subsurface soil samples. Prior to conducting a soil sampling investigation, a sampling strategy should be developed based on the objectives of the investigation.

Various methods are available to collect subsurface soil samples. Hand augers are advanced manually into the soil and may be used to collect samples to depths of 10 ft or less. The hand auger may be used to collect field screening samples for all analytes, including volatile organic compounds (VOCs), without sample liners. For those projects requiring definitive VOC analyses, EnCore® or equivalent samplers will be used. This method is used to reduce the loss of VOCs typically associated with traditional sampling, storage, and shipping procedures, such as VOC loss, handling of samples during collection, opening of sample containers prior to analysis, etc. SW-846 Method 5035 reportedly reduces or eliminates the activities or practices associated with these circumstances. See Subsurface Soil Sampling Attachment A for manufacturer's instructions for use of the sampler.

Split-spoon (American Society for Testing and Materials [ASTM] Method D 1586) samplers, thin-walled samplers (ASTM Method D1587), continuous soil core samplers, and Geoprobe® samplers are mechanically pushed, driven, or vibrated into undisturbed soil. The samplers collect the soil sample in an enclosed tube, which prevents mixing and contamination of the samples by uphole soils. Soil samples may be collected for geotechnical information and/or chemical analyses. Field screening samples for VOC analyses may be collected directly from the sampler. For those projects requiring definitive VOC analyses, EnCore® or equivalent samplers will be used.

Subsurface soil samples are collected to determine the type(s) and level(s) of contamination and to define the contaminated area(s). These samples may be collected as part of an investigative plan, confirmation sampling, and/or as a screen for "hot spots," which may require more extensive sampling.

The details within this SOPP should be used in conjunction with the Work Plan, which will generally provide the following information:

- Sample collection objectives;
- Locations and depths of soil samples to be collected;

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- Numbers and volumes of soil samples to be collected;
- Types of analyses to be conducted for the samples;
- Specific quality control (QC) procedures and sampling required.

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3.0 RESPONSIBILITY MATRIX

3.1 Site Manager

The Site Manager or Field Team Leader, is responsible for ensuring field activities are completed to meet the project objectives, are conducted in accordance with the project plans and requirements, and all activities are performed according to the respective procedures. The Site Manager is responsible for ensuring all site personnel are trained in the procedures, the procedures are adhered to, and all activities are documented.

3.2 Field Team

All members of the field team (samplers, technicians, field geologists, engineers, etc.) are responsible for understanding and implementing this field procedure as well as ensuring all team members also perform work in accordance with this procedure.

3.3 Site Contractor Quality Control Systems Manager (CQCSM)

The CQCSM is responsible for ensuring that this procedure is correctly implemented and that the quantity and quality of surface-soil samples collected meet the requirements of the project work plan and scope.

4.0 DEFINITIONS

Hand Auger. A stainless steel cylinder (bucket) approximately 3 to 4 inches in diameter and one foot in length, open at both ends with the bottom edge designed to twist into the solid and cut out a soil core. The bucket collects the soil sample. The auger has a T-shaped handle (for hand operation attached to the top of the bucket by an extendable stainless steel rod.

En Core® Sampler – A disposable volumetric sampling device used for collecting, storing and delivery of a soil sample.

Shelby Tube. A cylindrical sampling devise, generally made of brass, which is driven into the subsurface soil through the hollow-stem auger. Once the tube is retrieved, it is capped and the undisturbed soil sample is extruded in the laboratory prior to analysis.

Split-Spoon. A steel tube, split in half lengthwise, with the halves held together by threaded collars at either end of the tube. This device can be driven into resistant (semiconsolidated) materials using a drive weight or drilling jars mounted in the drilling rig. A standard split-spoon sampler (used for performing standard penetration tests) is 2 inches in outside diameter and 1-3/8 inches in inside diameter. This standard spoon typically is available in two common lengths, providing either 20-inch or 26-inch internal longitudinal clearance for obtaining 18-inch or 24-inch long samples, respectively. Six-inch long sleeves (tubes) of brass, stainless steel, or plastic are commonly placed inside the sampler to collect and retain soil samples. A five-foot long split-spoon sampler is also available. A California modified split-spoon sampler is also commonly used. The design is similar to the standard split-spoon except the outside diameter is 2½ inches and the inside diameter is 2 inches.

Subsurface Soil. The soil which exists deeper than approximately one foot (30 cm) from the surface, but above bedrock or any other consolidated material.

Grab Sample. A discrete portion or aliquot taken from a specific location at a given point in time.

Auger Flight. A stainless steel section length attached to an auger to extend the auger as coring depth increases.

5.0 TEXT

5.1 Required Records And Forms

1. Sample Collection Log (SCL)
2. Field Activity Daily Log (FADL)
3. Sample tags/labels and the appropriate forms/documentation for sample shipment
4. En Core® Sampler manufacturer's instructions.
5. Material Safety Data Sheets (MSDS).

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5.2 General Required Materials, Equipment, or Supplies

The following is a list of the supplies and equipment needed to implement this SOPP in the field:

1. Indelible black-ink pens and markers
2. Appropriate sample containers
3. Insulated cooler and waterproof sealing tape
4. Latex or Nitrile gloves
5. Plastic Zip-Loc® bags
6. Decontamination equipment and supplies, including rinse bottles and deionized water
7. Personal protective clothing and gear
8. Stainless steel and/or Teflon®-lined spatulas and pans, trays, or bowls
9. Stainless steel and/or Teflon®-lined trowels and/or augers
10. Appropriate equipment and meters for obtaining field measurements as specified in the Work Plan (i.e., PID/FID)
11. Linear measuring device (e.g., tape measure)
12. Stainless steel, brass, Lexan® or Teflon® inserts of auger
13. Plastic end caps for the sleeves, aluminum foil, and Teflon® or silicon tape
14. Plastic sheeting to contain all cuttings
15. Stainless steel blade to trim excess soil from end of liners (if used)
16. Sufficient waste containers to containerize all cuttings and IDW
17. En Core® Sampler
18. En Core® T-Handle.

5.3 Required Materials, Equipment, or Supplies for Hand Augering

The following equipment is needed for hand augering:

1. Hand auger (i.e., flighted-, bucket-, or tube-type augers) and/or slide hammer sampler
2. Extension rods as needed
3. Wrench(es)
4. Stainless steel hand trowel or sampling spoon
5. Large stainless steel, glass, or Pyrex® mixing bowl

5.4 Required Materials, Equipment, or Supplies for Split-Spoon Sampling

The following equipment is needed for split-spoon sampling:

1. Drilling rig equipped with a 140-pound (lb) drop hammer and sufficient hollow-stem augers to drill to the depths required by the site WP,
2. Sufficient number and type of split-spoon samplers so that at least one is always decontaminated and available for use; three split-spoon samplers are generally the minimum necessary,
3. Sufficient numbers and types of sampler liners.

5.5 Required Materials, Equipment, or Supplies for Thin-Walled Sampling

The following equipment is needed for thin-walled sampling:

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1. Drilling rig equipped with a 140-pound (lb) drop hammer and sufficient hollow-stem augers to drill to the depths required by the site work plan.
2. Sufficient number and type of thin-walled samplers so that at least one is always decontaminated and available for use; thin-walled samplers generally are used only once.

5.6 Required Materials, Equipment, or Supplies for Geoprobe System

The following equipment is needed for use with the Geoprobe system:

1. Geoprobe system truck capable of pushing sampler to depths required by the Work Plan
2. Assemble Geoprobe sampler (standard or large bore as described in the Work Plan)
3. Sufficient extension rods to reach the depths required
4. Extension rod couplers
5. Extension rod handle
6. Stop pin
7. Sampler liners, as needed (e.g., stainless steel, acetate, or brass).

5.7 Required Materials, Equipment, or Supplies for Continuous Core Sampler

The following equipment is needed for continuous core sampling:

1. Drilling rig with continuous coring capability (i.e., hollow-stem auger or rotasonic drill)
2. Clear plastic sleeving to hold rotasonic drill cores
3. Drive sleeves (if used to collect samples for off-site laboratory VOC analyses)

5.8 General Requirements

The collection of subsurface soil samples is an intrusive event and requires knowledge of the site and careful planning before commencing. Several standard steps should be taken before beginning any subsurface sampling activity.

1. Ensure that all subsurface soil sample locations have been appropriately cleared of all underground utilities and buried objects per the project work plans. Review all forms and diagrams documenting the location of the cleared sampling locations, as well as that of any underground utilities or lines, or other buried objects. Conformance to Shaw HS308 is mandatory regarding utility clearance.
2. Verify that all personnel have read and understood the approved site-specific health and safety plan and have the proper training and certifications required under OSHA.
3. Verify the site location by existing maps and surface features. Mark off the boundaries of the work site with flagging or other means to prohibit access to unauthorized personnel.
4. Set up a decontamination line for equipment and personnel.

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5. Check to see that all the necessary equipment (including PPE and samplers) is available at the site, is in good working condition, and has been properly decontaminated.
6. Check that all monitoring equipment is properly calibrated and operating.
7. Set up the IDW management system as outlined in the Work Plan and Attachment 10.

At no time should samples, decontaminated sample sleeves, or decontaminated samplers be touched by unprotected (i.e., ungloved) hands. A fresh or decontaminated pair of gloves must be used for each sample collection. All downhole tools and samplers must be kept off the ground and/or free from contamination between the time they pass through the decontamination procedure until they are used in the boring.

5.9 Specific Requirements for Hand Augering

Hand augering consists of manually advancing the auger into the soil to collect subsurface soil samples, generally at depths of 10 ft or less. There are several types of hand augers available (e.g., Iwan, ship, closed spiral, and open spiral). All these devices are used in much the same way. The auger is attached to the bottom of a length of steel rods that have a crossbar (handle) at the top. The operator advances the auger by rotating the crossbar while pressing the auger into the ground. As the auger advances, it fills with soil. When the auger is filled with soil, the unit is removed from the hole, cleared, and reinserted. Additional rods are added until the desired depth is reached. Upon reaching the sampling depth, the auger is removed. A decontaminated auger is then used to collect the sample. The same auger may be used in drilling and sampling, but it must pass through the decontamination process between drilling and sampling. When done properly, this method will result in samples for definitive analysis for all analytes except VOCs; however, this method will yield screening data for VOCs. To obtain definitive levels for VOCs, EnCore® or equivalent samplers **must** be used.

The steps for hand-auger sampling are:

1. Complete the general steps for subsurface sampling (Section 5.8)
2. Don PPE as required by the SSHP
3. Using a decontaminated auger, auger to the desired depth
4. Place drill cuttings on plastic sheeting spread beside boring. Cuttings should be placed in stratigraphic order to show changes as the boring progresses
5. After reaching the desired sampling depth, remove the auger from the boring and decontaminate. Alternatively, a different auger (decontaminated) may be used to collect the sample.
6. Insert the decontaminated auger into the boring and advance until full. If definitive samples are required for VOC analyses, an auger or slide hammer sampler with a properly positioned sampling sleeve will be used. The type and material of the sleeve will be specified in the Work Plan. The EnCore® Samplers EnCore® Samplers will be used be used to collect the sample following manufacturer's instructions (Attachment A).

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7. Remove auger from borehole and field screen with the method and equipment specified in this and Attachment 1 of Appendix D. Extract sample and place in appropriate containers as specified in the Work Plan. If a liner was used, remove liner from auger/slide hammer and place aluminum foil on ends (shiny side away from sample), cap and seal both ends of the liner with Teflon or silicone tape, and place appropriate label on the liner.
8. Place sample container (e.g., liner and jar) in resealable plastic bag and place bag containing sample into an insulated cooler with ice. Samples should be maintained at 4 ± 2 °C from the time of collection until received at the laboratory.
9. Record all information on the Sample Collection Log.
10. Doff contaminated gloves and don fresh or decontaminated gloves.
11. Repeat steps 1 through 10 until sampling is completed.
12. Dispose of cuttings and nonsalvageable equipment as outlined in this appendix.
13. Plug and abandon borehole as specified in this appendix.
14. Decontaminate all equipment and personnel.

5.10 Specific Requirements for Split-Spoon Sampling

The split-spoon sampler consists of a threaded steep pipe that is split in two pieces along the axis of the pipe. A hardened steel driving shoe is screwed onto the downhole end and a threaded "head" with a check valve is screwed onto the top. The sampler is driven (ASTM Method D1586) into the undisturbed soil. The sampler collects the soil sample in the enclosed tube, which prevents mixing and contamination of the sample by up hole soils. Soil samples may be collected for geotechnical information and/or chemical analyses. When done properly, this method will result in samples for definitive analysis for all analytes except VOCs; however, this method will yield screening data for VOCs. To obtain definitive levels for VOCs, a liner sleeves must be used in the sampler and EnCore® Samplers will be used to collect the sample.

1. Complete the general steps for subsurface sampling (Section 5.8).
2. Don PPE as required by the HASP.
3. Using a decontaminated auger, auger to the desired depth.
4. Place drill cuttings on plastic sheeting spread beside boring. Upon reaching the desired sampling depth, attach a decontaminated split spoon to the sampling rods and insert into boring. If definitive analyses are required for VOCs, a split spoon with properly positioned liners will be used. Position the drive hammer on the sampling rods and lightly tap the rods to seat the sampler.
5. Drive the sampler in accordance with ASTM Method D1586 (i.e., a 140-lb hammer is repeatedly dropped 30 in. while counting the number of blows required to drive the sampler each 6-in. interval). Cease driving when the sampler is full, or when 50 blows of the hammer have moved the sampler less than 1 in. (Depending on lithology, this method of driving the sampler may not be needed.)
6. Remove the split spoon from the boring. Carefully open the split spoon and immediately field screen the sample with the equipment specified in Attachment 1. Extract the sample and place it in appropriate containers, as specified in the Attachment 8. If liners were used, separate the liners and immediately field screen between each liner. Immediately after field screening, remove the liner

designated for VOC analyses from the split spoon. Collect the VOC sample using the EnCore® Samplers following manufacturer's instructions (Attachment A). Proceed to remove, cap, seal, and label the other liners as necessary.

7. Place sample container (e.g., liner and jar) in resealable plastic bag and place bag containing sample into an insulated cooler with ice. Samples should be maintained at 4 ± 2 °C from the time of collection until received at the laboratory.
8. Record all information on the Sample Collection Log.
9. Doff contaminated gloves and don fresh or decontaminated gloves.
10. Repeat steps 3 through 11 until total required depth is reached.
11. Remove augers from the boring. **Note: when the boring is completed and the augers have been removed, it is sometimes advisable to leave the borehole open for several hours to check for groundwater inflow. This information can be valuable later in the project.**
12. Decontaminate all equipment and personnel as specified in the Equipment Decontamination procedure in Attachment 9 in Appendix D.
13. Dispose of cuttings and nonsalvageable equipment as outlined in the Investigation-Derived Field Procedures, Attachment 10 in Appendix D.
14. Plug and abandon borehole as specified in Attachment 11 in Appendix D.

5.11 Specific Requirements for Split-Spoon Sampling

The thin-walled sampler (also known as a Shelby tube) consists of a one-piece hollow steel tube that is usually 2 to 5 in. in diameter and from 1 to 3 ft in length. The thin-walled sampler is mechanically pushed or driven (ASTM Method D1587) into undisturbed soil. The sampler collects a column of relatively undisturbed soil in the tube. This method generally is used to collect samples for geotechnical information, but it can also be used to collect soil for chemical analyses. When done properly, this method will result in samples for screening and definitive analyses for all analytes. Screening samples for VOC analyses may be collected directly from the sampler in the field. For definitive VOC samples, the sample must be extruded and the EnCore® Samplers will be used to collect the sample following manufacturer's instructions (Attachment A).

1. Complete the general steps for subsurface sampling (Section 5.8).
2. Don PPE as required by the SSHP.
3. Using a decontaminated auger, auger to the desired depth.
4. Place drill cuttings on plastic sheeting spread beside the boring. Upon reaching the desired sampling depth, attach a decontaminated thin wall sampler to the sampling head and screw onto the sampling rods. Insert the sampler into the boring.
5. Position the drill head (ram) on the sampling rods and, using the rig hydraulics, push the sampler to the required depth (i.e., fill the tube) or until refusal. A smooth, sustained push will generally yield the best sample. If the rig hydraulics cannot push the tube, it can be driven using the drive hammer. The weight of the hammer, height of drop, and number of blows should be recorded on the Visual Classification of Soils form.
6. Twist the drill rods clockwise to break loose the sample. Withdraw the sampler from the boring.

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7. Detach the sampler from the sample rods and remove the tube from the sampling head.
8. For geotechnical analyses, trim off excess soil from either end of the tube until it is at least flush with the rim of the tube. Cap and seal both ends of the tube and mark the "up" end. The sealed tube should be handled carefully to minimize vibration or impacts and should be transported to the laboratory in the upright position. If geotechnical analyses are not desired, the sample may be extruded from the tube on-site, field screened, and placed in appropriate containers. The VOC screening sample must be collected first and as soon after extruding the soil from the container as possible. Proceed to fill the other containers as necessary. Immediately after collection, place sample containers in resealable plastic bags and place bags containing samples into an insulated cooler. Samples should be maintained at 4 $\pm$ 2 °C from the time of collection until received at the laboratory.
9. Record all information on the Sample Collection Log.
10. Remove contaminated gloves and don fresh or decontaminated gloves.
11. Repeat steps 3 through 11 until total required depth is reached.
12. Remove augers from the boring. **Note: when the boring is completed and the augers have been removed, it is sometimes advisable to leave the borehole open for several hours to check for groundwater inflow. This information can be valuable later in the project.**
13. Decontaminate all equipment and personnel according to Attachment 9.
14. Dispose of cuttings and non-salvageable equipment as outlined in Attachment 10, Investigation-Derived Waste found in this appendix.
15. Plug and abandon borehole as specified in Attachment 11.

5.12 Records

For each surface soil sample collected, the technician will complete a Sample Collection Form. This form prompts the technician to identify and record information such as: site ID, sample location ID, sample number, collection date and time, sample containers, and associated QC sample information. All sampling data and information will be recorded in the Field Activity Data Log (FADL) for the site sampled. The FADL entries will be recorded chronologically and the time of the entry recorded first. All FADL continuation pages will be sequentially numbered and the last page recorded for the day will be signed and dated by the recording technician.

6.0 EXCEPTION

None

7.0 CROSS REFERENCE

EPA, September 1987, *Compendium of Superfund Field Operations Methods*, EPA 540/P-87/001a, OSWER 9355.0-14.

EPA, August 1988, *EPA Guidelines for Conducting Remedial Investigation and Feasibility Studies under CERCLA,* Interim Final OSWER Directive 9355.3-01.

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En Novative Technologies, Inc., Green Bay, Wisconsin, *Disposable En Core™ Sampler Sampling Procedures Using the En Core™ T-Handle.*

8.0 TABLES

None

9.0 ATTACHMENTS

A. EnCore® Sampler Information/Description

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Disposable En Core® Sampler

Sampling Procedures

Using The En Core® T-Handle

En Novative Technologies, Inc.
1241 Bellevue Street
Green Bay, WI 54302
Phone: 920-465-3960 • Fax: 920-465-3963
Toll Free: 888-411-0757
www.ennovativetech.com

NOTE:

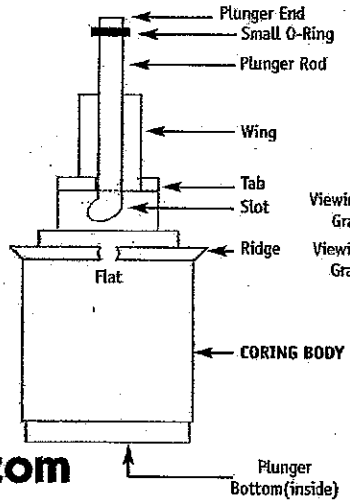
1. En Core® Sampler is a SINGLE USE device. It cannot be cleaned and/or reused.

2. En Core® Sampler is designed to store soil. Do not use En Core Sampler to store solvent or free product!

3. En Core® Sampler must be used with En Core® T-Handle and/or En Core® Extrusion Tool exclusively. (These items are sold separately.)

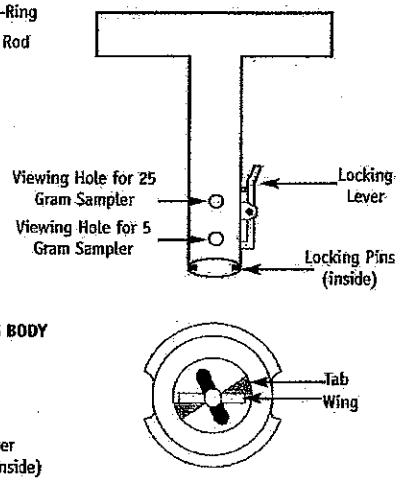
En Core®

Top



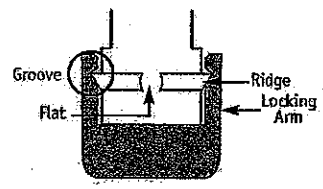
Bottom

En Core® T-Handle



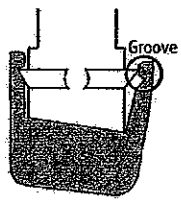
Sampler Correctly Capped

(Locking arm grooves seated over coring body ridge.)



Sampler Incorrectly Capped

(Cap appears crooked; locking arm grooves not fully-seated over coring body ridge.)



BEFORE TAKING SAMPLE:

1. Hold **coring body** and push **plunger rod** down until **small o-ring** rests against **tabs**. This will assure that plunger moves freely.

2. Depress **locking lever** on En Core T-Handle. Place coring body, **plunger end first**, into open end of T-Handle, *aligning the (2) slots on the coring body with the (2) locking pins in the T-Handle*. Twist coring body clockwise to lock pins in slots. Check to ensure Sampler is locked in place. Sampler is ready for use.

TAKING SAMPLE:

3. Turn T-Handle with T-up and coring body down. This positions plunger bottom flush with bottom of coring body (ensure that plunger bottom is in position). Using T-Handle, push Sampler into soil until coring body is completely full. When full, small o-ring will be centered in T-Handle **viewing hole**. Remove Sampler from soil. Wipe excess soil from coring body exterior.

4. Cap coring body while it is still on T-handle. *Push* **cap** over **flat** area of **ridge** *and twist* to lock **cap** in place. **CAP MUST BE SEATED TO SEAL SAMPLER (see diagram).**

PREPARING SAMPLER FOR SHIPMENT:

5. Remove the capped Sampler by depressing locking lever on T-Handle while twisting and pulling Sampler from T-Handle.

6. Lock plunger by rotating extended plunger rod fully counter-clockwise until **wings** rest firmly against tabs (see plunger diagram).

7. Attach completed tear-off label (from En Core Sampler bag) to cap on coring body.

8. Return full En Core Sampler to zipper bag. Seal bag and put on ice.

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Disposable En Core® Sampler

EXTRUSION PROCEDURES

USING THE En Core® EXTRUSION TOOL

CAUTION! Always use the Extrusion Tool to extrude soil from the En Core Sampler. If the Extrusion Tool is not used, the Sampler may fragment, causing injury.

1. Use a pliers to break locking arms on cap of En Core Sampler. Do not remove cap at this time. **(CAUTION: Broken edges will be sharp.)**

2. To attach En Core Sampler to En Core Extrusion Tool: Depress locking lever on Extrusion Tool and place Sampler, plunger end first, into open end of Extrusion Tool, aligning slots on coring body with pins in Extrusion Tool. Turn coring body clockwise until it locks into place. Release locking lever.

3. Rotate and gently push Extrusion Tool plunger knob clockwise until plunger slides over wings of coring body. (When properly positioned plunger will not rotate further.)

4. Hold Extrusion Tool with capped Sampler pointed upward so soil does not fall out when cap is removed. To release soil core, remove cap from Sampler and push down on plunger knob of En Core Extrusion Tool. Remove and properly dispose of En Core Sampler.

Warranty and Disclaimers

IMPORTANT: FAILURE TO USE THE EN CORE® SAMPLER IN COMPLIANCE WITH THE WRITTEN INSTRUCTIONS PROVIDED HEREIN VOIDS ALL EXPRESS AND IMPLIED WARRANTIES, INCLUDING WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

PRINCIPLE OF USE. The En Core Sampler Cartridge System is a volumetric sampling system designed to collect, store and deliver a soil sample. The En Core Sampler comes in two sizes for sample volumes of approximately 25 or 5 grams. There are four components: the cartridge with a movable plunger; a cap with two locking arms; a T-handle (purchased separately); and an extrusion handle (purchased separately). NOTE: The En Core Sampler is designed to store soil. It is not designed to store solvent or free product.

The soil is stored in a sealed headspace-free state. The seals are achieved by three special Viton® * o-rings, two located on the plunger and one on the cap of the Sampler. At no time and under no condition should these o-rings be removed or disturbed.

QUALITY CONTROL. The cartridge is sealed in an airtight package to prevent contamination prior to use. Due to the stringent quality control requirements associated with the use of this system, the disposable cartridge is designed to be used only once.

WARRANTY. En Novative Technologies, Inc. ("En Novative Technologies") warrants that the En Core Sampler shall perform consistent with the research conducted under En Novative Technologies' approval, within thirty (30) days from the date of delivery, provided that the Customer gives En Novative Technologies prompt notice of any defect or failure to perform and satisfactory proof thereof. THIS WARRANTY DOES NOT APPLY TO THE FOLLOWING, AS SOLELY DETERMINED BY EN NOVATIVE TECHNOLOGIES: (a) Damage caused by accident, abuse, mishandling or dropping; (b)Samplers that have been opened, taken apart or mishandled; (c)Samplers not used in accordance with the directions; and (d)Damages exceeding the cost of the sampler. Seller warrants that all En Core Samplers shall be free from defects in title. THE FOREGOING WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, WHETHER ORAL, WRITTEN, EXPRESSED, IMPLIED OR STATUTORY, INCLUDING ANY INFORMATION PROVIDED BY SALES REPRESENTATIVES OR IN MARKETING LITERATURE. IMPLIED WARRANTIES OF FITNESS AND MERCHANTABILITY SHALL NOT APPLY. En Novative Technologies' warranty obligations and Customer's remedies, except as to title, are solely and exclusively as stated herein.

LIMITATION OF LIABILITY. IN NO EVENT SHALL EN NOVATIVE TECHNOLOGIES BE LIABLE FOR ANTICIPATED PROFITS, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES, INCLUDING, BUT NOT LIMITED TO, DAMAGES FOR LOSS OF REVENUE, DOWN-TIME, REMEDIATION ACTIVITIES, REMOBILIZATION OR RESAMPLING, COST OF CAPITAL, SERVICE INTERRUPTION OR FAILURE OF SUPPLY, LIABILITY OF CUSTOMER TO A THIRD PARTY, OR FOR LABOR, OVERHEAD, TRANSPORTATION, SUBSTITUTE SUPPLY SOURCES OR ANY OTHER EXPENSE, DAMAGE OR LOSS, INCLUDING PERSONAL INJURY OR PROPERTY DAMAGE. En Novative Technologies' liability on any claim of any kind shall be replacement of the En Core Sampler or refund of the purchase price. En Novative Technologies shall not be liable for penalties of any description whatsoever. In the event the En Core Sampler will be utilized by Customer on behalf of a third party, such third party shall not occupy the position of a third-party beneficiary of the obligation or warranty provided by En Novative Technologies, and no such third party shall have the right to enforce same. All claims must be brought within one (1) year of shipment, regardless of their nature.

En Novative Technologies, Inc.
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Toll Free: 888-411-0757
www.ennovativetech.com

The En Core™ Sampler is covered by One or More of the Following U.S. Patents: 5,343,771; 5,505,098; 5,517,868; 5,522,271. Other U.S. and Foreign Patents Pending.

* Viton® is a registered trademark of DuPont Dow Elastomers.

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SHAW STANDARD OPERATING PROJECT PROCEDURE

LONGHORN ARMY AMMUNITION PLANT

ATTACHMENT 6

Subject: SURFACE SOIL SAMPLING

1.0 PURPOSE AND SUMMARY

This Standard Operating Project Procedure (SOPP) establishes guidelines and procedures for use by field personnel in the collection and documentation of surface (0 to 1-foot depth) soil samples for physical and chemical analysis. Proper collection procedures are necessary to assure the quality and integrity of all surface soil samples. Documents other than those required by the contract and consulted in the preparation of this SOPP are listed under "Cross Reference."

Surface-soil samples are collected to determine the type(s) and level(s) of contamination and define the contaminated area(s). Samples are collected from the shallowest depth that can be obtained practically. These samples may be collected as part of an investigative plan, confirmation sampling, and/or as a screen for "hot spots," which may require more extensive sampling.

Sediment(s) and sludge(s) that have been exposed by evaporation, stream rerouting, or any other means are collected by the same methods as those for surface soil(s). Typically for sediment and sludge, the top 1 to 2 centimeters of material is carefully removed before collection of the sample. Based on analytical requirements, surface soil and exposed sediments or sludge are easily collected using stainless steel and or Teflon®-lined trowels or augers, or EnCore® Samplers or equivalent.

Surface soil samples for VOC analysis will be collected using the EnCore® Samplers unless otherwise directed. This method is used to reduce the loss of VOCs typically associated with traditional sampling, storage, and shipping procedures, such as VOC loss through biodegradation, handling of samples during collection, opening of sample containers prior to analysis, etc. SW-846 Method 5035 reportedly reduces or eliminates the activities or practices associated with these circumstances. For instance, several sample collection methods utilize a hermetically-sealed sample vial, the seal of which is never broken from the time of sampling to the time of analysis. Since the sample is never exposed to the atmosphere after sampling, the loss of VOCs during sample transport, handling, and analysis is minimized.

Prior to conducting a soil sampling investigation, a sampling strategy should be developed based on the objectives of the investigation. The details within the SOPP should be used in conjunction with the Work Plan, which will generally provide the following information:

- Locations and depths of soil samples to be collected;
- Numbers and volumes of soil samples to be collected;
- Types of analyses to be conducted for the samples; and
- Specific quality control (QC) procedures and sampling required.

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3.0 RESPONSIBILITY MATRIX

3.1 Site Manager

The Site Manager or Field Team Leader is responsible for ensuring field activities are conducted in accordance with the project plans and requirements, and all activities are performed according to the respective procedures. The Site Manager is responsible for ensuring all site personnel are trained in the procedures, the procedures are adhered to, and all activities are documented.

3.2 Field Team

All members of the field team (samplers, technicians, field geologists, engineers, etc.) are responsible for understanding and implementing this field procedure as well as ensuring all team members also perform work in accordance with this procedure.

3.3 Site Contractor Quality Control System Manager (CQCSM)

The Site CQCSM is responsible for ensuring that this procedure is correctly implemented and that data collected meet the requirements of the work plan.

4.0 DEFINITIONS

Surface Soil – The soil which exists down from the land surface approximately one foot (30 cm).

Grab Sample – A discrete portion or aliquot taken from a specific location at a given point in time.

En Core® Sampler – A disposable volumetric sampling device used for collecting, storing and delivery of a soil sample.

Auger – A stainless steel cylinder ('bucket') approximately 3 to 4 inches in diameter and one foot in length, open at both ends with the bottom edge designed to twist into the soil and cut out a core. The bucket collects the soil sample. The auger has a T-shaped handle (for hand operation) attached to the top of the bucket by an extendable stainless steel rod.

Trowel – A small stainless steel shovel approximately 6 to 8 inches in length with a slight curve across. The trowel has a stem-like handle (for hand operation). Samples are collected with a spooning action.

5.0 TEXT

5.1 Required Records and Forms

1. Sample Collection Log (SCL)
2. Field Activity Daily Log (FADL)
3. Sample tags/labels and the appropriate forms/documentation for sample shipment.
4. Material Safety Data Sheets (MSDS)
5. Site-Specific Field Sampling Plan
6. En Core® Sampler manufacturer's instructions (Surface Soil Sampling Attachment A).

5.2 Required Materials, Equipment, or Supplies

1. Indelible black-ink pens and markers
2. Appropriate sample containers
3. Insulated cooler
4. Waterproof sealing tape
5. Latex gloves
6. Plastic Zip-Loc® or equivalent bags
7. Decontamination equipment and supplies, including rinse bottles and deionized water
8. Personal protective clothing and gear
9. Stainless steel and/or Teflon®-lined spatulas and pans, trays, or bowls
10. Stainless steel and/or Teflon®-lined trowels and/or augers
11. Appropriate equipment and meters for obtaining field measurements as specified in the SFSP (i.e., PID/FID)
12. Linear measuring device (e.g., tape measure)
13. Stainless steel, brass, Lexan® or Teflon® inserts for auger
14. Plastic end caps for the sleeves, and Teflon® or silicon tape
15. En Core® Sampler or equivalent
16. En Core® T-Handle

5.3 General Requirements

The following steps must be followed when preparing for sample collection:

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1. Ensure that all surface soil sample locations have been appropriately cleared of all underground utilities and buried objects per the project work plans. Review all forms and diagrams documenting the location of the cleared sampling locations, as well as that of any underground utilities or lines, or other buried objects.
2. Don the appropriate personal protective clothing as dictated by the site-specific health and safety plan.
3. Place clean plastic sheeting on a flat, level surface near the sampling area, if possible, and place equipment to be used on the plastic; (place decontamination equipment and supplies and the insulated cooler(s) on separate plastic sheeting). Cover all equipment and supplies with clean plastic sheeting when not in use.
4. Document the sampling events, recording the information on the SCL or equivalent form as specified. Document any and all deviations from this procedure in the field log book or on the FADL and include rationale for changes.

5.4 Specific Requirements for Collection of Surface Soil Samples

Following the manufacturer's instructions (Disposable En Core® Sampler Sampling Procedures Using the En Core® T-Handle [see Subsurface Soil Sampling Attachment A]), samples for VOC analysis should be collected in the following manner:

5.4.1 Before Collecting the Sample

5.4.1.1 Hold the coring body and push the plunger rod down until the small o-ring rests against the tabs. This is to assure that the plunger moves freely.

5.4.1.2 Depress the locking lever on the En Core® T-Handle, aligning the two slots on the coring body with the two locking pins in the T-Handle. Twist the coring body clockwise to lock pins into slots

5.4.1.3 Check to ensure the Sampler is in place. The Sampler is ready for use.

5.4.2 Collecting Sample:

5.4.2.1 Follow the sampling pattern outlined in the Work Plan

5.4.2.2 Carefully remove stones, vegetation, snow, etc., from the sampling location surface and the top 1 to 2 cm of exposed soil, sediment, or sludge before sample collection.

5.4.2.3 Turn T-Handle with T up and coring body down. This positions the plunger bottom flush with the bottom of the coring body.

5.4.2.4 Using T-Handle, push the Sampler into soil until coring body is completely full. When full, the small o-ring will be centered in the T-Handle viewing hole.

5.4.2.5 Remove Sampler from soil. Wipe excess soil from coring body exterior.

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5.4.2.6 Cap the coring body while it is still on the T-Handle. Push and twist cap over bottom until grooves on locking arms seat over ridge on the coring body. **Cap must be seated on both sides to seal sampler**.

5.4.2.7 Samples containing gravel/rocks or very wet/loose soils may be difficult to collect using the En Core® Sampler. Special care should be used when collecting samples in this media to ensure the proper amount of sample is collected for analysis.

5.4.3 Preparing Sampler for Shipment

5.4.3.1 Remove the capped Sampler from the T-Handle by depressing the locking lever on the T-Handle while twisting and pulling Sampler from T-Handle.

5.4.3.2 Lock the plunger by rotating the extended plunger rod counter-clockwise until wings rest firmly against tabs.

5.4.3.3 Attach the completed label from the En Core® Sampler bag to the cap on the coring body.

5.4.3.4 Place the Sampler into supplied zipper bag. Seal the bag and place the bag containing the Sampler on ice.

5.4.3.5 Note that *three* En Core® Samplers need to be filled for each sampling location. Collect each sample from the same soil stratum or the same section of the solid waste being sampled (for high concentration samples) and within close proximity (1-4") to each other.

5.4.3.6 In addition to the En Core® Samplers collected at each sampling location, at least *one* additional aliquot of sample (typically in a 4 oz or 125 ml jar) must be collected for dry weight determination (if no other analyses are being performed on the sample). This sample container must not contain any preservative solution.

5.4.3.7 Place the containers in individual zip-top or similar plastic bag(s) and seal the bag(s).

5.4.3.8 The sample coordinator will appropriately preserve, handle, package, and ship all samples going to the same laboratory in a cooler. Include properly-completed chain-of-custody, and affix signed and dated custody seals to the three unhinged sides of the cooler lid. The samples shall also be maintained under custody at all times.

5.4.3.9 Fill and abandon the sample hole as required by the SFSP.

5.4.4 The requirements for collecting samples of surface soil for non-volatile organic or inorganic analyses are as follows:

5.4.4.1 Label each sample container with the appropriate information. Secure the label by covering it with a piece of clear tape.

5.4.4.2 Use a decontaminated stainless steel or Teflon®-lined trowel or auger as many times as necessary to obtain the volume needed to fill the specified sample containers.

5.4.4.3 Empty the contents of each fill of the sampling device directly into

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a clean stainless steel or Teflon®-lined tray or bowl.

5.4.4.4 Homogenize the sample by thoroughly mixing together the total volume of sample using a decontaminated stainless steel or Teflon® spoon, spatula, or trowel.

5.4.4.5 Use the spoon, spatula, or trowel to distribute the uniform mixture into the labeled sample containers.

5.4.4.6 Secure the appropriate cap on each container immediately after filling it.

5.4.4.7 Wipe the sample containers clean with a clean Kimwipe® or paper towel. Follow the proper sample handling, packaging, and shipping requirements as detailed in the field procedures sample handling section.

5.4.4.8 Place sample containers in individual zip-top or similar plastic bags and seal the bags.

5.4.4.9 The sample coordinator will pack all samples going to the same laboratory in a cooler. Include properly-completed chain-of-custody forms, and affix custody seals to the three unhinged sides of the cooler lid. See Attachment 8 of Appendix D.

5.4.4.10 To minimize cross-contamination, decontaminate sampling equipment after sample collection at each sample location. See Attachment 9 of Appendix D.

Surface soil samples are normally collected from the least-contaminated to the most-contaminated areas. Stay outside of a specific sampling location until all samples are collected at that location.

5.6 Restrictions/Limitations

- The sampled material contained in an En Core® Sampler can only be currently stored in the device for up to 48 hours. Consequently, the samples must be shipped by overnight delivery to the laboratory on the same day that the samples are collected. Failure to ship samples immediately will require contractor to resample.

- The En Core® Sampler is a single use devise.

- The En Core® sampler must be used with En Core® accessories exclusively.

5.7 Records

For each surface soil sample collected, the technician will complete a SCL. This form prompts the technician to identify and record information such as: site ID, sample location ID, sample number, collection date and time, sample containers, and associated QC sample information. All sampling data and information will be recorded on the FADL for the site sampled. The FADL entries will be recorded chronologically and the time of the entry recorded first. All FADL continuation pages will be sequentially numbered and the last page recorded for the day will be signed and dated by the recording technician.

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6.0 EXCEPTION PROVISIONS

None

7.0 CROSS REFERENCE

EPA, 1996, *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*, Region 4, Athens, GA.

HAZWRAP, 1996. *Document No. DOE/HWP-100, Standard Operating Procedure 5A, Sampling of Surface Soils and Other Surficial Materials.*

En Novative Technologies, Inc., Green Bay, Wisconsin, *Disposable En Core™ Sampler Sampling Procedures Using the En Core™ T-Handle.*

8.0 TABLES

None

9.0 ATTACHMENTS

None.

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SHAW STANDARD OPERATING PROJECT PROCEDURE

LONGHORN ARMY AMMUNITION PLANT

ATTACHMENT 7

Subject: SURFACE-WATER SAMPLING

1.0 PURPOSE AND SUMMARY

The objective of this Standard Operating Project Procedure (SOPP) is to define requirements and methodologies for collecting surface-water samples. The sampler should refer to the work plan and work plan addenda when appropriate for project specific requirements and objectives. Documents other than those required by contract and used in the preparation of this SOPP are listed in the "Cross Reference" section.

Surface water sampling techniques and equipment are designed to minimize effects on the physical and chemical integrity of the sample.

Because data quality objectives (DQO), contaminant types, and surface-water body configurations vary from site to site, a variety of sampling equipment and techniques will be necessary. The procedures described herein define the methods and equipment required to collect surface-water samples in a variety of environments.

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3.0 RESPONSIBILITIES

3.1 Site Manager

The Site Manager, or Field Team Leader, is responsible for ensuring field activities are completed to meet the project objectives, are conducted in accordance with the project plans and requirements, and all activities are performed according to the respective procedures. The Site Manager is responsible for ensuring all site personnel are trained in the procedures, the procedures are adhered to, and all activities are documented.

3.2 Field Team

All members of the field team (samplers, technicians, field geologists, engineers, etc.) are responsible for understanding and implementing this field procedure as well as ensuring all team members also perform work in accordance with this procedure.

3.3 Site Contractor Quality Control Systems Manager (CQCSM)

The Site CQCSM is responsible for ensuring that this procedure is correctly implemented and that the quantity and quality of field measurable physical characteristic samples collected meet the requirements of the project.

4.0 DEFINITIONS

Surface water: Water that flows over or rests on the land and is open to the atmosphere; it includes ditches, streams, rivers, lakes, pools, ponds, basins, or any other that fits the definition of surface water.

Grab samples: Discrete aliquots representing a specific location at a given point in time. The sample is collected all at once and at only one particular point in the sample medium. Grab samples are not mixed or composited with other samples.

Composite samples: Nondiscrete samples composed of more than one specific aliquot collected at various locations or at different points in time. Analytical results from this type sample represent an average value for the locations or time periods incorporated into the sample. Composite samples can be collected where investigative goals indicate that is

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appropriate; otherwise, grab samples should be collected.

5.0 TEXT

5.1 Required Records and Forms

1. Field activity daily log (FADL)
2. Sample collection log (SCL)
3. Sample tags/label and the appropriate forms/documentation for sample shipment
4. Material safety data sheets (MSDS)

5.2 Required Materials, Equipment, and Supplies

The list of potential sampling equipment and supplies needed for collection of surface water samples includes but is not limited to the items listed below. The specific requirements for each sampling project should be identified from the results of the pre-sampling field reconnaissance.

1. Life preservers
2. Polyethylene safety line (floatable)
3. Cellular phone or radio
4. Site maps
5. Pond sampler or extended dipper with 1-liter (L) beaker, clamp, and telescoping heavy duty pole, sample collection vessels- bucket, bailer, beakers- composed of Teflon, glass, stainless steel, or other inert material
5. Weighted bottle sampler, Wheaton bottle, or Kemmerer sampler
6. Peristaltic pump (or equivalent) with tubing and power supply
7. Syringe sampler device
8. Horiba U-10 Water Quality Checker (for measurement of pH, specific conductivity, temperature, and dissolved oxygen), redox meter (for measurement of oxygen reduction potential), or a Horiba U-22 Water Quality Checker (for measurement of pH, specific conductivity, temperature, dissolved oxygen and oxygen reduction potential) and DRT meter (for measurement of turbidity).
9. Sample bottles with preservative
10. Sample coolers with ice or blue ice
11. Sample labels and tape
12. Black pens
13. Permanent marker pens
14. Sample collection logs
15. pH paper
16. Paper towels
17. Plastic trash bags
18. Folding ruler or yardstick
19. 100 m measuring tape
20. Stopwatch
21. Camera and film
22. Wooden stakes

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23. Flagging tape
24. Sledge hammer
25. Boat or canoe if needed
26. Waders
27. Mudders

5.3 Procedures

5.3.1 General Considerations

Regardless of the sampling methods or equipment selected, several general procedures are applicable to the collection of all surface-water samples.

1. If surface water is extremely silty or muddy, sampling should be postponed until better conditions prevail.

2 Plan to collect samples first from those areas suspected of being the least contaminated so areas of suspected contamination are collected last, thus minimizing the risk of cross-contamination.

3. If sediment samples are to be collected at the same location as surface water samples, the surface water samples must be collected first. In general, surface water samples should be collected from near the base of the water column, as near to the sediment/surface water interface as possible. The exception would be when sampling to assess a floating layer or sheen.

4. Surface water sampling from flowing bodies should be coordinated so as to reflect base flow conditions, and not during or immediately after a rainfall event.

5. The flow rate in a flowing water body should be measured or estimated.

6. When sampling in flowing water, the sample locations will depend upon the flow conditions and channel geometry relative to location of the suspected release. Stagnant pools should be avoided unless they are adjacent to a suspected discharge point. Samples are to be collected from the active flow tube within the stream. If the channel is linear, the sample should be collected from the same side of the stream as the source or suspected discharge point. When sampling for VOCs, avoid sampling below waterfalls or riffles or in shallow water in direct sunlight, where volatility effects could impact sample integrity.

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7. Where possible, take field measurements (pH, temperature, conductivity, etc.) directly from the surface water body (not the sample) in the location from which the sample was collected.

8. Whenever possible, surface-water samples should be collected directly into the sample container. Samples for oil and grease, total petroleum hydrocarbons (TPH), etc., must be collected directly into the sample container. This procedure reduces any loss of volatiles, cross-contamination, or other alteration that could occur during transfer from a collection vessel into the sample container.

9. Samples collected for analysis of volatile organic compounds (VOCs) and some semivolatile organic compounds (SVOCs) must not be composited.

10. For any given stream, sampling should begin with the sampling point located farthest downstream and proceed upstream to prevent cross-contamination of downstream samples by upstream activities. For lakes and ponds, sampling should begin with the sampling point located closest to the discharge point and proceed around the lake or pond in an orderly fashion.

11. If wading is required, one should approach the sample site from downstream, being careful not to disturb any bottom sediment. The mouth of the sample container should be positioned so it faces upstream while the sampling personnel are standing downstream. In water bodies with little or no current, the sampling personnel should not enter the actual sample area. A pond sampler with an extendable handle should be used to reach the sample site.

12. Unless required otherwise, samples should be collected from below the water surface. The sample container should be submerged and then opened underwater to expel air.

13. Sample packaging, handling, and shipping shall be conducted in accordance with Sampling Handling Procedures in Attachment 8.

14. The collection of surface-water samples should be documented on the appropriate FADL and/or a sample collection form.

5.3.2 Preparation

The following steps should be taken when preparing for sampling surface water.

1. Conduct a presampling field reconnaissance to verify the presence of surface water and to assess field conditions. The

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field reconnaissance will assist in the selection of appropriate equipment for health and safety and sampling requirements. The sampling locations should be assessed to 1) verify the surface water body is not excessively silty or muddy, and 2) for flowing water bodies, to verify that baseflow conditions prevail.

2. Calibrate field equipment and instruments as required and ensure they are in proper working order.

3. Record on the FADL a description of the site and sampling location. Include description of the water body (size, depth, flow, bottom materials).

4. Put on required protective clothing and gear as specified in the SAP and/or the Health and Safety Plan.

5. Prepare sampling site by laying out plastic sheeting on the ground and on any tables used. Segregate sampling equipment and supplies from the decontamination area.

6. Sampling equipment must be decontaminated prior to, between, and after sample locations in accordance with Attachment 9, Decontamination Procedures.

5.3.3 Shallow Surface-Water Sample Collection

5.3.3.1 Method of Collecting Samples of Near-Shore Surface Water for Volatile Organic Analysis

The following steps must be taken when collecting samples of near-shore surface water for volatile organic analysis (VOA).

1. Slowly dip VOA vial completely beneath the water and fill. Do not disturb bottom sediments. The open end of the vial should be pointed upstream in undisturbed, gently flowing water. The vial should be inverted so that only water from the desired sample point enters when turning the vial upright, expelling air (Otherwise, the sample contains the water that first enters the vial as it enters the water.

2. Be sure to dislodge any air bubbles from the vial before sealing with the cap.

3. If the VOA vial contains a preservative, carefully submerge a portion of the lip of the vial. Slowly fill the container while being careful not to overfill the vial Use

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the vial cap to finish filling the vial. Ensure a meniscus is raised above the lip of the vial before capping.

4. Place cap with Teflon septum on each vial as it is filled.

5. Turn the vial upside down and check for air bubbles. Tap the bottom of the vials to dislodge any bubbles that may have formed around the cap or sides. If bubbles are present, remove the cap and refill the vial. If the vial contains a preservative, a new vial will be used.

6. Wipe dry the sample vials and label.

7. Place sample container(s) in zip-top or other plastic bags and immediately place into a sample cooler with ice and cool to 4 ± 2 ° Celsius (°C).

5.3.3.2 Method for Shallow Surface-Water Sample Collection for Nonvolatile Organic and Inorganic Compounds

The following steps must be followed when collecting shallow, surface-water samples for nonvolatile organic and inorganic compounds.

1. Use the appropriate flask, dipper, pail, or pond sampler (if required) to collect samples.

2. Immerse sample container into the water and fill. Do not disturb underlying sediments.

3. When collecting grab samples, the sample containers should be filled directly underwater.

4. If the Work Plan requires the collection of composite samples, collect a sufficient volume of water to fill all sample containers and place pooled samples into a stainless steel or glass mixing bowl. Homogenize the sample by stirring and pour into the appropriate sample containers.

5. Seal sample containers, wipe dry, and label.

6. Place sample container(s) in zip-top plastic bags and immediately place into a sample cooler with ice and cool to 4 ± 2 °C.

5.4 Collection of Samples for Oil and Grease, Total Petroleum Hydrocarbons, etc.

Samples collected for oil and grease, TPH, etc., must be collected directly into the sample containers from the water surface. Never composite samples collected for oil and grease, TPH, etc. These analytes will coat out on automatic samplers.

5.5 Deep Surface-Water Sample Collection

Numerous methods and devices have been used to collect discrete, at-depth samples from surface waters. The most practical methods incorporate the use of either a weighted bottle, Wheaton bottle, Kemmerer bottle, or a peristaltic pump.

The weighted bottle and the Wheaton bottle are very similar. The device is lowered to the desired depth, at which time a mechanism is activated to open the sampler. When the sampler is full, the device is raised to the surface and the contents are transferred to the appropriate sample containers.

The Kemmerer bottle is a messenger-activated water-sampling device. In the open position, water or other sample fluid flows through the device. Once lowered to the desired depth, a weighted messenger is dropped down the sample line, thus tripping the release mechanism and closing the bottle. In the closed position the bottle is sealed, allowing retrieval of the sample.

The peristaltic pump sampling system can be used to obtain surface-water samples at depths up to approximately 26 feet (ft). The peristaltic pump is suitable for most physical, chemical, or radiological parameters. If the flow rate of the pump is reduced to minimize sample agitation, this method may permit VOC sampling for definitive confirmation (if permitted by the appropriate regulatory agencies).

Note: All sampling equipment should be constructed of material that will not compromise the integrity of the sample (e.g., Teflon, stainless steel, or glass).

5.5.1 Method for Specified Depth Collection of Surface-Water Samples Using a Weighted Bottle Sampler

The basic operation of the weighted bottle sampler, the Wheaton bottle, and the Kemmerer bottle are similar; therefore, to avoid repetition, only the procedure for use of the weighted bottle is detailed here. The following steps must be followed when collecting (specified depth) surface water samples using a weighted bottle sampler.

1. Lower the weighted sampler to the specified depth.

2. Remove the stopper by pulling on the sampler line; this will fill the sampler.

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3. Release the sampler line to reseat the stopper and retrieve to the surface.

4. Fill the appropriate sample containers. Samples may be composited in stainless steel or Teflon containers if required.

5. Seal each container as it is filled. Check for air bubbles in VOC samples. If bubbles are present, remove the cap and refill the container. If the vial contains a preservative, a new vial will be used.

6. Wipe dry the sample containers and label.

7. Place sample container(s) in zip-top plastic bags and immediately place in a sample cooler with ice and cool to 4 ± 2 °C.

5.5.2 Method for Deep Surface Water Sample Collection by Peristaltic Pump

The following steps must be followed when collecting deep, surface-water samples by peristaltic pump.

1. Install clean, medical-grade silicon or Tygon tubing on the pump head. Leave sufficient tubing on the discharge side for convenient dispensing of liquid directly into sample containers.

2. Select the appropriate length of Teflon intake tubing necessary to reach the specified sampling depth. Attach the intake sampling tube to the intake pump tube.

3. Lower the intake tube to the specified depth.

4. Start the pump and allow at least three volumes of liquid to flow through and rinse the system before actual sampling. Collect the purged liquid and then return it to the source after sample collection is complete.

5. If VOC samples are to be collected, reduce the flow rate of the pump to minimize sample agitation. Disconnect the Teflon tubing from the intake side of the pump. Seal the end of the tubing with the thumb and remove the Teflon tubing from the surface body of water. Slowly fill the VOA bottles from the end of the tubing. For VOC samples, allow a meniscus to form at the top before capping.

6. Fill the appropriate sample containers-for all analyses except VOCs-directly from the discharge line. Allow the liquid to flow

gently down the side of the sample bottle to minimize entry turbulence.

7. Cap and seal sample containers. Wipe dry the sample containers and label

8. Place sample container(s) in zip-top plastic bags and immediately place in a sample cooler with ice and cool to 4° ± 2°C.

9. Drain pump system and properly decontaminate and/or dispose of used materials.

5.5.3 Method for Deep Surface Water Sample Collection by Syringe Sampler (VOC Only)

1. Install clean, medical-grade silicon tubing on the 60 milliliter (ml) sterile medical catheter syringe. Leave sufficient tubing on to allow for sample collection depth with respect to the sample collection personnel (i.e., if a sample is being collected at the bottom of a sink hole that is 6 feet in depth and the sides of the sink hole are 4 feet from the center, then you will need approximately 11 feet of silicon tubing). A pole and cable ties will be needed to attach the syringe sampler in order to collect the sample at the desired location.

2. Attach a disposable polyethylene tubing connector to the silicon tubing. Attach a three foot section of clean disposable teflon tubing. The volume of the tubing will be approximately 90 ml. Attach the other disposable polyethylene tubing connector to the end of the Teflon® tubing in order to retain the sample volume.

3. Lower the syringe sampler intake tube to the specified depth.

4. Draw a vacuum by pulling back the syringe plunger. Collect the surface water drawn into the Teflon tubing and fill the appropriate VOC sample containers from the intake line. Allow the liquid to flow gently down the side of the sample bottle to minimize entry turbulence. Slowly push in the plunger which will slowly fill the VOA bottle from the end of the tubing. Allow a meniscus to form at the top before capping.

5. Return any excess volume to the surface water body after the sample collection is complete.

6. Cap and seal sample containers. Wipe dry the sample containers and label.

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7. Place sample container(s) in zip-lock bags and immediately place in a sample cooler with ice and cool to 4 ± 2 °C.

8. If the dedicated materials come in contact with the sampling medium, decontamination or disposal is required to prevent cross-contamination.

5.6 Surface-Water Sample Compositing

Surface water samples can be composited on a spatial or temporal basis.

5.6.1 Surface Water Spatial Compositing

The following steps are to be followed when collecting spatially composited surface-water samples.

1. Determine where composite sample(s) will be obtained as detailed in the Work Plan.

2. Note: VOC and, in some cases, SVOC samples must be collected and contained immediately as discrete samples and, therefore, cannot be composited.

3. Collect a minimum of three equal-volume samples from the specified sample location. The volume of each sample must be at least the amount required for a single sample.

4. Place the samples in a stainless steel bowl and homogenize the pooled samples with a stainless steel spoon or dipper.

5. Transfer aliquots of the composited sample into the appropriate sample containers. Seal, rinse, label sample containers, and immediately place in a cooler with ice and cool to 4 ± 2 °C.

5.6.2 Time Averaged Compositing

Time averaged composite sampling is used to determine mass-per-unit time concentrations and to identify sporadically discharged contaminants from outfalls or streams. The system can be used for basins, ponds, pools, lakes, or streams. Time averaged composite samples can be collected with an automated sampler (i.e. ISCO sampler) or manually. Factor influencing the selection of the time averaged sampling method (automated sampler or manual sample collection) include, but are not limited to considerations such as sampling frequency, location accessibility, security, and budget constraints.

The following steps are to be followed when collecting time-averaged composite surface water samples with an automated sampler:

1. Place the automated sampler with the refrigerated sample-collection jar near the specified sample point. Appropriate

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cleanliness applies here as it does for other surface-water sample collection.

2. Set mechanisms on the sampler to collect a selected volume at the desired time frequency (e.g., 250 milliliters of the total discharge at the same time each hour).

3. At the end of the period of sampling specified in the Work Plan, decant the samples, (including VOCs) into the appropriate sample containers.

4. Seal, rinse, label sample containers, and place in a cooler with ice and cool to 4 ± 2 °C. Handle with the same care as other samples from the site.

For each surface water sample collected, the technician will complete a SCL. This form prompts the technician to identify and record information such as: site ID, sample location ID, sample number, collection date and time, sample containers, and associated QC sample information. Other pertinent information to be recorded includes an estimate of flow rate (if applicable), diagram of sampling site, channel configuration, and height of water column. All sampling data and information will be recorded on the FADL for the site sampled. The FADL entries will be recorded chronologically and the time of the entry recorded first. All FADL continuation pages will be sequentially numbered and the last page recorded for the day will be signed and dated by the recording technician.

Records generated as a result of this SOPP will be controlled and maintained in the project record files.

5.7 Marking of Surface-Water Sample Locations

Sampling locations will be marked by a spray painted and labeled wooden stake that will be pounded into the bank deep enough to ensure it will remain during periods of high water or high flow. If the sampling location cannot be staked, the stake should be placed at the bank of the water body and the distance from the sampling location to the stake noted on the FADL or sample collection form.

If the staked location is not easily seen, flagging tape will be used to clearly mark the path to the sampling location. Prior to leaving the site, a sketch of the sampling location will be drawn, depicting all relevant landmarks. Photographs depicting the labeled stake may also be required to document the sample location.

6.0 EXCEPTION PROVISION

1. Surface water samples should not be collected if the area has received a significant amount of rainfall, and surface water bodies do not reflect baseflow conditions.

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2. Surface water samples should not be collected if the surface water body is excessively muddy or silty.

3. Peristaltic pumps generally are not capable of collecting samples from depths exceeding 20-25 ft.

7.0 CROSS REFERENCE

Department of Energy, Environmental Survey Manual, DOE/EH-0053,19. Lockheed Martin Energy Systems, Inc., Quality Control Requirements for Field Methods, DOE/HWP-69/R2. , Hazardous Waste Remedial Actions Program, Oak Ridge, Tennessee, 1996.

Martin Marietta Energy Systems, Inc., *Grab Sampling with Kemmerer Bottles,* Environmental Surveillance Procedures, Method No. ESP 3014, 1988.

PEER Consultants, P.C., *Water Sampling With Wheaton Bottle,* Field Sampling Procedures, Method No. F-18, ESP-A-002B-1, 1990.

U.S. Environmental Protection Agency, *Practical Guide for Groundwater Sampling,* EPA/600/2-85/104, 1985.

U.S. Environmental Protection Agency, *A Compendium of Superfund Field Operations Methods,* EPA/540K/P-87/001, 1987/

U.S. Environmental Protection Agency, *Data Quality Objectives Process for Superfund,* EPA/540/G-93/071, 1993.

U.S. Environmental Protection Agency, Environmental Investigations Standard Operating Procedures and Quality Assurance Manual, 1996.

8.0 TABLES

None.

9.0 ATTACHMENTS

None.

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SHAW STANDARD OPERATING PROJECT PROCEDURE

LONGHORN ARMY AMMUNITION PLANT

ATTACHMENT 8

Subject: NON-HAZARDOUS SAMPLE HANDLING, PACKAGING AND SHIPPING

1.0 PURPOSE AND SUMMARY

This Standard Operating Project Procedure (SOPP) establishes guidelines and procedures for field personnel to use in the packaging and shipping of environmental samples for chemical and physical analysis.

This SOPP only applies to the packaging and shipping of low concentration environmental samples. This procedure does not apply to those samples considered hazardous materials, hazardous waste, mixed waste, radioactive waste, or dangerous goods. Those requirements are specified in the Department of Transportation (DOT) 49 CFR 171-178 and the most current edition of the International Air Transport Association (IATA) Dangerous Goods Regulations. The details within this SOPP are only applicable to the general requirements for sample packaging and shipping and should only be used as a guide for developing more job-specific work plans.

The details within this SOPP should be used in conjunction with the Work Plan, which will generally provide the following information:

- Sample collection objectives
- Locations and depths of soil samples to be collected
- Numbers and volumes of soil samples to be collected
- Types of analyses to be conducted for the samples
- Specific quality control (QC) procedures and sampling required

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3.0 RESPONSIBILITY MATRIX

3.1 Site Manager: The Site Manager or Field Team Leader, is responsible for ensuring field activities are completed to meet the project objectives, are conducted in accordance with the project plans and requirements, and all activities are performed according to the respective procedures. The Site Manager is responsible for ensuring all site personnel are trained in the procedures, the procedures are adhered to, and all activities are documented.

3.2 Field Team: All members of the field team (samplers, technicians, field geologists, engineers, etc.) are responsible for understanding and implementing this field procedure as well as ensuring all team members also perform work in accordance with this procedure.

3.3 Site Contractor Quality Control Systems Manger (CQCSM): The Site CQCSM is responsible for the periodic review of documentation generated during sample handling, packaging, and shipping and the periodic review and audit of field personnel as they perform the work. If problems arise, the site CQCSM is also responsible for swift implementation of corrective action (i.e., retraining personnel, additional review of work plans and procedures, variances to requirements, issuing nonconformances).

4.0 DEFINITIONS

Environmental Sample - A low concentration sample that does not meet DOT or IATA definitions for a regulated shipment.

Hazardous Materials/Dangerous Goods Sample - Medium or high concentration sample regulated by either DOT or IATA.

Hazardous Waste - Any substance listed in 40 CFR Subpart D (260.30 et seq.) or otherwise characterized as ignitable, corrosive, reactive, or toxic as specified in Subpart C (261.20 et seq.) that would be subject to manifest and packaging requirements specified in 40 CFR 262. Hazardous waste is defined and regulated by the U.S. Environmental Protection Agency (USEPA).

Hazardous Material/Dangerous Good - A material in a quantity or form which may pose an unreasonable risk to health, safety, and/or property as defined by DOT when transported in commerce. Hazardous materials are defined by DOT (49 CFR 171.8), and dangerous goods are defined by IATA (Section 3).

Sample - Physical evidence collected from a facility or the environment which is representative of conditions at the point and time at which the sample is collected.

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U. S. DOT Regulations – Requirements for shipping hazardous materials by highway domestically found at 49 CFR 171-178.

IATA Regulations, current edition – Requirements for shipping dangerous goods by air both domestically and internationally.

5.0 TEXT

5.1 Supplies and Equipment

The following is a list of the supplies and equipment needed to implement this SOPP in the field.

5.1.1 Required Records and Forms

1. Sample Collection Log (SCL)
2. Field Activity Daily Log (FADL)
3. Sample tags/labels and the appropriate forms/documentation for sample shipment
4. Material Safety Data Sheets (MSDS)
5. Site-Specific Field Sampling Plan.
6. CFR 171-178 for ground shipping or the IATA regulations for air shipping.

5.1.2 Materials, Equipment, or Supplies

1. Indelible black-ink pens and markers
2. Plastic or metal coolers (typically provided by the laboratory)
3. Waterproof sealing tape
4. Ice (double bagged)
5. Fiberglass packing tape
6. Nitrile or Latex gloves
7. Plastic Zip-Loc® bags
8. Bubble wrap, styrofoam packing material, vermiculite (or other absorbent)

5.2 Procedures

The following steps must be followed when packaging and shipping non-regulated environmental samples:

1. Properly label (with indelible ink) sample container with the site, unique sample identifier, matrix type, time and date of collection, analytical method, preservatives, and sampling personnel at the time of sample collection. Clear tape should be placed over the label to minimize damage to sample label caused by moisture.

2. As soon as possible after sample collection, tightly seal the container, and place a piece of custody tape over or around the cap. The custody tape should be placed over the cap so that any attempt to remove the cap will cause the tape to be

broken. Do not place custody tape over a volatile organic analysis (VOA) vial septum.

3. Prepare chain-of-custody and request for analyses forms as required by the Quality Control Plan.

4. Place all containers in separate, appropriately sized, airtight, seam sealing polyethylene bags (e.g., Ziploc®). Seal the bag, removing any excess air and wrap with bubble wrap or similar material.

5. Place the bagged container inside an insulating shipping container, such as a common plastic picnic cooler (not styrofoam).

6. Surround the bagged container with absorbent material (e.g., vermiculite).

7. Samples must be packed so they are surrounded and covered by a sufficient volume of ice to maintain a 4 ± 2 degrees Celsius (°C) temperature immediately following collection of the samples in the field and during the entire shipping period. Ice used in the cooler must be contained in two sealed, leak-proof plastic bags to prevent contact of the sample containers with melted ice.

8. Samples labels must be compared to the COC forms to ensure proper documentation. Sample labels must be attached so they will not come loose from sample containers during shipment or if they become wet (the use of clear tape wrapped around the label will prevent this).

9. Place additional packing material (e.g. bubble wrap, vermiculite, or styrofoam) on top of the samples to eliminate the potential for samples to shift during shipment. Cushioning materials may be used to inhibit breakage of sample containers; however, cushioning material must not interfere with maintaining sample cooling.

10. Record the air bill number or other shipping information on the COC.

11. Place the original COC in a resealable bag and tape to inside of top of cooler. A copy of the COC must be retained for the field file.

12. Place custody seals on shipping container. Use custody seals on individual bottles if coolers might be opened during transport (customs, etc.).

13. Seal cooler with strapping tape over the custody seals. Place address label on cooler. Mark the container "THIS END UP," or apply arrow labels that indicate the proper position to be maintained during shipping.

14. If samples are shipped via commercial overnight delivery service, a copy of the shipping bill must be retained in the appropriate files. All pertinent information

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must also be recorded on the FADL. If sampling personnel are delivering samples to the laboratory, this should be noted on the COC. In this case, the cooler need not have custody seals during transport.

15. The laboratory should be contacted to confirm safe arrival of all samples. If delivery of samples will occur at the laboratory on weekends or holidays, the laboratory will be notified to have someone available to receive them. Any problems occurring after sample shipment should be recorded on the FADL along with the names of personnel at the laboratory who explained the problem.

16. For packages containing preserved samples or sample containers with preservative inside, shipping details are provided in Section 7.0, "Restrictions/Limitations".

6.0 EXCEPTION PROVISIONS

1. Blue ice or similar products are not allowed for shipping because it/they do not maintain the 4°C standard required for sample shipping, it should only be used while in the field collecting samples.

2. Samples must be packed so they are surrounded and covered by a sufficient volume of ice to maintain a 4 ± 2 °C temperature immediately following collection of the samples in the field and during the entire shipping period. Ice used in the cooler must be contained in sealed, leak-proof plastic bags to prevent contact of the sample containers with melted ice.

3. When shipping packages containing samples preserved with corrosives such as hydrochloric acid, sulfuric acid, and sodium hydroxide, the samples will not meet DOT's definition of Class 8 – Corrosives because of the preservative as long as these limitations are met:

   - hydrochloric acid in water solution at a concentration of 0.04% or less by weight ($pH \geq 1.96$),
   - nitric acid in water solution at a concentration of 0.15% or less by weight ($pH \geq 1.62$),
   - sulfuric acid in water solution at a concentration of 0.35% or less by weight ($pH \geq 1.15$), and
   - sodium hydroxide in water solution at a concentration of 0.08% or less weight ($pH \geq 12.30$).

4. After it has been established that the samples do not meet DOT's definition of Class 8 – Corrosive because of the preservative, it must still be determined if the contaminant of concern causes the sample to meet any of DOT's hazard class definitions. If it does, appropriate identification, classification, packaging, marking, labeling, and documentation must be performed accordingly.

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5. When shipping bottles that contain only preservatives, the trained shipper will attempt to meet the small quantity/excepted quantity or limited quantity requirements detailed in the DOT or IATA regulations in order to reduce preparation time, materials costs, handling hazards, and shipping costs. Complete instructions and found in the appropriate sections of the applicable regulations.

6. Per 49 CFR 172 Subpart H, an employee who performs hazardous materials (or dangerous goods) shipping is required to complete General Awareness and Function-Specific Training covering his or her particular shipping responsibilities to be updated at least every three years for domestic shipping or every two years for international shipping.

7.0 RECORDS

All sample packaging and shipment data will be recorded on the book or FADL for the samples shipped. The FADL entries will be recorded chronologically and the time of the entry recorded first. All FADL continuation pages will be sequentially numbered and the last page recorded for the day will be signed and dated by the recording technician.

Records generated as a result of this SOPP will be controlled and maintained in the project record files.

8.0 CROSS REFERENCE

Department of Transportation, *Hazardous Materials Regulations*, 49 CFR Parts 171-180.

EPA, 1996, *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*, Region 4, Athens, GA.

HAZWRAP, 1996. *Document No. DOE/HWP-100, Standard Operating Procedure 5C, Packing and Shipping Environmental Samples.*

International Air Transport Association, *Dangerous Goods Regulations*, current edition.

9.0 TABLES

None.

10.0 ATTACHMENTS

None.

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SHAW STANDARD OPERATING PROJECT PROCEDURE

LONGHORN ARMY AMMUNITION PLANT

ATTACHMENT 9

Subject: FIELD EQUIPMENT DECONTAMINATION

1.0 PURPOSE AND SUMMARY

The objective of this procedure is to describe the proper methods for decontaminating downhole and sampling equipment used to perform field investigations.

Decontamination of field equipment is necessary to ensure that chemical analyses reflect actual concentrations at sampling locations by maintaining the quality of samples and preventing cross-contamination. Furthermore, decontamination reduces the health hazards to field personnel and prevents the spread of contaminants off-site.

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- 5.2 Required Materials Equipment, or Supplies
- 5.3 Specific Requirement for Small Sampling Equipment
- 5.4 Specific Requirement for Downhole and Heavy Equipment
- 5.5 Specific Requirement for Pump and Pump Assemblies
- 5.6 Specific Requirement for Downhole Probes
- 5.7 Restrictions and Limitations

6.0 Exception Provision
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3.0 RESPONSIBILITY MATRIX

3.1 Site Manager

The Site Manager or Field Team Leader, is responsible for ensuring that field activities are completed to meet the project objectives, that they are conducted in accordance with the project plans and requirements, and that all activities are performed according to the respective procedures. The Site Manager is responsible for ensuring that all site personnel are trained in the procedures, that the procedures are adhered to, and that all activities are documented.

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3.2 Field Team

All members of the field team (samplers, technicians, field geologists, engineers, etc.) are responsible for understanding and implementing this field procedure as well as ensuring that all team members perform work in accordance with this procedure. The field team members are also responsible for communication of issues with task managers and technical leads, and for documenting change orders and directions.

3.3 Site Contractor Quality Control System Manager

The site CQCSM is responsible for ensuring that this procedure is correctly implemented and that the quantity and quality of field equipment decontamination activities meet the requirements of the project Work Plan.

4.0 DEFINITIONS

Decontamination. The process of removing or reducing undesirable physical and chemical constituents, from equipment or materials that come into direct contact with the sample media. Decontamination minimizes the potential for cross-contamination and ensures the representativeness of physical or chemical analyses proposed for a given sample.

Sampling Equipment. Sampling equipment includes split spoons, hand augers, bailers, submersible pumps, bowls, knives, scoops, water samplers, non-disposable filtration equipment, or any equipment that directly contacts samples.

Sample Contacting Equipment. Equipment that comes in direct contact with the sample or portion of the sample that will undergo chemical analyses or physical testing (for example, bailer, split-spoon sampler).

Potable water. Tap water used for drinking purposes by general population.

Deionized water. Deionized, solvent-free water (ASTM Type II or equivalent). Deionized water can be provided by the laboratory.

Detergent. Laboratory grade detergent for washing equipment is recommended such as Liquinox® or Alconox®.

5.0 TEXT

5.1 Required Forms and Documentation

- Field Activity Daily Log (FADL)
- Material safety data sheets (MSDS).

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5.2 Required Materials, Equipment, or Supplies

Decontamination procedures for small equipment; downhole and heavy equipment; pumps; and downhole probes are described below separately. Each section also includes the required materials, equipment, and supplies.

5.3 Specific Requirement for Small Sampling Equipment

Before samples are collected, small sample-contacting equipment will be decontaminated appropriately. Small sampling equipment includes split spoons, bailers, knives, mixing bowls, etc. Equipment necessary to complete decontamination procedures includes:

- 5-gallon (gal) or larger plastic buckets or troughs
- Laboratory-grade detergent; Liquinox® recommended
- Three stiff-bristle brushes capable of cleaning the inside and outside of equipment
- Teflon® sprayers or wash bottles, or 2 - to 5 - gallon manual pump sprayer (pump sprayer material must be compatible with the solution used)
- Plastic sheeting
- Disposable wipes
- Aluminum foil
- Potable water
- Deionized water
- 10 % Nitric acid solution made from reagent grade nitric acid and deionized water (use only on glass, Teflon®, or stainless steel)
- Gloves, goggles, and other protective clothing as specified in the site-specific health and safety plan.

The following decontamination procedures will be followed:

1. Set up a decontamination line on plastic sheeting covering the ground or on a table covered by plastic sheeting or aluminum foil (shiny side away from equipment). At a minimum, clean plastic sheeting must be used to cover the ground beneath decontamination equipment and plastic sheeting or aluminum foil must cover tables or other surfaces where decontaminated equipment is to be placed. The decontamination area should be located away from potential contaminant sources (e.g., construction areas) to reduce or eliminate potential cross-contamination during decontamination. The decontamination area should progress from "dirty" to "clean" and end with an area for drying equipment.

2. The decontamination line should consist of several buckets or troughs in one line. The first bucket will contain a detergent solution. The next two buckets will contain potable water for rinses. A final liberal rinse of deionized laboratory grade water with a bottle sprayer completes the line.

3. Dislodge as much loose dirt as possible from equipment before beginning the decontamination process. Wash the item thoroughly in the bucket or trough of

detergent solution. Use a stiff-bristle brush to dislodge any clinging dirt. Before washing, disassemble any items that might trap contaminants internally.

4. Rinse in second bucket or trough containing potable water. Rinse water shall be replaced as necessary (generally when water is cloudy).

5. Repeat step 3 in the third bucket or trough for a second rinse. A rinse with nitric acid in a spray bottle may be added before this step if sampling for metals.

6. Using a hand sprayer, rinse the item with deionized water over the fourth bucket.

7. If the equipment will have time to fully air dry before its next use, allow to air dry. If the equipment will not be allowed to fully air dry, rinse with deionized water over the last rinse bucket before reassembling or using any equipment.

8. If equipment will not be used immediately after drying, wrap in aluminum foil (shiny side out) for storage and transport.

9. Record decontamination protocol, equipment types, and date on the FADL at each occurrence.

10. After the decontamination activities are complete, collect all contaminated waters, plastic sheeting, aluminum foil, disposable gloves, boots, and clothing. Place contaminated items in properly labeled containers for disposal. Liquids and solids must be drummed separately. Decontamination water can be taken to the on site groundwater treatment system for disposal.

5.4 Specific Requirement for Downhole and Heavy Equipment

Downhole equipment consists of nonsampling tools such as hollow-stem augers, drill pipe, bits, casing, and screen. Drill rigs, backhoes, and other heavy machinery are also included. Equipment necessary to complete decontamination procedures includes:

- Plastic sheeting or steel, prefabricated decontamination pad. See below for decontamination pad construction requirements.
- Metal, wooden, or plastic sawhorses or other stands
- Laboratory-grade detergent, Liquinox® recommended
- Steam cleaner or high pressure hot water washer capable of generating 2,500 pounds per square inch of pressure and producing steam or hot water (200 °F), with soap compartment
- Stiff-bristle brushes
- 2- to 5-gal manual pump sprayer (pump sprayer must be compatible with the solution used)

- Potable water
- Gloves, goggles, boots, and other protective clothing as specified in the site-specific health and safety plan.

Before drilling, sampling, excavating, leaving the site, and in between each location, all drilling equipment used in field sampling activities must be decontaminated. All downhole augering, drilling, and sampling equipment shall be sandblasted (off-site) if it is new, painted, (such as split spoons or auger flights) or exhibits build-up of rust or caked material. Heavy equipment not directly used for sampling will be decontaminated at a designated area designed to contain decontamination wastes and waters. The area designated is located at the on site wastewater treatment plant decontamination pad. If a decontamination pad is needed for site-specific requirements, a temporary pad can be constructed. The following steps must be taken when decontaminating this equipment.

1. Set up a decontamination pad that is large enough (up to the size of the drill rig) to fully contain the equipment to be cleaned. If practical, a centralized decontamination area should be established. This area should be set up to contain contaminated rinse waters and may be constructed using one or more layers of heavy plastic sheeting, 6mm or heavier, with bermed sides, a lined excavated pit, or a bermed concrete or asphalt pad. If possible, the area should be constructed to eliminate or minimize any overspray or wind-blown spray from decontamination activities (e.g., plastic sheeting secured to a wood frame surrounding the area). The decontamination area must be constructed so that fluids can be easily pumped from the area to holding containers.

2. Set up a "clean" area upwind of the decontamination pad to receive cleaned equipment for air drying. At a minimum, clean plastic sheeting must be used to cover surfaces on which decontaminated equipment is to be placed.

3. Don personal protective equipment as specified in the site-specific health and safety plan before beginning cleaning activities.

4. For heavy equipment, areas exposed to contaminated soil should be sprayed using a steam spray unit. Be sure to spray down all surfaces, including the undercarriage. It is also good practice to clean the motor, hydraulic lift, oil fill, and fuel tank area to avoid introducing contamination at the work site.

5. For smaller equipment such as augers, place the objects to be cleaned on metal or plastic-covered wooden sawhorses, supports, or decontamination trays. Using the steam-spray unit, spray the contaminated equipment. Be sure to spray inside corners and gaps especially well; use a brush, if necessary, to dislodge dirt.

6. For steps 4 and 5, aim the sprayer downward as much as possible to avoid spraying outside the decontamination area.

7. If the condition of downhole or heavy equipment warrants using hot soapy water in the steam-spray unit, rinse the equipment with clean, clear potable water following the steam spray. If using steam spray without a detergent the potable water rinse is not necessary.

8. Remove the equipment from the decontamination area to the "clean" area to dry.

9. Record decontamination protocol, equipment types, and date on the FADL.

10. After decontamination procedures are complete, or any time the decontamination fluids fill the bermed or contained area, decontamination fluids will be collected and transferred to appropriate containers. Place all plastic and personal protective equipment into appropriate containers. All containers must be labeled properly for disposal. Liquids and solids must be drummed separately.

5.5 Specific Requirement for Pump and Pump Assemblies

Any pump in which potentially contaminated fluids come into contact with any part of the pump equipment requires decontamination. This requirement does not apply to peristaltic pumps because water does not contact any part of the pump. Only Teflon® or Teflon®-lined tubing should be reused for sampling after decontamination. If using PVC or polyethylene tubing, discard the tubing after each use unless the tubing is used for well development, where properly-decontaminated tubing may be reused. Polyethylene or PVC tubing can not be properly decontaminated and potential for cross-contamination during sampling remains high. This requirement also applies to the tygon tubing attached to the rollers of a peristaltic pump. The tygon tubing shall be discarded after use at a well.

The procedure provided below applies primarily to the decontamination of bladder pumps. A field setup may be implemented while decontaminating pumps other than bladder pumps or if frequent trips to the field office are not practical or cost effective. Equipment needed to complete decontamination procedures include:

- Deionized water
- Plastic sheeting
- Source of electricity (generator or direct line)
- Compressor and controller for bladder pumps
- Three to five decontamination cells (4-inch diameter PVC) for pumps and tubing
- Laboratory-grade detergent, Liquinox® recommended
- Gloves, goggles, boots, and other protective clothing as specified in the site-specific work plan.

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Following the use of a pump for development, purging, or sampling, the pump should be decontaminated by the following method.

1. Set up decontamination cells in a line on the plastic. Only three cells are required for normal decontamination.

2. Add potable water with a small amount of detergent to the first container; add potable water alone to the second container. Add deionized water to the third container. There should be sufficient water in each container to accomplish the decontamination procedure.

3. Place one drum close enough to the decontamination area to collect the spent decontamination fluids.

4. Place the pump in the first container and pump enough water through it to equal at least three pump-and-tube-volumes. Pump the water into the waste drum. Move the pump to the second container and repeat. Repeat again with deionized water in the third cell. However, one volume of deionized water is the minimum amount required for this rinse.

5. If necessary, the pump can be disassembled and each part can be decontaminated using several buckets as described in the equipment decontamination method above.

6. Record decontamination protocol, equipment types, and date on the FADL.

7. After decontamination activities are complete, collect all contaminated water; solvents; plastic sheeting; aluminum foil; and disposable gloves, boots, and clothing. Place contaminated items in properly labeled drums for disposal. Liquids and solid wastes must be drummed separately and handled in accordance with the investigation-derived waste procedure. (Liquids will be disposed at the on site wastewater treatment plant.)

5.6 Specific Requirement for Downhole Probes

Decontamination of downhole probes, such as water level indicators, pressure transducers, Trolls®, etc. shall be based on the contamination expected in a well and on professional judgment.

5.6.1 Water Level Indicator

For decontaminating water level indicators during snapshot water level sweeps, follow the steps given below:

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1. Carry a detergent solution and deionized water in two separate spray bottles.

2. Spray detergent solution in a piece of paper towel and deionized water in another piece of paper towel.

3. This method involves wiping the water level indicator cable as it is pulled out of a well.

4. Grab the water level indicator cable with the two paper towels in your hands such that the detergent paper towel is below the deionized water paper towel.

5. The cable should be pulled out slowly by a second person and rolled onto the carrying wheel.

6. Once the probe is out of the well, spray it first with the detergent solution and then with deionized water. Wipe with a clean paper towel and store in the carrying case.

Records generated as a result of this written procedure will be controlled and maintained in the project record files.

5.7 Restrictions and Limitations

- Fluids decontamination rinses must be stored separately until disposal is made at the on site wastewater treatment plant.

- All deionized or distilled water must have field-blank samples collected and analyzed at the proper frequency to ensure the purity of the water.

6.0 EXCEPTION PROVISIONS

None.

7.0 REFERENCES

American Society for Testing of Materials (ASTM), 1990, *Standard Practice for Decontamination of Field Equipment Used at Radioactive Waste Sites*, D 5088-90, September.

U.S. Environmental Protection Agency (EPA), 1991, *Handbook of Suggested Practices for the Design and Installation of Around-Water Monitoring Wells*, EPA/600/4-89/034, PB 92-216886, March.

U.S. Environmental Protection Agency (EPA), 1996, *Standard Field Cleaning Procedures, Appendix B, Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*, USEOA Region 4, May.

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8.0 TABLES

None

9.0 ATTACHMENTS

None.

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SHAW STANDARD OPERATING PROJECT PROCEDURE

LONGHORN ARMY AMMUNITION PLANT

ATTACHMENT 10

Subject: INVESTIGATION DERIVED WASTE

1.0 PURPOSE AND SUMMARY

This Standard Operating Project Procedure (SOPP) establishes specific management practices for the handling and subsequent disposition of environmental media generated as a result of investigation actions.

Longhorn Army Ammunition Plant (LHAAP) is conducting investigation activities that generate waste materials. The waste materials typically consist of environmental media (drill cuttings, monitor well purge and development water), and project-related trash (spent PPE and other inert materials such as plastic, rope, tape, paper, etc. that are generated during well installation and sampling activities and associated site activities. When accumulated, the waste materials must be managed appropriately to minimize the exposure to human health and the environment while adhering to applicable regulatory requirements.

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6.0 Exception Provision
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3.0 RESPONSIBILITIES

3.1 Site Manager

The Site Manager or Field Team Leader, is responsible for ensuring that field activities are completed to meet the project objectives, that they are conducted in accordance with the project plans and requirements, and that all activities are performed according to the respective procedures. The Site Manager is responsible for ensuring that all site personnel are trained in the procedures, that the procedures are adhered to, and that all activities are documented.

3.2 Field Team

Members of the field team (samplers, technicians, field geologists, engineers, etc.) are responsible for understanding and implementing this field procedure as well as ensuring that all team members also perform work in accordance with this procedure.

3.3 Site Contractor Quality Control Systems Manager (CQCSM)

The Site CQCSM is responsible for ensuring that this procedure is correctly implemented and that the quantity and quality of field measurable physical characteristic samples collected meet the requirements of the project.

4.0 DEFINITIONS

None.

5.0 TEXT

5.1 Required Records and Forms

- Sample Collection Log (SCL)
- Field Activity Daily Log (FADL)
- Sample tags/labels and the appropriate forms/documentation for sample shipment
- Material Safety Data Sheets (MSDS)
- Field Sampling Plan/Work Plan.

5.2 Required Materials, Equipment, or Supplies

- Indelible black ink pens and markers
- Appropriate sample containers
- Insulated cooler and water proof sealing tape
- Nitrile or latex gloves
- Decontamination equipment and supplies, including rinse bottles and deionized water
- Personal protective clothing and gear
- Appropriate equipment and meters for obtaining field measurements (i.e., PID/FID).

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5.3 Procedures

5.3.1 Preparation

The following steps must be followed when preparing for management of IDW:

- Verify that all personnel have read and understand the approved site-specific health and safety plan and have the proper training and certifications required under OSHA.
- Don the appropriate personal protective clothing as dictated by the site-specific health and safety plan.
- Document the sampling events, recording the information on the SCL or equivalent form as specified. Document any and all deviations from standard operating procedures on the FADL and include rationale for changes.

5.3.2 Specific Preparation

The following paragraphs detail the planned methodologies for dealing environmental media once generated during site activities

Initial Handling Requirements

All environmental media will be managed in an effort to minimize exposure to human health and the environment. Typically, the media will be generated as a result of two major activities, drilling soil-test borings and constructing and sampling ground-water monitoring wells. In instances where soil test borings are advanced, either for the sole purpose of retrieving soil samples or to allow for the retrieval of a ground-water sample via a hydropunch or similar sampling device, including obtaining a sample from an open borehole, the following handling protocols for investigation-derived waste (IDW) soil will be used:

- All soil cuttings will be placed adjacent to the borehole on plastic or other suitable material capable of precluding contact with the ground surface.
- All cuttings will be covered daily or during rainfall events to prevent contact with moisture.
- Upon completion of the downhole activity (i.e., drilling, groundwater sampling, etc.), the soil cuttings will be placed back into the borehole from which they were generated.
- Replaced cuttings will be compacted to the extent practical and a 1- by 1-foot by three inches thick grout cap will be placed over the top of the borehole to prevent vertical migration of surface water.

In cases where a soil-test boring is advanced for the purposes of installing a groundwater monitoring well, all environmental media accumulated will be containerized to allow for characterization upon generation and situated at a

designated staging area or near the point of generation. As solids are generated, they will first be placed into 55-gallon drums, or other approved containers including roll-off boxes, until they are characterized as hazardous or nonhazardous. Pending further characterization, solids may be bulked into larger approved containers situated within the work area. Liquids may be bulked upon generation unless directed otherwise. All solids and liquids will be separated prior to disposal.

After each container (i.e., drum, roll-off box, etc.) has been filled, the container and lid, if appropriate, will be labeled indicating a description of the media (i.e., soil, purge water, decon water, PPE), origin of media (i.e., sample identification such as boring or well), date the media was placed in the container, site identification (i.e., LHAAP-##), date container was sealed and sampled, and any other pertinent information (i.e., hazardous versus nonhazardous). The containers may be labeled using a paint pen or other indelible marker that will not fade when exposed to weather. A record of the number of containers and their contents will be completed at each generation site and will be included in the logbook before leaving each site.

At the end of each day and/or field activity, all containers will be sealed or covered in such a way to prevent the introduction of rain water or surface run-off.

A centralized staging area will be assigned for each site prior to initiation of any site work. Unless directed otherwise, the staging area will be located within the boundaries of the site where field work will take place. All filled containers generated for a given site will be placed in the central location. The containers will be moved from their original filling location to the staging area within 5 days of filling. In the event that conditions indicate the potential for reactive wastes, special handling and storage precautions will be utilized. The integrity of containers moved to the staging area will be monitored routinely, as required.

Waste may be transported between sites when required or in preparation for disposal activities without specific regulatory concurrence.

5.4 Characterization of Environmental Media

The characterization of environmental media will be determined by a two-step process. First, the materials will be characterized using analytical data obtained during the activity from which the materials were generated previously. As stated, it is anticipated that specific generation activities will include soil-test borings, monitoring well installations, and monitoring well purge and development actions. Water obtained from specific monitor well sampling points (i.e., purge and development water) will be characterized using groundwater sampling data taken from the specific well site from which the water was obtained. Analytical data

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obtained from a particular borehole reflecting soil contaminant levels will be used to characterize solids generated from that borehole. Other solids such as rock and other environmental media generated during field activities will be characterized for disposal based on the analytical results of the soil and water sampled at the specific location where the solids were generated. Analytical results from both soils and water will be used to characterize decon water. When appropriate, analytical data will be extrapolated to reflect toxicity characteristic leaching procedure (TCLP) values (i.e., 20x divisor rule for soils). Generator's knowledge may be used to evaluate the media potential for corrosivity, ignitability, and reactivity.

If analytical results indicate contaminant levels below 75 percent of TCLP values, no additional analytical testing will be performed and the media will be considered nonhazardous. When analytical results indicate that elevated contaminant levels (i.e., more than 75 percent of TCLP) are present, additional analyses will be performed. In these cases, composite samples will be taken for each type of media generated (i.e., soil, water) and for each specific generation location (i.e., monitoring well, soil boring, etc.). Samples will be taken directly from the containers. Where multiple numbers of containers are generated for a particular media and generation site, the samples will be taken to ensure that the volume of soil from which one composite sample is prepared is equivalent to no more than the volume contained by ten 55-gallon drums. The suite of analyses to be run will be determined based on suspected contaminants and any prior available analytical data. Generator knowledge may be used to minimize the volume of analytical test required to adequately characterize the media. Hazardous versus nonhazardous determinations will be made utilizing those parameters outlined in the Texas Administrative Code. All sampling and analytical testing protocols will be consistent with TCEQ/EPA requirements and methodologies.

5.5 Management and Disposition

Once adequately characterized, the containers will be labeled as described. U.S. Department of Transportation (DOT) approved labels will be used if transportation outside of LHAAP boundaries is required or anticipated. Waste materials may also be bulked on site (within the staging area), with like waste streams possessing compatible nonreacting characteristics. Hazardous and nonhazardous materials will be segregated and all liquids and solids will be separated. Other specific management requirements are as follows:

5.6 Waste Water

In general, all waste water (including decontamination water) generated during the described site activities will be disposed within the confines of LHAAP at the onsite groundwater treatment plant (GWTP). Other specifics are as follows:

5.6.1 Nonhazardous Wastewater

Wastewater determined to be nonhazardous (Section 40 Code of Federal Regulations [CFR] Part 261), but possessing some level of contaminants, will be disposed directly into LHAAP's GWTP.

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5.6.2 Hazardous Wastewater

Hazardous wastewater will be transported, when required, and treated at an appropriate treatment facility when the following conditions are met:

1. The treatment facility meets the definition of a waste water treatment unit as defined in the Texas Administrative Code.

2. The treatment facility is capable of (a) rendering characteristically hazardous wastes nonhazardous or (b) removing listed wastes from the contaminated media so that the media no longer contains the listed waste for which the media was originally considered hazardous. If after treatment, analytical tests show the listed waste is not present above laboratory detection limits, then the contaminated media will be considered to no longer contain the listed waste and will no longer be considered hazardous.

Wastewater determined to be hazardous may be transported between sites and within LHAAP boundaries for treatment/disposition in accordance with the previously outlined provisions without specific regulatory concurrence.

In the event that LHAAP does not have a facility on-line capable of treating the hazardous wastewater, the water will be taken to a fully permitted, off-site treatment/disposal facility in accordance with state and federal regulations.

Unless specifically mandated by TCEQ and the EPA, the treatment and disposal of hazardous and nonhazardous wastewater will be performed as previously described. The wastes will be treated and disposed in a timely manner so as to expedite site activities and to ensure the protection of human health and the environment. Except where noted, specific written concurrence from TCEQ and EPA prior to those actions previously described is not required.

5.7 Solids

Solids may include soil cuttings, rock, grout, and other environmental media generated during field activities. All solids will be containerized at or near the point of generation and staged as described in Section 5.3.2. Other specific management practices are as follows:

5.7.1 Nonhazardous Solids

Soil cuttings and rock determined to be nonhazardous will be staged within the confines of the site from which they were generated. After characterizations (hazardous versus nonhazardous) are finalized and depending upon site conditions, nonhazardous cuttings will be removed from containers and replaced "at or near" the location from which they were derived. "At or near" infers a media will be placed as near to its point of origin as is practical. Examples would be placing monitoring well cuttings

around the monitoring well from which they originated as opposed to within it. However, when not practical, the media may be centrally located within the confines of the originating site in an area of minimal traffic and where the media could be managed in a manner protective of human health and the environment.

In the event that site conditions are not conducive to the replacement of the materials, soils exhibiting contaminant levels below analytical detection limits are considered non-regulated and will be disposed at the discretion of LHAAP representatives.

5.7.2 Hazardous Solids

For management and disposition purposes, the solids will be broken into two major categories: those exhibiting hazardous characteristics and those containing listed hazardous waste.

Solids exhibiting hazardous characteristics or that contain a listed hazardous waste will be stored upon generation "at or near" the point of generation within the site of origin or bulked in anticipation of disposal activities at a centralized location at LHAAP. Secondary containment will not be required for the storage of hazardous solids as long as the containers are secure and monitored routinely for releases. Unless otherwise directed, the solids will not be subject to 90-day storage requirements.

Whenever practical and depending upon actual site conditions, containerized solids that do not possess hazardous characteristics but do contain listed wastes, will be removed from their storage containers and replaced "at or near" the location from which they were derived. The solids may be replaced anytime after characterization is complete, but most likely at the end of the project phase. Once replaced, the materials will be managed in a manner as to minimize surface erosion. Because of the known presence of contaminants, the solids will be managed in a manner protective of human health and the environment.

The disposition of solids possessing hazardous characteristics will be determined on a case-by-case basis depending on specific contaminants, concentrations, and site conditions. The solids will be returned (i.e., from storage containers) to the site from which they were generated and the remediation of the media, if required, will be addressed, at which time a remedial plan is prepared for other contaminated soil at the site. Prior to this replacement, a request detailing the planned placement procedures with a site sketch indicating the planned placement location will be provided.

In the event that hazardous solids are not allowed to be returned to the site and on site treatment is not available, the media will be disposed off-site in

accordance with state and federal requirements in a permitted disposal facility, as required.

5.8 Trash

Trash includes nonhazardous solids such as spent PPE, plastic sheeting, rope and unused monitor well construction materials generated during field activities. These materials will be placed into dumpsters or roll-offs for disposal at a permitted solid waste disposal facility.

6.0 EXCEPTION PROVISION

None.

7.0 CROSS REFERENCES

U.S. Environmental Protection Agency (EPA), 1992a, ***Guide to Management of Investigative-Derived Wastes***, Office Of Solid Waste and Emergency Response, Publication 9345.3-03FS, April 1992.

U.S. Environmental Protection Agency (EPA), 1992b, ***Management of Contaminated Media***, Region IV EPA, Guidance Number TSC-92-02, December 28, 1992.

U.S. Environmental Protection Agency (EPA), 1991, ***Management of Investigative-Derived Wastes During Site Inspections***, Office Of Research and Development, Publication, EPA/540/G-91/009, May 1991.

8.0 TABLES

None.

9.0 ATTACHMENTS

None

SHAW STANDARD OPERATING PROJECT PROCEDURE

LONGHORN ARMY AMMUNITION PLANT

ATTACHMENT 11

Subject: MONITORING WELL AND BOREHOLE ABANDONMENT

1.0 PURPOSE AND SUMMARY

This Standard Operating Project Procedure (SOPP) establishes guidelines and procedures for field personnel to use in the supervision of borehole or soil boring abandonment and groundwater monitoring well abandonment (destruction) activities. Any exceptions to the requirements are addressed in the section entitled "Exception Provision." Documents other than those required by the contract and consulted in the preparation of this SOPP are listed under "Cross Reference."

The goals of borehole and monitoring well abandonment are to:

- Prevent vertical migration of fluids in the borehole or monitoring well being abandoned;
- Prevent intermixing of waters from different water-bearing zones;
- Eliminate physical hazards (e.g. open boreholes); and
- Preserve aquifer properties.

The exact type of methodology that is used at a site is dependent upon specific regulatory requirements, and may actually be negotiated with the applicable regulatory agencies. Two general types of abandonment are applicable to address the goals and objectives stated above.

- Abandonment of a well in place
- Removing the well and associated materials from the aquifer

Abandoning the well in place basically consists of filling and isolating the screened interval and cementing the casing in place, usually with a cement bentonite grout. The grout is commonly pumped through a tremie pipe inside the well. Abandonment in place can be considered when no cross-contamination can occur between various zones and contamination can not enter from the surface.

Certain conditions may require perforating prior to grouting the well in place. Such conditions include excess sand pack interval (i.e., behind blank casing), and/or intervals of poor cement seal (as determined from a cement bond log run inside the casing). The grouting is then conducted in successive stages across the perforated intervals. Microfine grout facilitates the passage of grout from the well into the surrounding borehole to provide a good seal. In other instances, the regulatory agencies may require in-place abandonment be conducted using pressure grouting techniques.

Removal of the well materials is most commonly performed by overdrilling. Hollow stem auger drilling is most commonly used, but air rotary drilling with a washover casing, and drilling with a tricone bit are other options. The drill string size is selected so that the inside

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diameter of the drill string is slightly greater than the well casing and screen. Using hollow stem augers as an example, the auger is centered over the casing with the center plug and pilot bit removed, or a small guide plug inserted in the casing. The cement seal, bentonite seal, and sand pack is then drilled out with the augers as they are advanced or washed over the well casing and screen. Once the cement seal, bentonite seal, and sand have been drilled out and circulated to the surface, the well casing and screen are then pulled from the hole. The remaining boring is then usually sealed with a tremied cement grout.

The above methodologies also commonly incorporate the removal of the well head and surface completion materials down to a pre-specified depth. The surface is then sealed and a permanent marker or monument may also be emplaced at the surface.

Any of the above methodologies are effective in rendering the wells inoperable and preventing them from becoming conduits for enhanced vertical transport.

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3.0 RESPONSIBILITY MATRIX

3.1 Site Manager

The Site Manager is responsible for ensuring that all abandonment activities are conducted and documented in accordance with this SOPP and any other appropriate procedures. This will be accomplished through staff training and by maintaining quality assurance/quality control (QA/QC).

3.2 Field Team

All field team members assigned to borehole and well abandonment activities are responsible for completing their tasks according to specifications outlined in this SOPP and other appropriate procedures. All staff are responsible for reporting deviations from the procedures to the Site Manager or Task Manager.

3.3 Site Contractor Quality Control Systems Manager (CQCSM)

The CQCSM is responsible for periodic review of field generated documentation associated with this SOPP. The CQCSM is also responsible for the implementation of corrective action (i.e., retraining personnel, additional review of work plans and SOPPs, variances to the abandonment requirements, issuing nonconformances, etc.) if problems occur.

4.0 DEFINITIONS

Borehole Abandonment - The process whereby boreholes or soil borings are grouted or sealed following completion of drilling, sampling and/or logging.

Bridging - The process where material poured or dropped from the ground surface down a borehole or tremie pipe jams and causes a blockage. This impedes the material from reaching the bottom of the borehole.

Casing splitter - A device attached to the drill string that breaches the well casing allowing communication between the inside of the well and the annular space.

Grout - sealing material that is composed of cement, bentonite, or a cement-bentonite mixture.

Native material - Naturally occurring geologic materials found at the site.

Overdrilling - Drilling where the existing well passes up the inside diameter of the drill string and the material in the annular space is removed from the boring.

Perforation - a breach (slot or hole) created in the well casing to allow communication between the inside of the well and the annular space.

Plugging - The process of placing a material in the well or borehole that has a lower hydraulic conductivity than the surrounding geologic formation.

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PVC - Polyvinyl chloride is the material of which monitoring wells are constructed.

Tremie Pipe - a pipe that is inserted into a well or borehole to transport grout or other well materials from the ground surface to a specified depth. The specification of a side-exiting tremie pipe is often made. A side exiting tremie pipe has a fitting on the end that causes the material being pumped through the tremie pipe to exit in a lateral direction.

Well Abandonment - For the purposes of this SOPP "well abandonment" will refer to the abandonment of groundwater monitoring wells only. Well abandonment is the process of formally destroying the well such that it may never be used again.

5.0 TEXT

5.1 Required Records And Forms

1. Field Activity Daily Log (FADL)
2. Site-Specific Field Sampling Plan
3. Well Abandonment Forms (Well Abandonment Procedures Attachment 1)
4. Site Specific Health and Safety Plan
5. Installation-Wide Safety and Health Plan
6. Appropriate Standard Operating Procedures

5.2 Required Materials, Equipment, Or Supplies

1. Indelible black-ink pens and markers
2. Copies of the Well Construction form and/or boring log.
3. Latex or Nitrile gloves
4. Decontamination equipment and supplies
5. Personal protective clothing and gear
6. Drill Rig with appropriate drill rods, bits, and tools
7. Grout Mixing Equipment
8. Grout Pumping Equipment
9. Tremie Pipe equipped with a side-discharging tip
10. Bentonite
11. Portland Cement (ASTM Type I or Type II)

5.3 General Requirements

This section contains responsibilities, procedures and requirements for borehole and well abandonment. Abandonment procedures to be used at a particular site must incorporate project-specific regulatory requirements. Consequently, the Work Plan will identify the following:

- Abandonment objectives
- Boreholes to be abandoned
- Monitoring wells to be abandoned
- Specific procedures for borehole and well abandonment beyond those covered in this SOPP.

- Applicable site-specific regulatory requirements for monitoring well abandonment

5.4 Specific Requirements for Abandonment of Boreholes

Methods of borehole abandonment differ based on the diameter of the boring and the material into which the boring is completed. Soil borings that are of small diameter (e.g., hydropunch) will be backfilled with bentonite pellets; larger diameter soil borings (e.g. auger holes) will be backfilled with the cuttings from that location; and boreholes that extend into rock and are not completed as wells will be grouted to the surface.

5.4.1 Hydropunch Boreholes

1. Upon removal of the direct push rods from the soil, the open borehole will be filled with bentonite pellets. These pellets will be dropped from the surface and allowed to fall by gravity; therefore, care should be taken to assure that the feed rate of the bentonite pellets is sufficiently slow to avoid bridging.

2. The bentonite pellets will be inserted into the borehole until they reach the surface.

3. If the boring is completed into asphalt or cement (e.g. parking lots or sidewalks, or runways) The upper 1 foot of the boring will be completed with a like material. For example, if the boring was advanced through an asphalt parking lot, the upper 1 foot will be completed with asphalt patching material.

5.4.2 Auger Boreholes

1. Upon removal of the augers from the open borehole, the soil cuttings will be used to backfill the borehole. Because the soil is dropped from the surface and allowed to fall by gravity, care should be taken to assure that the feed rate of the soil is slow to avoid bridging.

2. The soil will be shoveled into the borehole until the tamped soil is at the ground surface.

3. If the boring is completed into asphalt or cement (e.g. parking lots or sidewalks, or runways). The upper 1 foot of the boring will be completed with a like material. For example, if the boring was advanced through an asphalt parking lot, the upper 1 foot will be completed with asphalt patching material.

5.4.3 Bedrock Boreholes

1. Using a decontaminated weighted tape, measure the total depth of the borehole.

2. Calculate the volume of the borehole using the formula found in MW and Borehole Abandonment Procedures Attachment 1. This calculation should

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be performed on the FADL. This volume will be useful to determine the volume of neat cement needed and should be compared to the volume of cement actually used to document that bridging did not occur.

3. Mix the neat grout to be used for sealing the well. Neat grout is a mixture of Portland American Society for Testing and Materials (ASTM) Type I or II cement, water, and bentonite. Type II cement should be used in applications where the groundwater contains high concentrations of dissolved sulfates. The organic-free bentonite (granular) will be added at a rate of 2 to 5 pounds of bentonite per 94 pound sack of cement to produce a grout that is 2 to 5 % bentonite by weight. This will be mixed with 5 to 7.5 gallons of water to create a pumpable slurry. Refer to the table in Attachment 2 to determine exact grout volumes for differing bentonite/water/cement ratios.

4. Measure the grout weight using a mud balance if available. The weight will be recorded on the FADL.

5. Assemble and insert a decontaminated tremie pipe with a side-discharging tip into the borehole.

6. When the grout is thoroughly mixed begin pumping the grout down the tremie pipe. The tremie pipe should be raised as the borehole fills with grout; however, the tip of the tremie pipe should remain submerged in the top of the grout column.

7. Raise the drill casing as the boring fills with grout. The casing should be slowly extracted during grouting such that the bottom of the casing does not come above the top of the grout column.

8. The rise of the grout column should also be visually monitored or sounded with a weighted tape.

9. In the event that highly cavernous bedrock conditions are encountered and there is significant grout loss, additional measures may be taken. These may include, but are not limited too: addition of bentonite pellets to plug the borehole, use of additives such as calcium chloride to speed up the grout setting time, use of grout baskets or the addition of lost-circulation materials to plug the borehole. All of these procedures may be used to plug the borehole so that it can be grouted according to the procedures listed in steps 1-8.

10. During the grouting process, the drilling hands performing the task should be supervised to assure that potentially contaminating material (oil, grease, or fuels from gloves, pumps, hoses, et. al) does not enter the grout mix and that personnel are properly wearing personal protective equipment as specified in the project Health and Safety Plan.

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11. After grouting, barriers should be placed over grouted boreholes as the grout is likely to settle in time, creating a physical hazard. Grouted boreholes will typically require at least a second visit to "top off" the hole. Repeat visits as necessary.

12. The surface hole condition should match the pre-drilling condition (asphalt, concrete, or smoothed flush with native surface), unless otherwise specified in the project work plans.

5.5 Specific Requirements for Abandonment (destruction) of Wells

The aquifer properties well materials, well construction type, and status and type of contamination at the site should be considered when selecting a method of well abandonment. In general, two methods of monitoring well abandonment are presented here. The first involves leaving the well materials in the ground and either grouting the casing intact or splitting the casing and grouting with microfine grout under pressure. The second method involves the removal of the casing, and well materials (sandpack, bentonite seal, and annular seal) and grouting the remaining boring to the surface.

5.6 Specific Requirements for Pre-Abandonment Activities

Plans for abandonment presented should be reviewed by the field crew. The procedures for the abandonment within the plan should be consistent with applicable regulatory requirements

Certain information may be required prior to the abandonment activities. This information may include the following:

- The subsurface lithology/soil types in the immediate vicinity of the well, as derived from the boring, soil core and/or borehole geophysical logs compiled from the particular well.

- Knowledge of depth to bedrock, cavities/fractures in bedrock or prior well construction problems.

- The well condition information based upon historical or operations records (including sample collection forms) and previous inspection activities (e.g., tape soundings, video camera logging, borehole geophysical logging, etc.).

- The well construction information, including type and diameter of casing and well screen, and depths, composition and thicknesses of sand packs, bentonite seals and cement seals.

- Past analytical results of groundwater samples collected from the well.

5.7 Specific Requirements for In-Place Well Abandonment

Two general methods of in-place well abandonment (cementing) are discussed in this section. One method leaves the well intact and can be used when the construction details of the well are known and the well is known to have a competent annular seal. The second method of in-place abandonment involves breaching the well casing and pumping microfine grout into the well and into the surrounding formation around the well.

5.7.1 In-Place Abandonment with the Casing Intact

1. Upon initiation of abandonment activities, all downhole sampling (e.g., dedicated purge pumps, sample pumps, etc.) and monitoring equipment must be removed from the well.

2. Obtain a measurement of the total depth of the well and compare to the existing well construction information. Record this information on the well abandonment log and the FADL.

3. If granular material (e.g., sand pack, formation sediment, etc.) is believed present inside the well based upon the sounding, a bailer may be run to bottom to attempt to ascertain the type of debris.

4. The granular well debris should then be removed from the well by bailing, pumping or other appropriate techniques.

5. If the condition of the well casing is suspect or of concern it may be advisable to run a video log of the well, if it has not already been done. However, judgment and caution will need to be exercised to prevent sticking the camera inside the well during the video logging.

6. If significant scaling or encrustation of the well is observed the well should then be brushed, cleaned, and the free material removed by pumping or bailing

7. Calculate the volume of the screened interval, as determined from the construction log, using the formula provided in MW and Borehole Abandonment Procedures **Figure 1** of this SOPP. This calculation should be documented on the FADL.

8. Fill the screened interval with clean silica sand so that sand is two feet above the top of the screen. The sand should be poured slowly to ensure that bridging does not occur.

9. Sound the top of the clean silica sand with a decontaminated weighted tape. Record this measurement on the abandonment form and on the FADL. Sufficient time should be allowed to ensure that all of the sand has settled prior to this final measurement.

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10. Add a two-foot-thick bentonite seal above the silica sand. Bentonite pellets are recommended and shall be poured slowly to avoid bridging.

11. Sound the top of the bentonite seal with a decontaminated tape and record this measurement on the abandonment form and the FADL.

12. Allow the bentonite seal to hydrate per the manufacturer's instructions.

13. Mix the neat grout to be used for sealing the well. Neat grout is a mixture of Portland American Society for Testing and Materials (ASTM) Type I or II cement, water, and bentonite. Type II cement should be used in applications where the groundwater contains high concentrations of dissolved sulfates. The organic-free bentonite (granular) will be added at a rate of 2 to 5 pounds of bentonite per 94 pound sack of cement to produce a grout that is 2 to 5 % bentonite by weight. This will be mixed with 5 to 7.5 gallons of water to create a pumpable slurry. Refer to the table in Attachment 2 to determine exact grout volumes for differing bentonite/water/cement ratios.

14. Measure the grout weight using a mud balance. The weight will be recorded on the FADL.

15. Assemble and insert a decontaminated tremie pipe with a side-discharging tip into the borehole.

16. When the grout is thoroughly mixed begin pumping the grout down the tremie pipe. The tremie pipe should be raised as the borehole fills with grout; however, the tip of the tremie pipe should remain submerged in the top of the grout column.

17. The rise of the grout column should also be visually monitored or sounded with a weighted tape.

18. Remove pads, posts and cut off casings to one foot below grade and seal with bentonite or cement grout.

19. After grouting, barriers should be placed over grouted boreholes as the grout is likely to settle in time, creating a physical hazard. Grouted boreholes will typically require at least a second visit to "top off" the hole. Repeat visits as necessary

20. The surface hole condition should match the pre-drilling condition (asphalt, concrete, or smoothed flush with native surface), unless otherwise specified in the project work plans.

5.7.2 In-Place Abandonment with Breached Casing

1. Upon initiation of abandonment activities, all downhole sampling (e.g., dedicated purge pumps, sample pumps, etc.) and monitoring equipment must be removed from the well.

2. Obtain a measurement of the total depth of the well and compare to the existing well construction information. Record this information on the well abandonment log and the FADL.

3. If granular material (e.g., sand pack, formation sediment, etc.) is believed present inside the well based upon the sounding, a bailer may be run to bottom to attempt to ascertain the type of debris.

4. The granular well debris should then be removed from the well by bailing, pumping or other appropriate techniques.

5. If the condition of the well casing is suspect or of concern it may be advisable to run a video log of the well, if it has not already been done. However, judgment and caution will need to be exercised to prevent sticking the camera inside the well during the video logging.

6. If significant scaling or encrustation of the well is observed the well should then be brushed, cleaned, and the free material removed by pumping or bailing

7. Calculate the volume of the screened interval, as determined from the construction log, using the formula provided in MW and Borehole Procedure Attachment 1 of this SOPP. This calculation should be performed on the FADL.

8. Fill the screened interval with clean silica sand so that sand is two feet above the top of the screen. The sand should be poured slowly to ensure that bridging does not occur.

9. Sound the top of the clean silica sand with a decontaminated weighted tape. Record this measurement on the abandonment form and on the FADL. Sufficient time should be allowed to ensure that all of the sand has settled prior to this final measurement.

10. Install a two-foot-thick bentonite seal above the silica sand. Bentonite pellets are recommended and shall be poured slowly to avoid bridging.

11. Sound the top of the bentonite seal with a decontaminated tape and record this measurement on the abandonment form and on the FADL.

12. Allow the bentonite seal to hydrate per the manufacturer's instructions.

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13. Install the casing splitter into the well riser and advance it to a depth 3 to 5 feet above the top of the bentonite seal. This should result in a well casing that is breached on multiple sides at a point near the bentonite seal.

14. Mix microfine grout composed of Portland Cement and bentonite to create a pumpable slurry.

15. Measure the grout weight using a mud balance. The weight will be recorded on the FADL.

16. Pressure grout the casing until grout is returned at the surface.

17. After grouting, barriers should be placed over grouted boreholes as the grout is likely to settle in time, creating a physical hazard. Grouted boreholes will typically require at least a second visit to "top off" the hole. Repeat visits as necessary.

18. The surface hole condition should match the pre-drilling condition (asphalt, concrete, or smoothed flush with native surface), unless otherwise specified in the project work plans.

5.8 Specific Requirements for Abandonment with Well Removal

This section describes basic requirements for monitoring well abandonment by drilling the well out. The drilling technique used depends on the well material. For PVC wells, hollow-stem auger drilling techniques are most commonly employed. For stainless and mild steel casings a washover casing and air-rotary drill rig will be used.

5.8.1 PVC, Teflon, And Other Plastic-Type Casings

1. Upon initiation of abandonment activities, all downhole sampling (e.g., dedicated purge pumps, sample pumps, etc.) and monitoring equipment must be removed from the well.

2. Obtain a measurement of the total depth of the well and compare to the existing well construction information. Record this information on the well abandonment form and on the FADL.

3. If granular material (e.g., sand pack, formation sediment, etc.) is believed present inside the well based upon the sounding, a bailer may be run to bottom to attempt to ascertain the type of debris.

4. The granular well debris should then be removed from the well by bailing, pumping or other appropriate techniques.

5. If significant scaling or encrustation of the well is observed the well should then be brushed, cleaned, and the free material removed by pumping or bailing

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6. If the condition of the well casing or screen is suspect (e.g. parting is suspected) a video log may be run inside the well. If parting of the casing or screen is evident, drilling the well out may not be feasible and abandoning the well in-place may need to be considered as a more viable option.

7. Prepare the site for drill rig access so that the rig can be centered over the well. The lead auger is positioned such that it will wash over the well casing during drilling. A small guide plug may then be positioned through the inside of the auger and into the casing.

8. The cement seal and sand pack are then drilled out by advancing the augers and adding auger joints to the drill string. Drilling should be conducted following procedures specified in applicable drilling method SOPPs and regulatory guidance.

9. Advance the borehole to at least the depth equal to the total depth of the boring containing the well. If possible the overdrilling should continue to 0.5 ft beyond the well. The boring should be cleaned by circulating the augers. This will remove the cement, sand pack and cuttings.

10. The well casing is then removed using casing jacks, drill line or other appropriate methods. If the casing is disconnected during removal it is advisable to suspend and hold the casing with slips. Care should be taken to prevent the remaining casing from falling back into the hole.

11. Using a decontaminated weighted tape, measure the total depth of the borehole.

12. Calculate the volume of the borehole using the formula in Attachment 1. This calculation should be performed on the FADL. This volume will be useful to determine the volume of neat cement needed and should be compared to the volume of cement actually used to assure that bridging did not occur. For rough calculation assume that one 94 Lb. sack of cement (when mixed with 5 gallons of water) will fill approximately one cubic foot of space. The addition of 2 to 5 pounds of granular bentonite (2-5% bentonite by weight) and additional water will change the volumes. A table containing water, cement, and bentonite rations and associated volumes is located in Attachment 2.

13. Measure the grout weight using a mud balance. The weight will be recorded on the FADL.

14. Assemble and insert a decontaminated tremie pipe with a side-discharging tip into the borehole.

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15. When the grout is thoroughly mixed begin pumping the grout down the tremie pipe. The tremie pipe should be raised as the borehole fills with grout; however, the tip of the tremie pipe should remain submerged in the top of the grout column.

16. The rise of the grout column should also be visually monitored or sounded with a weighted tape until undiluted grout is at the surface

17. After grouting, barriers should be placed over grouted boreholes as the grout is likely to settle in time, creating a physical hazard. Grouted boreholes will typically require at least a second visit to "top off" the hole. Repeat visits as necessary.

18. The surface hole condition should match the pre-drilling condition (asphalt, concrete, or smoothed flush with native surface), unless otherwise specified in the project work plans.

19. The final well surface disposition should be completed as stated in the abandonment and/or project work plans.

20. Any problems or unusual conditions observed during the entire abandonment process should be recorded on the FADL. A well abandonment form (Attachment 1) should also be completed for the well during and upon completion of abandonment activities to provide appropriate documentation.

5.8.2 Stainless Steel and Mild Steel Casings

1. Upon initiation of abandonment activities, all downhole sampling (e.g., dedicated purge pumps, sample pumps, etc.) and monitoring equipment must be removed from the well.

2. Obtain a measurement of the total depth of the well and compare to the existing well construction information. Record this information on the well abandonment form and on the FADL.

3. If granular material (e.g., sand pack, formation sediment, etc.) is believed present inside the well based upon the sounding, a bailer may be run to bottom to attempt to ascertain the type of debris.

4. The granular well debris should then be removed from the well by bailing, pumping or other appropriate techniques.

5. If significant scaling or encrustation of the well is observed the well should then be brushed, cleaned, and the free material removed by pumping or bailing

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6. If the condition of the well casing or screen is suspect (e.g. parting is suspected) a video log may be run inside the well. If parting of the casing or screen is evident, drilling the well out may not be feasible and abandoning the well in-place may need to be considered as a more viable option.

7. Prepare the site for drill rig access so that the rig can be centered over the well. Center the well casing inside the washover casing.

8. Advance the washover casing over the well casing using an air-rotary drill rig. The washover casing should be advanced to at least the depth equal to the total depth of the boring containing the well.

9. Remove the washover casing from the borehole.

10. The well casing is then removed using casing jacks, drill line, crane or other appropriate methods. If the casing is disconnected during removal it is advisable to suspend and hold the casing with slips. Care should be taken to prevent the remaining casing from falling back into the hole.

11. Using a decontaminated weighted tape, measure the total depth of the borehole.

12. Calculate the volume of the borehole using the formula in MW and Borehole Procedures Attachment 1. This calculation should be performed on the FADL. This volume will be useful to determine the volume of neat cement needed and should be compared to the volume of cement actually used to that bridging did not occur. Assume that one 94 Lb. sack of cement (when mixed with 5 gallons of water) will fill approximately one cubic foot of space. The addition of 2 to 5 pounds of granular bentonite (2-5% bentonite by weight) and additional water will change the volumes. A table containing water, cement, and bentonite rations and associated volumes is located in MW and Borehole Procedures Attachment 2.

13. Measure the grout weight using a mud balance. The weight will be recorded on the FADL.

14. Assemble and insert a decontaminated tremie pipe with a side-discharging tip into the borehole.

15. When the grout is thoroughly mixed begin pumping the grout down the tremie pipe. The tremie pipe should be raised as the borehole fills with grout; however, the tip of the tremie pipe should remain submerged in the top of the grout column.

16. The rise of the grout column should also be visually monitored or sounded with a weighted tape.

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17. After grouting, barriers should be placed over grouted boreholes as the grout is likely to settle in time, creating a physical hazard. Grouted boreholes will typically require at least a second visit to "top off" the hole. Repeat visits as necessary.

18. The surface hole condition should match the pre-drilling condition (asphalt, concrete, or smoothed flush with native surface), unless otherwise specified in the project work plans.

19. Any problems or unusual conditions observed during the entire abandonment process should be recorded on the FADL. A well abandonment form (Attachment 1) should also be completed for the well during and upon completion of abandonment activities to provide appropriate documentation.

For each well abandoned, the activities, calculations, locations, and materials used should be recorded on the FADL. A well abandonment form will also be completed. Portions of this form are taken directly from existing boring and construction logs and may be completed prior to arriving at the site. The remaining information is to be competed while on site during the abandonment process. Entries to the FADL, or well abandonment form are should be completed in a timely manner. The general guidelines of documentation will be followed. Records generated as a result of this SOPP will be controlled and maintained in the project record files.

5.9 Records

All information pertinent to the collection of sediment samples should be recorded on the FADLs and/or the Sample Collection Forms. At a minimum, the following information shall be recorded in the FADL and abandonment logs.

- Project name (include site name and Longhorn identification number)
- Date and times of activities
- Well locations
- Level of PPE required
- Weather or other environmental conditions
- Equipment used (include serial numbers of field instruments)
- Any deviation to the approved work plan
- Notation of any visitors to the site

6.0 EXCEPTION PROVISIONS

None.

7.0 CROSS REFERENCE

Texas Administrative Code, Title 16, Part 4, Chapter 76, Rule §76.1004, Technical Requirements – Standards for Capping and Plugging Wells that Penetrate Undesirable Water

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or Constituent Zones <http://info.sos.tx.us/pls/pub/readtac$ext.TacPage?sl=R&app=9&p_dir=&p_rloc=&p...>

American Standard of Testing and Materials (ASTM), *Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers*, ASTM Designation D 5092 - 90, published October 1990, reapproved 1995).

ASTM, (1996) Standard Guide pp. Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities, D 5299 - 92.

Driscoll, F. G., 1986, Groundwater and Wells, (second edition, Johnson Division, St. Paul , Minnesota, 1089 pp.

EPA, September 1987, Compendium of Superfund Field Operations Methods, EPA 540/P-87/001a, OSWER 9355.0-14.

EPA, August 1988, EPA Guidelines for Conducting Remedial Investigation and Feasibility Studies under CERCLA, Interim Final OSWER Directive 9355.3-01.

U.S. Environmental Protection Agency (EPA), *Manual of Water Well Construction Practices*,
EPA/570/9-754)()1, 1975.

Hazardous Waste Remedial Action Program, 1996, *Standard Operating Procedures For Site Characterization,* DOE/HWP-1OO, September 1996.

U.S. Army Corps of Engineers, Engineering and Design *Monitoring Well Design, Installation, and Documentation, at Hazardous, Toxic, and Radioactive Waste Sites*, EM 1110-1-4000, November,1998.

8.0 TABLES

None

9.0 FIGURES

Figure 1 - Formulas and other Useful Information
Figure 2 - Well Abandonment Forms (1 coversheet plus 2 pages of forms)

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Monitoring Well and Borehole Abandonment Procedures
Figure 1

Formulas and Other Useful Information

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Formulas and Other Useful Information

Grout Slurry Densities (HAZWRAP, 1996)

Percentage (by weight) Bentonite	Water to Cement Ratio	Minimum Density in Pounds per Gallon	Volume in Ft^3 per Sack of Cement
2	6.0 gal / Sack of Cement	14.7	1.36
3	6.5 gal / Sack of Cement	14.4	1.45
4	7.2 gal / Sack of Cement	14.1	1.55
5	7.8 gal / Sack of Cement	13.8	1.64

Conversions

7.481 Gallons of water in 1 cubic foot (Gallons/7.481) = cubic feet of water
8.345 Pounds per Gallon (Gallons * 8.345) = pounds of *water*

1 SACK OF CEMENT DRY = 0.48 FT^3
1 94 LB SACK OF CEMENT MIXED WITH 5 GALLONS OF WATER = ABOUT 1 FT^3

The formula for calculating the borehole volume is

$$V = [(D^2(()/4](L$$

Where: V = Well volume in cubic feet (ft^3)
D = Well diameter in feet (ft)
L = Length of borehole in feet (ft)

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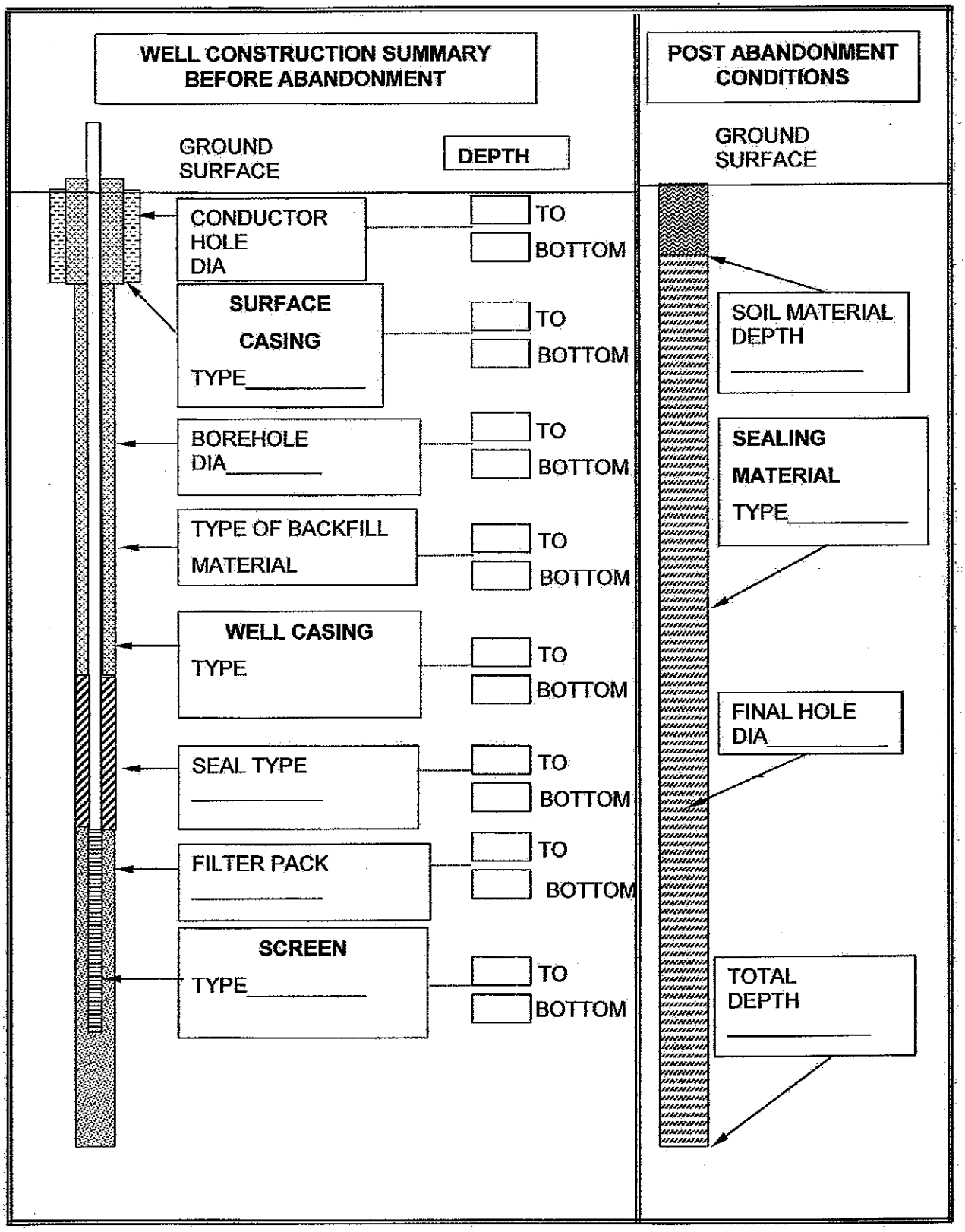
Monitoring Well and Borehole Abandonment Procedures
Figure 2

Well Abandonment Forms

		Well Abandonment Form	
Project:		Well No.	
Client:		Coordinates:	
Project No.		N E	
Date Begun:	Date Completed	Prepared By	Reference Point for Measurements
Well Type: (circle one) Overburden Bedrock Extraction Temporary Other_____		NOTES:	
BEFORE ABANDONMENT		**AFTER ABANDONMENT**	
WELL CONSTRUCTION SUMMARY (SEE DIAGRAM ON BACK OF FORM)		**NO YES N/A** **Concrete Pad Removed** **Protective Posts Removed** **Surface Casing Removed** **Flush Mount Removed** **(SEE DIAGRAM ON BACK OF FORM)**	
Well No.	Location		
TD	Drilled By		
Date Completed	Ground EL.		
	TOC EL.		

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SITE SKETCH


WELL CONSTRUCTION SUMMARY BEFORE ABANDONMENT
POST ABANDONMENT CONDITIONS
GROUND SURFACE
DEPTH
GROUND SURFACE
CONDUCTOR HOLE DIA
TO
BOTTOM
SURFACE CASING
TYPE_____
TO
BOTTOM
BOREHOLE DIA_____
TO
BOTTOM
TYPE OF BACKFILL MATERIAL
TO
BOTTOM
WELL CASING
TYPE
TO
BOTTOM
SEAL TYPE
_____
TO
BOTTOM
FILTER PACK
_____
TO
BOTTOM
SCREEN
TYPE_____
TO
BOTTOM
SOIL MATERIAL DEPTH
_____
SEALING MATERIAL
TYPE_____
FINAL HOLE DIA_____
TOTAL DEPTH
_____

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TITLE 16	ECONOMIC REGULATION
PART 4	TEXAS DEPARTMENT OF LICENSING AND REGULATION
CHAPTER 76	WATER WELL DRILLERS AND WATER WELL PUMP INSTALLERS
RULE §76.1004	**Technical Requirements--Standards for Capping and Plugging of Wells and Plugging Wells that Penetrate Undesirable Water or Constituent Zones**

(a) All wells which are required to be plugged or capped under Texas Occupations Code Chapters 1901 and 1902 or this Chapter shall be plugged and capped in accordance with the following specifications:

(1) all removable casing shall be removed from the well;

(2) any existing surface completion shall be removed;

(3) the entire well pressure filled via a tremie pipe with cement from bottom up to the land surface ;

(4) In lieu of the procedure in paragraph (3) of this section, the well shall be pressure filled via a tremie tube with clean bentonite grout of a minimum 9.1 pounds per gallon weight followed by a cement plug extending from land surface to a depth of not less than two (2) feet, or if the well to be plugged has one hundred 100 feet or less of standing water the entire well may be filled with a solid column of 3/8 inch or larger granular sodium bentonite hydrated at frequent intervals while strictly adhering to the manufacturers' recommended rate and method of application. If a bentonite grout is used, the entire well from not less than two (2) feet below land surface may be filled with the bentonite grout. The top two (2) feet above any bentonite grout or granular sodium bentonite shall be filled with cement as an atmospheric barrier.

(5) Undesirable water or constituents shall be isolated from the fresh water zone(s) with cement plugs and the remainder of the wellbore filled with neat cement or clean bentonite grout of a minimum 9.1 weight followed by a cement plug extending from land surface to a depth of not less than two (2) feet.

(b) Large hand dug and bored wells 36-inches or greater in diameter to one hundred (100) feet in depth may be plugged by back filling with compacted clay or caliche to surface. All removable debris shall be removed from the well. If the well contains standing water, it shall be chlorinated by adding chlorine bleach at a rate of one (1) gallon of bleach for every five hundred (500) gallons of standing water. Leave mounded to compensate for settling.

(c) Wells which do not encounter groundwater (dry holes) may be plugged by backfilling with drill cuttings from total depth to within two (2) feet of the surface; where a two (2) feet cement plug shall be poured.

(d) Drillers may petition the Department, in writing, for a variance from the methods stated in subsection (a) of this section. The variance should state in detail, an alternative method proposed and all conditions applicable to the well that would make the alternative method preferable to those methods stated in subsection (a) of this section.

(e) A non-deteriorated well which contains casing in good condition and is beneficial to the landowner can be capped with a covering capable of preventing surface pollutants from entering the well and sustaining weight of at least four hundred (400) pounds and constructed in such a way that the covering cannot be easily removed by hand.

Source Note: The provisions of this §76.1004 adopted to be effective November 8, 2001, 26 TexReg 8814; amended to be effective December 1, 2003, 28 TexReg 10468

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SHAW STANDARD OPERATING PROJECT PROCEDURE

LONGHORN ARMY AMMUNITION PLANT

ATTACHMENT 12

Subject: SCREENING LEVEL METALS ANALYSIS USING A PORTABLE X-RAY FLUORESCENCE INSTRUMENT

1.0 SCOPE AND APPLICATION

The following standard operating procedure (SOP) describes the steps required to use a portable X-ray Fluorescence (XRF) instrument for the screening level analysis of metals in soils and sediments. The SOP is based on the Draft U.S. Environmental Protection Agency (EPA) SW-846 Method 6200 (1996 and 1998) with minor modifications based on Shaw Environmental, Inc.'s (Shaw) experience. The SOP is applicable to in situ and ex situ analysis of samples for the detection and quantification of XRF target metals (**Table 1**). Data from XRF analysis using this SOP is considered to be "screening level" only and is useful for initial screening and contaminant delineation. "Screening level" data generated by the XRF should not be used for risk assessments or waste disposal. Matrix effects, lack of sample preparation, and interferences may affect comparability with fixed-base laboratory methods for metals analysis.

The detection limits achieved with the XRF are dependent on the analyte of interest, the type of detector, the strength of the source, count times, matrix affects, and interferences. **Table 1** summarizes the detection limits that are typically achievable in "blank" soil matrices (i.e., silica sand). Actual detection limits in site soils may be higher.

This SOP is prepared specifically for the Niton XRF instrument. The general approach described in the procedure is also applicable to other instruments with modification for their particular equipment specifications and requirements. In all cases, the instrument manufacturer's directions and instructions will be followed.

Use of this SOP should be restricted to personnel trained and knowledgeable in the operation of an XRF instrument or under the supervision of personnel who are trained and knowledgeable in the operation of an XRF instrument.

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4.4 Chemical Matrix Effects
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Table 1 - List of XRF Analytes and Instrument Detection Limits
Attachment A - Field Forms

3.0 RESPONSIBILITY MATRIX

3.1 Site Manager

The Site Manager is responsible for ensuring that field activities are completed to meet the project objectives, that they are conducted in accordance with the project plans and requirements, and that all activities are performed according to the respective procedures. The site manager is responsible for ensuring that all site personnel are trained in the procedures, that the procedures are adhered to, and that all activities are documented.

3.2 Field Technician (Analyst)

The Field Technician or Analyst is responsible for conducting appropriate calibration on instrumentation and documenting all field activities. As part of the Field Technician's specialized training and expertise, he/she will incorporate the needs of the project and the objective of the XRF measurement in completing the screening analysis and fulfilling project requirements.

3.3 Site Contractor quality Control systems Manager (CQCSM)

The Site CQCSM is responsible for ensuring that this procedure is correctly implemented and that data collected meet the requirements of the contract.

4.0 METHOD SUMMARY

4.1 Principles of Operation

XRF is a nondestructive qualitative and quantitative analytical technique used to determine the metal components of samples. The XRF uses a sealed radioisotope source to irradiate samples with x-rays. The atom either absorbs or reflects the x-rays. When an atom absorbs the source x-rays, a shifting of electrons occurs between electron shells. The rearrangement of electrons results in the emission of x-rays, or fluorescence. Each element emits a characteristic x-ray line spectrum. The element may be identified by the energy of the wavelength. Fluorescent and reflected (backscattered) x-rays enter through a detector window where their energies are converted to electric pulses. The number of counts at a given energy per unit of time is representative of the analyte concentration. An onboard data processor converts the detector signals into useable information: elements present, their concentrations in parts-per-million, and the standard deviation (error) of the measurement.

4.2 Sample Preparation

Sample preparation is dependent on the mode of analysis. For samples analyzed in the field, rock and vegetative matter will be removed as the sample is homogenized. If any metal debris (such as bullets or bullet fragments) are present in the sample, they will be identified by the analyst and removed. The amount and type of metal debris observed will be recorded on the sample analysis form.

For samples analyzed in a laboratory environment: (a) rock, vegetative matter, and metal debris will be removed as the sample is homogenized; (b) an aliquot of sample will be placed in a disposable, oven-safe container and dried; (c) after cooling, the sample will be crushed with a ceramic pestle if necessary, and passed through a ASTM No. 10 (2-mm) wire mesh sieve and onto a piece of wax paper. After sieving, samples may be analyzed directly in a pile or placed into plastic XRF cups and sealed using Kapton or Mylar film supplied by the instrument manufacturer.

4.3 Sample Analysis

Sample analysis begins by exposing the sample to primary radiation from the source. The soil faceplate is placed over the mounded sample pile or cup so that the XRF window is directly over a representative portion of the sample.

If analyzing a sample pile, the analyst will ensure the protective faceplate is in stable contact with the pile and mount the instrument on top of the faceplate so that the instrument window and the faceplate window are properly aligned. The analyst will initiate the analysis by pressing the shutter lock release mechanism as he presses the instrument down against the faceplate. The shutter plunger will fully retract as the shutter opens and the analysis begins. To ensure that the analysis continues for the allotted count time, the analyst will use a weight to secure the instrument in the "on" position. To end the analysis, the analyst will remove the weight and raise the instrument slowly from the faceplate. The XRF plunger will engage and close the shutter.

If analyzing a sample prepared in an XRF cup, the cup will be inserted into the well on the XRF analysis platform so that its film window is face up. The instrument will be mounted on top of the platform and the analysis started by pressing the shutter lock release while pressing the XRF down onto the platform. The XRF is held in place by engaging the platform bracket which holds the instrument down in the "on" position. To end the analysis, the platform bracket is released while raising the instrument off the platform. This action causes the XRF plunger to engage and closes the shutter.

During the analysis, the instrument will constantly update its display to show the elapsed count time of the run, the concentration and standard deviation of the metals detected, and the detection limit of the metals which are not detected. The analyst will monitor this display and discontinue the analysis run when one of the following three conditions are met:

- A specific count time has passed
- If the analyte(s) of interest is detected, the standard deviation of the measurement has decreased to an appropriate level
- If the analyte(s) of interest are not detected, the reported detection limit has decreased to an appropriate level

The needs of the project and the objective of the XRF measurement will be taken into account by the analyst to determine the length of analysis.

5.0 INTERFERENCES

5.1 Physical Matrix Effects

Physical matrix effects result from variations in parameters such as moisture, particle size, uniformity, and homogeneity, and sample position.

5.1.1 Moisture Content

Overall error from moisture is minimal for soil with moisture contents of 5% to 20%. Drying in a commercial toaster or laboratory oven can minimize error. No sample will be analyzed in situ if it contains greater than 20% moisture (i.e., the soil is visually wet or contains any free water). In-the-field measurements can be performed on soil that is dried by squeezing the material through paper towels or coffee filters to remove water from the samples prior to analysis. Alternatively, the sample can be collected in the field and brought into the onsite laboratory for oven drying. If necessary, the samples will be dried for 4 to 8 hours at 120 degrees Celsius (or as needed) to remove moisture.

5.1.2 Particle Size, Uniformity, and Homogeneity

To minimize the analytical error attributable to particle size, uniformity and homogeneity laboratory prepared samples will be crushed, sieved and homogenized as part of the sample preparation process. Crushing will be performed using a ceramic pestle (or soil grinder if needed). Crushed material

will be passed through an ASTM No. 10 (2-mm pore size) standard sieve to remove small rock and debris. Finer size sieves may be used also depending on the project objectives. Once crushed and sieved, the material that passes through the sieve is piled onto a sheet of wax paper where it is homogenized and blended by using a rolling action.

5.1.3 Sample Position

Inconsistent positioning of samples is a potential source of error. The x-ray signal decreases as the distance from the source increases. The window of the XRF should be in direct contact with the faceplate or Kapton/Mylar film window, which should be in direct contact with the sample.

5.2 Chemical Matrix Effects

Concentrations of certain elements interfere with others. The effects may occur as peak overlaps, x-ray absorption, or x-ray enhancement. Common matrix effects include: iron may interfere with the quantification of copper and cobalt, a high lead concentration elevates the detection limit of arsenic, and the presence of vanadium may affect chromium quantification.

6.0 SAFETY

When in the field, the instrument will be operated in compliance with the manufacturer's recommended procedures found in the instrument manual. **Under no circumstances will the XRF's sealed sources be opened, removed, or serviced by the analyst.** If the instrument malfunctions, the manufacturer will be contacted for further instructions.

The safety procedures found in the instrument manual will be explicitly followed. These include:

- Shutter lockout will be engaged when the instrument is not in use.
- The analyst will always be aware of the source position and angle of the x-rays.
- The analyst will operate the instrument only on a stable, flat surface when performing a measurement.
- The analysis area will be separate from other work areas and dedicated to sample preparation and analysis.
- Leak detection testing within the last six months shall be performed on the XRF and certificates of analysis included in the shipping container. Required licensing documentation and storage requirements shall be enforced.
- When the XRF is not in use for long time periods, it will be stored in its original shipping container.

Shaw's health and safety personnel and a certified health physicist have reviewed instrument safety procedures and conducted radioactivity measurements of the Niton XRF while in operation. Human exposure to radiation is typically measured in rems or in one-thousandths of a rem, called millirem (mR). The allowable limit in the U.S. for occupational exposure is

5,000 mR/year for a whole-body or 50,000 mR for shallow penetration of extremities. Exposure from a properly used Niton will be less than 50 mR per year, even if the instrument is used 2,000 hours per year. Therefore, radiation safety badges or dosimetry monitoring are not required if the procedures are followed.

7.0 EQUIPMENT AND SUPPLIES

- XRF analyzer - An XRF analyzer should have four major components: x-ray source, sample presentation device, detector, and data processing and display unit.
- Calibration verification standards (blank soil and certified standard reference materials)
- Spare battery and a charger
- Sampling tools (examples: steel trowel, hand rake, spoon, hand auger)
- Oven-safe drying containers (disposable aluminum pans)
- Ziploc storage bags
- Drying oven
- Kapton/Mylar x-ray window film (supplied by the manufacturer)
- Mortar and pestle
- Sieve and sieve brushes
- Laboratory scoopula
- Waste container (for material that does not pass sieve)
- Indelible marking pens
- Paper toweling, disposable wipes
- Gloves, safety glasses, and dust mask (if crushing and sieving fine dried soils)

8.0 STANDARDS

8.1 Standard Reference Materials

Standard reference materials (SRMs) are prepared soil samples containing certified concentrations of metals in soil or sediment. Typically SRMs are purchased from the National Institute of Standards and Technology (NIST) or commercial supplier such as Environmental Resource Associates (ERA). They are used for accuracy and performance checks of XRF analyses. Three standards containing the analytes of interest at low, medium, and high levels are recommended to verify the instrument performance. Historical concentrations at the site and the concentrations of any project-specific regulatory clean up or remedial goals or action levels of the analytes of interest will be evaluated in the selection of SRMs.

Site-specific SRMs made up of a site soil which are prepared (dried, crushed, and sieved), thoroughly homogenized, and split with fixed-base laboratory for comparison analysis are not typically used to support XRF projects that generate data of "screening level" quality. If sufficient number of analytical replicates (minimum of 3 per sample) is performed at the fixed-base laboratory, the average result may be acceptable to use as a "certified" standard if the replicates agree within a 15% relative standard deviation.

8.2 Blanks

A blank sample of "clean" quartz or silica dioxide sand that is free of any of the analytes of interest at the detection limits is required. Usually this material will be supplied by the instrument manufacturer.

9.0 QUALITY CONTROL

9.1 Data

All field data sheets and quality control data should be maintained for reference or inspection.

9.2 Calibration

Instrument calibration should follow the calibration procedures outlined in the manufacturer's operator's manual. Other than the internal calibration the Niton instrument undergoes during start up or when the instrument is reset, no additional calibration by the analyst is necessary.

9.3 Calibration Verification Checks

A calibration verification is performed using SRMs to check the accuracy of the instrument and to assess the stability and analysis of analytes of interest. Check samples should be analyzed at least at the beginning of each day. Additional checks may be analyzed during the day and at the end of the day. The count time of the calibration check should approximate the analysis time of the field samples.

In general, the measured value for each target analyte should be less than 20% difference (%D) from the certified value. The %D is defined as the absolute difference divided by the average and is expressed as a percent. If the %D falls outside this range, the check should be reanalyzed. If the value is outside the acceptable range again, the analyst should note this condition on the calibration log form. At very low concentrations near in the detection limit, exceedances of the 20% criterion are not uncommon. Depending on the objective of the XRF measurements, the analyst should consider increasing the count time of the verification check (and also the field samples) to determine if the XRF measurement accuracy would improve with increased exposure.

9.4 Blanks

A blank sample of quartz or silica dioxide sand should be analyzed at the beginning of each day. No analytes of interest should be detected above the typical detection limit (**Table 1**).

9.5 Detection Limits

The method detection limit is defined as three times the standard deviation of the results for the low-level standard. The method quantitation limit is defined as ten times the standard deviation of the results for the low-level standard. The XRF reported standard deviation can be decreased by increasing the instrument count time as appropriate to meet the objectives of the work.

10.0 PROCEDURE

Before operating any XRF instrument, consult the manufacturer's manual.

10.1 Instrument Warm-up and Operating Environment

After installing a newly charged battery, turn the instrument on and allow it to warm-up for at least fifteen minutes. The instrument performs best in a dry, temperature-controlled environment. The Niton can be operated in light to moderate rain (as long as the instrument and sample remain dry) and in relatively high ambient temperatures. Caution should be taken to protect the display from direct exposure to strong sunlight (by covering the instrument screen or operating in the shade). If the internal temperature of the Niton XRF exceeds operating specifications, the instrument will show a warning message on the display screen and shut down. If this occurs, the analyst should leave the instrument off and remove the XRF to a lower temperature environment (interior of an air conditioned building or car) for 15 minutes and then restart.

10.2 Internal Calibration

Check the energy level, source strength and XRF clock date/time. Begin the automated internal calibration sequence of the XRF.

10.3 Blank Analysis

After completing a successful internal calibration sequence, analyze a quartz or silica dioxide sand blank. The polyethylene sample cup is placed in the cup receptacle on the instrument base, with the Kapton/Mylar film facing up. The analyst will initiate the analysis by pressing the shutter lock release mechanism while pressing the instrument down against the sample cup. The shutter plunger will be fully retracted as the shutter opens and the analysis begins. The XRF will lock into place and secure the instrument in the "on" position. After a count time of at least 30 seconds, the analysis can be terminated (depending on the desired detection limits of the project). To terminate the analysis run, the analyst will raise the instrument slowly from the base. The XRF plunger will engage, close the shutter, and end the analysis run. Record results on calibration form (Attachment A) or a project-specific form may be used instead.

10.4 Calibration Check Verification

After successful analysis of a blank, analysis of a series three concentration level SRMs is recommended (low, medium and high level) depending on project objectives and the availability of SRMs. The sample cup containing the SRM is analyzed in the same manner as the blank. After a count time of at least 30 seconds, the analysis can be terminated (depending on the desired accuracy and detection limits of the project). Record results on calibration form (Attachment A) or a project-specific form may be used instead.

10.5 Sample Analysis

After successful verification of calibration, sample analysis can begin. Follow the procedures described in Sections 2.2 and 2.3. After a count time of at least 30

seconds, the analysis can be terminated (depending on the desired accuracy and detection limits of the project). Record the analytes of interest on a data form (Attachment A) or a project-specific form may be used instead.

Immediately after analysis, the prepared sample can be archived for up to 6 months at room temperature for later confirmation analysis at a fixed-based laboratory. It is recommended that the sample be secured in a Ziploc storage bag and placed in a cooler for storage for archive. If the sample is to be sent for fixed-base laboratory analysis, then no further processing is necessary. The sample can be transferred into the appropriate sample container for labeling and shipping off site.

Following sample preparation and analysis, all disposable materials that have come in contact with the soil will be discarded appropriately. Materials that are reusable will be decontaminated using brushes, disposable wipes, paper toweling, and air drying.

10.6 Post-Sample Analysis Calibration Check Verification

After analysis of project samples, the calibration should be verified at the end of the analysis cycle to document instrument stability. Repeat step 8.3 in total or use a blank and the low or mid-level SRM. The necessity of this check depends on the project objectives.

11.0 DATA ANALYSIS

Forms. All data from the XRF is manually captured and reported by the analyst using project-specific forms. Forms will be used to record the sample collection, preparation, and analysis and XRF instrument calibration. Attachment A contains example forms.

Electronic Data. The XRF is capable of storing results and spectra for approximately 1,000 samples. Data may be downloaded to a computer in comma delimited, ASCII format and converted to a standard spreadsheet for storage and reporting. Downloads will occur according to project-specific requirements.

12.0 WASTE MANAGEMENT

No liquid waste should be generated from the analysis of soils by XRF. All sample debris, personal protective equipment, and laboratory waste will be collected and disposed in compliance with project-specific waste management practices. Archived soil samples can be held for up to 6 months at room temperature without preservation before disposal.

13.0 REFERENCES

U.S. Environmental Protection Agency (EPA), 1996, Region 1, EPA-New England, *Standard Operating Procedure for Elemental Analysis using the X-MET 920 Field X-ray Fluorescence Analyzer*, October 1996.

U. S. Environmental Protection Agency (EPA), 1998, Test Methods for Evaluating Solid Waste, Physical/Chemical Properties, SW-846, Method 6200, *Field Portable X-Ray Fluorescence Spectrometry for the Determination of Elemental Concentrations in Soil and Sediment*, January 1998.

TABLES

Table 1
List of XRF Analytes and Instrument Detection Limits[a]

Element	Typical Reporting Limits for Each Radioactive Source (mg/kg)		
	Fe-55	Cd-109	Am-241
Sulfur	1,500		
Chlorine	450		
Potassium	160		
Calcium	70		
Titanium	55		
Chromium	90	260	
Manganese		205	
Iron		110	
Cobalt		100	
Nickel		65	
Copper		45	
Zinc		35	
Mercury		30	
Arsenic		25	
Selenium		15	
Lead		15	
Rubidium		5	
Strontium		4	
Zirconium		3	
Molybdenum		4	
Cadmium			50
Tin			85
Antimony			45
Barium			30
Silver			9

[a] Typically achievable in a clean, silica sand matrix. Actual sample detection limits will be higher due to the sample matrix interferences.

mg/kg milligrams per kilogram

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ATTACHMENT A

FIELD FORMS

Shaw
Shaw Environmental & Infrastructure, Inc.

XRF Laboratory Sample Results Form

Project No: 117591 Cost Code:_____

1. General Sample Location and Identification: (circle one): **Grid S.Fan Other**
(if "other" describe):

Sample Loc/Description: _____

_____ _____ _____ to _____
(location) (type) (depth, ft)

Location comments: _____ Date: _____ Time: ____ : ____

Sample Number: _____ Associated QC: _____

2. Sample Preparation:

(Check all that apply)

In situ	Drying	Crushing	Coarse Sieve
(pan prep)	(Temp: ____ C for ___ hrs)		(#10, 2 mm)

Sample Prep Comments / Fragments Observed? _____

3. Analytical Results: **(all units are ppm)**

Measurement Date: _____
Time: _____

Source(s): Cd-109 [X] count: _____ sec
Fe-55 [NA] count: N/A sec
Am-241 [NA] count: N/A sec

	Original Analysis		Dup Analysis*		RPD	
	Conc	Std Dev	Conc	Std Dev	%	Comment
Pb						
Cu						
Ni						
Zn						

* If performed

Other Metals (As, Hg, Cr): _____
Comments: _____

4. Analytical Team:

Form Completed by: _____
Signature Date

Shaw
Shaw Environmental & Infrastructure, Inc.

Page ___ of ___

XRF Calibration Form

Project No: 117591 Cost Code: _____

1. Initial Calibration Data: Date: _____ Check XRF clock.

Is XRF warm-up >15 min? **Yes** **No** Time: _____ Agree? **Yes** **No**

Internal calibration complete? **Yes** **No** Comments: _____

Record energy resolution: _____ eV Source Strength: _____ mCi

2. Start-of-Day Calibration: Note: Cd-109 will be used for Pb, Cu calibration; Am-241 will be used for Sb.

Sources Used (check all that apply): [X] Cd-109 [NA] Fe-55 [NA] Am-241

Blank - SiO_2, Count: ____ sec

Element	Conc (ppm) Certified	Conc (ppm) Detected	< DLs Accept?
Pb	< 25		
Cu	< 50		
Ni	< 70		

Other metals: Zn (<40) _____, As (<30) _____,

Hg(<35) ____, Cr (<300) _____

Moderate Lead-NIST 2711, Count: ____ sec

Element	Conc (ppm) Certified	Conc (ppm) Detected	% RPD Accept?
Pb	1,162		
Cu	114		
Ni	< 70		

Other metals: Zn (350.4) _____ As (105) _____,

Hg (<35) ____, Cr (<300) _____

Low Lead-NIST 2586, Count: ____ sec

Element	Conc (ppm) Certified	Conc (ppm) Detected	% RPD Accept?
Pb	432		
Cu	81 *		
Ni	75 *		

Other metals: Zn (352) _____, As (18.9) ____,

Hg(<35) ____, Cr (301) _____

High Lead-NIST 2710, Count: ____ sec

Element	Conc (ppm) Certified	Conc (ppm) Detected	% RPD Accept?
Pb	5,532		
Cu	2,950		
Ni	14.3		

Other metals: Zn(6,952) _____, As (626) _____,

Hg(32.6) ____, Cr(<300) _____

Comments: * Not a NIST certified value.

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Shaw Environmental & Infrastructure, Inc.

Page ___ of ___

XRF Calibration Form

Project No: 117591 Cost Code:_____

3a. Continuing Calibration Data:			Date: _____	Check XRF clock.	
Is XRF warm-up			Time: _____	Agree?	
>15 min?	**Yes**	**No**	**N/A**	**Yes**	**No**
Internal calibration complete?	**Yes**	**No**	Comments: _____		
Record energy resolution:	_____ eV		Source Strength: _____ mCi		
3b. Continuing Calibration Data:			Date: _____	Check XRF clock.	
Is XRF warm-up			Time: _____	Agree?	
>15 min?	**Yes**	**No**	**N/A**	**Yes**	**No**
Internal calibration complete?	**Yes**	**No**	Comments: _____		
Record energy resolution:	_____ eV				

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Shaw Environmental & Infrastructure, Inc.

Page ___ of ___

XRF Calibration Form

Project No: 117591 Cost Code: _____

4. End-of-Day Calibration: Date: _____ Check XRF clock.

Is XRF warm-up >15 min? **Yes** **No** **N/A** Time: _____ Agree? **Yes** **No**

Internal calibration complete? **Yes** **No** Comments: _____

Record energy resolution: _____ eV Source Strength: _____ mCi

Blank - SiO_2, Count: _____ sec

Element	Conc (ppm) Certified	Conc (ppm) Detected	< DLs Accept?
Pb	< 25		
Cu	< 50		
Ni	< 70		

Other metals: Zn (<40) _____, As (<30) _____,

Hg(<35) ____, Cr (<300) _____

Moderate Lead-NIST 2711, Count: ___ sec

Element	Conc (ppm) Certified	Conc (ppm) Detected	% RPD Accept?
Pb	1,162		
Cu	114		
Ni	< 70		

Other metals: Zn (350.4) _____ As (105) _____,

Hg (<35)____, Cr (<300)_____

Low Lead-NIST 2586, Count: ____ sec

Element	Conc (ppm) Certified	Conc (ppm) Detected	% RPD Accept?
Pb	432		
Cu	81 *		
Ni	75 *		

Other metals: Zn (352) _____, As (18.9) ____,

Hg(<35) ____, Cr (301)_____

High Lead-NIST 2710, Count: ____ sec

Element	Conc (ppm) Certified	Conc (ppm) Detected	% RPD Accept?
Pb	5,532		
Cu	2,950		
Ni	14.3		

Other metals: Zn(6,952) _____, As (626) _____,

Hg(32.6)____, Cr(<300) _____

Comments: * Not a NIST certified value.

Form Completed by:

_____

Signature Date

XRF Summary of Results

LHAAP-_____

Page 1 of 5

Location ID			Sampling Data		Prep			XRF Data		Conc (ppm)					Split to EMAX	Other Comments
Grid Node	Northing	Easting	Date	Time	Pan	Lab	Frag?	Read No.	Count (sec)	Pb	Std	Cu	Std	Other Metals		

XRF Summary of Results
LHAAP-_____
Page 2 of 5

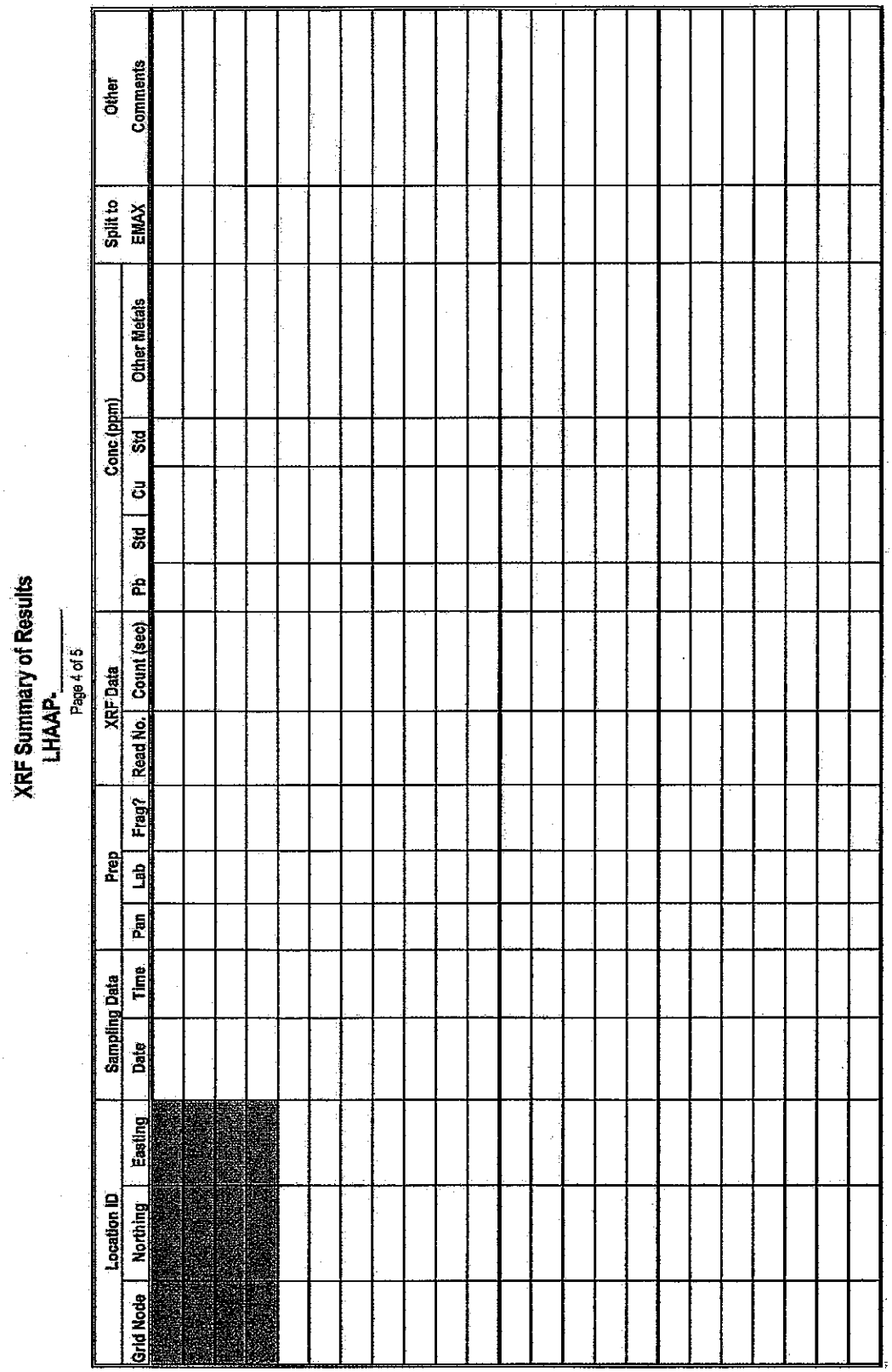
Location ID			Sampling Data		Prep			XRF Data		Conc (ppm)						Split to EMAX	Other Comments
Grid Node	Northing	Easting	Date	Time	Pan	Lab	Frag?	Read No.	Count (sec)	Pb	Std	Cu	Std	Other Metals			

N = 112

XRF Summary of Results
LHAAP-

Page 3 of 5

Location ID			Sampling Data		Prep				XRF Data		Conc (ppm)						Split to EMAX	Other Comments
Grid Node	Northing	Easting	Date	Time	Pan	Lab	Frag?	Read No.	Count (sec)	Pb	Std	Cu	Std	Other Metals				



XRF Summary of Results
LHAAP-
Page 4 of 5

Location ID			Sampling Data		Prep			XRF Data		Conc (ppm)					Split to EMAX	Other Comments
Grid Node	Northing	Easting	Date	Time	Pan	Lab	Frag?	Read No.	Count (sec)	Pb	Std	Cu	Std	Other Metals		

XRF Summary of Results
LHAAP-

Page 5 of 5

Location ID		Sampling Data		Prep			XRF Data		Conc (ppm)					Split to EMAX	Other Comments
Grid Node	Northing	Easting	Date	Time	Pan	Lab	Frag?	Read No.	Count (sec)	Pb	Std	Cu	Std	Other Metals		

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SHAW STANDARD OPERATING PROJECT PROCEDURE

LONGHORN ARMY AMMUNITION PLANT

ATTACHMENT 13

Subject: MONITORING WELL INSTALLATION PROCEDURES

1.0 PURPOSE AND SUMMARY

The purpose of this Standard Operating Project Procedure (SOPP) is to define the requirements for the installation of monitoring wells at Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas. The procedures and equipment requirements contained in this SOPP are subject to modification, based upon project specific requirements and site conditions. Drilling conditions at LHAAP can vary significantly from location to location. The procedures in this SOPP have been modified from multiple guidance documents listed in the reference section to reflect the typical field conditions encountered at LHAAP. The procedures are subject to change if unusual or unanticipated field conditions are encountered; however, all deviations must be approved by one of the following: the LHAAP technical lead or the LHAAP project manager before implementation.

The purpose of monitoring well installation is to provide access to groundwater for collecting samples, as well as for obtaining water levels and other data. Monitoring wells are potential contaminant migration routes between aquifers or from the surface to the subsurface. Construction procedures and standards must ensure that neither passive nor active introduction of contaminants can occur. Properly installed hydraulic seals and locking well covers reduce the potential for cross-contamination of monitoring wells.

2.0 TABLE OF CONTENTS

1.0 Purpose and Summary
2.0 Table of Contents
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- 3.1 Site Manager
- 3.2 Field (or rig) Geologist
- 3.3 Site Contractor Quality Control Systems Manager (CQCSM)

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5.0 Text
- 5.1 Required Records and Forms
- 5.2 Required Material, Equipment, or Supplies
  - 5.2.1 Drilling Subcontractor Equipment
  - 5.2.2 Field Geologist Equipment
- 5.3 General Materials Requirement
- 5.4 Specific Requirements for Monitoring Well Installation
  - 5.4.1 Installation of Overburden (Residuum) Monitoring Wells
  - 5.4.2 Installation of Interface and Bedrock Monitoring Wells
  - 5.4.3 Surface Completions
    - 5.4.3.1 Above Ground Surface Completions
    - 5.4.3.2 Flush Mount Well Completion

5.5 Special Considerations
5.6 Records
6.0 Exception Provision
7.0 Cross Reference
8.0 Tables
9.0 Attachments

3.0 RESPONSIBILITY MATRIX

3.1 Site Manager

The Site Manager is responsible for ensuring that field personnel are properly trained in monitoring well installation and for verifying that monitoring wells are installed in accordance with this SOPP. Some projects may have site-specific sampling plan attachments (work plan) or a drilling subcontractor Statement of Work (SOW). In general, these documents will take precedence over the SOPP.

3.2 Field (or rig) Geologist

The field geologist is responsible for documenting that the drilling subcontractor complies with the procedures and equipment requirements contained in this SOPP. The field geologist is responsible for recording all information relevant to the construction and materials used in monitoring well installation. All phases of well construction and installation, with the exception of surface completions, require oversight by the Shaw field geologist. If a field geologist or other authorized Shaw representative is not present for the surface completion activities, the surface completions shall be inspected after installation to document that criteria set forth in this SOPP or other project specific documents such as a SFSP or SOW are met. Any deviations from this SOPP, or the site specific work plan, or the subcontractor's SOW require approval from either the technical lead or project manager. All deviations shall be documented in writing.

3.3 Site Contractor Quality Control Systems Manager (CQCSM)

The Site CQCSM is responsible for ensuring that this procedure is correctly implemented and that data collected meet the requirements of the contract.

4.0 DEFINITIONS

Bentonite. Swelling of clay minerals, commonly sodium montmorillinite, that are used as a sealing material and are added to cement to create neat grout. Bentonite is typically found in the forms of granular

Filter Pack. Sand and gravel that is smooth, uniform, clean well rounded, and siliceous. It is placed in annulus of the wall between the borehole wall and the well screen to prevent formation material from entering the well screen.

PID. Photoionization detector

FID. Flame ionization detector

Tag. Tag is a measurement below ground surface to the top of the item being measured (e.g. tag the top of the sandpack).

Shallow monitoring well. A monitoring well with a monitoring interval (top of filter pack to base of filter pack) installed completely in the shallow zone at LHAAP (base approximately 15-25 feet bgs).

Intermediate monitoring well. A monitoring well with the monitoring interval straddling the intermediate zone at LHAAP (base approximately 30-40 feet bgs).

Deep monitoring well. A monitoring well with the monitoring interval (top of filter pack to base of filter pack) in the deep zone at LHAAP (base approximately 70-90 feet bgs).

5.0 TEXT

5.1 Required Records And Forms

1. HASP
2. Field Activity Daily Logs (FADL)
3. Boring log
4. Well construction form.

5.2 Required Materials, Equipment, or Supplies

5.2.1 Drilling Subcontractor Equipment

Potential equipment for monitoring well installation includes but is not limited to the following:

1. Drilling or augering equipment appropriate to site conditions, drilling depth, and other project requirements.
2. Drill bits appropriate for the expected rock type(s) to be encountered.
3. Sufficient threaded flush-joint riser pipe. Currently, Schedule 40 PVC is the accepted riser material. (Note: No glues are permitted.)
4. Sufficient threaded flush-joint continuous slot Schedule 40 PVC well screen. (Note: No glues are permitted). Prepack screens may be required at some locations. Well screens are typically of the slot size 0.010 (10 slot). The typical length is 10 feet, however, some wells may contain a longer screened interval, depending upon the purpose and location of the monitoring well.
5. Properly sized and washed filter pack material (# 1 quartz sand) in sufficient volume to meet the required well design criteria)
6. Bentonite or polymer-bentonite pellets, chips, or granules.
7. Powdered bentonite.
8. Portland cement [American Society for Testing and Materials (ASTM) Types I or II].
9. Black carbon steel surface casing (if required).
10. Steel protective casing with locking cap or flush mount junction boxes with manhole covers.

11. Tremie pump/box and pipe.
12. Steel or aluminum protective casing with locking cap or flush mounted junction boxes with manhole covers.
13. Grout baskets.
14. Centralizers.
15. Mud balance.
16. Grout mixer and pump (may be combined with tremie equipment).
17. Assorted tools (wrenches, shovels, etc.).
18. Personal protective clothing, as required by the site-specific health and safety plan.
19. Stainless steel weighted tape.
20. Decontamination supplies.

5.2.2 Field Geologist Equipment

- Straight edge or engineering ruler
- Calculator
- Munsell soil color charts
- Water level indicator
- Surveyor's measuring tape with weight for tagging depths of installed well materials
- Required Health and Safety Equipment- PPE, monitoring equipment cell phone or radio

5.3 General Materials Requirement

Monitoring wells that are installed are typically constructed of the materials listed below. This list of materials is subject to modification, based upon project specific requirements and objectives.

Casing (riser) and sump: 4-inch diameter Schedule 40 Polyvinyl Chloride (PVC). with threaded ends Casing length is dependent upon the completion depth of the borehole.

Well screen: 4-inch diameter Schedule 40 PVC continuous wrap screen, with threaded ends. Typical screen length is 10 feet, however the length may vary depending on the specific project objectives.

Surface casing: (For bedrock well installation) 6-inch inside diameter steel casing. The length of surface casing will depend upon depth to bedrock and project specific objectives.

Filter pack: - # 1 sand or equivalent.

Bentonite: 1/8 inch or ¼ inch diameter pellets. Bentonite chips are not acceptable for annular seal material.

Grout: - the grout mixture should consist of Portland cement, powdered bentonite, and potable water in the following proportions: for each 94-pound sack of Portland cement, add 2-5% (approximately 2 to 5 pounds) powdered bentonite, and 6 ½ to 7 gallons of potable water. Certain field conditions, such as highly solutioned or fractured bedrock, may require that accelerants, such as calcium chloride be added to reduce the grout curing time.

Well caps: - expanding well caps.

Locks: - well locks will be installed.

Surface Completion: - either stickup completion with protective steel casing or flush mounted.

5.4 Specific Requirements for Monitoring Well Installation

The typical drilling method for overburden monitoring wells is hollow stem augering. The inside diameter of the augers should be at least 4 inches greater than the outside diameter of the well materials.

5.4.1 Installation of Shallow Monitoring Wells

The typical drilling method for shallow monitoring wells at LHAAP is hollow stem augering. The inside diameter of the augers should be at least 4 inches greater than the outside diameter of the well materials.

1. When the total depth (TD) of the borehole is reached, the borehole should be cleaned out to remove excess drill cuttings. Because the overburden materials are primarily fine-grained silts and clays, care should be taken to prevent sealing of the borehole by excessive raising and lowering of the augers. Installation of the well should begin within 12 hours of reaching TD, except when if it is necessary to pull up the augers slightly to determine the static water level prior to setting a well Record the borehole TD and the depth to water prior to installation of well materials. Verify that the measured TD is desired completion depth. If the hole has partially collapsed or heaved, options for cleaning, redrilling, or installation in the open section of the borehole should be discussed with the task manager or technical lead.

2. In the event that the well completion depth is desired across an interval depth less than the total depth, the well should be plugged to the base of the desired interval, grout, bentonite pellets, or bentonite chips as specified by the work plan may be added to the bottom of the boring to raise the bottom of the hole to the desired depth. The grout should be pumped through a tremie pipe and fill from the bottom of the boring upward. During grouting, the tremie pipe should be submerged below the top of the grout column in the borehole to prevent free-fall and bridging. Well installation will not commence until the grout has cured, approximately 24 hours. Curing of the grout will be verified by a "hard tag". Generally, an

overnight curing period will be sufficient for an adequate cure. If bentonite is used, it should be added gradually to prevent bridging. Grout or bentonite addition will stop when its level has reached approximately one foot below the bottom of the desired string depth. A fine sand layer should be placed immediately above the bentonite/grout plug prior to filter pack placement. The bentonite plug will be hydrated for at least one hour before installation of a filter pack.

3. Verify the cleanliness of the well materials to be installed. If the materials are precleaned, wrapped in polyethylene bags, and documentation of precleaning is confirmed, then decontamination is not necessary. If the wrappings are not intact, and/or precleaning cannot be documented, then the well materials shall be decontaminated in accordance with SOPP 3.0.

4. Determine if the surface completion of the well will be above ground or flush mount to calculate the quantity of well riser required. Assemble the well string (sump, screen, and riser) by screwing together the various sections according to the manufacturer's instructions. No solvents or glues are to be used to assemble the sump, screen, and casing. All well materials shall be handled with clean latex or nitrile gloves or comparable substitutes. The well materials will be installed inside the augers. There should be a minimum of 6 inches and a maximum of 3 feet below the bottom of the well sump and the bottom of the borehole. Centralizers are required for wells with depths exceeding 50 feet bgs. At a minimum, centralizers shall be placed below the well screen, above the top of the bentonite seal. and every 30 to 50 feet thereafter. The Shaw field geologist shall record the location of all centralizers on the well construction diagram and the field notes.

5. Carefully lower the well string through the inside of the augers until the well string is at the desired depth. The well string should be suspended by the drill rig and should not rest on the bottom of the boring. In the event that the well string was dropped, lowered abruptly, or for any other reason is suspected of being damaged during placement, the string should be removed from the boring and inspected. In certain instances, the well string may rise after being placed in the borehole due to heaving sand. If this occurs, the driller must not place any drilling equipment, (drill pipe, hammers, etc.) to prevent the wellstring from rising. The amount of rise should be noted by the rig geologist who should then consult the Shaw task manager, technical lead, or project manager for an appropriate course of action. The field geologist shall document the start and finish time for installation of the well string and depths of sump, well screen, and riser.

6. Filter pack may be placed in the well annulus through the augers by gravity if the borehole is less than 50 feet deep. The filter pack should be poured from both sides of the augers to ensure an even distribution of filter pack material in the annulus. In wells greater than 50 feet or the water in

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the borehole has abundant silt and clay sized particles, the filter pack will be by the tremie method. The augers will be pulled up as the filter pack is installed for settling below the well and against the borehole walls. The filter pack will extend from the bottom of the borehole to 3 to 5 feet above the top of the screen unless otherwise specified in the drilling plan. The filter pack location shall not cross any confining layers. Periodic tagging of the filter pack during installation is recommended to prevent overfilling of the annulus. The field geologist shall document the quantity of filter pack used and compare the actual volume and calculated volume. Significant discrepancies between actual and calculated filter pack volumes should be explained as well as possible (loss of formation, borehole sloughing, etc.). Surging with a surge block may be used to compact the filter pack around the well screen. A minimum of 15 minutes between completion of the filter pack installation and initiation of the bentonite placement shall be observed to allow for settling of any filter pack through the water column. When installation of the filter pack is complete, both the drilling subcontractor and the Shaw field geologist shall tag and record the depth to the top of filter pack. Additional filter pack will be added as necessary until the necessary volume is emplaced. The Shaw rig geologist shall document base of filter pack, top of filter pack, and start and finish times for filter pack installation.

7. Bentonite pellets will be placed in the well annulus above the filter pack through the augers by gravity if the borehole is less than 50 feet deep. If the borehole is greater than 50 feet deep, the bentonite pellets should be installed by the tremie method. The bentonite should be added slowly and tamped to prevent bridging. If the augers have been removed completely from the borehole, the bentonite will be emplaced by the tremie method. A bentonite seal placed above the water table will be installed in 6-inch lifts, with each lift being hydrated and allowed to sit 15 minutes before the next lift is installed. A minimum of 3 feet to a maximum of 5 feet of bentonite will be placed in the annular space between the borehole and the well casing. The field geologist shall document the quality of bentonite used, the manufacturer, lot number, and compare the actual volume versus the calculated volume. Potable water shall be added to the borehole to hydrate bentonite emplaced above the water table. If approved by the Shaw task manager, technical lead, or project manager, a bentonite slurry, such as Volclay grout, may be used for seals above the water table. The manufacturer's instruction should be consulted to determine the optimal hydration time required. At a minimum, hydration time for the bentonite seal will be 8 hours. The top of the bentonite seal shall be tagged and recorded by the drilling subcontractor and the Shaw field geologist after installation and after hydration. Six-inches of fine filter sand may be placed above the bentonite seal to prevent grout infiltration. The field geologist shall document the base of the bentonite seal, top of the bentonite seal, and start and finish times for bentonite placement.

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8. After the bentonite seal has hydrated, the top of the seal should be tagged again to document the amount of swelling after hydration. The post-hydration measurement will be recorded on the well construction diagram as the top of the bentonite seal. The grout mixture will be mixed as specified in Section 5.0 of this SOPP, and pumped through a tremie pipe with a side discharge port from the top of the bentonite seal upward. The side discharge is required to prevent damage to the bentonite seal and/or the filter pack. The bottom of the tremie pipe should be maintained below the top of the grout to prevent free fall and bridging. Grout the well annulus to within 2 to 3 feet of the surface. The field geologist shall document the quantity of grout added to the borehole and compare the actual volume versus the theoretical calculated volume. Significant discrepancies between actual and theoretical volumes should be explained as well as possible. The base of the grout seal, the top of the grout seal, and start and finish times for grouting shall be documented by the field geologist. After the grout is cured, the top of grout should be measured and recorded again to estimate slumping or loss to the formation.

9. Grout may be required to be placed in lifts (approximately 25 foot/lifts) for deeper wells (>75 feet deep) to minimize the head of the grout and prevent compacting of the bentonite seal and filter pack or grout loss in the aquifer.

10. The grout should cure a minimum of 24 hours before starting surface completions. Requirements for above ground and flush mount surface completions are contained in Section 5.4.3.1 and 5.4.3.2 of this SOPP, respectively.

5.4.2 Installation of Intermediate and Deep Monitoring Wells

Drilling the well boreholes for intermediate or deep wells is done in two phases. The boreholes are advanced through the unconsolidated materials by hollow stem augering or by the mud rotary method. A surface casing is grouted in the aquitard or clay zone below the first shallow water boring zone. Surface casing should extend at least 3 feet into the aquitard. To complete the bedrock borehole, the drill string is advanced inside the surface casing by air or mud rotary method or by coring.

1. When the TD of the borehole is reached, the borehole should be cleaned out to remove excess drill cuttings and to condition the hole. Installation of the well should begin within 12 hours of reaching TD. However, it is recommended that well installation begins immediately, or as soon as reasonably possible after the borehole is cleaned out to avoid collapse of unconsolidated materials in the overburden. Record the borehole TD and the depth to water prior to installation of well materials. Verify that the measured TD is the desired completion depth. If the hole has partially collapsed, options for cleaning, redrilling, or installation in the open

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section of the borehole should be discussed with the technical lead or project manager.

2. In the event that the well completion depth is desired across an interval depth less than the total depth, the well should be plugged to the base of desired interval, grout, bentonite pellets, or bentonite chips may be added to the bottom of the boring to raise the bottom of the hole to the desired depth.

   Well installation will not commence until the grout has cured, approximately 24 hours.

   Grout or bentonite addition will stop when its level has reached approximately one foot below the bottom of the desired well string depth. A fine sand layer should be placed immediately above the bentonite/grout plug prior to filter pack placement.

3. Verify the cleanliness of the well materials. If the materials are precleaned, wrapped in intact polyethylene bags, and documentation of precleaning is confirmed, then decontamination is not necessary. If the wrappings are not intact, and/or precleaning cannot be documented, then the well materials shall be decontaminated in accordance with Attachment 9.

4. Determine if the surface completion of the well will be above ground or flush mount to calculate the quantity of well riser required. Assemble the well string (sump, screen, and riser) by screwing together the sections and tightening according the manufacturer's instructions. No solvents or glues are to be used to assemble the sump, screen, and casing. All well materials shall be handled with clean latex or nitrile gloves or comparable substitutes. There should be a minimum of 6 inches and a maximum of 3 feet below the bottom of the borehole and the bottom of the well sump. Centralizers for wells with depths exceeding 50 feet bgs. Centralizers shall be placed below the well screen, above the top of the bentonite seal, and every 30 to 50 feet thereafter. The Shaw field geologist shall record the location of all centralizers on the well construction diagram and the field notes.

5. Carefully lower the well string until it is at the desired depth. The well string should be suspended by the drill rig and should not rest on the bottom of the boring. In the event that the well string was dropped, lowered abruptly, or for any other reason is suspected of being damaged during placement, the string should be removed from the boring and inspected. In certain instances, the well string may rise after being placed in the borehole due to heaving sand. If this occurs, the driller must not place any drilling equipment, (drill pipe, hammers, etc.) to prevent the wellstring from rising. The amount of rise should be noted by the rig geologist who should then consult the Shaw task manager, technical lead,

or project manager for an appropriate course of action. The field geologist shall document the start and finish time for installation of the well string, and depths of sump, well screen, and riser.

6. The filter pack will be installed by the tremie method, except where cavities or highly fractured intervals are encountered that preclude the placement of a filter pack. At highly fractured intervals and cavities prepack screens should be used.

   The tremie pipe should be moved around the borehole annulus to ensure an even distribution of the filter pack material in the annulus. The filter pack will extend from the bottom of the borehole to 3 to 5 feet above the top of the screen unless otherwise specified in the drilling plan. The filter pack location shall not cross any confining layers. Periodic tagging of the filter pack during installation is recommended to prevent overfilling of the annulus. The field geologist shall document the quantity of filter pack used and compare the actual volume and calculated volume. Significant discrepancies between actual and calculated filter pack volumes should be explained as well as possible (loss of formation, borehole sloughing, etc.). Surging with a surge block may be used to compact the filter pack around the well screen. A minimum of 15 minutes between completion of the filter pack installation and initiation of the bentonite placement shall be observed to allow for settling of any filter pack through the water column. When installation of the filter pack is complete, both the drilling subcontractor and the Shaw field geologist shall tag and record the depth to the top of filter pack. Additional filter pack will be added as necessary until the necessary volume is emplaced. The Shaw rig geologist shall document base of filter pack, top of filter pack, and the start and finish times for filter pack installation.

7. Bentonite pellets will be placed in the well annulus above the filter pack by the tremie method. The bentonite should be added slowly and tamped to prevent bridging. A minimum of 3 feet and a maximum of 5 feet of bentonite will be placed in the annular space above the filter pack. If a prepack screen was utilized during well construction, a grout basket will then be used to support the bentonite above the cavernous interval. The field geologist shall document the quantity of bentonite used and compare the actual volume versus the calculated volume. Significant discrepancies between actual and calculated volumes should be explained as well as possible. Potable water shall be added to the borehole to hydrate bentonite emplaced above the water table. If approved by the Shaw task manager or technical lead, a bentonite slurry, such as Volclay grout, may be used for seals above the water table. The manufacturer's instruction should be consulted to determine the optimal hydration time required. At a minimum, hydration time for the bentonite seal will be 8 hours. The top of the bentonite seal shall be tagged and recorded by the drilling subcontractor and the Shaw field geologist after installation and after

hydration. The field geologist shall document the base of the bentonite, top of bentonite, and start and finish times for bentonite placement.

8. After the bentonite seal has hydrated, the top of the seal should be tagged again to document the amount of swelling after hydration. The post-hydration measurement will be recorded on the well construction diagram as the top of the bentonite seal.

9. The grout will be mixed as specified in Attachment 11, and pumped through a tremie pipe with a side discharge port and filled from the top of the bentonite seal upward. The side discharge is required to prevent damage to the bentonite seal and/or the filter pack. The bottom of the tremie pipe should be maintained below the top of the grout to prevent free fall and bridging. Other alternative grouting methods may be necessary if karst or highly permeable conditions are encountered (i.e., grout baskets above a cavernous interval). The grout may be required to be placed in lifts of approximately 25 feet for deeper wells (>75 feet deep) and the wells that require a grout basket. The lifts of grout are to prevent compacting of the bentonite seal and filter pack and to lessen the loss of grout into the formation. Grout the well to within 2 to 3 feet of the ground surface. The field geologist shall document the quantity of grout added to the borehole and compare the actual volume versus the calculated volume. Significant discrepancies between the actual and calculated should be explained as well as possible. The base of the grout seal, the top of the grout seal, and start and finish times for grouting shall be documented by the field geologist. After the grout is cured, the top of grout should be measured and recorded again to estimate slumping or loss to the formation.

10. A minimum grout cure time of 24 hours is required prior to above ground and flush mounted surface completion activities.

5.4.3 Surface Completions

The majority of the surface completions for monitoring wells installed are above ground completions, however some monitoring wells are located in high traffic areas and will require flush mount completions. The purpose of the surface completions is to prevent downward migration of surface water or rainfall through the monitoring well annulus.

Any cutting of the PVC riser during surface completion or any other phase of monitoring well installation will be done with a pipe cutter to ensure an even cut and to prevent PVC shavings from entering the well. Hacksaws are not an acceptable alternative to pipe cutters.

5.4.3.1 Above Ground Surface Completions

Above ground surface completions consist of an expanding well cap, concrete pad, protective casing with locking cap and 4 guard posts.

Concrete pad: The concrete pad will be a minimum of a 3-foot square and 4 inches thick. Approximately half of the pad thickness will be below land surface. The pad will be constructed so that it slopes away from the wellhead. If applicable, the freshly poured concrete should be protected from rain by covering with plastic until the concrete is cured. If forms are used, they are to be removed after the concrete has cured.

Protective Casing: The PVC well riser will be surrounded by aluminum (preferred) or steel protective casing with a locking cap. The protective casing will be five feet in length with a diameter a minimum of 4-inches larger than the riser pipe. An internal mortar collar will be placed within the protective casing and outside the PVC well casing to a height of approximately 6-inches above the ground surface inside the protective casing. The protective casing will be installed to a depth of approximately 2 ½ feet bgs. Two weep holes shall be drilled in the protective casing above the mortar collar for drainage approximately 6 to 8-inches above ground surface. The monitoring well will be stenciled in black on the protective casing. Additionally, a brass plate containing the well number and horizontal and vertical coordinates will be attached to the protective casing with screws. The PVC riser may have to be cut to accommodate the expansion well cap and locked inside the protective casing.

Guard posts: Four 3-inch diameter, 6-foot long steel guard posts will be installed on each corner of the concrete pad The posts will be installed approximately 4 feet from the well head to approximately 3 feet bgs, and cemented in. The posts will be filled with concrete and painted fluorescent orange with a paintbrush.

5.4.3.2 Flush Mount Well Completion

Flush mount well completions will be necessary at locations where an aboveground well completion would interfere with facility operation. Flush mount completions consist of a an expanding well cap, concrete pad, below ground traffic box or equivalent and an 8 or 12-inch steel, flush mount, bolt down traffic bearing cover.

Concrete pad: The concrete pad will be a minimum of 3-foot square and 4 inches thick. Approximately half of the pad thickness will be below land surface. If the pad is located in a roadway or parking lot, the edge of the pad shall be even with the existing concrete or asphalt surface to prevent vehicle damage. The pad will be constructed so that it slopes away from the wellhead. If applicable, the freshly poured concrete should be protected from rain by covering with plastic until the concrete is cured. If forms are used, they are to be removed after the concrete has cured.

Traffic box and manhole cover: The traffic box should be installed slightly above grade. The concrete pad will be flush with the top of the traffic box and slope to grade to promote surface drainage away from the well. The manhole cover shall be equipped with a gasket to prevent leakage if rainwater or surface water into the traffic box. The PVC riser may have to be cut to accommodate the expansion well cap and lock.

5.5 Special Considerations

- Perched Water. Where present, screen lengths and well construction should be adjusted to insure the monitored interval (including the filter pack) does not span or include both the perched water and water table in the overburden. Conversely, if a perched interval is the desired monitoring objective, wells should be drilled and installed with a short 5-foot screen across the perched zone only, with the base of the well and screen set no deeper than the underlying perched horizon (i.e., does not allow for migration below perched aquifer).

- Light Nonaqueous Phase Liquid (free product) considerations. There LNAPL is expected, screen interval lengths should be adjusted or constructed so as to straddle the water table (free product will not be detectable in a well screened below the water table horizon).

5.6 Records

At a minimum, the field geologist for well installation shall document the following information: The information is to be recorded in the FADL, field form, and well construction diagrams. The start and finish times for each phase of the well installation process shall be recorded. Additional relevant information may be recorded at the field geologist's discretion.

- Total depth of borehole [feet below ground surface (ft bgs)]
- Diameter of borehole (inches)
- Length, diameter, and material of surface casing
- Depth surface casing installed to (ft bgs)
- Location, diameter, and depth of any centralizers.
- Quantity of grout used to cement surface casing (type of grout, number of sacks, sack weight, type and quantity of any additives used- (i.e. used 12 – 50 pound sacks of Lonestar Type I Portland Cement mixed with approximately 25 pounds of Wyo-Ben powdered bentonite)
- Material, length, diameter, and slot size of the well screen
- Installation depth of well screen (ft bgs)
- Length, diameter, and material of casing
- Installation depth of casing (ft bgs)
- Casing stickup (if applicable)
- Quantity of filter pack (include manufacturer's name, sand size, number of sacks used, and sack weight)

- Tagged depth of filter pack (ft bgs)
- Quantity of bentonite used (include manufacturer name, diameter if pellets used, number of buckets, and weight of bucket)
- Tagged depth of bentonite (ft bgs) (Before and after hydration)
- Quantity of grout used to cement well casing (include manufacturer name, # of sack, sack weight, type and quantity of any additives used)
- Tagged depth of grout after installation and after curing (if multiple lifts are performed, record data for each lift)
- Surface completion information.

Any deviations from this SOPP, or the site-specific work plan will require approval from one of the following personnel: the technical lead or the project manager. All deviations shall be documented in writing.

6.0 EXCEPTION PROVISIONS

None.

7.0 CROSS REFERENCE

Driscoll, F. G., *Groundwater and Wells,* Second Edition, St. Paul, Minnesota, Johnson Division, 1986.

Hazardous Waste Remedial Action Program, Standard *Operating Procedures for Site Characterization,* DOE/HWP-1OO, July 1990.

U.S. Environmental Protection Agency (EPA) (Region 4) *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual,* May 1996.

U.S. Environmental Protection Agency (EPA), *A Compendium of Superfund Field Operations*
Methods, EPA/540/P-87/001, 1987.

U.S. Environmental Protection Agency (EPA), *Manual of Water Well Construction Practices*,
EPA/570/9-754)() 1, 1975.

American Standard of Testing and Materials, *Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers*, ASTM Designation D 5092 - 90, published October 1990, reapproved 1995).

American Standard of Testing and Materials, *Standard Guide for Design of Ground-Water Monitoring Systems in Karst and fractured-Rock Aquifers,* ASTM Designation D 5717-95, published June 1995.

U.S. Army Corps of Engineers, Engineering and Design *Monitoring Well Design, Installation, and Documentation, at Hazardous Toxic, and Radioactive Waste Sites*, EM 1110-1-4000, November 1998.

U.S. Environmental Protection Agency (EPA) , *Procedure Manual for Ground Water Monitoring at Solid Waste Disposal Facilities*, SW-611, December 1980.

U.S. Environmental Protection Agency (EPA), *Resource Conservation and Recovery Act (RCRA) Ground-Water Monitoring Technical Enforcement Guidance Document,* EPA/PB87-107751, 1986.

8.0 TABLES

None

9.0 ATTACHMENTS

A- Field Facts
B – Well Completion Form

0010359

ATTACHMENT A
Field Facts

Volume of Schedule 40 PVC Pipe				
Diameter (inches)	O.D. (inches)	I.D. (inches)	Volume (gal/linear ft.)	Weight of Water (lbs/linear ft.)
1¼	1.660	1.380	0.08	0.64
2	2.375	2.067	0.17	1.45
3	3.500	3.068	0.38	3.20
4	4.500	4.026	0.56	5.51
6	6.625	6.065	1.5	12.5
8	8.625	7.981	2.6	21.65
12	12.750	11.938	5.81	48.44

Hole Diameter	Volume/Linear Ft. of Hole		Nominal Casing Diameter	Volume/Linear Ft. of Annulus		Pounds Sand/ Linear Ft. of Annulus	Pounds ½" Pellets per Linear Ft. of Annulus
	Gal.	Cu. Ft.		Gal.	Cu. Ft.		
7¼"	2.14	0.29	1¼"	2.03	0.27	27	21
7¼"	2.14	0.29	2"	1.91	0.26	26	20
7¾"	2.45	0.33	2"	2.22	0.30	30	23
8¼"	2.78	0.37	2"	2.55	0.34	34	26
10¼"	4.29	0.57	2"	4.05	0.54	54	41
8¼"	2.78	0.37	3"	2.28	0.30	30	23
10¼"	4.29	0.57	3"	3.79	0.51	51	38
12¼"	6.13	0.82	3"	5.62	0.75	75	57
8¼"	2.78	0.37	4"	1.95	0.26	26	20
10¼"	4.29	0.57	4"	3.46	0.46	46	35
12¼"	5.13	0.82	4"	5.30	0.71	71	54
12¼"	6.13	0.82	6"	4.33	0.58	58	44

Miscellaneous Data:

1 Cu. Ft. = 7.5 gal. (approx.)
1 Gallon = 0.134 Cu. Ft. (approx.)
1 Cu. Yd. = 202 gal. (approx.)
1 Gallon = 0.005 Cu. Yd. (approx.)
1 Gallon of Water = 8.34 lbs. (approx.)
1 Cu. Ft. of Fresh Water – 62.4 lbs. (approx.)
PSI = 0.434 x the height of the water column in feet
Feet of Head = PSI x 2.304
1 Barrel = 42 gallons (approx.)
1 Sack of Sand = 1 Cu Ft. and approx. 100 lbs.
1 Sack of Cement = 1 Cu. Ft. and approx. 96 lbs.
1 Pail of Bentonite Pellets = 50 lbs. (approx.)

ATTACHMENT B

WELL COMPLETION FORM (Stickup or Above Grade Completion Well)

FIELD REPRESENTATIVE: _____
DRILLING CONTRACTOR: _____

DRILLING TECHNIQUE: _____
AUGER SIZE AND TYPE: _____

BOREHOLE IDENTIFICATION: _____
BOREHOLE DIAMETER: _____
WELL IDENTIFICATION: _____

WELL CONSTRUCTION START DATE: _____
WELL CONSTRUCTION COMPLETE DATE: _____

SCREEN MATERIAL: _____
SCREEN DIAMETER: _____
STRATUM-SCREENED INTERVAL (FT): _____

CASING MATERIAL: _____
CASING DIAMETER: _____

TYPE OF FILTER PACK: _____
GRADIATION: _____
AMOUNT OF FILTER PACK USED: _____

TYPE OF BENTONITE: _____
AMOUNT BENTONITE USED: _____

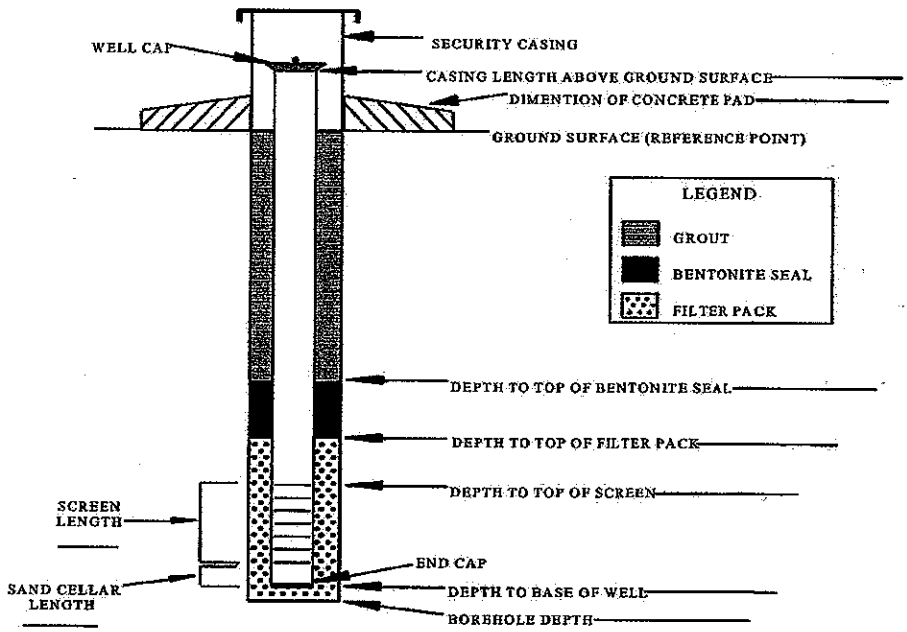
TYPE OF CEMENT: _____
AMOUNT CEMENT USED: _____
GROUT MATERIALS USED: _____

DIMENSIONS OF SECURITY CASING: _____

TYPE OF WELL CAP: _____
TYPE OF END CAP: _____

COMMENTS:

SPECIAL CONDITIONS
(describe and draw)



NOT TO SCALE

INSTALLED BY: _____ INSTALLATION OBSERVED BY: _____

DISCREPANCIES: _____

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

February 2, 2006

Ms. Rose Zeiler, Ph. D.
Longhorn AAP Site Manager
Post Office Box 220
727 South Brooklyn Road
Ratcliff, AR 72951

Re: Longhorn Army Ammunition Plant (LHAAP)
Final Installation-Wide Work Plan

Dear Ms. Zeiler:

The Environmental Protection Agency (EPA) has completed our review of the *Final Installation-Wide Work Plan* (Shaw Environmental, Inc., January 2006). The work plan provides descriptions of common field activities that are likely to be implemented at one or more LHAAP sites by Shaw Environmental, Inc. It is EPA's understanding that these descriptions are to be generally applicable and thus eliminate the need for repeatedly describing these activities in site-specific work plans. However, site-specific addenda to this work plan will be issued as necessary to address site-specific circumstances and/or activities. For example, in Appendix A (Health and Safety Plan), Table 8-1 (Direct Reading Air Monitoring Summary), the table indicates that for soil excavation and sampling, well installation, and ground water sampling, when PID/OVA readings exceed 1 part per million for 5 minutes, screening for benzene using colorometric detector tubes will be conducted. Contaminants found at LHAAP are primarily chlorinated solvents, metals, and perchlorate. Unless benzene is suspected at a particular site, screening for other contaminants should be specified in the subsequent site-specific addenda.

The *Final Installation-Wide Work Plan* will be incorporated into EPA's file system as a final document. Because this document provides general discussions of anticipated activities and site-specific addenda will be provided as necessary to address site-specific circumstances and/or activities, specific comments on the work plan will not be provided. If you have any questions or need additional information, please feel free to give me a call at (214) 665-6758.

Sincerely,

Chris G. Villarreal
Remedial Project Manager

cc: Cliff Murray, U.S. Army Corps of Engineers

Alen Etheredge, Texas Commission on Environmental Quality

Barry Forsythe, U.S. Fish and Wildlife Service

Praveen Srivastav, Environmental Resources Management

Shaw® Shaw Environmental, Inc.

Subject: **Comment Resolution Meeting, Installation-Wide Ecological Risk Assessment, Longhorn Army Ammunition Plant (LHAAP)**

Location: **Texas Center for Environmental Quality (TCEQ) Headquarters, Austin Texas**

Date Held: **February 9, 2006**

Date Issued: **Final Minutes (March 31, 2006); Draft Minutes (February 20, 2006)**

Meeting Attendees:

Shaw Environmental

David P. Cobb (DPC)
Jon Lindberg (JL)
Praveen Srivastav (PS)
Mark Weisberg (MW)

USACE-Tulsa

Cliff Murray (CM)
Susan Trussell (ST)

TCEQ

Alan Etheredge (AE)
Vickie Reat (VR)

TPWD

Charles (Chip) Wood (CW)

TGLO

Keith Tischler (KT)

USFWS

Paul Bruckwicki (PB)

USEPA Region 6

Susan Roddy (SR)
Chris Villarreal (CV)

USEPA – Superfund

Marc Greenberg (MG)

(Via Phone)

BRAC

Rose Zeiler (RZ)

Final minutes prepared by Shaw on behalf of the USACE, taking into consideration comments received from participants on the draft minutes.

Meeting participants are referred to by initials (e.g., "MG" = Marc Greenberg).

Regulatory agencies and other stakeholders, met with Army and Shaw representatives at TCEQ headquarters in Austin, Texas on February 9, 2006. The primary purpose of the meeting was to discuss the stakeholders' comments on the Installation-Wide Step 3 Ecological

Risk Assessment report. Rather than focus on individual comments, the meeting covered major issues that were the focus of many of the comments. A summary of the major agreements made at the meeting is provided at the end of the minutes.

The following files are submitted as attachments to these minutes:

1) *The agenda for the meeting*
2) *The power point presentation by Shaw presented at the meeting*

[Introductions]

DPC – The point of this meeting is to go through the larger issues on the Step 3 Report so that we can move forward. We won't be able to cover all comments, but we want to leave here with a clear path forward.

CV – I see CHPPM is not represented at this meeting. What is their role now?

RZ – It is primarily to monitor progress and compliance with Army policy and guidance.

PS - To summarize where we are, the Longhorn Ecological Risk Assessment Step 3 Report was submitted in November of 2004. We have worked out many of the issues, and have tried to move forward with the remaining issues through the response to comments and the other meetings. The last meeting was in July 2005 that was not attended by Shaw because the PBC procurement was in progress.

MW – The first issue is the use of alternate toxicity reference values (TRV) in Step 3. We will provide additional justification in the Step 3 report for chemicals such as lead (e.g., we will present technical information as to why metallic lead as opposed to lead acetate is appropriate for use as a TRV at this site). For chromium, we agreed to use a 6:1 Cr+3 to Cr+6 ratio, and if hazards exceeded acceptable criteria, we'd go out and obtain some speciation data to calculate a site-specific ratio. We did look at the chromium data, and there were elevated detections near possible chromate source areas, so we are currently planning on collecting some speciation data. A work plan has been written and will be presented to the regulators shortly.

- ✓ **There was general agreement on this approach**

MW - The next issue is the use of LOAELs in Step 3. Rather than taking the arithmetic mean of hazard quotients (HQs) calculated using TRVs based on the no-observed adverse effect level (NOAEL) and the lowest-observed adverse effect level (LOAEL), we are planning to use the geometric mean of these two values, which is consistent with the mid-point node as described in the "Rule of 5" approach.

MG – How will the Rule of 5 be used? That approach is for developing cleanup levels, not calculating HQs.

JL – We understand that it is used for calculating preliminary remediation goals (PRGs) that are protective of a concentration between the NOAEL and the LOAEL. However, we are using it at the HQ stage because if a chemical has an HQ less than 1 using a TRV that is "weighted" by using the geometric average of the NOAEL and the LOAEL, then what that means is that the exposure concentration is lower than the concentration that would ultimately be calculated using the "Rule of 5" approach at the PRG calculation stage. Therefore, these chemicals don't have to be carried forward as COPECs.

MG – The Rule of 5 is not to be used at Step 3. Just because you "think" a chemical below a LOAEL TRV is not a problem, doesn't mean you can screen it out.

There are three "bins" that you can put your COPECs into at the end of the ERA. One bin is the "no unacceptable risk" or "acceptable risk" bin, where you can put chemicals that occur below screening values that have an HQ < 1 using a NOAEL TRV, etc. The second bin is an "indeterminate bin". These are chemicals whose dose falls between the NOAEL and the LOAEL. You may or may not have to calculate PRGs for these chemicals. Then you have your "unacceptable bin" that has chemicals that are clearly a problem and require PRG calculations in a baseline ecological risk assessment (BERA). Another thing you can do is look at where your unacceptable chemicals are. If they overlap areas where the indeterminate chemicals are, you may be able to focus on the unacceptable ones and assume that if you clean up for them, you also clean up for the other ones that are questionable.

MW – That's essentially what we do in Section 10 of the Step 3 report. We discuss each chemical and recommend if it's a potential risk driver for additional evaluation.

MG – This Step 3 report really needs to be repackaged as a full BERA. It has nearly all the components, except for the calculation of PRGs.

MW – We considered doing that, but the stakeholders disagreed in the past. There are many conservative assumptions in the Step 3 report, such as the use of upper-bound uptake factors. Any PRGs that we calculate at this stage would be very conservative. We would like to have the option of collecting site-specific data to allow the calculation of more realistic PRGs.

MG – The question for the risk managers is this: Is it more efficient to do the PRG calculations now as part of a BERA, without any additional field work. Keep in mind that the PRGs aren't action levels. Those cleanup levels can be modified at the Feasibility Study (FS) stage when the NCP's 9 Criteria are applied.

MW- What else would we need to include if we re-packaged this as a BERA? Right now, we think we'll definitely need to go out and collect more field data for some chemicals. Would we submit the new BERA, and then refine the PRGs in another deliverable after the field work is finished?

PS- Also, we are not going to have a separate FS for eco risk assessment. The FS documents are organized around individual sites.

MG – This is just one option for moving forward. Step 3 would be part of the BERA. EPA is more likely to accept less conservative assumptions if we move into a BERA.

PS – What would trigger us to move into a BERA? For which chemicals? What would be the trigger for going out and collecting more data?

MG – Keep in mind that PRGs are risk-based values. They are not final cleanup levels.

MW – That is true, however, ecological PRGs developed during a BERA would not be revised at the FS stage, they would just be considered along with the 9 balancing criteria used during the FS evaluation of remediation alternatives in the selection of the final cleanup levels.

VR – What would this change to a BERA approach entail?

MG – You basically have all the information you need, except for risk characterization (Step 7 of the 8-Step ecological risk process). For chemicals that don't have a TRV, you can't calculate risk, and you just write up a narrative stating that risks for the following chemicals cannot be quantified and you're done (no PRGs are needed). For Indeterminate chemicals, these require some risk characterization. For Unacceptable chemicals, PRGs need to be calculated. Also:

- The Step 3 Report is a good approach, but it's a hybrid report.
- Apply chemical-specific LOAELs to chemicals that lack them (e.g., use phenanthrene's LOAEL as a surrogate for all PAHs, etc.). This is done within a particular chemical class where the mode of action for those chemicals is the same (e.g., non-polar narcosis assumed for PAHs).
- EPA is willing to use less conservative values (e.g., use of upper-bound rather than maximum uptake factors) if you do a BERA.
- One thing missing is a data quality objective (DQO) process for selecting where your risk drivers are.

MW - Well, this discussion of changing our approach from a Step 3 report to a BERA is a bit of a surprise. Let's move on for now and come back to this topic after we discuss the other major items on today's Agenda.

- ✓ **Shaw agreed to consider re-packaging the current Step 3 Report as a BERA.**

MW - The next issue is EPA's request for the use of maximum values in Step 3. We had stated in our response to comments that we will add a third "tier" to the food chain models that will use maximum uptake factors to satisfy EPA Region 6, but decisions regarding selection of final COPECs will still be made based on the use of upper-bound values.

MG - The assumptions in the Step 3 should be the same as for the BERA.

MW – We tried that, but EPA disagreed with this approach and wanted us to use maximum values.

SR – I have changed my mind about that. You may use upper-bound rather than maximum uptake factors. Just don't use averages. I would prefer if you didn't even present results based on average values.

MW – We didn't use the information from the Tier 2 (i.e., average) food chain models to make decisions, but we wanted to retain them for information purposes. They provide information on the lower end of the risk range, and this information is valuable for risk managers to consider.

JL – Perhaps we can present the Tier 2 results in an Appendix, separate from the main report.

The following points were agreed to:

- ✓ **Upper-bound (such as 90th percentile BCFs), rather than maximum uptake factors may be used in Step 3 (and carried forward into the BERA);**

- ✓ **The Tier 2 (or "average") food chain model results will not be used for decision making, and may be placed in an appendix.**

- ✓ **The report will be revised to make the approach used as clear and transparent as possible.**

MW – The next issue is the selection of organisms at the base of the food chain as assessment endpoints. In our comment responses, we will agree to add plants and earthworms as assessment endpoints, but the Army will not clean up solely for them. So we would not pursue further (field) investigation at areas whose only risk exceedances are for plants and earthworms. We would also limit the use of toxicity testing for these organisms.

JL – We would collect and present any toxicity information that is obtained from bioaccumulation tests, which are anticipated as being necessary at some sites, but we will not do toxicity tests solely for the purpose of developing cleanup levels for earthworms.

MG – You need to present documentation of potential risk to plants and earthworms in the risk assessment. We understand you won't develop PRGs for them. Add them as assessment endpoints, compare them to literature values, and that's all you have to do. We agree that you won't need to go forward to calculate PRGs for protection of these organisms and clean up for them

The following points were agreed to:

- ✓ **Plants and earthworms will be included as assessment endpoints;**

- ✓ **A risk management decision will be made to drop any chemical that is only a final COPEC because it exceeds plant and earthworm benchmarks (e.g., the NOAEL-based HQ in the food chain model is equal to or below 1 for all measurement receptors);**

- ✓ **Language will be added in the Step 3 <u>and the Step 7</u> portion of the document that this agreement (risk management decision) has been made by the project team.**

- ✓ **The Army will not perform cleanup for chemicals that exceed risk criteria only for earthworms and plants.**

MW – The next topic is the use of background evaluation in the Step 3 report. We have agreed to retain the list of chemicals that are background-related in the Step 3 report, and present them again in the BERA. But we will not quantitatively evaluate them any further past Step 3.

MG – You must characterize both site and background risk.

MW – We already quantify risk in Step 3. The removal of background COPECs isn't done until Section 10, after the risk has been calculated.

MG – You must present the risk associated with background chemicals separately, in Step 3 and Step 7. Then in Step 8, the risk managers will make the final determination regarding what to do with the chemicals that are associated with background.

JL – Since we have already calculated the risk associated with background chemicals, we can simply summarize it in Step 7.

MW – But we would need to get agreement from the regulators on our list of background chemicals at the end of Step 3, because we would not plan to do further evaluation or sampling for these chemicals in the BERA. We currently use statistics, including the Wilcoxon Rank Sum (WRS) test, comparisons to a "bright line" (i.e., an upper tolerance limit [UTL] or upper prediction limit [UPL]), box plots, and a geochemical evaluation. We've already agreed to add screening values and background concentrations to the geochemical plots.

MG – You should also consider doing a least squares regression on the geochemical plots to determine the amount of "scatter", and whether the linear relationship is strong. If correlation coefficients (i.e., r^2 values) are high, then there is greater confidence in the relationship. There is no "rule" as to how high the r^2 value needs to be, but an r^2 value of 0.8 may be considered an indicator of a strong relationship. There is some information in the Navy risk assessment guidance on this issue. John Fern of EarthTech, Inc. (Oahu office) may also be a resource.

MW – Our geostatisticians have cautioned against mixing statistics and geochemical plots. There are a number of issues that can result in artificially low r^2 values. For example, plotted points that represent non-detects fall well off the linear trend. You may also have outliers that lower the r^2 value.

MG – You can use a statistical test to determine outliers, and then remove them. There are also statistical methods in EPA guidance that recommend different approaches for handling data depending on the percentage of samples that are non-detect.

MW – How would we get consensus from all stakeholders on which chemicals are background so that we can move forward with work plans, the BERA, etc.?

PS – We could have a separate call on the topic, exchange emails, etc. It's difficult to get everyone in one place for a meeting.

- ✓ **Shaw agreed to consider adding least-squares regression results to the geochemical plots.**

*****BREAK*****

MW – There are a number of issues that we believe everyone has previously agreed upon, but we wanted to bring them up one last time to be sure. They include the following:

- Use of Sub-areas to spatially organize the site;
- Use of 0-3 feet as the soil depth;
- Use of bootstrapping to calculate 95% upper confidence limits (UCL).

MG – Take a look at the statistical methods proposed in EPA guidance, as well as a new statistical book written by Dennis Helsel, and make sure you can defend the bootstrap technique. Make sure you're consistent with the guidance.

- ✓ **There was general agreement on these approaches.**

VR – I'm still a little concerned about your sensitivity analysis for small- and large-range receptors.

JL – As we've mentioned before, we tried to do an analysis for large range receptors where we combined risks from multiple sub-areas and watersheds. However, there are an infinite number of combinations of overlapping spatial areas that a receptor could be exposed to. Therefore, we thought it would just be simpler to set the area use factor (AUF) equal to 1 for large-range receptors. We'll take another look at our small-range receptor sensitivity analysis.

MW- The next issue is the sediment to fish pathway. EPA and TCEQ felt we may not have adequately covered this pathway in our food chain modeling. We intend to use the fish tissue data from the EPA/TCEQ study to show that our modeling actually over-estimates tissue concentrations, and is protective.

VR – The fish tissue study used fish captured in the cove (adjacent to stream discharge locations). You must describe in your report why you think those fish are representative of fish that may be found in the streams on-site. Discuss the species of fish, life history, concentrations of chemicals in the sediment, etc. to make your case. You also need to show that your chemicals of concern overlap with chemicals that were sampled for in fish.

MW – Agreed.

MW – The next topic is the use of frequency of detection (FOD). To summarize, we have agreed in previous meetings to eliminate chemicals completely with less than 3% FOD, and to spatially plot chemicals with 3-5% FOD to see if there's a potential hot spot. We've already done this, and we have brought back in a few chemicals with less than 5% FOD that appeared to have clustered detections.

MG – Make sure you look to see if the detected concentrations exceed benchmarks. If they don't, you don't have to worry about them.

MW – Right, these are chemicals that have already been compared to benchmarks, so by definition they exceed them.

SR – I'm comfortable with this approach.

MG – As an alternative to spatial analysis, you can look at the maximum detected concentration (MDC). If the MDC is not more than 30% greater than the benchmark screening value, that chemical can be dropped. This has been used by EPA Region 6 in the past. The rationale behind it is that environmental data varies by about 30%. Keep in mind that this approach is only to be applied to compounds for which the frequency of detection is at or below 5% of the samples.

MW – OK, we will consider this option, although, as I already stated, we have already completed the spatial plots.

MW – The next topic is the use of spatial evaluation as a criterion to eliminate COPECs. In the Step 3 report, the adopted approach was that if elevated hits for a chemical were scattered, then there is unlikely to be a discrete source area or regular exposure to receptors, and that chemical was not proposed to be carried forward. We will de-emphasize the spatial relationship of sediment and surface water exceedances to address comments. This approach is only used as part of a weight of evidence argument, and was used in conjunction with other lines of evidence to refine the COPEC list.

MG – We are willing to entertain this approach as long as the risks associated with the chemicals are calculated first.

MW – Right. That's what we do in the Step 3 report

VR – This sounds reasonable as long as it's part of a weight of evidence. I agree with the de-emphasis on the sediment and surface water relationship. You also have to be careful to make sure that any isolated detections are truly isolated, and not simply an artifact of your sampling plan.

MW – The next thing we'd like to discuss is the evaluation of the Louisiana Black Bear (LBB) as a threatened species.

CW – The populations of LBB are on the increase in east Texas. We would prefer the bear be retained in the risk assessment, using conservative assumptions.

MG – The cleanup goals would reflect exposure using one of the surrogate species modeled in the risk assessment, probably the raccoon.

JL – We have recent information that TPWD indicates the LBB isn't present on site.

CW – You must be able to state that the habitat useable by the LBB isn't present on site. You would have a difficult time doing that for this installation.

MG/SR – Do NOT add a bear as a receptor. EPA does not evaluate endangered species using the species itself. Use one of your other receptors as a surrogate, and alter the exposure parameters to be protective of the LBB.

There was some confusion at this point as to how the raccoon's exposure parameters should be adjusted. It was made clear that exposure parameters must be within the range of the raccoon's. For example, if the home range for the raccoon is 5 to 815 hectares, the raccoon as surrogate for the LBB must be within this range, but it was unclear if the value should be conservative overall (i.e., closer to 5) or more representative of the LBB (i.e., closer to 815).

MG – EPA's preference is to complete the model for sensitive species in a conservative manner. Then, if the assumptions used are considered to be too conservative for the LBB, the final cleanup goal can be adjusted to be less conservative at the FS stage.

JL/MW – Our preference would be to select raccoon exposure factors that are more similar to the LBB (but within the range of the raccoon).

MG – You can do it that way, but then that raccoon surrogate won't be protective of other mammals that may have greater exposure (i.e., smaller home ranges). And you may have to adjust the final eco cleanup level lower rather than higher.

MG – You also want to describe the habitat for the LBB, and whether it exists on site.

VR – TCEQ and EPA rely on USFWS and TPWD to determine what sensitive species are in the area.

CW – It's fine to say in the risk assessment that the bear is "potentially present". You just need to be able to defend why you evaluate the LBB in whatever manner you choose.

MG – Our preference is to do the risk assessment as planned, and let the risk managers settle what the final eco cleanup level should be. If you do it conservatively, it will be recognized that you have been good environmental stewards. Also, USFWS may conduct a formal habitat assessment for the LBB in the future.

MW – Are there any other species of concern that need to be discussed?

VR – Even under the RRR, you need to use this approach, because it really all goes back to the Implementation Memo and Water Quality Standards. RRR guidance says to follow Chapter 307 that refers to the Implementation Memo. You can either use the 15th percentile value given in the guidance for your reach, or you can calculate your own hardness based on the 15th percentile of your on-site dataset. Use of average hardness values is not acceptable. You can use your combined data set for all your watersheds to compute this or watershed by watershed.

VR – There is also a possible issue with using total versus dissolved data. Your site data are total, but the water quality criteria are based on dissolved concentrations.

MG – You would have to face this issue down the road anyway, because the Texas Water Quality Standards will be an ARAR.

MW – Agreed.

MW – I have a related question for potential final surface water COPECs. Can we perform site-specific surface water toxicity tests in the BERA to address potential risks associated with surface water COPECs that have concentrations that exceed water quality criteria (including those that are calculated based on a site-specific15th percentile water hardness value)?

VR – Any site-specific surface water toxicity test results would have to be used to revise existing TCEQ water quality criteria. This could be a very time consuming process.

MW – In this case, would the use of EPA's Water Effect Ratio approach be preferable to TCEQ, compared with site-specific toxicity testing?

VR – Yes.

MW - The next issue is the use of wet weather data. We did not include water samples that were collected from areas that appeared to be dry most of the year because these were transient water pools that aren't considered true aquatic habitat.

MG – Per a request from Barry Forsythe, you need to look at the wet weather data qualitatively to address potential effects for amphibians that might use these transient (vernal) pools. Just present the range of concentrations, and make a few remarks. That should be sufficient.

- ✓ **Shaw agreed to qualitatively evaluate wet weather data so that consideration is given to the protection of amphibians that may use ephemeral water bodies.**

MW – One other minor issue that we want to bring up is that we had an inadvertent error in our calculations for soil and sediment ingestion rates that involved a wet-weight to dry-weight conversion. We'll fix that in the next version of the report.

MW – Are there any other issues that the other stakeholders would like to bring up?

SR – Most of mine have been covered.

VR – We intend to submit responses to your comments. The current schedule is to get them to AE by March 1, 2006. These will give you an idea if we agree or disagree with what you propose on specific issues. We will need to make sure that our responses are filtered with the knowledge of what we agreed upon today.

PS – We will prepare meeting minutes and distribute them by next week. For any conclusions and/or statements in the meeting minutes that contradict statements in the January 18, 2006 RTC, the minutes will override the RTC, based on our new agreements today.

VR – One main concern I have is that perchlorate isn't swept under the rug. The Army keeps putting off this issue.

RZ – Recent Department of Defense position papers have essentially given us the "green light" to evaluate perchlorate. I think we can proceed with it now.

MG – Todd Bridges with the U.S. Corps of Engineers in the Vicksburg laboratory might be a good person to consult with to see how the Army is dealing with perchlorate.

VR – We (TCEQ) can consolidate our ecological information about perchlorate and help provide you with information so that there's enough data to make it worth quantitatively evaluating in this deliverable.

RZ – I will check the Department of Defense position papers to see if there is any specific guidance on perchlorate related to ecological considerations.

- ✓ **It was agreed that information will be shared about perchlorate, and Shaw will try to quantify the risks associated with it in this report (whether it is the Step 3 Report, or a combined Step 3/BERA report).**

DPC – Our goal is to move the eco risk assessment along so that we can fill in the holes in the ROD and aren't at risk if we clean up sites to human health perchlorate standards. We want to make sure we only go out there and clean up once.

VR – What did the Army mean in Comment No. 2 when mentioning that site-specific evaluations may be run for eco for Early Closure Sites?

PS – You can ignore that. At this time we are not planning on doing any site-specific evaluations.

VR – I also have the following comments:

- I didn't agree with the response to Comment No. 26;
- For Comment No. 47, keep in mind that cleanup values for benthic invertebrates must be considered for silver, as well, and spatial plots do show a potential hot spot;
- As we discussed, take another look at metals in surface water, especially with regards to the hardness and dissolved vs. total issues;

- For Comment No. 19, with regards to the food ingestion calculations, look at the TCEQ update paper for eco risk assessments, issue #8. Be careful of wet/dry conversions. Also, you use one body weight for the equations, but then you use an ingestion rate from another source. That ingestion rate may be based on an organism with a very different body weight. Our preference is that you calculate the ingestion rate using allometric scaling.

SR – My one other concern is about the river otter. It is used as a measurement receptor, but I thought it was a threatened species.

JL – We requested a recent list of threatened species from TPWD. The otter is not a threatened or endangered species.

SR – OK, then it's not a problem.

KT – The geochemical approach and the way background is applied is our main concern.

DPC – Let's take a short break. Shaw needs to discuss the new direction that has been proposed at this meeting this morning.

*****BREAK*****

MW – Under our new contract mechanism, we have a schedule for certain sites that we need to close before we get paid. Therefore, we have some concern that if we go to a combined Step 3/BERA, we will not be able to close out some sites that are relatively clean. If we stay with the Step 3 as being separate from the BERA, does that change any of the agreements that we've reached today?

DPC – Switching to a BERA changes our schedule, as we have 28 sites to close. We just need to weigh our options, and therefore we need to know if agreements are in place for either option.

SR – Some of the approaches felt premature in a Step 3 document. Those concerns would disappear if we move forward to a BERA.

PS – The original plan was to finish Step 3 and eliminate some areas as not having an eco risk. Sites that fell in these areas could then exit the ERA and proceed with ROD. If we have to wait until a full BERA is done, that might affect our schedule.

MG – You can't make those types of management decisions without moving forward to a BERA.

PS – But we were under the impression that we could exit the process after Step 3 for some sites.

MG – EPA prefers not to eliminate chemicals at Step 3.

JL – I thought EPA stated earlier that the Step 3 assumptions should be the same as the BERA assumptions. So whichever option we choose, the agreements today should still hold.

MG – That's true.

MW – One of the things that's possibly problematic about doing a Step 3 combined with a BERA is that we would need consensus on the chemicals that we consider to be background related. We would retain these chemicals in a list and evaluate them qualitatively, as well as present the risks associated with them, as we agreed, in Steps 3 and 7.

SR – I'm ok with that.

MG – The proposal from EPA here today is to simply take the Step 3 report that you have and repackage it as a BERA. No more field work needs to be done. You have most of the components in there already. The advantage is you get this remedial investigation/risk assessment part done now, and move forward.

JL – But any cleanup levels (eco PRGs) that we calculate at this stage will be very conservative. We were planning on collecting more field data so that we could obtain more realistic cleanup levels.

MG – I agree, you'll probably need to go back into the field at some point.

MG/SR – To answer your question, yes, you may use upper-bound values (e.g., 90th percentile uptake factors) at Step 3, and our other agreements today apply whether you keep the Step 3 report separate or combine Step 3 and BERA. Don't use average values for decision making, and don't use LOAELs at Step 3. We're just trying to save you time by offering you the alternative to convert this to a BERA.

MG – With regards to background, it is different to say that background risk is equivalent to site risks. You must show the risk (both NOAEL- and LOAEL-HQs) associated with background chemicals. At the Step 3 stage, they are only <u>suspected</u> background chemicals. You just need to summarize the risk associated with background. You don't need to base additional field studies on suspected background chemicals.

MG – The fact that you are not doing installation-wide FS documents, but you have an installation-wide risk assessment is not a factor. You can still show whether a site is within ecological areas of concern or not.

PS – What would be the timing of field work if we wanted to do that?

MG – You can do some field work at the FS stage.

MW – What if we want to collect site-specific toxicity and bioaccumulation data? That option is closed if we don't do it in the BERA.

MG – True, you won't get as much use from those types of studies in the FS. But you can attack the problem from a different direction and do bioavailability studies at the FS stage. Those could modify your cleanup levels as well, by changing the calculated exposure.

CV– Recalculating ecological exposure during the FS, based on site-specific bioavailability studies, might be very confusing to the public.

MG – This might be a concern.

MW – While it might be possible to revise PRGs using bioavailability study results during the FS, our project managers need cleanup levels up front, not in the middle of the FS stage.

MW – What type of work plan would we need to send to the regulators for approval of field work?

MG – Keep it simple. Describe what you are doing, how you are going to use the data, etc.

DC – We'll have to have some more internal discussions before we decide which way to go on this. Thank you everyone for attending this meeting. Shaw will prepare minutes and distribute.

END OF MEETING

Summary of Agreed Approaches:

Chromium Speciation

- ✓ Stakeholders agreed with Shaw's intent to collect speciation data for chromium after using the 6:1 Cr+3 to Cr+6 ratio exceeded criteria, and elevated detections of chromium were found to be co-located with possible Cr+6 source areas.

Repackaging the Step 3 Report as a BERA

- ✓ Shaw agreed to consider repackaging the Step 3 report as a BERA, although the option remains open to do a Step 3 report separate from a BERA. If the Step 3 report is done separately, all agreements made at this meeting regarding assumptions used in the food chain models, etc. would apply. Assumptions would be consistent between the Step 3 and BERA, including the following:
    - o Upper-bound, rather than maximum uptake factors may be used in Step 3 (and carried forward into the BERA);
    - o The Tier 2 (or "average") food chain model results will not be used for decision making, and may be placed in an appendix.

- The report will be revised to make the approach used as clear and transparent as possible.

It is recognized that by combining the Step 3 report with the BERA, the ecological risk assessment could probably be finished more quickly, but individual sites could not exit the process after Step 3.

Base of the Food Chain as Assessment Endpoints

- ✓ Plants and earthworms will be included as assessment endpoints, but a risk management decision will be made to drop any chemicals that are final COPECs only because they exceed plant and earthworm benchmarks (e.g., the NOAEL-based HQ in the food chain model is equal to or below 1 for all measurement receptors). This will be documented in the Step 3 and the Step 7 portion of the eco risk assessment that this agreement has been made by the project team. The Army will not develop PRGs or perform cleanup for chemicals that exceed risk criteria only for earthworms and plants.

Background/Geochemical

- ✓ Shaw will evaluate adding least-squares regression results to the geochemical plots.

Sensitive Species

- ✓ Although the state- and federally-listed threatened LBB does not occur on site, it is recognized that Longhorn is within its historical range, and likely has habitat that is useable by the LBB. The LBB is listed as a "transient" species in Harrison County by the TPWD. The possible presence of the LBB will be addressed by adding an "modified" raccoon as a surrogate receptor for the LBB (in addition to the existing raccoon receptor already in the Step 3 Report). Exposure parameters within the range of the raccoon will be selected, but will be modified for the evaluation of the LBB. Shaw will determine whether to select conservative exposure parameters, or more realistic exposure parameters for the LBB evaluation, with the understanding that their decision may affect the final selection of cleanup values.

- ✓ Three other listed species-- the alligator snapping turtle, timber rattlesnake, and Rafinesque's Big Eared Bat-- have been described as present or possibly present at the site by wildlife agencies (i.e., the USFWS and TPWD) or other historical sources. However, no formal or official written notification of their presence on site has been received by Shaw or the Army. Nevertheless, Shaw agrees to address the potential risk to these species in the Installation-wide risk assessment. The alligator snapping turtle and timber rattlesnake will be addressed qualitatively in the report. Shaw agreed during the meeting to evaluate the Rafinesque's Big Eared Bat either quantitatively or qualitatively in the Uncertainty Section.

  [*Note 1: Because of the lack of official documentation of the bat and the uncertainty involved with modeling the chemical uptake from site media to moths (which are the primary prey item for the bat), it is Shaw's opinion that the most appropriate approach is to address the bat qualitatively, and intends to do so barring further discussions with or objections from the Longhorn stakeholders.*]

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

February 15, 2006

Ms. Rose Zeiler, Ph. D.
Longhorn AAP Site Manager
Post Office Box 220
727 South Brooklyn Road
Ratcliff, AR 72951

Re: Longhorn Army Ammunition Plant (LHAAP)
Draft Final Addendum 2
Additional Investigation at Pistol Range

Dear Ms. Zeiler:

The Environmental Protection Agency (EPA) received the *Draft Final Addendum 2 Additional Investigation at Pistol Range* (Shaw Environmental, Inc., February 2006) on Monday evening via email. A hard copy of the document was received on Tuesday, February 14, 2006. It is EPA's understanding that the contractor will be mobilizing to the site on Monday, February 20, 2006, to implement the sampling effort outlined in the Draft Final Addendum. The EPA has completed our initial review of this document. Based on this brief review, enclosed find EPA's comments. Please note that EPA may not always be able to conduct expedited reviews of documents and that additional time should be allocated in the contractor's schedule for EPA's reviews. If you have any questions, please feel free to give me a call at 214-665-6758.

Sincerely,

Chris G. Villarreal
Remedial Project Manager

Enclosures (1)

cc: Cliff Murray, U.S. Army Corps of Engineers
Alen Etheredge, Texas Commission on Environmental Quality
Barry Forsythe, U.S. Fish and Wildlife Service
Praveen Srivastav, Environmental Resources Management

EPA COMMENTS ON THE DRAFT FINAL ADDENDUM 2 ADDITIONAL INVESTIGATION AT PISTOL RANGE FEBRUARY 2006

1. **Section 1.1 Project Objectives, Page 1-1**

Text states, "*The objective of the activities described in this addendum is to determine the horizontal and vertical extent of lead within the area designated as the Pistol Range.*"

Comment

In addition to lead, small arms firing ranges may contain antimony, copper, zinc, and arsenic from bullets, fragments, and bullet jackets. In additional the six soil samples collected on June 21, 1995, and subsequent sample collected on November 11, 1995, at the pistol range [samples were analyzed for toxicity characteristic leaching procedure (TCLP) lead), has any other sampling occurred? Have samples been analyzed for metals other than lead?

2. **Section 1.2 Site Description, page 1-1**

Text states, "*The site is located directly east of Harrison Bayou ...*"

In addition to the sample locations identified, additional surface soil sampling should be conducted in any potential surface water flow pathways from the Small Arms Firing Range towards Harrison Bayou.

3. **Section 1.3 Previous Investigation, page 1-1**

Provide a figure showing the location of previous samples and analytical results.

4. **Section 2.2 Screening Survey Sample Collection, page 2-1**

Text states, "*Samples will be collected at each of the grid nodes shown on Figure 2-1.*"

Comment

The grid on Figure 2-1 only covers the eastern end of the firing range. The grid needs to be expanded to cover the entire firing range. As stated in Section 1.2 (Site Description), "*The Pistol Range was a small arms firing range, but it history and usage is not well documented.*" Based on the dimensions of the range (i.e., area of clearing), it is possible that guns other than pistols were used here. In respect to collecting grab samples, the

following discussion was taken from the Interstate Technology and Regulatory Council (ITRC) Small Arms Firing Range Team's Technical/Regulatory Guideline document, *Characterization and Remediation of Soils at Closed Small Arms Firing Ranges* (January 2003).

> *The single most important step in any soil characterization or treatability study is sample collection and preparation. As such, it is not necessarily the size of the sample submitted, but rather the accuracy and representativeness of the sample compared to the whole volume of soil to be treated. This is difficult to achieve as lead contamination at small arms firing ranges presents the following unique challenges:*
>
> - *Metal contaminants are present mostly as discrete particles ranging in size from intact bullets or shot to bullet fragments.*
> - *Lead bullets striking the impact berm at high speed can actually vitrify on impact, forming "melts" on individual soil particles.*
> - *Lead bullets at ranges that don't have an active environmental stewardship plan or lead management plan may corrode over time. During rainfall, the surface corrosion may dissolve.*
>
> *(Section 2.6.3 Sample Collection)*
>
> *Soil sampling procedures begin with appropriate sample collection. Soil samples from firing ranges are usually a heterogeneous mixture of matrix materials and contaminants. Individual granules of soil samples can be significant relative to the size of a subsample taken for analysis. Consequently, the analytical results can vary considerably depending on the particular group of granules selected in the subsample. Sample collection strategies should, therefore, be site specific and a function of particulate metal distribution and soil gradation.*
>
> *Several approaches for addressing the inherent variability of particulate metal distribution and soil gradation, as well as vertical and horizontal distribution of contaminants between different types of firing ranges (e.g., rifle and pistol versus trap and skeet), have been developed (see Appendix B).*
>
> *In soils where the distribution of contaminants is widespread and not easily predicted, a composite approach has been developed by Jenkins and others from the U.S. Army Cold Regions Research and Engineering Laboratory (USACRREL). This approach was initially developed for use in characterizing training range soils that had received indirect fire, with subsequent explosion of the rounds resulting in a heterogeneous distribution of explosives in the form of small particles. The typical small arms firing range floor is similar in nature in that it receives indirect fire, and the particulates that are present are generally fragments from high energy impacts and are dispersed in a heterogeneous manner.*

Since 1999, this approach has been successfully implemented at numerous small arms firing ranges. At Camp Edwards, located on the Massachusetts Military Reservation, this approach was used for both training ranges and small arms firing range floors. Collection began with dividing the area of interest into grids measuring 22 x 22 feet. Five subsamples were spaced in an "X" pattern. Each of the four corner subsamples was spaced 5.5 feet from the nearest grid edges. The center subsample was located at the center of the grid. Sampling intervals may vary but are usually 0-6, 6-12, 12-24, or 24-36 inches below ground surface (bgs), based on the location within the range and anticipated depth of penetration by projectiles.

The subsamples were then composited. Each composited sample was placed in a clean cement mixer and mixed for five minutes to maximize homogenization. Alternatively, the composited sample may be rolled on a plastic high-density polyethylene tarpaulin from each of the corners to the middle of the tarp, repeating the rolling process three times. In either case, homogenization equipment is decontaminated between samples.

For berm areas, however, the particles are concentrated in bullet pockets and can be found at depths exceeding several feet. In these areas, trenching through the berm will provide a more appropriate sample, with the added benefit of being able to visually inspect the berm core at depth. Samples are collected from the trench walls in this case and composited as outlined above.

The following comment was provided by Ruben Moya (EPA Project Manager) based on his military experience with firing ranges:

Pistol ranges, historically will have a high content of spent shell casings and depending on the time era that this range came into existence, a variety of bullet heads of various material...you'll have lead bullet heads and copper. The map attached to the workplan, by my measurements (approximations) shows a pistol range that is nearly 120 ft wide by nearly 300 ft in length...if these measurements are correct, by my military experience...this range was not just a pistol range but a rifle range as well.

The investigation to delineate the horizontal and vertical extent of lead may have to be extended/modified. When I attended various pistol ranges throughout my military career, depending on the frequency of usage, there was always one or two of my colleagues who would inadvertently fire their weapon into the ground after just having drawn them from their holster...hence several incidents of misfires not down range at targets, but anywhere from 3 yards from the target to 25 yards away from the target into the ground...this distance was increased as rifles were being tested and/or used to qualify with; shooting into the ground inadvertently while

trying to beat the "clock" for the type of "course of fire" qualifying for. I would extended the "grid node" from the berm out to Robert Ave to the length of the entire range...this site was used starting in 1942; the area manufactured various types of ammunition/munitions...the length of the range could be indicative of not just a pistol and rifle range, but also a testing facility (ammo/munitions...new types of firearms).

5. Section 3.2 Confirmation Samples, page 3-2

Text states, "*If analytical results indicate greater than 100 mg/kg, then the sample will be analyzed for TCLP.*"

I assume the 100 mg/kg criteria is based on the 5 mg/L regulatory limit of TCLP lead. In determining if a sample should submitted for TCLP analysis, soil type should also be considered. If sandy soils are encountered, some of these samples should also be submitted for TCLP analysis even if the 100 mg/kg criteria is not exceeded.

In addition to lead, confirmation samples should also analyzed for other metals of interest (i.e., antimony, copper, zinc, and arsenic).

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

February 16, 2006

Ms. Rose Zeiler, Ph. D.
Longhorn AAP Site Manager
Post Office Box 220
727 South Brooklyn Road
Ratcliff, AR 72951

Re: Longhorn Army Ammunition Plant (LHAAP)
Decision Documentation Report for
LHAAP-03, LHAAP-06, and LHAAP-23

Dear Ms. Zeiler:

The Environmental Protection Agency (EPA) has completed our review of the *Decision Documentation For LHAAP-03, LHAAP-06, and LHAAP-23* (Shaw Environmental, Inc., January 2006). Based on this review, sufficient documentation has been provided for LHAAP-03 (Waste Water Collection Point at Paint Shop), LHAAP-06 (Building 54F Waste Collection Point), and LHAAP-23 (Building 707-C Storage Area for PCBs), to support the no-further-action decision. However, one significant discrepancy between the report and its supporting documentation was noted. Namely, while the report and the majority of supporting documentation identifies LHAAP-23 as Building 707-C (Storage Area for PCBs), the Army's memorandum dated April 5, 1988 (regarding the Interim Final Report, Ground-water Contamination Survey no. 30-26-0851-88, Evaluation of Solid Waste Management Units - SWMU), includes a table (copy enclosed) with the following information:

SWMU Site Number	SWMU	Site Type
LHAAP-23 (N, S)	Open Burning Pans	Open Burning

The memorandum also includes a figure (Figure 2 Solid Waste Management Units at Longhorn Army Ammunition Plant) (copy enclosed) showing the locations of the various Solid Waste Management Units. The figure is not very clear but does show a different location for LHAAP-23 than was identified in Figure 1 (Environmental Sites – Decision Document) (copy enclosed) of the Decision Documentation report.

Based on the figures, it is apparent that LHAAP-23 (Building 707-C) is not the same LHAAP-23 identified in the Army's April 1988 memorandum. This being the case, to what site is the Army's April 1988 memorandum referring? How is the "Open

Burning Pans" site currently identified? Has any additional investigative and/or remedial work occurred at the "Open Burning Pans?" I look forward to resolving this issue.

Sincerely,

Chris G. Villarreal
Remedial Project Manager

Enclosures (3)

cc: Cliff Murray, U.S. Army Corps of Engineers

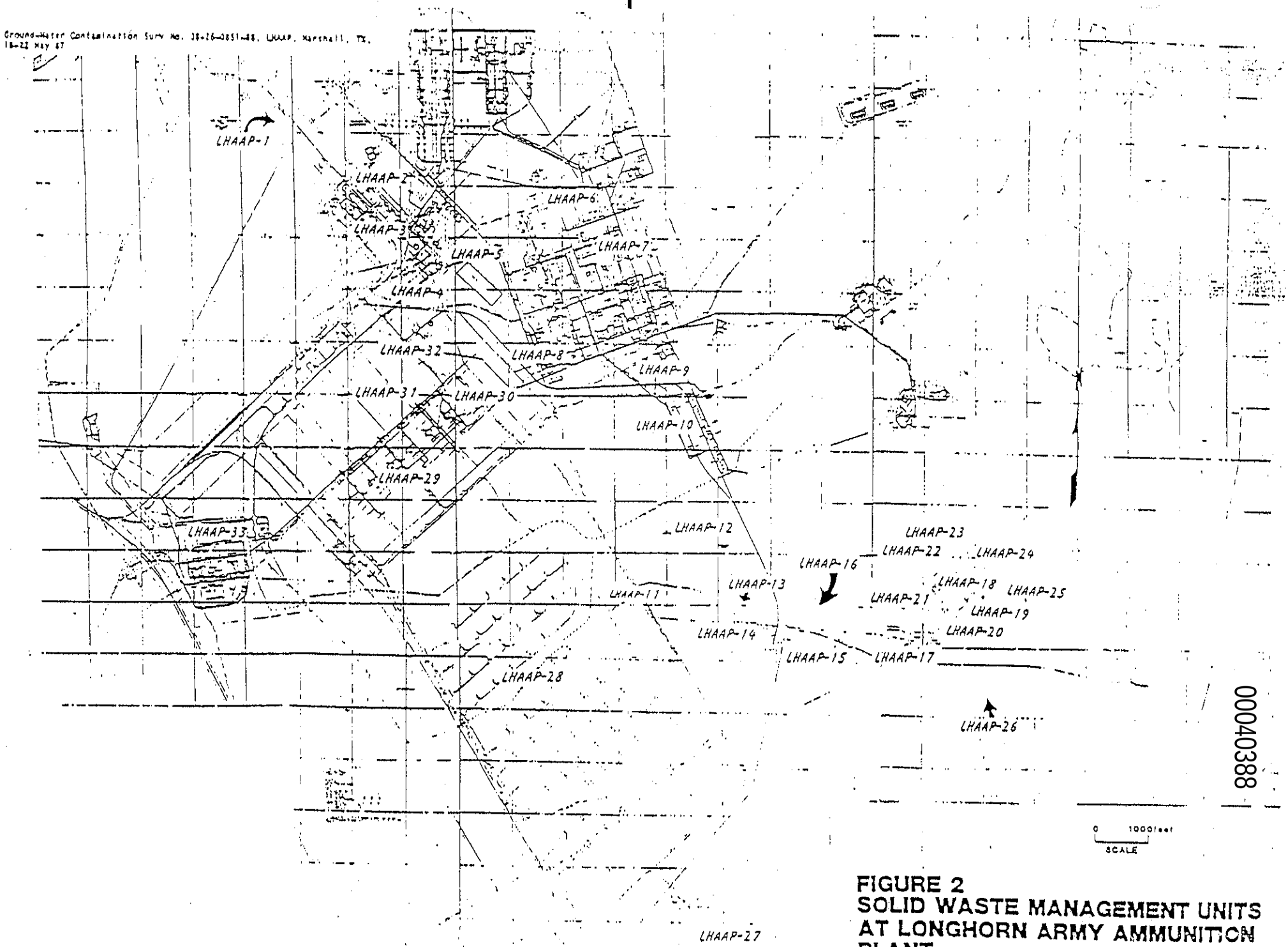
Alen Etheredge, Texas Commission on Environmental Quality

Barry Forsythe, U.S. Fish and Wildlife Service

Praveen Srivastav, Environmental Resources Management

Ground-Water Contamination Surv No. 38-26-0851-88, LHAAP, Marshall, TX, 18-22 May 87

SWMU Site Number	SWMU	Site Type
LHAAP-20	25X Washout Pad	Washdown Area
LHAAP-21	Air Curtain Destructor	Incineration
LHAAP-22 (E,C,W)	Open Burning Cages	Open Burning
LHAAP-23 (N,S)	Open Burning Pans	Open Burning
LHAAP-24	Unlined Evaporation Pond	Lagoon
LHAAP-25	Bldg 41-X	Storage
LHAAP-26	Construction Materials Landfill	Landfill
LHAAP-27	South Test Area	Demilitarization/ Burial
LHAAP-28	Magazine Area	Storage
LHAAP-29	Former TNT Production Area	TNT Manufacturing
LHAAP-30	TNT Red Water Pipeline	Pipeline
LHAAP-31	Bldg 707-C	Polychlorinated biphenyl (PCB) Oil Storage
LHAAP-32	Former TNT Waste Disposal Plant	Waste Treatment and Incineration
LHAAP-33	Bldg 701	PCB-Contaminated Soil Storage
LHAAP-34 (S1-S122)	Sump	Sump Collection Point
LHAAP-35 (X1-X20)	Explosive Waste Pads	Collection Point



00040388

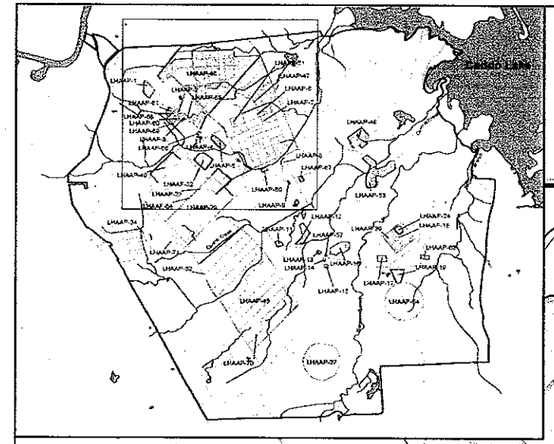
FIGURE 2
SOLID WASTE MANAGEMENT UNITS AT LONGHORN ARMY AMMUNITION PLANT

00040389

OFFICE	COMPILED BY		CHECKED BY		APPROVED BY	
Houston, TX	B.LU	10/27/04	A.MAYILA	10/27/04	P.SRIVASTAV	10/27/04

FILE LOCATION
selknxgis01/longhorn/gisworkspace/mxd/Env_Decision_Doc.mxd

PLOT DATE: 04/26/04
REVISION FORMAT: 10/05/04



LHAAP-1
LHAAP-2
LHAAP-3
LHAAP-4
LHAAP-5
LHAAP-6
LHAAP-7
LHAAP-8
LHAAP-9
LHAAP-23
LHAAP-29
LHAAP-32
LHAAP-46
LHAAP-47
LHAAP-49
LHAAP-50
LHAAP-51
LHAAP-58
LHAAP-60
LHAAP-61
LHAAP-64
LHAAP-66
LHAAP-67
LHAAP-68
LHAAP-69
Goose Prairie Creek
Central Creek

Legend

- Creek/Bayou
- Road
- Longhorn Army Ammunition Plant Approximated Boundary
- Sites Included in the Decision Document
- Sites Not Included in the Decision Document
- Water Body

Note: LHAAP-55 consists of 10 septic tanks.

N
W E
S

0 500 1,000 2,000 Feet

Shaw®

U.S. Army Corps of Engineers
Tulsa District
Tulsa, Oklahoma

Figure 1

Environmental Sites - Decision Document

Longhorn Ammunition Plant
Karnack, Texas

Shaw® Shaw Environmental, Inc.

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

Location of Meeting: Via Teleconference

Date of Meeting: **February 16, 2006, 9:00 – 11:00 AM**

Meeting Participants:

BRAC:	Rose M. Zeiler
USACE-Tulsa:	Cliff Murray, Rick Smith
USFWS:	Barry Forsythe, Paul Bruckwicki
Shaw Environmental:	Praveen Srivastav, Frank Eidson, Randy McBride
USEPA Region 6:	Chris Villarreal, Rubin Moya, Philip Allen
TCEQ:	Alan Etheredge

Some discussion occurred on the need for access to the Shaw portal. Paul Bruckwicki, Barry Forsythe, and Vicki Reat have been given access but they have not yet tried to access the portal. Philip Allen and Rubin Moya also need access.

The point of contact for administrative record management for Shaw is Praveen Srivastav. He should be copied on all correspondence that needs to go into administrative record.

Defense Environmental Restoration Program (DERP) PBC Update (PS)

Groundwater Treatement Plant Update. Praveen Srivastav informed the group that the plant is being operated under Shaw's management since Dec 1, 2005. The plant is now being operated by Shaw employees, without support from CES, since Feb 1, 2006. Shaw has hired the two former employees of CES. There have been no major issues with the operation of the plant. There is water in Harrison Bayou so discharge water from the plant can be released into the bayou.

Ecological Risk Assessment Status. The comment resolution meeting held on February 9 was considered a success. Shaw has submitted minutes of the meeting and is waiting for comments on the response. Shaw is also evaluating whether completion of the Step 3 report or moving to a BERA was in the best interest of achieving the project goals.

Document Status/Environmental Sites. A document status table was e-mailed to the participants before the call. Army received a letter from EPA agreeing with the no further action determination for sites LHAAP-03, 06, and 23. EPA has a concern that site LHAAP-23

is defined as two different ways and they do not want the Burn Pit definition of the site to fall through the cracks. Cliff Murray informed the group that the burn pit was incorporated into LHAAP-18/24. He will prepare a synopsis of this and provide to the regulators.

File review for Sites LHAAP-55, 64, 66, and 68 will be conducted by Shaw personnel at EPA Dallas office on February 27-28, 2006. Agnes Mayila and Susan Oller will conduct the file review.

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Defense Environmental Restoration Program (DERP) TERC Update

Document Status/Environmental Sites. A document status table was e-mailed to the participants before the call.

Alan Etheredge informed that he is expecting comments on the Modeling Report from the TCEQ reviewer around February 21, 2006.

The Army is resolving regulatory comments on the Draft Final ROD for LHAAP-12. Rose noted that there is an obligation to the public regarding the addition of MNA as a remedy and asked the regulators how this might be addressed without revising the Proposed Plan. Chris Villarreal suggested that the Army publish a notification in the newspaper about the change in remedy for the groundwater from monitoring to monitored natural attenuation. In his opinion, there is no need to revise the proposed plan and another public review. He suggested that the public be informed of the change in remedy at the next RAB meeting. Alan Etheredge stated that he will default to the EPA as to how MNA is incorporated into the ROD. It was agreed that MNA be added to the ROD through the responsiveness summary in the final ROD and that a qualitative reassessment of the remedy to include MNA be added to the Administrative Record by letter to the regulators. Additionally, it was agreed that the public will be provided notice of this change by public notice to be published in the newspaper and by addition to the RAB agenda.

To address a TCEQ comment on the Site 12 ROD, Rose Zeiler reviewed relevant portions from the Army and Navy guidance for Land Use Controls regarding language appropriate to the ROD vs. the RD LUC. Alan Etheredge agreed with Rose regarding the approach where LUC objectives are stated in the ROD and details, including implementation, are included in the LUC remedial design, but restated his concern that the RAOs be clearly set forth in the ROD.

Praveen Srivastav asked as to how the modeling completed recently to support MNA can be presented. Chris Villarreal suggested that the modeling be made a part of the administrative record. It was agreed that the new modeling language also be presented in a letter to the regulators to be made a part of the Administrative Record.

Praveen Srivastav discussed the status of sites LHAAP-32, 48, 53, 37, and 67. Rose Zeiler indicated that the Army intends to prepare the proposed plans for these sites and complete Army reviews, leaving place holders for ecological risk, because the ERA is not yet complete. She asked the regulators if they would be willing to review the proposed plans without eco

sections in them. Both Chris Villarreal and Alan Etheredge agreed to review the proposed plans.

Rose Zeiler discussed LHAAP-08 which has no industrial level risk for soil or groundwater. She indicated that the does not intend to perform residential risk assessment for this site because the site is in the production area where the Army plans to have an area wide LUC. She inquired if an FS will be required for LHAAP-08 in order to progress to proposed plan and ROD – and how industrial use will be addressed without a remedy. Chris Villarreal suggested that the Army can prepare a no action proposed plan and ROD. No action alternative can be considered because there is no remedy in this case. The 5-year reviews conducted for the production area will check if the land use has changed. Rose Zeiler mentioned that this would be consistent with the concept of reasonably anticipated future use or RAFU which does not require a remedy, but since it cannot be transferred "without restriction", five-year reviews would be required. Alan Etheredge mentioned that he is not sure why this is not an LUC remedy. He will read about the RAFU in ROD guidance and provide his input to the Army.

DERP Corps of Engineers Update

Groundwater Perimeter Wells (CM). No update, still trying to resolve issues as to who is going to conduct the sampling. The water levels in the wells have been low due to low precipitation. Rose Zeiler requested that the USACE check the water in creeks and wells to determine the current conditions.

MMRP (RPS). Rick Smith noted that response to regulatory comments have been submitted. An expedited review by EPA will be helpful. The mobilization by Cape is planned for March 06. Chris Villarreal stated that the EPA's MMRP reviewer has been out of the office so the status of the review is not known at the present time. EPA had concern that 3% of the coverage is not acceptable. Rick Smith asked if there was a problem with mobilizing on March 06. Chris indicated that he does not think that there will be an agreement on this issue of how much coverage is enough. It depends upon how the data is used. The Army may not want to investigate more if nothing is found with 3% coverage. However, the EPA may not agree with the conclusion of no further action based on the 3% coverage.

Permit. No update. Still on hold.

Demolition. The EPA CID has declined to pursue the matter any further. As far as they are concerned, the Army can remove their seals and access the landfill. The Army CID has more burden thus they are continuing the investigation.

The Army was issued a Notice of Violation by TCEQ for improper and unauthorized waste disposal at the demolition landfill. The Army needs to coordinate with TDH for sampling to demonstrate whether or not asbestos was friable. Mercury disposal was a major allegation but the final disposition of the mercury is uncertain. The Army CID has stated that the mercury was seized by EPA for analysis. Rose Zeiler needs to follow up with the EPA about mercury disposal allegation. What is it that the regulators need to see on this issue to put it to rest or determine a path forward? Chris Villarreal and Alan Etheredge stated that they will need documentation of what happened and will get back to the Army about this. Rose Zeiler

informed that the contractor will be allowed on the base but not on the landfill until the NOV has been resolved.

Transfer Update. The hold on the transfer is expected to be lifted soon. The next ECOP is expected to include the Eastern Further Investigation Area, two cemeteries, and LHAAP-12. The public hearing by County Commissioner's office is scheduled for February 27 at 7:00 PM.

Threatened/Endangered Species. Rose Zeiler stated that the Black Bear has not been confirmed on the installation. She asked if she has an obligation to conduct any studies regarding T/E species. Alan Etheredge and Chris Villarreal mentioned that they will check with the ecological risk assessors and get back to the Army on this issue. Rose further mentioned that a lot of work goes into the formal confirmation of T/E species on an Army installation and as of now there is no record of the Black Bear on Longhorn. She also noted that she was unaware of the Rafinesque Big Ear Bat. Rose asked when this study was conducted and by whom. Paul Bruckwicki indicated that the bat was sighted over two years ago by a bat specialist. He suggested that the Army contact Meg Goodman, a TPWD nocturnal mammal specialist.

Project Schedule. A brief discussion ensued on the project schedule. Praveen Srivastav indicated that the new schedule is available which was recently updated to the end of January, 2006. Rose Zeiler indicated that she had some changes to the schedule that she will transmit to Shaw via Tulsa District.

Meeting Adjourn.

Action Items:

Army – Research Perchlorate Ecological data with Army.
Army – Follow up on disposition of mercury.
TCEQ – Provide opinion on NFA at Site 8 and RAFU.
Tulsa – Measure water levels at perimeter wells.
Shaw – Provide additional EPA access to portal.

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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: **March 14, 2006, 6:30 – 7:30 PM**

Meeting Participants:

BRAC:	Rose M. Zeiler
USACE-Tulsa:	Cliff Murray, Rick Smith
USFWS:	Mark Williams, Paul Bruckwicki, Barry Forsythe
Shaw Environmental:	Dave Cobb, Kay Everett, Allen Willmore
USEPA Region 6:	Chris Villarreal
TCEQ:	Tom Erny, Alan Etheredge
RAB:	Judith Johnson, Ken Shaw, Robert Speight, Jr., Shirley Shivers, Nigel Shivers, Tony Novak, Tom Walker
Community:	C. Anderson, J. Webb, J. Sanders, M.J. Sanders, R. Anderson, B. Corrigan

An agenda for the meeting was distributed prior to the meeting and also attached with the minutes.

Welcome and Introductions – Rose Zeiler
Rose Zeiler opened the meeting.

Welcome and Introductions – Rose Zeiler
Rose Zeiler opened the meeting.

Open Items – Rose Zeiler and Paul Fortune
Rose Zeiler asked if there were comments or changes on the minutes from the December, 2005 RAB meeting.

A discussion of cost of the environmental restoration program to date took place. Dr. Zeiler stated that approximately $80 million has been expended to date, with a projected total cost (including the 30-year cost-to-complete liability) of approximately $116 million.

Regarding timber sales receipts, the county receives 40% of the net sales. This is after the Army costs are deducted. The county entitlements from the last 5 years total less than

$35,000. The Army has little remaining land that can be timbered and there is no plan to conduct any more timber sales.

Regarding oil and gas production, there is only one producing oil well on Longhorn. All oil and gas leasing is handled by the Bureau of Land Management.

Defense Environmental Restoration Program (DERP) (PBC) Update– Dave Cobb

Groundwater Treatment Plant (GWTP) Update
Dave Cobb, PBC Project Manager, indicated that the plant processed over 2,391,756 gallons in the last quarter. The influent received from the Site 18/24 was 1,086,803 gallons and from Site 16 was 125,810 gallons. Total influent received and processed from Site 18/24 from last month was 405,865 gallons and from Site 16 35,066 gallons.

Document Status/Environmental Sites
Dave Cobb indicated several documents were under preparation. Specifically, several feasibility studies are in development. "No further action" concurrence has been received from regulators for Sites 3, 6, and 23 and letters are expected to document this from the regulatory community.

DERP Total Environmental Restoration Contract Update – Kay Everett

Document Status/Environmental Sites
Several documents are in progress. The Final Record of Decision document for LHAAP-12 is expected to be submitted to the regulators within the next week. Comment resolution has been completed. The draft Land Use Control/Remedial Design document for Site 12 is in review with the Army. The draft final Proposed Plan for LHAAP-32 is in preparation; the comment resolution is completed. The Draft Final Revision 1 Modeling Report is in review with the regulators. EPA comments were received and TCEQ comments are pending. The Draft Final Background Surface Water and Sediment Report, Draft Final Evaluation of Perimeter Well Data for Use as Groundwater Background, Draft Final Data Gaps Investigation Report, and Draft Final Site Evaluation Report for LHAAP-48 and 53 are in review with the regulators. The Draft Work Plan Addendum for LHAAP-59 is in review with the Army and the Draft Proposed Plan for LHAAP-37 and 67 is in preparation.

DERP Corps of Engineers Update – Cliff Murray

Perimeter Well Monitoring
Nothing new to report at this time since there has not been enough water in the wells to sample.

Military Munitions Response Program (MMRP) Update – Rick Smith
Slide presentation
Mr. Smith explained what a MMRP site is and went over some basic acronyms. The MMRP sites may contain munitions and explosives of concern (MEC), what formally was known as unexploded ordinance which includes all .22 shells to mortars and the releases from these sources. This work is being conducted as part of an EE/CA (Engineering Evaluation/Cost Analysis). The contractor used in this effort is called CAPE. The work plan for doing this

effort has been completed and the work started February 28, 2006. The EE/CA is being conducted on three sites. The environmental investigation for Site 27 (South Test Area) has been completed. For the purposes of the MMRP, the sites have a new designation; labeled LHAAP-001-R-01 for the MMRP, Site 27 consists of 83 acres in which photoflash bombs were tested and demilitarized illuminating devices and leaking production items were detonated. Site 53 (Static Test Area), labeled LHAAP-002-R-01, is an area of approximately 27 acres that was used for static test firing of rocket motors and flares and illuminating devices. The third site, Site 54 (Ground Signal Test Area), designated LHAAP-003-R-01 for the MMRP, covers an area of approximately 80 acres where pyrotechnic munitions were tested.

Question from the community: How do you measure the accuracy of the work or how do we know we got everything?

There are different stages but they begin with the discovery process. This consists of inventory, interviews with relevant personnel, and researching historical data. The site is modeled and assigned a "number" (RAC) as to what risk the site has. It is a very conservative ranking, one which "errs on the side of safety".

Tests of geophysical methods were conducted by CAPE last fall. This step entailed burying representative objects that were used to test the sensitivity of the geophysical equipment. This test site will be used to periodically test equipment during the field work that will be conducted later. The schedule currently is to continue the field investigations through June 1, 2006 with a Draft Final EE/CA report by July 15, 2006. There will be a public review period of 30 days that would encompass July 25 through August 25, 2006. The Final Action Memo should be issued by October 15, 2006. This memo will consist of recommended actions for each site.

The future requirements are managed this way:

- If no MEC found, then a petition for No Further Action is conducted.
- If MEC is found in a few areas, a limited site characterization is conducted and removal may be performed.
- If MEC is found in large areas and/or in large quantities, additional site characterization and removal may be performed.

If areas were observed with some MEC, then the area is investigated further. It was noted that the coverage area initially investigated will be 3% and the EPA said they were not comfortable with the 3% coverage. Jeff Armstrong, Army Environmental Center, said that transects are used to cover the area in a systematic way.

Question from the community: Do you find it on the ground or surface? Was it tested underground? Answer: There was no subterranean testing. Maintenance was performed on rockets and in areas just below ground in bunkers, but that was the extent.

The earliest these sites will be available for transfer would be June 2007 (that may be optimistic). The more realistic date is January 2008. BRAC and AEC are looking at ways to mitigate the risks to public safety. They are trying to figure out ways to go to areas without disturbing these sites and this is dependent on the findings of the EE/CA.

Question from the community: Will there be access to the site by the public? Dr. Zeiler responded no. Removal actions may be engaged if something is found and an interim solution required. Something could come up to delay or add to this timeframe.

Question from the community: Are you saying no working access at the plant? Answer: Not to these particular sites but access to the Refuge is up to Fish and Wildlife. The original schedule for MMRP activities has undergone significant revision. The drought set the schedule back a year because a controlled brush burn was not possible. A funding delay also was a major setback.

Mary Sanders asked whether this area will be usable for public access or will the MMRP investigation delay the access to other property? The land that is already in the refuge and given to Fish and Wildlife, will we still have to wait to use it? Answer: That is a Fish and Wildlife (Mark Williams) call. Paul Fortune asked what the best case scenario is. Mark Williams said that August or September is the earliest and then it would be a limited opening.

Question from the community: Members of the Chamber of Commerce are involved in many engagements and need to know what to tell their audiences when asked about the opening of the refuge to the public. They would like to be specific. They also asked about setting up office space at the refuge. Is September/October a reasonable time frame? Mark Williams agreed and said some areas may be opened up in September, and others will be at least in October. He also indicated that there may be some office space for the Greater Caddo Lake Association at the refuge.

Transfer Update – Rose Zeiler
Dr. Zeiler informed the meeting participants that the hold was removed and that they were awaiting the documentation to continue with the next land transfer. The next ECOP IV will include the East Further Investigation Area. Community member Jay Webb said that he sent a letter to Hutchison's office about lifting the congressional hold.

Other Interest – Rose Zeiler and Paul Fortune
Dr. Zeiler said the hold on the demo landfill has been lifted. In January 2006, the EPA investigators made a finding that they are not inclined to pursue the matter any further. The Army continued to investigate and eventually took their findings to the US Attorney's office. They also declined to prosecute so the stop work order has been lifted and the contractor has been allowed back on the site. During the work stoppage, the state conducted an inspection of the site and issued a Notice of Violation (NOV). Since the area was restricted any attempt to address the violations could not be addressed until the criminal investigation concluded. Accordingly, a meeting with the state and other parties will be held on the 15th (the next day) at the site in order to move toward resolution of the NOV.

Next RAB Meeting
Rose Zeiler suggested that the next RAB meeting will be held on June 20, 2006 at 6:30 PM.

Adjourn

Attachments:
Agenda, Attendees Signup Sheet, December 2005 RAB Meeting Minutes

00040398

RAB Meeting 3/14/06

Christina Anderson 4448 FM3379
Marshall, TX 75670
903/938-3436 edgemont@shreve.net

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Tom Erny	TCEQ Tyler	terny@tceq.state.tx.us
Chris Villarreal	US EPA	villarreal.chris@epa.gov
Jeff Armstrong	USAEC	jeffrey.armstrong@us.army.mil
Jay Webb	Caddo Lake Chamber	JPWebb5@Valornet.com
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Larry McCathran	RAB	3024 Marshall-Leigh Rd. Marshall, TX 75672
Judith Johnson	RAB	1635 Borough Rd Karnack, 75661
Jack M. Sanders		P.O. Box 2007 - Marshall, TX
Mary Jane Sanders		
Robert Speight		(r.speightjr@att.Net) 2757 Quails Landing Karnack Tx 75661
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Richard M. Anderson	Atty.	P.O. Box 550 Marshall 75671
Mark Williams	MSFWS	P.O. Box 239, Karnack, TX 75661
Paul Bruckwicki	USFWS	" " "
Allen Willmore	Shaw	allen.willmore@shawgrp.com
Rose M. Zeiler	HHAAP	
Kay Everett	Shaw	
Bill Corrigan	ES	ces.service@valornet.com
Paul Fortune	RAB	plfortune@hotmail.com

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Subject: **Minutes on the Conference Call to Discuss Perchlorate and Threatened and Endangered (T&E) Species related to Ecological Risk Assessment Approach, Longhorn Army Ammunition Plant (LHAAP)**

Date of call: **March 21, 2006, 3:30 – 4:30 PM**

Date issued: **March 22, 2006**

Call Participants:

Shaw Environmental
Jon Lindberg (JL)
Praveen Srivastav (PS)
Mark Weisberg (MW)

USACE
Rick Smith (RS)
Cliff Murray (CM)

BRAC
Rose Zeiler (RZ)

USACHPPM
Larry Tannenbaum (LT)

Minutes prepared by Shaw on behalf of the USACE and BRAC.
Meeting participants are referred to by initials (e.g., "RZ" = Rose Zeiler).

Call was initiated at the request of RZ, in preparation for tentatively scheduled call on 3/22/06 with LHAPP stakeholders.

RZ asked LT to speak on threatened and endangered (T&E) species issues.

LT said there is no *formal* policy on how to address T&E species in ecological risk assessments (ERAs). He said before any assessment is completed, it is important to determine if the species is actually closely associated with the Site, e.g., migratory birds would be absent a significant portion of the time and therefore a quantitative assessment might not be necessary for this T&E receptor. He said it is important to carefully evaluate whether or not a Site would actually be remediated to protect a T&E species, especially as estimated hazard quotients (HQs) are likely to exceed 1, but they are not a definitive measure of adverse impact. LT stated that it is important to recognize the presence of sensitive species. LT explained the benefit of USACHPPM's rodent sperm analysis (RSA) technique, and why it is a more definitive assessment technique. MW added that Shaw plans on including RSA results in the

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STEP 3/BERA submittal, and that these results were likely to result in less stringent ecological preliminary remediation goals (PRGs).

RZ explained that Texas Parks and Wildlife Division (TPWD) is a State Trustee and not a regulator, therefore, their comments on the LHAAP ERA process are only recommendations, not requirements . Their ultimate concern is natural resource damages. Currently, TPWD is asking for a quantitative ERA hazard evaluation of the Rafinesque's big-eared bat (a T&E species documented at LHAAP), however, USEPA (Marc Greenberg) indicated at the Feb. 9, 2006 Eco Meeting in Austin that a qualitative assessment might be acceptable. MW noted that Shaw has already internally evaluated the Rafinesque's big-eared bat using the Townsend big-eared bat as a surrogate species, and although the estimated hazards do have some uncertainty associated with them, they are generally technically defensible. MW went on to say that Shaw's goal is to revise and submit the Step 3/BERA report and have it accepted by all stakeholders, and that including a quantitative assessment of the bat increases the chances of the deliverable being accepted. It may be difficult to argue that the bat should not be assessed quantitatively, as it is an important species at the Site and there are evaluation techniques available to assess its potential hazard from exposure to Site COPECs.

LT stated, and RZ agreed, that Army will not remediate a Site to protect a T&E species where the T&E species does not have a sustainable population at the Site. MW stated that the population size of the Rafinesque's big-eared bat at LHAAP is unknown at this time, but it has been observed at multiple locations at LHAAP.

Regarding the Louisiana Black Bear, RZ and LT questioned the need to assess this T&E species in the ERA, as its presence at LHAAP has not been confirmed. MW and JL stated that this issue was discussed at the February 9, 206 Eco Meeting in Austin, and stakeholders (primarily TPWD and TCEQ) repeated previous statements that appropriate habitat exists for this species at LHAAP and it may be present onsite, as LHAAP is within the bear's known geographic range. This is not the way I recall the Feb 9 meeting. I do not recall a statement during the teleconference with regulators that the appropriate habitat is known to exist at Longhorn nor do I recall a statement that the bear may be present on site. In fact I read an email from Craig Giggleman to the regulators asserting that the bear is not present. I do recall some discussion that even though it is unlikely to be present, since its range has been extended to Harrison County, is must be considered at Longhorn (Chip Wood). It is also my recollection that I asked Mark Greenberg whether a study to determine whether suitable habitat is present should be initiated. His response was that it should not at this time. Mark Greenberg stated that it is NOT EPA's position that a T&E should be evaluated as a receptor – rather he suggested that some parameters of the raccoon be manipulated to approximate the bear – like

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its range. Wouldn't this then imply that you need to be carefult to limit the amount of manipulation so that you don't end of evaluating a T&E (and generating a large HQ)? It is important to get the wording right - to reflect actual conditions. –The black bear is not confirmed at Longhorn, nor is it known that habitat is present. In fact, according to USFWS, the bear is not believed to be present. MW stated that the currently proposed approach is to use the raccoon as a surrogate for this listed species, and modify the raccoon's exposure factors so that they are closer to the bear's (e.g., use the maximum raccoon home range).

Regarding sensitive species in general, LT agreed that, although it's not the preferred approach, in order to move the process forward, it would be acceptable to quantify hazard estimates for sensitive species, as long as there was adequate discussion regarding the uncertainties involved with the calculations (particularly for a species that is not known to be currently present on site, such as the bear), and that it was made clear in the document that the species being evaluated may not meet all the Army's criteria for the evaluation of sensitive organisms.

Related to perchlorate, LT stated that USACHPPM had not recommended toxicity reference values (TRVs) for this COPEC. RZ stated that Army policy does not allow potential ecological hazards associated with perchlorate to drive remediation at a Site. RZ did confirm that recent Army Policy on perchlorate and human health concerns did allow remediation to protect human health. RZ went on to state that Army will not sign a ROD for LHAAP if a remediation is proposed to address ecological hazards for perchlorate based on eco literature values. Responding to a question from PS, RZ did say that Shaw would still be paid for the closure of a particular Site (e.g., Remedy in Place [RIP]) if ecological PRGs for all non-perchlorate constituents were achieved and perchlorate was remediated to human health. The CO will give you the final answer on the payment question. Also please see email from Jeff Armstrong.

PS and MW discussed that USEPA Region 6 (and TCEQ) would likely deem the Step3/BERA deliverable deficient if potential perchlorate hazards were not quantified. TCEQ recently sent Shaw a large compilation of published papers on perchlorate, so there does appear to be adequate information to evaluate potential perchlorate hazards. MW stated that perchlorate HQs for LHAAP wildlife receptors have already been calculated internally by Shaw, and hazards are lower than previously estimated, due in part to lower estimated bioaccumulation from soil to plants, based on a new regression equation presented at the November 2005 SETAC conference (that was also attended by Vickie Reat of TCEQ).

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RZ and LT agreed that the Step 3/BERA report could present estimated perchlorate HQs, but that the report should not present perchlorate PRGs. The reason for this approach is that Shaw cannot violate Army policy related to remediation of perchlorate at Sites solely to address ecological concerns (see previous discussion). Army agreed to work with Shaw to craft language on this sensitive issue when it came time to prepare the report.

Call terminated.

Texas Commission on Environmental Quality

INTEROFFICE MEMORANDUM

To: Alan Etheredge, Corrective Action Section II, Team 2 **Date:** March 27, 2006

From: Vickie Reat, Technical Support Section, Remediation Division

Subject: Draft Final, Addendum 5, Soil Sampling for Chromium Speciation in Soil
Final Installation-Wide Work Plan
Longhorn Army Ammunition Plant; Karnack, Texas
Prepared by Shaw Environmental, Inc.
February 2006

To support the Installation-Wide Ecological Risk Assessment (ERA) Longhorn proposes to conduct soil sampling to determine chromium speciation in soil at possible source and non-source areas for chromate. Shaw has evaluated site history information to identify possible Cr^{VI} (hexavalent chromium) sources. Three areas were identified where elevated total chromium in soil are near possible Cr^{VI} source areas (Buildings B-16, 68-C, and 24-X). A total of 9 soil samples for chromium speciation will be collected at these areas. Additionally, 9 soil samples for chromium speciation will be collected at non-source areas that have shown elevated total chromium levels. Chromium ratios in each area will be compared. If there is no significant difference between the ratios for each area, an overall chromium ratio will be used for all total chromium data. Otherwise, different ratios will be assumed for possible source areas and non-source areas in the ERA. All soil sampling will be conducted in the waste or industrial sub-areas. Samples will be analyzed for total chromium and Cr^{VI}. Generally, I believe the proposal to be sound. I have the following questions, which can probably be addressed by memo or letter.

- Given the size of the site, what is the rationale for the sample number selected for this study? The following two questions in the next bullet are related to this question.

- Presumably, all sample locations were selected to target locations that have exhibited elevated chromium (i.e. greater than the background concentration of 29 mg/kg). A number of possible chromate sources were identified other than those planned for sampling (Table 1-1). For these other locations, were any soil samples analyzed for chromium or did all sample results in these areas reflect concentrations less than 29 mg/kg? Similarly, were there no other (non-source area) sample locations that exhibited total chromium levels in surface soils above 29 mg/kg (including the low impact area)?

- If two different ratios are used, it is not clear how the borders will be determined in each sub-area since from Table 1-1 there are many possible sources of chromate. In other words, how will the exposure point concentrations for trivalent and hexavalent chromium be assigned in each sub-area relative to the receptor home range, and the source versus non-source ratios?

00040404

Shaw® Shaw Environmental, Inc.

Date: ***March 30, 2006***

Project No.:117591.0009A190

TRANSMITTAL LETTER:

To: Mr. Cliff Murray

***Address*:** US Army Corps of Engineers - Tulsa

CESWT-PP-M
1645 South 101st East Ave
Tulsa, Oklahoma 74128

Re: **Final Addendum 2 Additional Investigation at Pistol Range to Final Installation-Wide Work Plan**
Longhorn Army Ammunition Plant - Karnack, Texas

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

For: Review _____ As Requested _____ Approval _____ Corrections _____ Submittal **X** Other _____

Item No:	***No. of Copies***	***Date:***	***Document Title***
1	3	March 2006	**Final Addendum 2 Additional Investigation at Pistol Range to Final Installation-Wide Work Plan** (a) EPA Comments to Draft Final Addendum 2 Additional Investigation at Pistol Range (b) *Response to EPA Comments to Draft Final Addendum 2 Additional Investigation at Pistol Range* (c) TCEQ Comments to Draft Final Addendum 2 Additional Investigation at Pistol Range (d) *Response to TCEQ Comments to Draft Final Addendum 2 Additional Investigation at Pistol Range* (e) Draft Final Addendum 2 Additional Investigation at Pistol Range

Enclosed are three copies of the above-named document for your use. Verbal comment resolution from the EPA and TCEQ were concluded February 15, 2006. The written comment resolution is attached to the draft final document and, as such, constitutes the final document, Final Addendum 2 Additional Investigation at Pistol Range to Final Installation-Wide Work Plan.

Please distribute to interested parties. Copies have also been sent to people on the distribution list below.

Please call if any questions or comments.

Sincerely:

David P. Cobb

CC: See attached page

100 Technology Center Drive Stoughton, MA 02072 Phone: (617) 589-8000/Fax: (617) 589-2160

Distribution List:

Mr. Rick Smith, USACE, Tulsa (sent to C. Murray for distribution)
Mr. Ken Kebbel, USACE, Tulsa (sent to C. Murray for distribution)
Mr. Chris Villearreal, USEPA, Dallas
Mr. Alan Etheredge, TCEQ, Austin
Mr. Tom Erny, TCEQ, Tyler
Mr. Paul Bruckwicke, USFWL
Mr. Jeff Armstrong - AEC
Ms. Rose Zeiler – BRAC-LHAAP

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

March 30, 2006

DAIM-BD-H-LO

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

Re: Final Addendum 2 Additional Sampling at Pistol Range to Final Installation-Wide Work Plan, Longhorn Army Ammunition Plant, Karnack, Texas, March 2006

Dear Mr. Villarreal,

The above-referenced document is being transmitted to you for your files. 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 document has also been posted on Shaw's LHAAP Project Portal.

The point of contact for this action is the undersigned. I ask that David Cobb, 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, Ph.D.
Longhorn AAP Site Manager

Copies furnished:
Alan Etheredge, TCEQ, Austin, TX
Paul Bruckwicki, Caddo Lake NWR, TX
Cliff Murray, COE – Tulsa District, OK
Richard P. Smith, COE – Tulsa District, OK
David Cobb, Shaw – Stoughton, MA
P. Srivastav, Shaw – Houston, TX (for project files)

00040407

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

March 30, 2006

DAIM-BD-H-LO

Mr. Alan Etheredge
Texas Commission on Environmental Quality
Superfund Investigation (MC-143)
12100 Park 35 Circle, Bldg D
Austin, TX 78753

Re: Final Addendum 2 Additional Sampling at Pistol Range to Final Installation-Wide Work Plan, Longhorn Army Ammunition Plant, Karnack, Texas, March 2006

Dear Mr. Etheredge,

The above-referenced document is being transmitted to you for your files. 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 document has also been posted on Shaw's LHAAP Project Portal.

The point of contact for this action is the undersigned. I ask that David Cobb, 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, Ph.D.
Longhorn AAP Site Manager

Copies furnished:

Chris Villarreal, USEPA Region 6, Dallas, TX
Paul Bruckwicki, Caddo Lake NWR, TX
Cliff Murray, COE – Tulsa District, OK
Richard P. Smith, COE – Tulsa District, OK
David P. Cobb, Shaw – Stoughton, MA
P. Srivastav, Shaw – Houston, TX (for project files)

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

February 15, 2006

Ms. Rose Zeiler, Ph. D.
Longhorn AAP Site Manager
Post Office Box 220
727 South Brooklyn Road
Ratcliff, AR 72951

Re: Longhorn Army Ammunition Plant (LHAAP)
Draft Final Addendum 2
Additional Investigation at Pistol Range

Dear Ms. Zeiler:

The Environmental Protection Agency (EPA) received the *Draft Final Addendum 2 Additional Investigation at Pistol Range* (Shaw Environmental, Inc., February 2006) on Monday evening via email. A hard copy of the document was received on Tuesday, February 14, 2006. It is EPA's understanding that the contractor will be mobilizing to the site on Monday, February 20, 2006, to implement the sampling effort outlined in the Draft Final Addendum. The EPA has completed our initial review of this document. Based on this brief review, enclosed find EPA's comments. Please note that EPA may not always be able to conduct expedited reviews of documents and that additional time should be allocated in the contractor's schedule for EPA's reviews. If you have any questions, please feel free to give me a call at 214-665-6758.

Sincerely,

Chris G. Villarreal
Remedial Project Manager

Enclosures (1)

cc: Cliff Murray, U.S. Army Corps of Engineers
Alen Etheredge, Texas Commission on Environmental Quality
Barry Forsythe, U.S. Fish and Wildlife Service
Praveen Srivastav, Environmental Resources Management

EPA COMMENTS ON THE DRAFT FINAL ADDENDUM 2 ADDITIONAL INVESTIGATION AT PISTOL RANGE FEBRUARY 2006

1. **Section 1.1 Project Objectives, Page 1-1**

Text states, "*The objective of the activities described in this addendum is to determine the horizontal and vertical extent of lead within the area designated as the Pistol Range*."

Comment

In addition to lead, small arms firing ranges may contain antimony, copper, zinc, and arsenic from bullets, fragments, and bullet jackets. In additional the six soil samples collected on June 21, 1995, and subsequent sample collected on November 11, 1995, at the pistol range [samples were analyzed for toxicity characteristic leaching procedure (TCLP) lead), has any other sampling occurred? Have samples been analyzed for metals other than lead?

2. Section 1.2 Site Description, page 1-1

Text states, "*The site is located directly east of Harrison Bayou …*"

In addition to the sample locations identified, additional surface soil sampling should be conducted in any potential surface water flow pathways from the Small Arms Firing Range towards Harrison Bayou.

3. Section 1.3 Previous Investigation, page 1-1

Provide a figure showing the location of previous samples and analytical results.

4. Section 2.2 Screening Survey Sample Collection, page 2-1

Text states, "*Samples will be collected at each of the grid nodes shown on Figure 2-1*."

Comment

The grid on Figure 2-1 only covers the eastern end of the firing range. The grid needs to be expanded to cover the entire firing range. As stated in Section 1.2 (Site Description), "*The Pistol Range was a small arms firing range, but it history and usage is not well documented*." Based on the dimensions of the range (i.e., area of clearing), it is possible that guns other than pistols were used here. In respect to collecting grab samples, the

following discussion was taken from the Interstate Technology and Regulatory Council (ITRC) Small Arms Firing Range Team's Technical/Regulatory Guideline document, *Characterization and Remediation of Soils at Closed Small Arms Firing Ranges* (January 2003).

> *The single most important step in any soil characterization or treatability study is sample collection and preparation. As such, it is not necessarily the size of the sample submitted, but rather the accuracy and representativeness of the sample compared to the whole volume of soil to be treated. This is difficult to achieve as lead contamination at small arms firing ranges presents the following unique challenges:*
>
> - *Metal contaminants are present mostly as discrete particles ranging in size from intact bullets or shot to bullet fragments.*
> - *Lead bullets striking the impact berm at high speed can actually vitrify on impact, forming "melts" on individual soil particles.*
> - *Lead bullets at ranges that don't have an active environmental stewardship plan or lead management plan may corrode over time. During rainfall, the surface corrosion may dissolve.*
>
> *(Section 2.6.3 Sample Collection)*
>
> *Soil sampling procedures begin with appropriate sample collection. Soil samples from firing ranges are usually a heterogeneous mixture of matrix materials and contaminants. Individual granules of soil samples can be significant relative to the size of a subsample taken for analysis. Consequently, the analytical results can vary considerably depending on the particular group of granules selected in the subsample. Sample collection strategies should, therefore, be site specific and a function of particulate metal distribution and soil gradation.*
>
> *Several approaches for addressing the inherent variability of particulate metal distribution and soil gradation, as well as vertical and horizontal distribution of contaminants between different types of firing ranges (e.g., rifle and pistol versus trap and skeet), have been developed (see Appendix B).*
>
> *In soils where the distribution of contaminants is widespread and not easily predicted, a composite approach has been developed by Jenkins and others from the U.S. Army Cold Regions Research and Engineering Laboratory (USACRREL). This approach was initially developed for use in characterizing training range soils that had received indirect fire, with subsequent explosion of the rounds resulting in a heterogeneous distribution of explosives in the form of small particles. The typical small arms firing range floor is similar in nature in that it receives indirect fire, and the particulates that are present are generally fragments from high energy impacts and are dispersed in a heterogeneous manner.*

Since 1999, this approach has been successfully implemented at numerous small arms firing ranges. At Camp Edwards, located on the Massachusetts Military Reservation, this approach was used for both training ranges and small arms firing range floors. Collection began with dividing the area of interest into grids measuring 22 x 22 feet. Five subsamples were spaced in an "X" pattern. Each of the four corner subsamples was spaced 5.5 feet from the nearest grid edges. The center subsample was located at the center of the grid. Sampling intervals may vary but are usually 0-6, 6-12, 12-24, or 24-36 inches below ground surface (bgs), based on the location within the range and anticipated depth of penetration by projectiles.

The subsamples were then composited. Each composited sample was placed in a clean cement mixer and mixed for five minutes to maximize homogenization. Alternatively, the composited sample may be rolled on a plastic high-density polyethylene tarpaulin from each of the corners to the middle of the tarp, repeating the rolling process three times. In either case, homogenization equipment is decontaminated between samples.

For berm areas, however, the particles are concentrated in bullet pockets and can be found at depths exceeding several feet. In these areas, trenching through the berm will provide a more appropriate sample, with the added benefit of being able to visually inspect the berm core at depth. Samples are collected from the trench walls in this case and composited as outlined above.

The following comment was provided by Ruben Moya (EPA Project Manager) based on his military experience with firing ranges:

Pistol ranges, historically will have a high content of spent shell casings and depending on the time era that this range came into existence, a variety of bullet heads of various material...you'll have lead bullet heads and copper. The map attached to the workplan, by my measurements (approximations) shows a pistol range that is nearly 120 ft wide by nearly 300 ft in length...if these measurements are correct, by my military experience...this range was not just a pistol range but a rifle range as well.

The investigation to delineate the horizontal and vertical extent of lead may have to be extended/modified. When I attended various pistol ranges throughout my military career, depending on the frequency of usage, there was always one or two of my colleagues who would inadvertently fire their weapon into the ground after just having drawn them from their holster...hence several incidents of misfires not down range at targets, but anywhere from 3 yards from the target to 25 yards away from the target into the ground...this distance was increased as rifles were being tested and/or used to qualify with; shooting into the ground inadvertently while

trying to beat the "clock" for the type of "course of fire" qualifying for. I would extended the "grid node" from the berm out to Robert Ave to the length of the entire range...this site was used starting in 1942; the area manufactured various types of ammunition/munitions...the length of the range could be indicative of not just a pistol and rifle range, but also a testing facility (ammo/munitions...new types of firearms).

5. Section 3.2 Confirmation Samples, page 3-2

Text states, "*If analytical results indicate greater than 100 mg/kg, then the sample will be analyzed for TCLP*."

I assume the 100 mg/kg criteria is based on the 5 mg/L regulatory limit of TCLP lead. In determining if a sample should submitted for TCLP analysis, soil type should also be considered. If sandy soils are encountered, some of these samples should also be submitted for TCLP analysis even if the 100 mg/kg criteria is not exceeded.

In addition to lead, confirmation samples should also analyzed for other metals of interest (i.e., antimony, copper, zinc, and arsenic).

SHAW RESPONSE TO
EPA COMMENTS ON THE DRAFT FINAL
ADDENDUM 2
ADDITIONAL INVESTIGATION AT PISTOL RANGE
FEBRUARY 2006

1. **Section 1.1 Project Objectives, Page 1-1**

Text states, "*The objective of the activities described in this addendum is to determine the horizontal and vertical extent of lead within the area designated as the Pistol Range*."

Comment

In addition to lead, small arms firing ranges may contain antimony, copper, zinc, and arsenic from bullets, fragments, and bullet jackets. In additional the six soil samples collected on June 21, 1995, and subsequent sample collected on November 11, 1995, at the pistol range [samples were analyzed for toxicity characteristic leaching procedure (TCLP) lead), has any other sampling occurred? Have samples been analyzed for metals other than lead?

Response:
Agree that metals other than lead, including antimony, copper, zinc, and arsenic, are generally present in bullet fragments and may also be present in the soil at the LHAAP pistol range. However, the most likely source of any metals contamination present at this site is the expended rounds in the impact area and the primary constituent of the bullet cores will be lead. It is likely that either steel (copper, nickel and zinc) or copper bullet jackets would be present onsite as well. Antimony and arsenic, if actually used in the alloys that comprise the bullets fired at this range, will be present in much lower concentrations and very likely co-located with lead.

To address the comment, Shaw proposes to also perform antimony, copper, zinc, and arsenic analysis on a subset of the soil samples collected, i.e., those with the highest lead concentrations detected. These samples would be representative of the "worst-case" metals contamination at the pistol range and be the most likely samples to contain these other elements.

It is also important to note that, in addition to lead, the XRF will also detect and quantify copper, arsenic, nickel and zinc simultaneously and automatically during field screening analysis. The results from these other metals will be documented and reported along with the lead data.

To address the other questions in the comment, to our knowledge no other samples other than the TCLP lead samples collected in 1995 have been collected at the pistol range.

2. Section 1.2 Site Description, page 1-1

Text states, "*The site is located directly east of Harrison Bayou …*"

In addition to the sample locations identified, additional surface soil sampling should be conducted in any potential surface water flow pathways from the Small Arms Firing Range towards Harrison Bayou.

Response:
Agree. It is somewhat likely based on the relatively flat topography of the site that surface water may have flowed from the range impact areas toward Harrison Bayou. Once onsite, the Shaw sampling team will assess the likely flow directions and collect additional samples for XRF analysis as needed.

3. Section 1.3 Previous Investigation, page 1-1

Provide a figure showing the location of previous samples and analytical results.

Response:
Historical sketch attached.

4. Section 2.2 Screening Survey Sample Collection, page 2-1

Text states, "*Samples will be collected at each of the grid nodes shown on Figure 2-1*."

Comment
(Part A):
[Added by Shaw to aid in responding to comment]
The grid on Figure 2-1 only covers the eastern end of the firing range. The grid needs to be expanded to cover the entire firing range. As stated in Section 1.2 (Site Description), "*The Pistol Range was a small arms firing range, but it history and usage is not well documented*." Based on the dimensions of the range (i.e., area of clearing), it is possible that guns other than pistols were used here.

(Part B):
In respect to collecting grab samples, the following discussion was taken from the Interstate Technology and Regulatory Council (ITRC) Small Arms Firing Range Team's Technical/Regulatory Guideline document, *Characterization and Remediation of Soils at Closed Small Arms Firing Ranges* (January 2003).

The single most important step in any soil characterization or treatability study is sample collection and preparation. As such, it is not necessarily the size of the sample submitted, but rather the accuracy and representativeness of the sample compared to the whole volume of soil to

be treated. This is difficult to achieve as lead contamination at small arms firing ranges presents the following unique challenges:

- *Metal contaminants are present mostly as discrete particles ranging in size from intact bullets or shot to bullet fragments.*
- *Lead bullets striking the impact berm at high speed can actually vitrify on impact, forming "melts" on individual soil particles.*
- *Lead bullets at ranges that don't have an active environmental stewardship plan or lead management plan may corrode over time. During rainfall, the surface corrosion may dissolve.*

(Section 2.6.3 Sample Collection)

Soil sampling procedures begin with appropriate sample collection. Soil samples from firing ranges are usually a heterogeneous mixture of matrix materials and contaminants. Individual granules of soil samples can be significant relative to the size of a subsample taken for analysis. Consequently, the analytical results can vary considerably depending on the particular group of granules selected in the subsample. Sample collection strategies should, therefore, be site specific and a function of particulate metal distribution and soil gradation.

Several approaches for addressing the inherent variability of particulate metal distribution and soil gradation, as well as vertical and horizontal distribution of contaminants between different types of firing ranges (e.g., rifle and pistol versus trap and skeet), have been developed (see Appendix B).

In soils where the distribution of contaminants is widespread and not easily predicted, a composite approach has been developed by Jenkins and others from the U.S. Army Cold Regions Research and Engineering Laboratory (USACRREL). This approach was initially developed for use in characterizing training range soils that had received indirect fire, with subsequent explosion of the rounds resulting in a heterogeneous distribution of explosives in the form of small particles. The typical small arms firing range floor is similar in nature in that it receives indirect fire, and the particulates that are present are generally fragments from high energy impacts and are dispersed in a heterogeneous manner.

Since 1999, this approach has been successfully implemented at numerous small arms firing ranges. At Camp Edwards, located on the Massachusetts Military Reservation, this approach was used for both training ranges and small arms firing range floors. Collection began with dividing the area of interest into grids measuring 22 x 22 feet. Five subsamples were spaced in an "X" pattern. Each of the four corner subsamples was spaced 5.5 feet from the nearest grid edges. The center subsample was located at the center of the grid. Sampling intervals may

vary but are usually 0-6, 6-12, 12-24, or 24-36 inches below ground surface (bgs), based on the location within the range and anticipated depth of penetration by projectiles.

The subsamples were then composited. Each composited sample was placed in a clean cement mixer and mixed for five minutes to maximize homogenization. Alternatively, the composited sample may be rolled on a plastic high-density polyethylene tarpaulin from each of the corners to the middle of the tarp, repeating the rolling process three times. In either case, homogenization equipment is decontaminated between samples.

For berm areas, however, the particles are concentrated in bullet pockets and can be found at depths exceeding several feet. In these areas, trenching through the berm will provide a more appropriate sample, with the added benefit of being able to visually inspect the berm core at depth. Samples are collected from the trench walls in this case and composited as outlined above.

(Part C):

The following comment was provided by Ruben Moya (EPA Project Manager) based on his military experience with firing ranges:

Pistol ranges, historically will have a high content of spent shell casings and depending on the time era that this range came into existence, a variety of bullet heads of various material...you'll have lead bullet heads and copper. The map attached to the work plan, by my measurements (approximations) shows a pistol range that is nearly 120 ft wide by nearly 300 ft in length...if these measurements are correct, by my military experience...this range was not just a pistol range but a rifle range as well.

The investigation to delineate the horizontal and vertical extent of lead may have to be extended/modified. When I attended various pistol ranges throughout my military career, depending on the frequency of usage, there was always one or two of my colleagues who would inadvertently fire their weapon into the ground after just having drawn them from their holster...hence several incidents of misfires not down range at targets, but anywhere from 3 yards from the target to 25 yards away from the target into the ground...this distance was increased as rifles were being tested and/or used to qualify with; shooting into the ground inadvertently while trying to beat the "clock" for the type of "course of fire" qualifying for. I would extended the "grid node" from the berm out to Robert Ave to the length of the entire range...this site was used starting in 1942; the area manufactured various types of ammunition/munitions...the length of the range could be indicative of not just a pistol and rifle range, but also a testing facility (ammo/munitions...new types of firearms).

Response:

Part A and Part C:
Both of these parts of the comment are similar in theme and have been grouped together for a single response.

Agree with the comment that the historical use of the pistol range is not well documented and that the possibility exists that other weapons were fired and other types of small arms munitions may be present in the impact area. However, it is important to realize that whatever size the range may have been and wherever the range firing points may have been once located, the basic orientation of the range has always been the same. That is to say that the target line has been located on the east side of the site and the impact berm was located immediately behind. Therefore, the largest concentration of bullets and fragments on the ground surface (and the primary source of potential soil contamination) is located in the range impact area on the east side of the site and that is where the largest number of investigative samples should be collected.

During the work plan preparation, Shaw saw evidence in the field that the pistol range firing line was located at the end of Robert Avenue. The cleared area behind the firing line was presumed to be an assembly or training area for the users of the range and not part of the active range itself.

To address the comment, Shaw proposes to extend the planned sampling grid to the west, taking into account any field indicators that firing points may have once existed in this area. The number and depth of the sample points will be determined in the field. The Shaw field team will also look for drainage pathways in this area that lead toward Harrison Bayou and collect sediment or depositional soil samples where appropriate.

Part B:
Shaw is familiar with the referenced ITRC document and the procedures established by the Army CRREL for collecting soil samples for explosives analysis on former munitions ranges. Shaw also recognizes the challenges posed by collecting representative soil samples at small arms ranges where particulate lead-containing bullet fragments are sometimes present in high concentrations and can cause a significant biasing effect on the analytical sample results.

Keeping in mind the objective of this investigation as stated in Section 1.1 is to “delineate the horizontal and vertical extent” of lead contamination at the pistol range, Shaw proposes in the work plan a discrete sampling approach with real-time XRF analysis in the field. To combat the potential biases, Shaw will homogenize samples as much as possible, given the limitations of time in the field while maximizing the total quantity of samples analyzed. The presence of bullets and bullet fragments from the samples collected in the range impact zone

will be noted on the sample collection log, however these fragments will be removed from the sample prior to XRF and laboratory analysis and their biasing influences reduced. The remaining soil will be homogenized using the approved EPA cone-and-quarter procedure and analyzed with a 10 percent duplicate frequency to assess analytical precision.

The ultimate goal is to provide the Army and the regulatory agencies with a representative data set that will be useful in planning and executing the next phase of work - a soil removal phase. To achieve that end, a discrete sampling approach will work best. The data user will be able to compare the contamination present at a particular spatial point to the prescribed remedial goal and determine if that area either needs excavation or not. Composite sampling data does not lend itself well to the same approach.

It should be noted that the same method ("nature and extent" delineation during a small arms range investigation phase followed by remedial action and post-excavation confirmatory sampling phase) has been successfully used by Shaw at multiple DOD ranges over the past 10 years. It has been approved by numerous EPA regions and various state agencies.

5. Section 3.2 Confirmation Samples, page 3-2

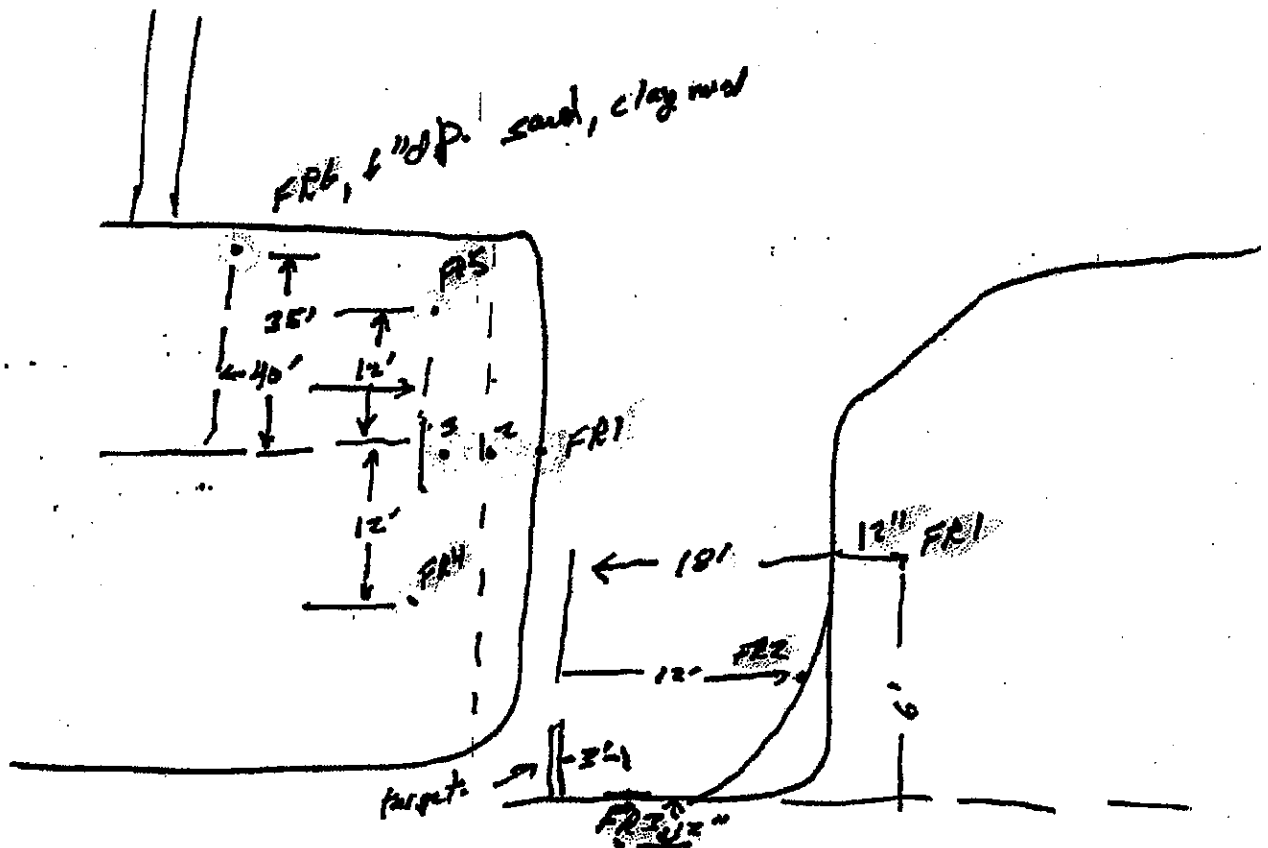
Text states, "*If analytical results indicate greater than 100 mg/kg, then the sample will be analyzed for TCLP*."

I assume the 100 mg/kg criteria is based on the 5 mg/L regulatory limit of TCLP lead. In determining if a sample should submitted for TCLP analysis, soil type should also be considered. If sandy soils are encountered, some of these samples should also be submitted for TCLP analysis even if the 100 mg/kg criteria is not exceeded.

In addition to lead, confirmation samples should also analyzed for other metals of interest (i.e., antimony, copper, zinc, and arsenic).

Response:
The purpose of the TCLP analyses is to get an approximate correlation between total lead and potential TCLP waste levels. What should have been stated in the work plan was that a few, selected samples will be analyzed for TCLP lead based on the laboratory reported total lead. Shaw anticipates five or fewer samples will actually be analyzed for TCLP lead.

6/21/95
Firing Range



FR2- Surface where shot has been hitting. Lead shot mixed in sample.
All samples clay unless noted.

00040419

TCEQ COMMENTS ON THE DRAFT FINAL ADDENDUM 2 ADDITIONAL INVESTIGATION AT PISTOL RANGE FEBRUARY 2006

Electronic transmission:
From: Alan Etheredge [mailto:AETHERED@tceq.state.tx.us]
Sent: Tuesday, February 14, 2006 8:55 AM
To: villarreal.chris@epa.gov; Srivastav, Praveen; Rose M Ms BRAC Zeiler
Cc: Cobb, Dave; Jones, Greg N; Everett, Kay; Cliff SWT Murray; Richard P SWT Smith
Subject: Re: Draft Final Work Plan Addendum, Pistol Range

Praveen:

I've reviewed the Draft Final Work Plan Addendum, Pistol Range, and offer the following comments:

- Overall the plan appears appropriate given the objectives;
- The proposed approach, to select samples over the range of encountered XRF values for 6010 confirmation, is appropriate. Please consider if 10% of the total sample count will give sufficient data to assess the XRF value correlation over the entire possible range - review of the XRF data may show that you need more 6010 confirmation samples at each end of the range to conduct a valid correlation evaluation at the margins of interest;

A very minor point - please clarify the "regulatory limit" mentioned in the last sentence of section 1.3 (we know the TCLP characteristic value has little to do with the risk assessment).

I'm still able to participate in a phone call if needed.

Thanks,
AFE

RESPONSE TO
TCEQ COMMENTS ON THE DRAFT FINAL
ADDENDUM 2
ADDITIONAL INVESTIGATION AT PISTOL RANGE
FEBRUARY 2006

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Subject: Re: Draft Final Work Plan Addendum, Pistol Range

Praveen:

I've reviewed the Draft Final Work Plan Addendum, Pistol Range, and offer the following comments:

- Overall the plan appears appropriate given the objectives;

RESPONSE: NOTED

- The proposed approach, to select samples over the range of encountered XRF values for 6010 confirmation, is appropriate. Please consider if 10% of the total sample count will give sufficient data to assess the XRF value correlation over the entire possible range - review of the XRF data may show that you need more 6010 confirmation samples at each end of the range to conduct a valid correlation evaluation at the margins of interest;

RESPONSE: NOTED; 10% WAS CONSIDERED AND INSTITUTED

A very minor point - please clarify the "regulatory limit" mentioned in the last sentence of section 1.3 (we know the TCLP characteristic value has little to do with the risk assessment).

RESPONSE: NOTED. TCLP REGULATORY LEVEL IS NOT SIGNIFICANT TO THE INVESTIGATION AND MAY BE IGNORED.

I'm still able to participate in a phone call if needed.

Thanks,
AFE

DRAFT FINAL

ADDENDUM 2
ADDITIONAL INVESTIGATION AT PISTOL RANGE
TO
FINAL
INSTALLATION-WIDE WORK PLAN
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.
3010 Briarpark Suite 4N
Houston, Texas 77042

Contract Number W912QR-04-D-0027
Task Order No. DS02

February 2006

ADDENDUM 2
ADDITIONAL SAMPLING AT PISTOL RANGE
TO
INSTALLATION-WIDE WORK PLAN
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
FEBRUARY 2006

PRAVEEN SRIVASTAV
Name of Texas Professional Geoscientist

1696
License Number

SHAW ENVIRONMENTAL, INC.
Company

3010 BRIARPARK DRIVE, SUITE 4N, HOUSTON, TX 77042
Address

I certify with my signature below, that the written descriptions and graphical depictions of geology and hydrogeology contained within this report were prepared under my supervision, and accurately reflect existing knowledge about the geology and hydrogeology of the referenced site.

Signature

2/13/06
Date Signed

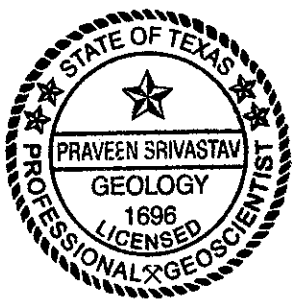


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Acronyms and Abbreviations

bgs	below ground surface
DPT	direct push technology
GPS	global positioning system
LHAAP	Longhorn Army Ammunition Plant
MARC	Multiple Award Remediation Contract
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
Shaw	Shaw Environmental, Inc.
TCLP	toxicity characteristic leaching procedure
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
XRF	x-ray fluorescence

1.0 Introduction

The U.S. Army Corps of Engineers (USACE), Tulsa District, contracted Shaw Environmental, Inc. (Shaw), to perform an additional investigation to delineate the horizontal and vertical extent of lead at the Pistol Range located at the former Longhorn Army Ammunition Plant (LHAAP). This work is being performed under the Louisville District's Multiple Award Remediation Contract (MARC) No. W912QR-04-D-0027, Task Order DS02, with oversight by the Tulsa District. This addendum provides details about the work activities planned for the field investigation of the Pistol Range and describes how the site objectives will be accomplished.

1.1 Project Objectives

This document is an addendum to the *Final Installation-Wide Work Plan, Longhorn Army Ammunition Plant, Karnack, Texas* (Work Plan) (Shaw, 2006). The objective of the activities described in this addendum is to delineate the horizontal and vertical extent of lead within the area designated as the Pistol Range. A portable x-ray fluorescence (XRF) spectrometer will be used to quantify the horizontal and vertical extent of lead. Soil samples will be collected for laboratory analysis to confirm the XRF results.

1.2 Site Description

The Pistol Range encompasses 0.4 acres and is located in a heavily wooded area at the end of Robert Avenue south of Avenue "Q". The site is located directly east of Harrison Bayou in the southern portion of the former LHAAP installation. The Pistol Range was a small arms firing range, but its history and usage is not well documented.

1.3 Previous Investigation

Six soil samples were collected on June 21, 1995, and a subsequent sample was collected on November 11, 1995 at the Pistol Range (Complete Environmental Service, 2004). The samples were analyzed for toxicity characteristic leaching procedure (TCLP) lead. Samples collected from 12 inches below ground surface (bgs) or from the clay berm had TCLP lead concentrations of 0.46 milligrams per liter (mg/L) or less. Soil samples collected from the ground surface behind the target had concentrations up to 1,100 mg/L for TCLP lead. The regulatory limit of TCLP lead is 5 mg/L.

2.0 Site Activities

This section defines the field sampling activities proposed for the Pistol Range. Tasks include site reconnaissance, screening with an XRF to delineate lead contamination, and selection and analysis of confirmation samples.

2.1 Site Reconnaissance

Prior to mobilization with the XRF spectrometer, a site reconnaissance will be performed to achieve the following:

- Evaluate site conditions
- Conduct brush clearing, if needed
- Confirm the overall physical extent of the firing range
- Confirm historic locations of firing lines, targets, projectile impact areas
- Establish sampling locations

XRF sample locations will be delineated using stakes or flags. The locations will be based on a pre-established grid. **Figure 2-1** shows the grid pattern established in 25-foot rectangular sections to cover the site.

The 25-foot grid will provide approximately 25 locations to be screened (sampled) at the grid node points. Samples will be taken at incremental depths.

2.2 Screening Survey Sample Collection

Samples will be collected at each of the grid nodes shown on **Figure 2-1**. Additional sample locations will be established east of the firing line and on the berm since lead concentrations are probably denser at these locations due to the operational use of the site. Sample locations at the berm will vary as a function of elevation along the west-facing berm. Locations will include two height intervals corresponding to the approximate lower and upper half of the berm height. At each of these height intervals in the berm, a series of grab samples will be collected parallel to the ground surface at depths into the berm ranging from 0 to 1 foot, 1 to 2 feet, and 2 to 3 feet. A schematic of this is shown on **Figure 2-2**. Up to approximately three samples located at each height interval will be collected (**Figure 2-2**) from the berm. Two to four sampling locations east of the firing line will be established to check for the presence of lead residue from firearm discharge.

For sampling the ground west of the berm, initial samples will be collected at each sampling point at ground surface using a decontaminated hand auger advanced to 6 inches bgs. A second sample will be collected at the 0.5- to 1-foot bgs interval. A third sample will be collected from

the 1.0 to 1.5-feet bgs. Based on the findings of the shallow samples, it may be necessary to screen additional soil at incremented intervals from the 1.5 to 2-feet bgs interval or deeper to determine the vertical extent of lead at each sample location. Based on site-specific criteria, it may be necessary to increase the vertical increments from 6-inch to 1-foot increments. Hand augering is estimated to terminate at 3 feet bgs. In the event samples below 3 feet bgs are needed to delineate lead contamination in the vertical extent, a direct push technology (DPT) rig may be mobilized.

2.3 X-Ray Fluorescence Survey Method

A field portable Niton 700 XLt series XRF spectrometer or equivalent will be utilized to field screen soil samples. At the completion of the initial survey, the aerial and vertical extent of the presence of lead at the pistol range will be determined. For field screening, soil will be analyzed in situ or in a sample container in accordance with SW-846 Method 6200 (U.S. Environmental Protection Agency [EPA], 1997), utilizing the XRF spectrometer. To check the XRF spectrometer in the field, chemical standards will be used to calibrate the instrument.

An in situ reading will be taken at each sample location for in situ analysis prior to collecting incremental samples. Any large or non-representative debris will be removed from the soil before analysis. This debris may include rocks, pebbles, leaves, vegetation, roots, and concrete. The soil surface should be as smooth as possible so that the probe window will have a good contact with the surface. This may require some leveling of the surface with a stainless-steel trowel. The soil must not be saturated with water. The XRF instrument will perform adequately for soil with moisture content of 5 to 20 percent but will not perform well for saturated soil, especially if ponded water exists on the surface. Consequently, some sampling locations may be revised in the field if saturated conditions are encountered.

Another recommended technique for in situ analysis is to tamp the soil to increase soil density and compactness for better repeatability and representativeness. Longer source count times (such as two minutes) will increase the instrument's sensitivity. More information on the operation of the portable XRF spectrometer can be found in the standard operating procedure located in Appendix D of the Final Installation-Wide Work Plan (Shaw, 2006).

2.4 Confirmation Sample Selection

Ten percent of the samples screened using the XRF spectrometer will be collected as confirmation laboratory samples. These samples will be selected based on the XRF screening results. To the extent practical, the confirmation samples will cover the range of results observed with XRF. Laboratory analytical results will provide a quality control check for the XRF results. Sample handling and analysis are discussed in **Section 3.2**.

2.5 Sampling Nomenclature

Samples will be identified by numeric designation. An example of the sampling nomenclature is in **Table 2-1** where "PR" is the Pistol Range, "SS" identifies the sample as a soil sample, "0x" represents the number of the sample, and "#-#" represents the vertical component of that sample or the sampling depth from which that sample was collected. The numbering sequence in this table is not complete and continues as needed. For confirmation laboratory samples, an "A" is added at the end of the sample name to distinguish laboratory samples from screening samples (e.g. PR-SS-01-0-6A). A field duplicate will be collected for every 10 confirmation laboratory samples analyzed and an "FD" will be added at the end of the sample name (e.g., PR-SS-01-0-6FD).

Table 2-1
Pistol Range Soil Sampling Nomenclature for XRF Screening and Analytical Sampling

Example Sample ID	Depth (feet bgs)	Example Sample ID	Depth (feet bgs)
PR-SS-01-0-6	0-0.5	PR-SS-03-0-6	0-0.5
PR-SS-01-6-12	0.5-1	PR-SS-03-6-12	0.5-1
PR-SS-01-12-18	1-1.5	PR-SS-03-12-18	1-1.5
PR-SS-01-18-24	1.5-2	PR-SS-03-18-24	1.5-2
PR-SS-02-0-6	0-0.5	PR-SS-03-24-30	2-2.5
PR-SS-02-6-12	0.5-1	PR-SS-04-0-12	0-1
PR-SS-02-12-18	1-1.5	PR-SS-04-12-24A	1-2
PR-SS-02-18-24	1.5-2	PR-SS-04-24-36FD	2-3

Notes:

A laboratory sample
bgs below ground surface
FD field duplicate
PR pistol range
SS screening sample (soil)

2.6 Surveying

Shaw will use a global positioning system (GPS) unit to survey the sampling locations, approximate boundary of the actual firing range, approximate location of the firing line, and general boundaries of the berm. If necessary, a surveying crew will be mobilized to survey the site. Surveying will be performed under the direction of a Texas-registered land surveyor. Survey coordinates will have an accuracy of +/- 0.1 foot horizontal and +/- 0.01 foot vertical.

00040430



Legend

- Proposed Screening Sample Point
- Road
- Site
- 25-foot Grid

Note:

Additional samples will be collected from impact areas.

0 30 60 120 Feet

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

FIGURE 2-1

SAMPLE LOCATION MAP
PISTOL RANGE

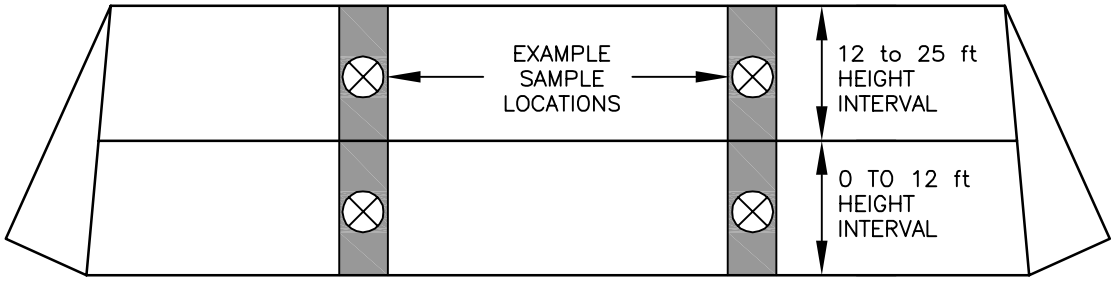
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

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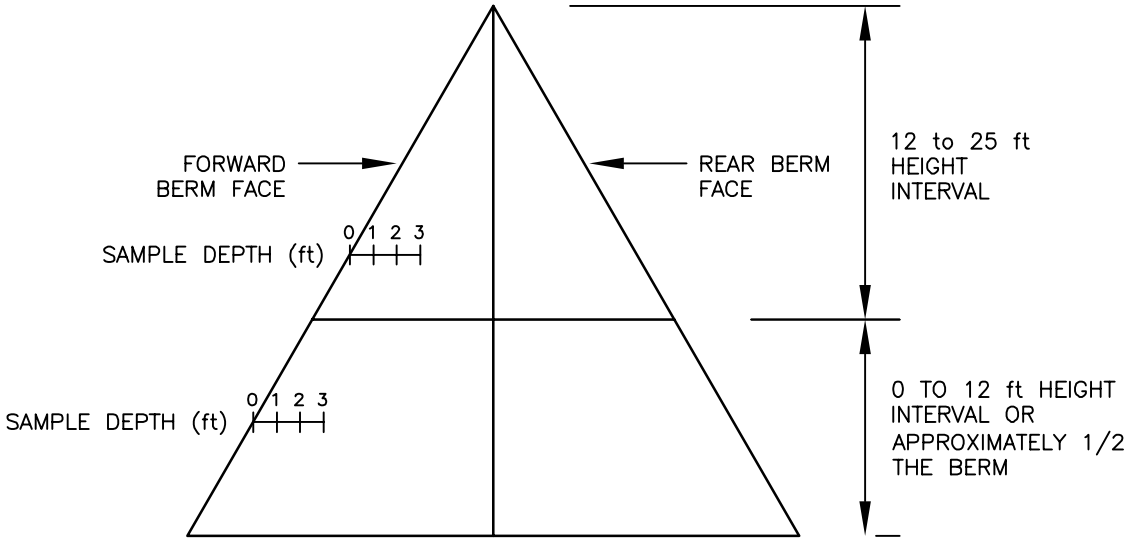
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PLOT DATE: 01/05/06
FORMAT REVISION 7/15/03

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SIDE VIEW – CROSS SECTION



"DRAWING NOT TO SCALE"

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

FIGURE 2-2

BERM SAMPLING SCHEMATIC

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

NOTE:

THIS FIGURE APPLIES TO ALL BERM SOIL AREAS.
HEIGHT DIMENSIONS WILL BE VERIFIED IN THE FIELD.

3.0 Sampling and Analysis Procedures

This section describes the soil sampling procedures for the collection of screening samples and laboratory confirmation samples. Up to six soil samples will be collected from each location as necessary for vertical delineation. Laboratory confirmation samples will be selected based on the screening results.

3.1 Screening Samples

Surface soil will be screened in situ using the XRF spectrometer. Using a decontaminated hand auger, the auger will be advanced and soil samples will be collected and screened in 6-inch or 1-foot increments to a depth of 2 feet bgs. In the event the 1.5 to 2-foot bgs sample is above the maximum background number of 33.8 milligrams per kilogram (mg/kg) (the screening number used to define the extent of contamination), the field sampling supervisor may choose to advance in 1-foot (rather than 6-inch) increments, and samples will be collected and screened to 3 feet bgs.

The procedures for sampling each soil screening location are summarized as follows:

1. Soil sampling locations will be marked with a stake or flag, where practical, using a GPS device.
2. Calibrate the XRF unit and health and safety instruments.
3. Don a new pair of disposable sample gloves between sampling intervals to prevent cross-contamination.
4. Decontaminate the sampling equipment as described in the Chemical Data Acquisition Plan, Appendix C of the Installation-Wide Work Plan (Shaw, 2006).
5. Prepare the XRF samples by removing rocks, pebbles, leaves, vegetation, roots, and concrete with a decontaminated shovel or trowel.
6. Position the decontaminated bucket auger on the sample point.
7. Rotate the bucket auger in a manner that it enters the ground being sampled.
8. Once the auger has reached the desired depth, pull it straight out.
9. Place the XRF spectrometer film window in direct contact with the sample (level the surface with a stainless steel trowel when necessary.)
10. Make the XRF measurement and complete the XRF sampling documentation as appropriate.

11. Record the location, soil color, odors, textures, sample-depth, and any field measurements obtained, including GPS readings, in the field logbook.

12. Maintain a photographic record of sample locations.

In the event that the presence of lead exceeds the maximum background level of 33.8 mg/kg at the 3-foot bgs interval, then deeper samples may be needed to delineate lead contamination vertically. If local conditions prohibit continued use of the bucket auger, deeper samples will be collected using a DPT rig.

3.2 Confirmation Samples

Samples collected and analyzed during the initial screening survey will be secured in sealable plastic storage bags and stored in a cooler until selected as a confirmation sample. The unused samples can be held for up to 6 months at room temperature without preservation, before disposal. Ten percent of the screening samples will be selected as confirmation samples for off-site laboratory analysis. Each sample selected will be placed in a 4- or 8-ounce wide-mouth glass jar. The jar will be labeled using the sampling nomenclature described in **Section 2.5**. The jar will be enclosed in a sealable plastic bag and placed in a cooler for shipping to the laboratory. The chain-of-custody documentation will be completed and added to the cooler and shipped according to sample handling requirements detailed in Appendix C of the Final Installation-Wide Work Plan (Shaw, 2006).

The samples will be analyzed for total lead using EPA Method 6010B with a 21-day turnaround time. The maximum holding time for lead analysis is 6 months. If analytical results indicate greater than 100 mg/kg, then the sample will be analyzed for TCLP.

Health and safety procedures related to the XRF are described in **Section 4.0** and additional information can be found in the Health and Safety Plan, Appendix A of the Final Installation-Wide Work Plan (Shaw, 2006).

4.0 XRF Spectrometer Health and Safety Procedures

The XRF instrument will be operated in compliance with the manufacturer's recommended procedures found in the instrument manual. Under no circumstances will the XRF's sealed sources be opened. The manufacturer's safety procedures will be followed. An abbreviated summary is listed below.

1. Shutter lockout will be engaged when the instrument is not in use.
2. The analyst will always be aware of the source position and angle of the x-rays.
3. The instrument will be operated only on a stable, flat surface when performing a measurement.
4. The analysis area will be separate from other work areas and dedicated to sample preparation and analysis.
5. Leak detection testing will be performed on the XRF every six months and the latest certificate of analysis included in the shipping container. Licensing and storage requirements will be enforced.
6. When the XRF is not in use for long time periods, it will be stored in its original shipping container.

A hazard analysis for XRF sampling and surveying at the Pistol Range is presented in **Table 4-1**. Additional safety instructions and instrument handling procedures are provided in the instrument manual and the standard operating procedures found in Appendix D of the Final Installation-Wide Work Plan (Shaw, 2006).

Table 4-1
Sample Screening Hazard Analysis Using XRF Instrumentation

Potential Hazards Involved	Hazard Control Measures
Manual lifting/material handling hazards	● Make certain the load can be lifted safely ● Do not lift more than 60 pounds ● Use proper lifting techniques. Bend knees. Do not lift and twist
Slips, trips, and falls	● Maintain good housekeeping ● Pick up tools and debris ● Clean up spills immediately ● Walk or climb only on equipment surfaces designed for personnel access
Exposure to hazardous materials	● Wear required PPE. Wear splash protection as appropriate ● Follow the HASP from the Installation-Wide Work Plan, Appendix A
Vehicle operating hazards	● Operators are responsible for the safe and legal operation of vehicles ● Seat belt use is mandatory ● Personnel shall drive at posted speed limits or at safe speeds according to site conditions ● Follow Shaw vehicle safety procedure HS800.
XRF radiation hazard	● Always use the probe safety cover when measuring samples ● Keep XRF unit in secure place for storage ● Review radiation hazards with operating personnel
Berm access hazard	● Provide safe access to collect samples on berm

5.0 References

Complete Environmental Service, 2004, Letter from William R. Corrigan, III, addressed to Rose M. Zeiler, LHAAP Site Manager, Department of the Army, Karnack, Texas, July 6.

Shaw Environmental, Inc., 2006, *Final Installation-Wide Work Plan, Longhorn Army Ammunition Plant, Karnack, Texas*, Houston, Texas, November.

U.S. Environmental Protection Agency, 1997, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846)*, 3rd Edition, Update IIIA (June 1999) or most recent update, Office of Solid Waste and Emergency Response, Washington, D.C., <http://www.epa.gov/epaoswer/hazwaste/test/main.htm> (December 2005).

Shaw® Shaw Environmental, Inc.

Subject: **Minutes on the Conference Call to Discuss Follow-Up Issues to the February, 2006 Eco Risk Meeting**

Date of call: **March 30, 2006, 2:00 – 3:30 PM EST**

Date issued: **April 5, 2006**

Call Participants:

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TPWD
Chip Wood (CW)

Minutes prepared by Shaw on behalf of the USACE and BRAC.
Meeting participants are referred to by initials (e.g., "SR" = Susan Roddy).

The purpose of the call was to provide a follow-up discussion to the February 9th, 2006 Longhorn ecological risk assessment meeting held in Austin, Texas, and obtain clarification/consensus on a few outstanding issues before moving forward with the eco risk effort. An agenda and White Paper describing the technical rationale for not conducting

statistical (i.e., least-squares regression) tests on geochemical plots was provided to the call participants prior to the discussion.

MW – The first agenda item is tying up some loose ends. We still haven't received EPA Region 6's (i.e., SR's) responses.

SR – My comments were mostly semantics issues, but MG's comments on the minutes covered my main concerns. My biggest concerns were how the Louisiana Black Bear was going to be addressed and if the final short list of COPECs was going to be expanded.

MW – As the revised report will just use NOAELs at Step 3, as recommended by EPA, the final short list of COPECs will likely be expanded.

MG – Several options for evaluating the bear were proposed at the last meeting. It's up to the Army as to which option they want to choose.

SR – What about chemicals that lack toxicity values? How will they be addressed?

MW – They will be listed as an uncertainty.

SR – Please make sure that they are discussed in the Uncertainty Section as a possible source of "indeterminate" risk (LT suggested the term "hazard" rather than "risk"), rather than "no" risk.

MW – Agreed. [*Note: The term "Indeterminate risk" was used differently in the Feb. 9th, 2006 meeting minutes to refer to chemicals that actually have toxicity values, but that may or may not require the development of an ecological preliminary remediation goal (PRG). The revised report will discuss the uncertainties involved with chemicals lacking toxicity values, and will not imply that there is no risk associated with these chemicals.*]

SR – Also, did we resolve the issue of how to calculate LOAELs from NOAELs?

MW – We're using EPA's suggestion of using NOAEL x 3, except for non-toxic chemicals such as iron. In those cases, we'll use NOAEL x 10.

MG – That's reasonable.

MW – The next loose end is responses to our Response to Comments. We've just received them from TCEQ. When can we expect them from EPA?

SR – They're in CV's hands. I just had some minor issues. Mostly semantics.

CV – I just sent them to Army. [*Note: The comments were received by the Army and Shaw via e-mail during the call*]

MW – OK. The final loose end is in regards to the chromium speciation work plan.

CV – I've passed that on to Philip Allen. I don't know when he'll be done looking at it. I'll talk to Dave Cobb about it next week.

[*MW was asked to summarize the work plan. He said that the plan described the collection of soil samples from areas with elevated total chromium. Nine samples would be collected from areas where there is documented use of chromate (hexavalent chromium), and nine would be collected from areas where there is no reason to suspect the past use of hexavalent chromium. The samples would be compared statistically, and used to determine the appropriate trivalent:hexavalent ratio that would be applied to chromium soil data in the eco risk assessment. There was some discussion about the appropriate use of biased vs. random sampling locations, but because the purpose of the exercise is primarily to develop a ratio, rather than a statistical comparison, that issue was determined to be minor. Reviewers asked whether there was enough information in the Work Plan (e.g., sample locations, purpose statement, etc.) for a meaningful review, and were assured that there was.*]

- ✓ **The outstanding issues were addressed.**

MW – The next issue is that Shaw has decided to follow EPA's suggestion and do a combined Step3/BERA report. However, we need to get agreement on the final list of COPECs after the Step 3 refinement (that is now a section of the combined report), before we proceed to the field and do field work. If we mobilize to the field without getting this agreement, we are at risk, because the regulators may not agree with all the chemicals that we eliminated, or listed as background, during the Step 3 refinement, and we may have to go back out and resample. What is the best way to present the final list of COPECs? We could present all the details, which would essentially be a huge interim deliverable that would take much time to review and discuss, or we could summarize the results in a short memo. The latter approach is preferred to expedite the process, but it may not provide enough detail for the reviewers to be comfortable with.

SR – One concern would be COPECs that you remove (i.e., put in the background list) because of the geochemical/background analysis.

MW – Right, but that's just one line of evidence in the COPEC selection process. How do we get all the information to you to review?

MG – Why don't you just take what you've got now at the end of the current Step 3 report, and carry that list forward to the BERA?

MW – That final list of COPECs that we have now has not been agreed upon. We've made many changes to our approach based on recent meetings, etc., so we'll have a brand new list of COPECs. We need to make sure everyone is comfortable with it before we go out in the field.

SR – We do not have a strong comfort level with the current list of final COPECs. That's why Shaw is revising their report.

MG – EPA's position is that you don't need any more field data at this point.

MW – But the Army believes that collecting more field data will be beneficial to them. We'll likely be able to derive more accurate cleanup goals because we'll be able to move away from the conservative assumptions that were used in our models.

MG – You can do desktop studies in the BERA, and do additional, focused, field studies at the feasibility study (FS) stage.

MW – It's preferable to have the cleanup goals established prior to going to the FS.

MG – Just move the chemicals that are background-related to the Risk Characterization section.

SR – Are you still using the geochemical approach to determine if a chemical is background related?

MW – Yes.

SR – Well, if you're going to do limited field work, and at the end of the BERA you mention the background chemicals, you should be okay, as long as we agree with the chemicals you list as background.

MW – How about if Shaw provides the stakeholders with an interim deliverable that contains a list of final COPECs that we will develop using our revised approach that we have been discussing over the past several weeks, and a short summary of how they were developed, and go from there?

[*There was general agreement that this was the preferred approach. The time frame for this interim deliverable was estimated at approximately 4 to 5 weeks.*]

- ✓ **Shaw will provide stakeholders with a list of final COPECs that will be targeted in the BERA and a short summary of the approaches used to develop this list. Approaches will be based on recent discussions and agreements with LHAAP Stakeholders.**

MW – The next agenda item involves the evaluation of sensitive species. We intend to evaluate the Louisiana Black Bear by using a raccoon as a surrogate, modified to most closely resemble the bear in terms of its life history statistics, but still within range of the raccoon.

VR – That's fine, but make sure you also take into account other omnivores.

MW – Right, we'd include a "normal" raccoon to cover mammalian omnivores, and also the "bear-like" raccoon to cover the bear.

MG – Don't mention the bear, though. Call it a larger, "bear-like omnivore" or something along those lines. I know that sounds a bit strange, but it's a big deal.

MW – The bear is already mentioned in the draft report, and it is cited as one of the reasons the raccoon is selected as a measurement receptor (because it is a surrogate for a listed species).

LT – What is the merit of calculating hazard for the bear? The bear does not fit the Army's criteria of a sensitive species because it does not occur on site.

RZ – I'm not sure the Army would remediate for a sensitive species anyway. We need to make sure that we're not confusing Trustee and regulatory issues.

CW – We agreed previously to move forward and evaluate the bear this way. There is no commitment to doing any remediation based on the outcome. That decision can be moved down to the risk management step.

RZ – OK.

LT – Our preference is to state up front that this species is not really a valid receptor because it is not present at the site. Please state that in the report.

MW – We can add some text to that effect.

MW – Now what about the Rafinesque's Big-Eared Bat? We would like to address this species qualitatively. EPA seemed to agree to a qualitative evaluation at the February meeting.

VR/CW – That is not acceptable to us. Sensitive species must be evaluated quantitatively per Texas regulatory requirements.

MG – There are bat models out there you could use to quantify risk. It's unlikely that we would make decisions based on the bat.

LT – How do you know that?

MG – Based on my involvement with other sites that included a bat as a measurement receptor.

MG – Is the bat in the conceptual site model?

MW – It is now.

VR – Information about the bat came up after the original report was finished. TCEQ requested that Shaw include the bat in the conceptual site model once it was documented as being on site.

MW – OK, based on the previous discussion, we'll do a quantitative evaluation of the bat.

- ✓ **Shaw will include a raccoon that has been modified to be as similar to the Louisiana Black Bear as possible, but within the raccoon's life history parameters, to represent a "bear-like omnivore". A "normal" raccoon will also be included to be protective of other mammalian omnivores. A bat species will also be added as a surrogate measurement receptor for the Rafinesque's Big-Eared bat.**

MW – Let's skip to Agenda Item #6 because LT has to leave soon. The Army has submitted the Rodent Sperm Analysis (RSA) report to Longhorn stakeholders, which was done as a separate, concurrent study by CHPPM. Shaw intends to use some of the information in the RSA report in the eco risk assessment.

SR – How will the RSA data be used?

MW – We don't have an exact answer at this time. We are simply requesting that stakeholders review the RSA report at this time, and submit their review comments.

MG – As long as the RSA report addresses the risk questions in some way, we'll certainly be happy to consider it.

MW – OK.

- ✓ **The RSA report will be reviewed and considered by stakeholders. Shaw intends to use the RSA report conclusions in the LHAAP BERA.**

MW – Let's move to Agenda Item #5, which is the evaluation of perchlorate. We agree to quantify hazard for perchlorate in the risk assessment. One change is that we plan to use a regression equation developed by Brad Sample to estimate uptake from soil to plants. This equation was presented at a SETAC conference presentation in November, 2005.

MG – Please send a copy of the presentation to us.

MW – OK.

VR – Why don't you just use the Smith et al. paper that presented perchlorate uptake data for LHAAP?

MW – The goal of that paper was not to develop uptake factors for plants. It was only to document that uptake was occurring. There was much uncertainty as to the locations of the soil and plant samples. It wasn't clear if they were co-located.

MG – We can take a look at the regression equation and contact Brad (Sample) if we have any questions.

VR – You still intend to quantify other exposure pathways other than just soil-to-plant, correct?

MW – Correct.

VR – OK.

MW - So we will quantify the hazard associated with perchlorate. However, we cannot calculate ecological cleanup goals for this chemical, as that is against current Army policy.

[*There was no response to this statement*]

- ✓ **Shaw will quantify hazard associated with perchlorate. However, no ecological cleanup goals will be presented for this chemical due to current Army policy.**

MW – Ok, the next issue is the use of background. EPA had asked us to include least-squares regression (LSR) analyses with our geochemical plots. We sent out a White Paper that described why we think this is inappropriate.

MG – We read that paper, and it had some good points. However, the inclusion of LSR is recommended under Navy policy in their guidance document. We asked for this as another line of evidence. We simply want you to provide additional information supporting your geochemical analyses. If you don't do it, you are left with a qualitative interpretation of the results.

KTh/JM – That's not entirely accurate. In place of the LSR that the Navy guidance recommends, we do a ratios plot that is a quantitative exercise that lets us see which samples exceed the maximum background ratios. This is not qualitative, and allows us to identify results that exceed the background ratios.

MG – All we're saying is we want to see the linear regression coefficients for our consideration. If you don't do them, we will.

KTh/JM – Statistical tests are performed to answer specific questions. An r^2 is calculated to assess the linearity of a relationship. The problem is that the relationships aren't always linear. Natural curvatures exist for some element pairs, as explained in the report. Therefore, you're coefficients are not going to be very high most of the time, but that's not a reflection of the quality of the geochemical analysis. Also, you're left with having to decide what r^2 value is acceptable. There are false-positives involved with any kind of statistical test. Statistical tests were already performed on the site data sets, and these tests indicated potential contamination. At this point in the site-to-background comparison process we need to move beyond statistics and consider the geochemistry, to determine if the elevated concentrations identified via statistical testing may have a natural source or if they reflect site-related contamination. If we apply a quantitative decision rule to the geochemical correlations, then we're left with more

false-positives. One concern we have is that site samples with elemental ratios that are identical to the background elemental ratios would be declared contaminated.

MG – This is not a big deal. Again, if you insist on not doing them, we will.

KTh – What would the acceptable r^2 value be?

MG – That could be decided later.

BF – Also, in those ratios plots, you are using the maximum ratio of background as your delineator (i.e., "bright line") for samples that contain contamination. I'm still not comfortable with that. You've also argued before that weaknesses in the data set prohibit you from taking certain steps or making certain conclusions. It seems like you're talking out of both sides of your mouth.

JM – I don't see the contradiction. There are differences between the site and background data sets, such as different reporting limits, but they can be explained.

MW – How would we incorporate a LSR component into our weight-of-evidence debate? As we disagree on its merit, we would propose to give it a lower weight-of-evidence.

BF – Well, we haven't talked about weighting lines of evidence at all, so we can't really discuss this.

KTh – That raises a good point. The geochemical evaluation is used as just one line of evidence to determine if an element is a site contaminant. It's not the only line of evidence.

PS – We're not going to solve this today. Let's table this issue and Shaw will talk more about it internally and get back to the stakeholders at a later date.

- ✓ **This issue was tabled, but please see below regarding Shaw's proposal for the inclusion and use of statistical techniques (e.g., least squares regression) on geochemical background plots.**

MW – OK. Thanks for your time. We will prepare conference call minutes and distribute to everyone.

Call terminated.

Follow-Up to the Topic of Applying Least-Squares Regression Statistical Analysis to Geochemical Analysis

Following the March 30 eco conference call, Shaw technical experts discussed the merits of conducting a least-squares regression (LSR) statistical test on the geochemical plots. Although Shaw maintains that this approach is not technically defensible or appropriate for the reasons indicated in the White Paper issued to stakeholders prior to the conference call, Shaw believes that if such a test is required by EPA, it should be done by those most familiar with the data and as part of the report submittal. Therefore, Shaw agrees to conduct a LSR analysis on geochemical plots for some metals. Only metals that are hazard drivers, and for which geochemical analysis provided a key line of evidence supporting their determination as background (COPECs to be put on the Background List) will be included in this analysis. The BERA will contain a full description of the methodology used, the results of the LSR, and a discussion of the substantial uncertainties involved with using this approach in conjunction with a geochemical analysis.

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

Location of Meeting: Army Trailer, Longhorn AAP, TX

Date of Meeting: **April 25, 2006, 1:00 – 3:30 AM**

Meeting Participants:

BRAC:	Rose M. Zeiler, Lanis Reiger
USACE-Tulsa:	Cliff Murray, Rick Smith
USFWS:	Barry Forsythe
Shaw Environmental:	Praveen Srivastav, Dave Cobb, Van Vangala
USEPA Region 6:	Chris Villarreal, Scott Harris, Raji Josiam, Stephen Tzhone
TCEQ:	Fay Duke

Shaw distributed copies of the meeting agenda, minutes of March 15, 2006 Monthly Managers' Meeting, and document status tables for the TERC and PBC work.

Rose Zeiler opened the meeting with a welcome note to the new member of the team, Fay Duke, of TCEQ. Fay replaced outgoing Alan Etheredge. Also present were Scott Harris, Raji Josiam, and Stephen Tzhone of EPA who have joined Chris Villarreal to support Longhorn AAP. A round of introductions followed for the rest of the team. Rose Zeiler mentioned that Lanis Reiger will be leaving Longhorn soon.

Rose Zeiler went through the list of action items from the previous monthly managers' meeting. All action items have been addressed. Below are the highlights of this discussion:

- Rose Zeiler distributed copies of e-mail correspondence with EPA regarding disposal of mercury collected from the construction landfill. The e-mail from EPA suggested that an EPA laboratory was asked to properly dispose off mercury. No analysis was conducted because the material was clearly mercury.
- Access to LHAAP MMRP sites has been granted for EPA's Philip Allen, Rubin Moya, and Chris Villarreal. Chris requested that access be also given to Scott Harris.
- Shaw provided hard copies of GWTP monthly report to EPA and Army. In future, Shaw will submit the monthly reports to the Army, EPA, TCEQ, and USFWS. E-mails to the regulators will be sent directly by Shaw without first submitting them to the Army.
- The Army has received a letter from Shaw regarding sampling of perimeter wells and creeks. USACE is resolving the issue.

- Rose Zeiler asked regulators what action is to be expected from regulators, considering that the quarterly sampling of perimeter wells and creeks has not taken place for two quarters because of the delay in resolution of issues between the Army and Shaw. Chris Villarreal requested that the Army keep the EPA informed about the progress on this issue. He will inform EPA management on this subject.
- Rose Zeiler stated that Allan Etheredge of TCEQ had asked what the Army's policy was on perchlorate. Rose Zeiler read out an e-mail response from Jeff Armstrong of AEC, which stated that the Army is to follow established human health levels and to revisit ecological risk at a later date when ecological levels have been established.
- TCEQ had decided in the past not to review MMRP documents. Fay mentioned that Alan Etheredge suggested this be revisited..

Defense Environmental Restoration Program (DERP) PBC Update (Dave Cobb)

Field Update. Dave Cobb mentioned that Shaw was conducting field work during the week to collect Chromium speciation samples for ERA. Chris Villarreal asked whether Shaw had provided notification. Dave Cobb stated that a 2 week notification was provided. EPA had no comments on the work plan for Chromium speciation. Fay Duke mentioned that TCEQ comments were provided in the past. Shaw will look up and address the comments.

Document Status. Dave Cobb went through the PBC document status table. Following are the highlights of discussion on this topic:

- Fay Duke stated that TCEQ agreed with the closure of LHAAP-23. However, the NFA documentation for LHAAP-03 and -06 is dated 1988 but there is no closure documentation for these two sites. TCEQ does not agree with the NFA decision for these sites without additional closure information that shows that these sites were not active beyond 1988. Fay to issue a letter documenting her comments next week.
- Shaw has resolved all comments on the Step 3 ERA report and is continuing with development of final list of chemicals of potential ecological concern (COPECs).
- To a question from Chris Villarreal, Dave Cobb mentioned that Shaw is still planning on time critical removal actions during 2006. Issues such as ecological clean up goals for metals and perchlorate can be established.
- A discussion occurred on removal action approval memorandum. Rose Zeiler stated that an approval memorandum is not required for a time-critical removal action, however, she can forward justification for such a removal action to the regulators via e-mail for their review and concurrence.

Groundwater Treatment Plant Update. Van Vangala provided an update on the operation of the GWTP. Harrison Bayou does not have much water and is slowing down as the summer progresses. However, the INF pond has a lot of storage capacity. Waste filter cake was shipped out in April. Shaw has recently completed calibration of the IC unit that is used to analyze effluent parameters. Monthly reports for February and March were distributed to Army and regulators.

Defense Environmental Restoration Program (DERP) TERC Update (P. Srivastav)

Document Status/Environmental Sites. Highlights of discussion on TERC sites are as follows:

- LHAAP-12. BRAC has approved the ROD. EPA requires Army signatures first. Chris Villarreal mentioned that EPA attorneys have also approved the ROD. Fay Duke mentioned that TCEQ needs another 15-30 days before signatures are completed.
- The field work at LHAAP-12 was completed in Jan 2006. Shaw will submit a report soon. Stephen Tzhone mentioned that he reviewed the work plan addendum for LHAAP-12. He will send his comments even though the field work is already complete.
- P. Srivastav stated that Shaw is looking at EPA (Raji Josiam) comments on LHAAP-48/53 site evaluation report. Rose Zeiler requested TCEQ to expedite review of LHAAP-48/53 report because these sites are scheduled for closure in FY06. Praveen Srivastav mentioned that the elevated chromium levels at LHAAP-48 are similar to what was observed at LHAAP-12. Fay Duke asked if Shaw sampled for chromium in replacement wells. Praveen Srivastav replied that the new wells were not sampled for chromium because the chromium issue was considered closed based on other evidence before the wells were sampled. The evidence was provided to the regulators during various meetings. Shaw will review the minutes and identify the relevant ones to TCEQ.
- Chris Villarreal mentioned that Scott Harris is looking at Chain of Custody forms in the Draft Final Data Gaps Report (2004). Scott Harris pointed out that the field COC forms were not signed by the sampling person before transferring custody to the sample coordinator, who packaged and shipped the coolers. Praveen Srivastav stated that Shaw will correct problem with the COCs in the next field effort.

DERP Corps of Engineers Update (Rick Smith)

Groundwater Perimeter Wells and Creek Sampling. USACE is resolving the issue of whether the Army or Shaw is responsible for perimeter well sampling and the creeks for perchlorate. USACE has received a letter on Shaw's position on this issue and is currently responding to that letter.

MMRP. The MMRP contractor (Cape) demobilized from the field on April 1, 2006 due to issues with the survey data and brush clearance. The Army has denied their claim for the survey data. The Army may provide additional funds for brush clearance. The paperwork for this will take 30 days or more. Stephen Tzhone asked if this was going to impact Shaw's schedule. Rick Smith replied that the two investigations were completely separate, thus no impact to Shaw's schedule is expected.

Other (Rose Zeiler)

Transfer Update. Rose Zeiler submitted the Eastern Further Investigation Area (EFIA) report to EPA for review. Chris Villarreal has reviewed the report and provided a verbal concurrence to Army. Army's JAG is waiting to review ECOP IV. Chris Villarreal mentioned that he will send his concurrence letter on the EFIA evaluation to Rose.

Demolition. The contractor is working on demolition. Rose Zeiler mentioned that she has not been able to get funds for demolition of the Power House. She has received a bid of $150,000 for moving the switches outside the Power House.

Electricity. USFWS has informed Army that they will not accept the transformer into their inventory. Therefore Army intends to notify USFWS that power is being cut to their offices. This will solve Army's dilemma and might help USFWS to get a connection directly from SWEPCO.

Miscellaneous. Rose Zeiler mentioned that she has received a letter from the Army agency that tested various sampling techniques at LHAAP. She would receive the report from them at a later date and will make copies available to others upon request.

Schedule. IAP meeting is scheduled for May 10, 2006 at 8:00 AM. RAB meeting is scheduled for June 20, 2006 at 6:30 PM. Monthly Managers' meeting for June is scheduled for June 21, time to be decided.

Meeting Adjourn.

Action Items:

Army – Resolve perimeter well and creek sampling issue
EPA – Send letter regarding EFIA review to Army
TCEQ – Provide comments on LHAAP-48/53 report
Shaw – Provide February and March 2006 GWTP monthly reports in electronic format.

- Review and identify meeting minutes pertinent to chromium issue at Site 12
- Revisit Chain-of-Custody corrective actions at May Managers' Meeting

00040450

Shaw® Shaw Environmental, Inc.

Longhorn Army Ammunition Plant
Monthly Managers Meeting

Location: Longhorn AAP, Karnack, TX
Date: April 25, 2006

ATTENDEES

Name (printed)	Signature	Organization	Phone	E-mail
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Larry R. Soward, *Commissioner*
Glenn Shankle, *Executive Director*

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

May 1, 2006

Ms. Rose Zeiler
Army / BRAC Site Manager
Longhorn Army Ammunition Plant
Post Office Box 220
Ratcliff, AR 72951

Re: Longhorn Army Ammunition Plant (LHAAP)
Decision Documentation Report for
LHAAP-03, LHAAP-06, and LHAAP-23

Dear Ms. Zeiler:

The Texas Commission on Environmental Quality (TCEQ) has completed its review of the *Decision Documentation For LHAAP-03, LHAAP-06, and LHAAP-23* (Shaw Environmental, Inc., January 2006). Based on this review, TCEQ concurs that sufficient documentation has been provided for LHAAP-23 (Building 707-C Storage Area for PCBs) to support the No Further Action (NFA) decision. However, the TCEQ does not concur that sufficient information has been provided to support the NFA decisions on LHAAP-03 (Waste Water Collection Point at Paint Shop), or LHAAP-06 (Building 54F Waste Collection Point). Following are our comments:

LHAAP-03

The documentation supporting the NFA decision for LHAAP-03 includes the RCRA Facility Assessment (Texas Water Commission (TWC), 1988) and the Preliminary Assessment (Environmental Protection Agency (EPA), 1988) reports for Solid Waste Management Unit (SWMU): LHAAP-03, Bldg 722-P, Paint Shop. Both of these assessments were performed in 1988 during the time this facility was still active. It is unclear as to the duration in which this unit operated after the 1988 assessments. A closure report was not included to indicate this unit has been properly closed.

LHAAP-06

The documentation supporting the NFA decision for LHAAP-06 includes the RCRA Facility Assessment (TWC, 1988) and the Preliminary Assessment (EPA, 1988) reports for SWMU: LHAAP-06, Bldg 54-F, Collection Point. Both of these assessments were performed in 1988

during the time this facility was still active. It is unclear as to the duration in which this unit operated after the 1988 assessments. A closure report was not included to indicate this unit has been properly closed

If you have any questions or need additional information, please feel free to contact me at (512) 239-2139.

Sincerely,

Fay Duke, Project Manager
Team 2, Environmental Cleanup Section II

FD/fd

cc: Chris Villareal, U. S. Environmental Protection Agency Region 6
Cliff Murray, U.S. Army Corps of Engineers
Barry Forsythe, U.S. Fish and Wildlife Service

Shaw® Shaw Environmental, Inc.

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

Location of Meeting: Army Trailer, Longhorn AAP, TX

Date of Meeting: **May 10, 2006, 1:15 – 3:30 AM**

Meeting Participants:

BRAC:	Rose M. Zeiler
USAEC:	Jeff Armstrong, Tim Rodeffer
USACE-Tulsa:	Cliff Murray, Rick Smith
USFWS:	Barry Forsythe, Paul Bruckwicki, Mark Williams
Shaw Environmental:	Praveen Srivastav, Dave Cobb
USEPA Region 6:	Chris Villarreal, Scott Harris, Stephen Tzhone
TCEQ:	Fay Duke, Tom Erny

Shaw distributed copies of the meeting agenda, minutes of April 25, 2006 Monthly Managers' Meeting, and document status tables for the TERC and PBC work.

The meeting was held in conjunction with the Installation Action Plan work shop. While the main session of the monthly meeting occurred from 1:15 – 3:30 PM, some of the topics were discussed during the IAP and were not repeated during the monthly meeting. The minutes summarize those discussions as they relate to the topics normally covered by the monthly managers meeting.

- Rose Zeiler went through the list of action items from the previous monthly managers' meeting. All action items have been addressed

Defense Environmental Restoration Program (DERP) PBC Update (Dave Cobb)

Field Update. Field work is on hold waiting on review of work plan addenda by the Army and regulators. No field work will occur in May 2006 for this reason.

Document Status. PBC document status table was provided to the participants. No further discussion took place on the status of documents.

Defense Environmental Restoration Program (DERP) TERC Update (P. Srivastav)

Document Status. TERC document status table was provided to the participants. No further discussion took place on the status of documents.

DERP Corps of Engineers Update (Rick Smith, Tim Rodeffer)

MMRP. Rick Smith informed that the MMRP contractor has filed two claims for change order. Fort Worth has denied the first claim in which the contractor alleged that the USACE had provided inaccurate survey data to the contractor. The claim was denied on the basis that the data provided were accurate but the contractor made the wrong assumptions in the use of the data. The second claim regarding the relocation of the magazine has been accepted for a change order by Fort Worth. The issue of the brush clearing is still being resolved.

Other (Rose Zeiler)

Transfer Update - ECOP IV. Rose Zeiler mentioned that the Army is trying to get ECOP IV out for EPA's review next week. The transfer parcel includes the production area with 60 foot circles around sump locations cut out from the transfer. The parcel also includes EFIA and some other smaller areas. Praveen Srivastav requested a copy of the transfer map. Rose mentioned that Cliff Murray will supply a map to Shaw. Paul Bruckwicki commented that he thought that the Army did not wish to transfer areas with holes in them. Rose Zeiler replied that the transfer of this "clean" acreage within the Production Area Parcel was USFWS's proposal. Army agreed with this strategy and supplied funds and help for confirmation sampling. She asked if USFWS had changed their minds about this property. Paul Bruckwicki stated that the existence of sumps in that area was not mentioned to USFWS. Dave Cobb requested USFWS data from EFIA and production area. Rose indicated that USACE will provide the data to Shaw.

Schedule. The RAB meeting was rescheduled for June 27, 2006 at 6:30 PM, with monthly managers meeting earlier that day, time to be decided. The July monthly meeting was tentatively scheduled for July 18, 2006 in Houston.

Meeting Adjourn.

Action Items:

Army – Provide Shaw ECOP IV transfer map
Army – Provide Shaw USFWS data from EFIA and production area (in a GIS friendly format)
TCEQ – Provide comments on LHAAP-48/53 report
Shaw – Schedule a conference call to discuss human health risk assessment for LHAAP-48/53 with TCEQ

Shaw® Shaw Environmental, Inc.

Longhorn Army Ammunition Plant
Monthly Managers Meeting

Location: Longhorn AAP, Karnack, TX
Date: May 10, 2006

ATTENDEES

Name (printed)	Signature	Organization	Phone	E-mail
Rose Zeiler		BRAC	479-635-0110	rose.zeiler@us.army.mil
Rick Smith		USACE-Tulsa	918-669-4956	richard.p.smith@usace.army.mil
Cliff Murray		USACE-Tulsa	918-669-7573	cliff.murray@usace.army.mil
Dave Cobb		Shaw	617-589-5561	dave.cobb@shawgrp.com
Praveen Srivastav		Shaw	713-996-4588	praveen.srivastav@shawgrp.com
Chris Villarreal		EPA - Region 6	214-665-6758	villarreal.chris@epa.gov
Fay Duke		TCEQ	512-239-2443	fduke@tceq.state.tx.us
Barry Forsythe		USFWS	214-665-8467	forsythe.barry@epa.gov
Tom Erney		TCEQ	903-535-5142	terney@tceq.state.tx.us
STEPHEN TZHONE		EPA	214.665.8409	tzhone.stephen@epa.gov
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Mark Williams	Mark Williams	USFWS	903 679 9144	mark_williams@fws.gov

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

May 17, 2006

Ms. Rose Zeiler, Ph. D.
Longhorn AAP Site Manager
Post Office Box 220
727 South Brooklyn Road
Ratcliff, AR 72951

Re: Longhorn Army Ammunition Plant (LHAAP)
EPA Comments on Numerous LHAAP Documents

Dear Ms. Zeiler:

The Environmental Protection Agency's (EPA) has completed our review of the following documents:

- Draft Final Data Gaps Investigation Report Longhorn Army Ammunition Plant (May 2005);
- Draft Final Background Surface Water and Sediment Report (October 2004);
- Draft Final Evaluation of LHAAP-02 Surface Soil Analytical Data (March 30, 2006).

These documents were reviewed by the following EPA Remedial Project Managers: Scott Harris and Stephen Tzhone (comments enclosed). Please feel free to contact me at (214) 665-6758 if you have any questions.

Sincerely,

Chris G. Villarreal
Remedial Project Manager

Enclosures (2)

cc: Cliff Murray, U.S. Army Corps of Engineers
Faye Duke, Texas Commission on Environmental Quality
Barry Forsythe, U.S. Fish and Wildlife Service
Praveen Srivastav, Environmental Resources Management

EPA COMMENTS ON THE DRAFT FINAL DATA GAPS INVESTIGATION REPORT LONGHORN ARMY AMMUNITION PLANT MAY 2005

Key issue:

Numerous remaining data gaps are identified in the report, as detailed in the following examples. Please describe how or whether these will be addressed.

1. Section 4.2.2 (LHAAP-17), pages 4-1, 2

"The perchlorate contaminant plume in the shallow zone is not well defined to the north or south of the site."

"Offsite migration of perchlorate to the northwest is indicated by the current data."

"The perchlorate contaminant plume in the deep groundwater zone can not be adequately established."

2. Section 4.2.4 (LHAAP-29), page 4-2

"The m-nitrotoluene contaminant plume is not defined to the southeast."

"The vertical extent [of methylene chloride] is not defined..."

3. Section 4.2.5 (LHAAP-35A/58), page 4-3

"Since there are only two wells, a contaminant plume for TCE is not adequately defined."

4. Section 4.2.8 (LHAAP-47), page 4-3

"The lateral extent of the plume is not defined to the northeast."

5. Section 4.2.9 (LHAAP-48), page 4-4

"However, the effect of slightly elevated turbidity on sample results could not be evaluated because the sample was not analyzed for the full TAL metals suit [sic] and, thus, aluminum and iron results are not available."

Stephen Tzhone/R6/USEPA/US
05/12/2006 01:35 PM

To Chris Villarreal/R6/USEPA/US@EPA
cc rose.zeiler@us.army.mil, Praveen.Srivastav@shawgrp.com, Dave.Cobb@shawgrp.com
bcc
Subject comments on LHAAP plans

Chris,

I've completed the review of the "Draft Final Background Surface Water and Sediment Report, October 2004" and "Draft Final Evaluation of LHAAP-02 Surface Soil Analytical Data, March 30, 2006". Both documents appear satisfactory and I only have one comment for both documents:

- Consider integration of EPA's OSWER Guidance on UCLs: "Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites," OSWER 9285.6-10, December 2002 and the EPA ProUCL software.

The guidance is attached and the EPA software can be found here:


EPA_UCL.pdf

EPA ProUCL software: http://www.epa.gov/esd/tsc/software.htm

Stephen L. Tzhone
Superfund Remedial Project Manager
USEPA Region 6
1445 Ross Ave, Ste 1200, 6SF-AP
Dallas, TX 75202

Office: 214-665-8409
Mobile: 214-695-0306
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Kathleen Hartnett White, *Chairman*
R. B. "Ralph" Marquez, *Commissioner*
Larry R. Soward, *Commissioner*
Glenn Shankle, *Executive Director*

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

May 18, 2006

Ms. Rose Zeiler
Army / BRAC Site Manager
Longhorn Army Ammunition Plant
Post Office Box 220
Ratcliff, AR 72951

Re: Longhorn Army Ammunition Plant (LHAAP)
Final Addendum 2 Additional Investigation at Pistol Range
To Final Installation Wide Work Plan

Dear Ms. Zeiler:

The Texas Commission on Environmental Quality (TCEQ) has completed its review of the *Final Addendum 2, Additional Investigation at Pistol Range to Final Installation Wide Work Plan* (Shaw Environmental, Inc., March 30, 2006). We are satisfied with the responses provided to the TCEQ's comments on the draft final work plan and have no additional comments.

If you have any questions or need additional information, please feel free to contact me at (512) 239-2443.

Sincerely,

Fay Duke, Project Manager
Team 2, Environmental Cleanup Section II

FD/fd

cc: Chris Villareal, U. S. Environmental Protection Agency Region 6
Cliff Murray, U.S. Army Corps of Engineers
Barry Forsythe, U.S. Fish and Wildlife Service

00040460

Kathleen Hartnett White, *Chairman*
R. B. "Ralph" Marquez, *Commissioner*
Larry R. Soward, *Commissioner*
Glenn Shankle, *Executive Director*

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

May 23, 2006

Ms. Rose Zeiler
Army / BRAC Site Manager
Longhorn Army Ammunition Plant
Post Office Box 220
Ratcliff, AR 72951

Re: Longhorn Army Ammunition Plant (LHAAP)
Draft Final Addendum 1, Soil Sampling at LHAAP-04
To Final Installation Wide Work Plan

Dear Ms. Zeiler:

The Texas Commission on Environmental Quality (TCEQ) has completed its review of the *Draft Final Addendum 1, to Final Installation Wide Work Plan, Soil Sampling at LHAAP-04, Former Pilot Wastewater Treatment Plant,* (Shaw Environmental, Inc., February 2006). We have also reviewed the comments provided by the U.S. Environmental Protection Agency to the referenced document. We concur with EPA's comments and offer additional attached review comments.

If you have any questions or need additional information, please feel free to contact me at (512) 239-2443.

Sincerely,

Fay Duke, Project Manager
Team 2, Environmental Cleanup Section II

FD/fd

cc: Chris Villareal, U. S. Environmental Protection Agency Region 6
Cliff Murray, U.S. Army Corps of Engineers
Barry Forsythe, U.S. Fish and Wildlife Service

TCEQ Review Comments
Longhorn Army Ammunitions Plant (LHAAP)

DOCUMENT: Draft Final Addendum 1, Soil Sampling at LHAAP-04, Former Pilot Wastewater Treatment Plant, to Final Installation Wide Work Plan (Shaw Environmental, Inc., February 2006)

NO.	REFERENCE	COMMENT
1	Section 1.1, Page 1-2, second paragraph from top of the page	It is stated that 16 samples were collected adjacent to the Pilot Wastewater Treatment Plant. It is also stated that four samples were analyzed only for perchlorate but there is no information as to the type of analysis that were performed on the other 12 samples. Please revise.
2	Section 1.1, Page 1-2, fifth paragraph from top of the page	With regards to the pilot study conducted in this unit, it is stated that "complete removal of perchlorate in the surface soils was observed and varied reduction in the deeper layers." It is also understood that one of the objectives of this sampling event is to collect additional data to "determine the post-pilot study conditions." In order to evaluate whether sampling intervals are appropriate to meet this project objective, it is necessary to understand the depth of soil that was treated in the pilot study. Please revise to include additional information regarding the vertical extent of soils that were subject to the perchlorate treatment pilot study.
3.	Section 2.2.1, Page 2-1, sampling interval	It is stated that soil samples will be collected "from surface interval (0-0.5 feet bgs), from 1-3 feet and from immediately above the water table." Which sampling techniques (composite or grab) will be used to collect soil samples from the 1-3 feet interval? If composite sampling is planned, please include procedures to ensure a homogeneous sample. We were not able to find the procedure in the Final Installation-Wide Work Plan (January 2006). The depth to groundwater is estimated to be 10 feet below ground surface. If the objective is to delineate vertically the perchlorate contamination, please consider adding additional soil analysis between the 1-3 feet soil interval and the soil interval "immediately above the groundwater table" in locations where high concentration is detected at depths greater than 3 feet. Our recommendation is based on the assumption that the cost of sampling is high in comparison with the cost of analysis.

Shaw The Shaw Group Inc.™

To: **Longhorn Army Ammunition Plant Stakeholders**

From: **Shaw Environmental, on behalf of the United States Army**

Subject: **Selection of Final Chemicals of Potential Ecological Concern (COPEC) for Further Evaluation in the Baseline Ecological Risk Assessment**

Date: **June 6, 2006**

The purpose of this memorandum is to provide Longhorn Army Ammunition Plant (LHAAP) stakeholders with the list of final chemicals of potential ecological concern (COPEC) that have been identified following the COPEC refinement step (i.e., Step 3 of the 8-Step ecological risk assessment process; USEPA, 1997). The ecological risk assessment process is a tiered process, in which successive iterations of investigation progressively use more lines of evidence and more realistic assumptions. Federal EPA risk assessment guidance mandates that an initial, highly conservative screening level assessment be performed during Steps 1 and 2. Following that screening level ecological risk assessment (SLERA), multiple lines of evidence may be weighed during Step 3 of the 8-Step Process to determine which chemicals are recommended for further evaluation in a baseline ecological risk assessment (BERA). These chemicals that require further investigation (described here as "final COPECs") are essentially chemicals in site media that have a realistic potential for resulting in adverse ecological effects. This memorandum provides the list of final COPECs recommended to be carried forward and investigated further in the LHAAP BERA, and summarizes the approach that was used in their determination.

Because the final COPECs were selected based on approaches agreed upon during extensive dialogue with LHAAP stakeholders (including formal Response to Comments on the previous Step 3 Report, and additional meetings and conference calls), it is anticipated that consensus on the final COPECs can be reached and the BERA can proceed with minimal delay. However, the Army wishes to encourage additional questions or dialogue regarding the COPEC selection process after this memorandum is reviewed to ensure that stakeholders are comfortable with the final COPEC selection. This is particularly important given the fact that stakeholders agreed to this "Interim Deliverable" as the mechanism to convey the list of final COPECs, rather than review all the details and complexities of the selection process that were described in the previous Step 3 Report for this site, and will be presented in the forthcoming Step 3/BERA combined report (anticipated to be submitted late in 2006). It is anticipated that a conference call will be arranged to discuss the final COPEC list discussed herein.

The selection of final COPECs followed the general procedure described in the document titled *Step 3 Report for the Installation-Wide Ecological Risk Assessment, Longhorn Army Ammunition Plant, Karnack, Texas* (Shaw, 2004), as modified by extensive discussions and agreements reached among LHAAP stakeholders since the Step 3 report was submitted in

November, 2004. The first step in the identification of final COPECs involved a conservative screening step, in which all detected chemicals in site media were compared with conservative benchmark concentrations (note: the screening benchmarks for soil were updated such that EPA Ecological Soil Screening Values were used as the primary benchmark concentrations, per a request made by EPA Region 6, and updated surface water, sediment and soil screening values from TCEQ [2005]). Any chemical whose source-term concentration exceeded the benchmark concentration (in addition to chemicals that lacked benchmarks) was considered an "initial COPEC", and carried forward to the COPEC refinement (i.e., Step 3 of the 8-Step process). Essential nutrients and chemicals detected infrequently (i.e., less than 5 percent detection frequency) were generally not carried forward, although an additional evaluation of infrequently detected chemicals was conducted at the request of stakeholders to ensure that infrequent detections did not consist of a potential hotspot. Several chemicals were placed back in as initial COPECs following this exercise. All bioaccumulative chemicals (as listed in TNRCC, 2001) detected in site media were retained as initial COPECs regardless of the screening results.

The large numbers of chemicals selected as initial COPECs were then evaluated using multiple lines of evidence, which included the following:

1. A direct toxicity evaluation for receptors at the base of the food chain (i.e., plants, earthworms, aquatic life) which consisted of a comparison of upper-bound (e.g., 95% upper confidence limit [UCL] and average media concentrations to multiple benchmark values protective of the target receptors;
2. A desktop food chain model to estimate risks to potentially impacted feeding guilds;
3. A background evaluation in which several statistical and non-statistical approaches were used and considered to determine if a chemical was naturally occurring or present at ambient levels;
4. Consideration of alternate exposure and toxicity assumptions, and
5. A spatial analysis of elevated concentrations of COPECs.

Table 1 presents a summary of the final COPEC selection for all media. **Tables 2 through 4** provide the selection matrix for final COPECs in soil, sediment, and surface water, respectively, for chemicals in each terrestrial sub-area (Industrial, Waste, and Low Impact) or watershed (Goose Prairie Creek, Central Creek, Harrison Bayou, and Saunders Branch). Candidate chemicals for final COPEC selection in Tables 1 through 4 included initial COPECs that had at least one ecological effects quotient (EEQ, also known as a hazard quotient, or HQ) for any modeled measurement receptor that exceeded 1; because of the conservative nature of the food chain model, chemicals with EEQs below 1 for all receptors were considered innocuous, and not considered further, unless direct contact hazards were noted. It should be

represent a realistic threat to wildlife, particularly because many of the model inputs are likely to overestimate the dose or toxicity of a given chemical.

The chemical is considered background-related:
If a chemical was considered to be present in site samples at concentrations consistent with background concentrations, then it was not considered a final COPEC. Numerous statistical and non-statistical approaches were applied to chemicals to determine if they were naturally occurring (metals) or present at ambient levels in the environment (some organics, such as pesticides). These approaches included:

- A "bright line" comparision, for which a chemical's maximum concentration was compared with the chemical's representative LHAAP-specific background concentration (either a upper-tolerance limit [UTL] or upper predication limit [UPL]);
- A Wilcoxon Rank Sum (WRS) test, which is a non-parametric statistical test for whether the site and background samples are from the same population;
- A geochemical evaluation (for metals only) that is designed to overcome some of the weaknesses of the bright-line and WRS tests by identifying samples that have anomalous ratios when compared with other trace elements;
- Box-and-whisker plots that show the maximum, upper quartile, median, lower quartile, and minimum concentrations for both site and background concentration ranges

All statistical approaches inherently have the potential to result in "false-positives", i.e., the determination that background and site data are significantly different. One of the advantages of the geochemical approach is that it avoids false-positives by evaluating data based on pure geochemistry. On the other hand, even if contamination is observed in the geochemical analysis, overall concentration levels may be lower than ambient background concentrations (i.e., the UTL or UPL), which would indicate that ecological receptors are not being exposed to concentrations greater than on unimpacted areas in the local vicinity. Therefore, all lines of evidence were considered when determining whether a chemical was considered background-related. Typically, multiple lines of evidence were available to support the determination that a chemical was background-related. However, the finding that a chemical was background-related by any one of the major approaches (i.e., geochemical, bright-line comparison, or WRS test) was usually considered adequate evidence that chemical concentrations were not present at significantly elevated concentrations—particularly if there were other, non-background related lines of evidence supporting this conclusion-- and the chemical was not included as a final COPEC.

The following changes from the Step 3 Report (Shaw, 2004) were made to the background approach for the refinement of COPECs based on recent discussion and agreements with LHAAP stakeholders:

- Background (i.e., UTL or UPL) and ecological screening values were added to all geochemical ratios plots;

- A least squares regression analysis was conducted on the geochemical plots for a limited number of chemicals. Only chemicals for which background was a key justification for elimination as a final COPEC were subjected to the least squares analysis. The results of this analysis were not considered relevant for the purposes of interpreting the geochemical relationships, however, and did not affect the conclusions of the geochemical evaluation;

- All chemicals that would have been selected as final COPECs if they had not been identified as background-related were retained in a list of "Background COPECs" that will be carried forward to further steps of the risk assessment. These chemicals will not be included as chemicals requiring further investigation in the BERA, but will also not be eliminated entirely at the COPEC refinement stage (i.e., Step 3). Rather, they will be presented in Step 7 (Risk Characterization) for consideration by risk managers.

Use of more appropriate alternate uptake factors and/or toxicity reference values (TRV):
If the use of alternative uptake factors or TRVs that were considered more appropriate than the ones used in the original food chain model resulted in EEQs less than one, then the chemical was generally not considered a final COPEC. During the food chain modeling exercise, when multiple uptake factors (i.e., multipliers used to estimate accumulation of a chemical in plants or animals) or TRVs (i.e., intake doses associated with no-effect observations for a certain type of organism) were available for a given chemical, a conservative value was always selected. This was done to protect the overall conservativeness of the food chain model. However, in some cases the selected uptake factor or TRV was not a realistic value given the conditions likely to be present in the environment at LHAAP. For example, the TRV that was used to estimate the effects of lead on birds was based on a study that used lead acetate. Metals complexed to organic molecules are known to enhance bioavailability in oral diet studies. Therefore, the use of an alternative TRV based on metallic lead was used to estimate food chain hazard as well, because lead in a metallic or inorganic form is much more likely at LHAAP. If the EEQs using more appropriate or realistic values were close to or below 1, potential risk associated with the chemical was considered acceptable, and the chemical was often not recommended as a final COPEC requiring further study.

An additional source of data (that was not available when the previous Step 3 report was issued) regarding the uptake of chemicals from surface water and sediment into fish was used in this iteration of the COPEC selection. In the previous Step 3 Report (Shaw, 2004), potential impacts resulting from the bioaccumulation of chemicals from surface water and sediment to fish were estimated by first modeling concentrations in fish tissue, and then comparing the fish tissues to Critical Body Residues (CBR) associated with potential adverse effects. For the

surface water pathway, concentrations were modeled for the fathead minnow using a surface-water-to-fish bioconcentration factor. For the sediment pathway, concentrations were modeled for the brown bullhead catfish and estimated using the computer software TrophicTrace®. In 2004, USEPA Region 6 and TCEQ conducted a study to determine contaminant residues in fish from Caddo Lake adjacent to LHAAP (USEPA, 2004). One of the sampling locations of this study was the Goose Prairie Creek drainage area into Caddo Lake. This area was determined in the previous Step 3 Report to be one of the most impacted areas with regards to the transport and deposition of sediment containing elevated concentrations of chemicals from possible on-site sources. By comparing fish tissue concentrations presented in the USEPA (2004) report with modeled fish tissue concentrations from surface water and sediment, it could be determined if the modeling overestimated fish tissue COPEC concentrations used in the previous Step 3 Report. In most cases, the modeling used in the previous COPEC refinement step overestimated actual concentrations by a large amount (e.g., overestimation by a factor of 40 or more was not uncommon). Therefore, the CBR conclusions from the previous Step 3 Report were re-examined in light of this new information during this iteration of COPEC refinement. Thus, some conclusions regarding possible impacts resulting from bioaccumulation in fish were reversed if the EPA (2004) data indicated that bioaccumulation did not appear to be problematic for the particular chemical based on field observations.

Spatial analysis:

Chemicals that were sporadically detected or were detected in no discernable pattern were often not considered final COPECs. Sample locations with elevated concentrations (i.e., concentrations exceeding the ecological benchmark concentration and/or background concentration) of a given chemical were plotted on a map. Chemicals with grouped locations of elevated detections were given more weight for being selected as final COPECs, because grouped locations may be indicative of a CERCLA-related release, and also because they represent localized areas of elevated concentrations (i.e., “hot spots”) that are more likely to be encountered regularly by ecological receptors. Chemicals that had elevated detections that were scattered and at a low frequency were given less weight for being selected as COPECs, as this type of spatial pattern is not suggestive of a release, and chances are reduced that ecological receptors (particularly “small-range” receptors, whose limited home range would preclude their exposure to multiple sampling locations with elevated concentrations) would regularly encounter the elevated concentrations.

Direct contact evaluation:

In addition to the food chain modeling, which was conducted for the purposes of estimating potential hazards associated with ingestion of prey for receptors in the middle and upper trophic levels of the food web, a direct contact evaluation was conducted for terrestrial (i.e., plants and earthworms) and aquatic (i.e., water fleas [daphnids]) organisms at the base of the food chain. The direct contact evaluation was conducted by comparing upper-bound (Tier 1) and average (Tier 2) concentrations of COPECs in soil, sediment, and surface water to

benchmark concentrations from multiple sources protective of base-of-the-food chain organisms. Special attention was paid to surface water chemicals that exceeded State- or Federally- promulgated criteria. If a surface water chemical exceeded promulgated criteria, it was selected as a final COPEC, unless it was determined to be background related. A project-specific agreement has been made with LHAAP stakeholders to include organisms at the base of the terrestrial food chain (e.g. terrestrial invertebrates and terrestrial plants) as assessment endpoints (defined in USEPA, 1997 as "an explicit expression of the environmental value that is to be protected") in the ecological risk assessment, but chemicals would not be proposed as final COPECs if terrestrial benchmark exceedance was the only reason for their selection. Therefore, the direct contact evaluation was used as a line of evidence as to whether a chemical should or should not be carried forward as a final COPEC into the BERA, but no chemicals were selected as final COPECs solely because of this evaluation.

Additionally, the bioaccumulation of COPECs in sediment and surface water to fish tissue was modeled, and these estimated tissue concentrations were compared with critical body residues (CBR) associated with potential adverse effects in fish. As an addition to the original Step 3 Report (Shaw, 2004), measured fish tissue COPEC concentrations were compared to modeled fish tissue concentrations to estimate the accuracy of the modeled CBR HQs.

Other considerations:

Other considerations were also taken into account when selecting final COPECs. For example, following normal operating procedures at the time, pesticides and herbicides were historically applied throughout the installation to limit nuisance species, and are ubiquitous at low levels in the environment. If a pesticide was present at multiple locations, but no concentration gradient was observed that might suggest a spill or other type of release (other than normal historical applications according to the manufacturers recommendations), the determination may be made that the chemical is present at ambient concentrations, and it is not feasible or practical to carry it forward as a final COPEC.

SUMMARY OF FINAL COPECs

The following chemicals are considered final COPECs, and will be targeted for further study in the BERA. An asterisk (*) indicates that the chemical was selected as a final COPEC in the previous Step 3 Report (Shaw, 2004):

SOIL

Industrial Sub-Area

- Cadmium
- Chromium
- Zinc
- Perchlorate (*)

Waste Sub-Area

- Barium (*)
- Chromium
- Lead (based on new data from Pistol Range)
- 2,4-DNT (*)
- 2,6-DNT (*)
- TNT (*)
- Dioxins (*)

Low Impact Sub-Area

- None selected

Perchlorate was selected in the previous Step 3 Report (Shaw, 2004) as a final COPEC in soil in the Waste and Low Impact sub-areas. However, hazards associated with perchlorate were not calculated during the previous version of the COPEC refinement step, and perchlorate was retained as a COPEC because of the uncertainty involved. For this version of the COPEC refinement, enough data in the literature were identified for the calculation of EEQs, and only receptors in the Industrial Sub-Area were predicted to have unacceptable risk.

SEDIMENT

Goose Prairie Creek

- Lead (*)
- Mercury (*)

Central Creek

- None selected

Harrison Bayou

- None selected

Saunders Branch

- None selected

Zinc was selected in the previous Step 3 Report (Shaw, 2004) as a final COPEC in sediment in the Goose Prairie Creek watershed due to bioaccumulation in fish. However, findings from recent field investigations (USEPA, 2004) show that zinc concentrations previously estimated in fish tissue (and the associated CBR EEQs) were highly overestimated using the bioaccumulation modeling approach (e.g., one order of magnitude overestimation). Therefore,

the revised conclusion for zinc is that bioaccumulation in fish is not significant, and it is not necessary to include zinc as a final COPEC in sediment.

SURFACE WATER

- No final COPECs selected

Barium and dioxin were selected as final COPECs in the Harrison Bayou watershed in the previous Step 3 Report (Shaw, 2004). During the current iteration of Step 3, barium was screened out during the benchmark screening stage due to an updated (i.e., higher) TCEQ (2005) benchmark screening value. Dioxin was previously selected as a final COPEC due to modeled concentrations in fish, which were ingested by various measurement receptors (e.g., the River Otter). However, in light of the recent field data and analysis presented in the USEPA Region 6 (2004) fish sampling report, this exposure pathway was not considered to be of concern. Although dioxins were found in all whole fish samples collected, the report found that dioxins were generally higher in the Clinton Lake (i.e., the control area) fish, and some dioxin congeners were only detected in fillet samples from fish caught in Clinton Lake. Edible fillets harvested from fish collected at both Harrison Bayou and Goose Prairie Creek were non-detect for dioxins. Because the only detected dioxins in edible tissue were harvested in the control area upstream of LHAAP, the report suggests that LHAAP is not the likely source for dioxins in the edible tissue. These findings suggest that dioxin in fish tissue is present at much lower concentrations than were estimated in the Step 3 food chain models, and that sources not related to historical processes at LHAAP are the primary contributors to the low levels of dioxin detected in fish tissue. Therefore, although the current food chain model again indicated some possible risk to measurement receptors as the result of fish ingestion (particularly in Harrison Bayou), the results of the USEPA Region 6 (2004) indicate that this pathway was overly conservative, and dioxin was not selected as a final COPEC in the Harrison Bayou watershed.

SUMMARY OF CHEMICALS PLACED ON THE BACKGROUND LIST

COPECs put on the Background List, to be considered during Step 7 by risk managers, are as follows:

SOIL

Industrial Sub-Area

- Aluminum
- Vanadium
- Dioxins

Waste Sub-Area

- Aluminum

- Cadmium
- Vanadium
- Zinc

Low Impact Sub-Area
- Vanadium

SEDIMENT

Goose Prairie Creek
- Aluminum
- Silver
- Thallium

Central Creek
- Aluminum
- Thallium

Harrison Bayou
- Aluminum
- Thallium

Saunders Branch
- Aluminum
- Vanadium

SURFACE WATER
Goose Prairie Creek
- Aluminum
- Copper
- Iron
- Lead

Central Creek
- Aluminum
- Cadmium
- Copper
- Iron
- Lead

Harrison Bayou

- Aluminum
- Copper
- Iron
- Lead

Saunders Branch

- Lead

References Cited

Shaw Environmental, Inc. (Shaw), 2004, *Step 3 Report for the Installation-Wide Ecological Risk Assessment, Longhorn Army Ammunition Plant, Karnack, Texas, Draft Final*, November.

Texas Commission on Environmental Quality (TCEQ), 2005, *Update to Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas*, RG-263 (Revised), Remediation Division, September.

Texas Natural Resource Conservation Commission (TNRCC), 2001, *Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas*, RG-263 (Revised).

United States Environmental Protection Agency (USEPA), 1997, *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments*, Interim Final, Office of Solid Waste and Emergency Response, OSWER 9285.7-25 EPA540-R-97-006.

USEPA Region 6, 2004, *Investigation of Contaminants in Fish Tissue, Caddo Lake Biological Sampling and Risk Assessment for Longhorn Army Ammunition Depot*, in cooperation with Texas Commission on Environmental Quality (TCEQ) and US Fish and Wildlife Service (USFWS), November.

Shaw® Shaw Environmental, Inc.

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

Location of Meeting: Army Trailer, Longhorn AAP, TX

Date of Meeting: **June 27, 2006, 1:15 – 3:30 AM**

Meeting Participants:

BRAC:	Rose M. Zeiler
USAEC:	Jeff Armstrong (phone), Tim Rodeffer (phone), Mary Ellen Maly (phone)
USACE-Tulsa:	Cliff Murray (phone), Rick Smith
USACE-Fort Worth	Harmon Slappy
USFWS:	Paul Bruckwicki, Mark Williams
Shaw Environmental:	Praveen Srivastav, Dave Cobb, Van Vangala
USEPA Region 6:	Chris Villarreal, Scott Harris, Stephen Tzhone
TCEQ:	Fay Duke
Cape, Inc.	Elliott Adler

Shaw distributed copies of the meeting agenda, minutes of April 25, 2006 Monthly Managers' Meeting, and document status tables for the TERC and PBC work.

Rose Zeiler went through the list of action items from the previous monthly managers' meeting. All action items have been addressed. Below are the highlights of this discussion:

- **Army – Provide Shaw ECOP IV transfer map and USFWS data from EFIA and production area:** ECOP IV transfer map and USFWS data were provided, although the USFWS data were not in GIS format.
- **TCEQ – Provide comments on LHAAP-48/53 report:** The comments were received on July 5, 2006
- **Schedule a conference call to discuss human health risk assessment at LHAAP-48/53**: Fay Duke indicated that there was no need for a call at this point. She would like to finish her review first.

Defense Environmental Restoration Program (DERP) PBC Update (Dave Cobb)

Field Update. Shaw mobilized on June 25 for sampling at sites LHAAP-04, 07, and 51. The field work is expected to be complete by Friday, June 30, but may continue over the weekend and after the July 4th weekend, if necessary.

GWTP. Van Vangala provided handouts of the GWTP report. The plant is functioning well with the exception of a power outage and regular maintenance. Sprinkling of the discharge water has started because the INF pond is near capacity. Also, the grass on the landfill covers was drying up so sprinkling can be useful there. Rose Zeiler explained the history of TCEQ approval of the discharge water sprinkling. Last summer the Army requested permission to sprinkle the water at LHAAP-18/24 and LHAAP-16. TCEQ had sent a letter of approval. Van Vangala added that the permit allows sprinkling as long as flooding and ponding of the water do not occur.

Document Status. PBC document status table was provided to the participants. Fay Duke said she is almost finished with her review of the LHAAP-29 work plan. Chris Villarreal indicated that Raji Josiam of EPA is the primary reviewer of LHAAP-29 and 35/36 work plan and has not finished her review as yet. Chris Villarreal will check with Susan Roddy and Marc Greenberg regarding their availability for a conference call on Final COPEC memo from Shaw. Dave Cobb pointed out that the minutes from March 30, 2006 conference call on ERA have not been finalized, pending input from regulators. Comments are also overdue on the LHAAP-02 evaluation report.

MMRP. Elliott Adler of Cape, Inc. gave a presentation of their approach and ongoing work at LHAAP. Following are highlights of some of the discussion.

- Cape is using a forestry machine (Hydroax) to remove trees along their transect lines.
- The meandering transects do not affect Cape's data collection because the location is continuously recorded by their instruments and plotted on maps
- Cape is using Robotic Total Station (RTS) for positioning because it is more accurate than other available technologies
- EE/CA will contain a narrative of field activities, soil sampling results, risk analysis, cost analysis and a recommendation for future action
- An action memo will follow the EE/CA to document the decision
- The EE/CA is expected in 4-5 months after brush clearing (May-June 2006), geophysics (June-July 2006) and intrusive activities (2-3 months) are completed. EE/CA will be due within 30 days after the completion of field work
- Geophysics work was completed ahead of time, currently anomaly reacquisition is going on
- To a question from Rose Zeiler, Elliott Adler replied that Cape has not seen anything big. Harmon Slappy added that some near surface frag material from photoflash bombs has been dug up.
- The depth of detection of the EM-61 is 10-12 inches for flares and four feet or deeper for an unexpended photoflash bomb.

- It is very important to provide Cape information on the future use of the sites because it impacts risk analysis to be presented in the EE/CA. Rose Zeiler indicated that the Army has to discuss issues related to future use and level of cleanup.
- Chris Villarreal asked what Cape would conclude about the remaining 97% of the area, based on the 3% data they intend to collect. Elliott Adler replied that Cape's approach is standard practice. Statistical interpolation will be done based on the data collected.
- Rose Zeiler asked EPA whether they continue to be concerned about the approach because they have asked about the 3% coverage before. Chris Villarreal replied that EPA's response will be based on what the Army desires to accomplish with the data. If areas are restricted for access, then there may not be as much concern. However, the concern would be higher if the areas are open to unrestricted access.
- To a question from Stephen Tzhone, Elliott Adler replied that he has seen risk analysis done on less than 3% coverage. He emphasized that the sampling by Cape is biased sampling of area suspected to have UXO. In addition scarred area will be addressed.
- To a question from Paul Bruckwicki as to whether or not there will be 100% surface clearance, Elliott Adler replied that Cape will pickup what is visible on the surface from the transects. They will not pickup from areas between the transects unless it is something significant.

Defense Environmental Restoration Program (DERP) TERC Update (P. Srivastav)

Document Status. TERC document status table was provided to the participants. Highlights of discussion are:

- Chris Villarreal will provide the signature page after the ROD has been signed by the EPA. Shaw will provide a PDF of the ROD to stakeholders.
- Fay Duke suggested that the document presenting the remedy details (originally called RD Addendum) should be just called an RD.
- LHAAP-48/53 is on BRAC's FY06 list and the Army would like to get those sites to proposed plan stage.
- Fay Duke will provide comments on the Background SW/SD report within a week
- Proposed plans scheduled for FY06 are for sites LHAAP-08, 37/67, 32, and 48/53.

DERP Corps of Engineers Update (Rick Smith)

Perimeter Well Sampling
Rick Smith informed that Shaw has submitted a letter saying that Shaw will begin sampling if directed to do so but will reserve its right to file a claim for change order later. USACE is preparing a response. Dave Cobb asked how the regulators would respond if a request came in to reduce the frequency of sampling to annual. Chris Villarreal replied that EPA is always supportive of reduction in frequency of sampling if the data provided supports it. He asked if Shaw will provide a proposal to reduce frequency. Dave Cobb replied that it needs to be discussed between Shaw and the Army. EPA and TCEQ also indicated that the two agencies would not wait much longer before a letter of non-compliance is issued.

Other (Rose Zeiler)

Transfer Update. Rose Zeiler informed that the Army has no money available to work on the permit or ECOP IV. As a result those two items are on hold until funds become available.

A discussion ensued on USFWS' plan to open up the refuge to public beginning September 22, 2006. Highlights were as follows:

- USFWS plans to open up a loop for the public to drive around. The loop would go around sites LHAAP-29 and 49 and pass near the fire station. USFWS and Army may erect gates to restrict access to other parts of the base. The refuge would be open Monday – Friday, morning to evening. The access could be restricted anytime upon Army's request if active remedial operations are being conducted. Rose Zeiler expressed surprise at the level of access – it had been her understanding that only limited vehicular tours would take place – not that the refuge gates would be opened.
- Concerns were raised by EPA and Shaw about the exposure to public during remedial actions and liabilities associated with it. There are chemical and physical hazards. Shaw faces liability, especially during its operations related to remediation in active sites. In general there was an opposition to unrestricted public access.
- A suggestion was made to run guided tours through the refuge which would allow the public to see a large section of the installation but reduce the possibility of members of public venturing into restricted areas.
- USFWS does not have personnel or funds to provide guided tours, but it is a good possibility. It was decided to put this question to the public during the RAB meeting scheduled for the evening that day.

Electricity

- Rose Zeiler said that BRAC had no funds to pay for gwtp electricity. It is AEC's or Shaw's cost, however, AEC has no mechanism to pay to a utility company.
- USFWS can pay to the utility company if a bill is provided but it can not pay Shaw because Shaw is not the utility company.
- SWEPCO makes only a single reading for both Circuits 3 and 7.
- Rose Zeiler informed that the power to the Administration Building (currently USFWS office) will be disconnected effective August 1, 2006 if USFWS can not find a way to begin paying for its power usage.
- USFWS is trying to find out if SWEPCO (electric company) will provide them electricity under the law after the disconnection on August 1.

Schedule. No discussion

Meeting Adjourn.

Action Items:

Army – Resolve MMRP sites future use/cleanup level issue
- Send Site 12 letter re change in alternatives

- Check AR for demolition documents

TCEQ – Provide comments on LHAAP-48/53 report, LHAAP-29 and 35/36 work plans
EPA – Provide comments on work plans for LHAAP-29, and 35/36

LONGHORN ARMY AMMUNITION PLANT
MONTHLY MANAGERS' MEETING

Location	Longhorn Trailer		
Date	27 June, 2006	**Time**	1300

ATTENDEES

Name (printed)	Signature	Organization	Phone	E-mail
Longhorn Team Members				
Rose M. Zeiler	Rose M. Zeiler	BRAC	(479) 635-0110	rose.zeiler@monroe.army.mil
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Tim Redeffer	On Phone MMRP	USAEC		
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Elliott Adler		CAPE, Inc	8659341336	eadler@cape-inc.com
Mary Ellen Maly	On phone MMRP	AEC		
Jeff Armstrong	On phone	AEC		

00040479

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

June 8, 2006

DAIM-BD-LO

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

Re: Final Addendum 1 Soil Sampling at LHAAP-04, Former Pilot Wastewater Treatment Plant, Final Installation-Wide Work Plan, Longhorn Army Ammunition Plant, Karnack, Texas, June 2006

Dear Mr. Villarreal,

The above-referenced document is being transmitted to you for your files. 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 document has also been posted on Shaw's LHAAP Project Portal.

The point of contact for this action is the undersigned. I ask that David Cobb, 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, Ph.D.
Longhorn AAP Site Manager

Copies furnished:
Fay Duke, TCEQ, Austin, TX
Paul Bruckwicki, Caddo Lake NWR, TX
Cliff Murray, COE – Tulsa District, OK
Richard P. Smith, COE – Tulsa District, OK
P. Srivastav, Shaw – Houston, TX

00040480

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

June 8, 2006

DAIM-BD-LO

Ms. Fay Duke
Texas Commission on Environmental Quality
TCEQ Environmental Cleanup Section II MC-221
12100 Park 35 Circle
Austin, TX 78753

Re: Draft Final Addendum 1 Soil Sampling at LHAAP-04, Former Pilot Wastewater Treatment Plant, Final Installation-Wide Work Plan, Longhorn Army Ammunition Plant, Karnack, Texas, June 2006

Dear Ms. Duke,

The above-referenced document is being transmitted to you for your files. 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 document has also been posted on Shaw's LHAAP Project Portal.

The point of contact for this action is the undersigned. I ask that David Cobb, 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, Ph.D.
Longhorn AAP Site Manager

Copies furnished:
Chris Villarreal, USEPA Region 6, Dallas, TX
Paul Bruckwicki, Caddo Lake NWR, TX
Cliff Murray, COE – Tulsa District, OK
Richard P. Smith, COE – Tulsa District, OK
P. Srivastav, Shaw – Houston, TX

Response to Comments on
Draft Final Addendum 1, Soil Sampling at LHAAP-04 Former Pilot Wastewater Treatment Plant (February 2006)
Final Installation-Wide Work Plan
Longhorn Army Ammunition Plant, Karnack, Texas

June 2006

Reviewer: EPA and TCEQ
Respondents: Pernilla Lindblom and Praveen Srivastav, Shaw Environmental, Inc.

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

Comment #	Page	Section/ Paragraph	Comment	C, D, E or X[1]	Response	A or D[2]
Comments from EPA received 4/19/06						
1	1-2	Section 1.1 (Site Description and History)	The location, extent and proposed disposition of the referenced mercury-contaminated area are not apparent. Since the stated focus of this investigation appears specifically to be perchlorate contamination, please clarify the rationale for not including mercury.	D	Data and figures for the mercury sampling are included in Attachment 1. The mercury contamination is confined to a small area at boring SB-11 and considered well-defined based on previous sampling. Soil borings SB-12, SB-13, and SB-10 were collected approximately 15 to 20 feet west and east of SB-11 and results showed no mercury detected to 0.4 mg/kg of mercury. Pipe-2 is located to the south of SB-11 and analytical results showed no mercury detected. Pipe-2 was collected 3 to 5 feet bgs. Samples collected from two soil boring locations associated with Sump 122 (LH-S122-01 and LH-S122-02) showed no mercury detected. It is not believed more assessment is necessary.	
2		Figure 1-1 (Sample Location Map)	It is unclear how areas N/NW of the Former Treatment Plant will be assessed or characterized. This area contains many of the highest perchlorate values, but will not be bounded by the proposed sampling points.	D	It is unclear what sampling data is being referred to as we are not aware of any samples being collected N/NW of the plant. The sample collected farthest north (04BS03) has perchlorate concentrations significantly lower than locations being resampled. Please let us know if you have data that have not been included in our work plan or tell us what is the basis for determining the high perchlorate values in the N/NW area.	
Comments from TCEQ received 5/23/06						
1	1-2	Section 1.1, second paragraph from top of the page	It is stated that 16 samples were collected adjacent to the Pilot Wastewater Treatment Plant. It is also stated that four samples were analyzed only for perchlorate but there is no information as to the type of analysis that were performed on the other 12 samples. Please revise.	C	All 16 samples were analyzed for perchlorate. The paragraph will be revised as follows: As part of Phase III site investigations in 2000, 16 soil samples were collected from six locations adjacent to the Pilot Wastewater Treatment Plant and analyzed for perchlorate (Jacobs, 2002b). These included four	

Response to Comments on
Draft Final Addendum 1, Soil Sampling at LHAAP-04 Former Pilot Wastewater Treatment Plant (February 2006)
Final Installation-Wide Work Plan
Longhorn Army Ammunition Plant, Karnack, Texas

June 2006

Reviewer: EPA and TCEQ
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Comment #	Page	Section/ Paragraph	Comment	C, D, E or X[1]	Response	A or D[2]
					samples collected in June 2000 from two locations (04SB01 and 04SB02) at depth intervals of 0 to 0.5 feet and 1 to 2 feet. Another twelve soil samples were collected in December 2000 from four locations (04SB03 through 04SB06) at depth intervals of 0 to 0.5 feet, 1 to 3 feet, and 3 to 5 feet.	
2	1-2	Section 1.1, fifth paragraph from top of the page	With regards to the pilot study conducted in this unit, it is stated that "complete removal of perchlorate in the surface soils was observed and varied reduction in the deeper layers." It is also understood that one of the objectives of this sampling event is to collect additional data to "determine the post-pilot study conditions." In order to evaluate whether sampling intervals are appropriate to meet this project objective, it is necessary to understand the depth of soil that was treated in the pilot study. Please revise to include additional information regarding the vertical extent of soils that were subject to the perchlorate treatment pilot study.	C	Carbon sources were added to the top 12 inches of soil in the pilot study cells. Water was then added to saturate soil to 24 inches. Soil samples were collected from three intervals: 0 to 12 inches, 12 to 24 inches, and 24 to 36 inches. This information will be added to the work plan.	
3	2-1	Section 2.2.1, sampling interval	It is stated that soil samples will be collected "from surface interval (0-0.5 feet bgs), from 1-3 feet, and from immediately above the water table." Which sampling techniques (composite or grab) will be used to collect soil samples from the 1-3 foot interval? If composite sampling is planned, please include procedures to ensure a homogeneous sample. We were not able to find the procedure in the Final Installation-Wide Work Plan (January 2006). The depth to groundwater is estimated to be 10 feet below ground surface. If the objective is to delineate vertically the perchlorate contamination, please consider adding additional soil analysis between the 1-	C D	A composite sample representative of the 1-3 foot depth interval will be collected. A bullet has been added to the procedures for sampling on page 2-3, 10th paragraph (10th bullet) and reads, "Samples will be composited by collecting representative portions of soil from the designated interval, placing in a decontaminated stainless steel bowl or disposable container for mixing, and placing in the appropriate laboratory-supplied sample jar." Two samples are proposed to be collected from above the water bearing zone and should adequately provide information regarding vertical delineation.	

Response to Comments on
Draft Final Addendum 1, Soil Sampling at LHAAP-04 Former Pilot Wastewater Treatment Plant (February 2006)
Final Installation-Wide Work Plan
Longhorn Army Ammunition Plant, Karnack, Texas

June 2006

Reviewer: EPA and TCEQ
Respondents: Pernilla Lindblom and Praveen Srivastav, Shaw Environmental, Inc.

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2. Commenter Agrees (A) with response, or Does not Agree (D) with response.

Comment #	Page	Section/ Paragraph	Comment	C, D, E or X[1]	Response	A or D[2]
			3 feet soil interval and the soil interval "immediately above the groundwater table" in locations where high concentration is detected at depths greater than 3 feet. Our recommendation is based on the assumption that the cost of sampling is high in comparison with the cost of analysis.			

In addition, Shaw has made the following changes.

1	Binder Cover	Binder Cover	Delete "to" in title for consistency in all addenda.			
2	Signature Page	Signature Page	Delete "to" in title on signature page.			
3	i	Table of Contents	Change title of Figure 1-1 to "Sample Location Map."			
4	ii	Acronyms and Abbreviations	Change "Above ground storage tank" to "aboveground storage tank." Change "semi-volatile organic compounds" to "semivolatile organic compounds."			

FINAL

ADDENDUM 1
SOIL SAMPLING AT LHAAP-04
FORMER PILOT WASTEWATER TREATMENT PLANT

FINAL

INSTALLATION-WIDE WORK PLAN
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.
3010 Briarpark Drive, Suite 4N
Houston, Texas 77042

Contract Number W912QR-04-D-0027
Task Order No. DS02

June 2006

FINAL
ADDENDUM 1
SOIL SAMPLING AT LHAAP-04
FORMER PILOT WASTEWATER TREATMENT PLANT
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
JUNE 2006

PRAVEEN SRIVASTAV
Name of Texas Professional Geoscientist

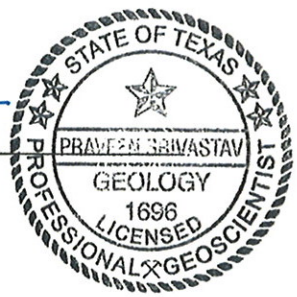
1696
License Number

SHAW ENVIRONMENTAL, INC.
Company

3010 BRIARPARK DRIVE, SUITE 4N, HOUSTON, TX 77042
Address

I certify with my signature below, that the written descriptions and graphical depictions of geology and hydrogeology contained within this report were prepared under my supervision, and accurately reflect existing knowledge about the geology and hydrogeology of the referenced site.

Signature



06/08/06
Date Signed

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Attachment 1 LHAAP-04 RCRA Closure Data

Acronyms and Abbreviations

ACE	Anderson Columbia Environmental, Inc.
AST	aboveground storage tank
ASTM	ASTM International (formerly American Society for Testing and Materials)
bgs	below ground surface
EPA	U.S. Environmental Protection Agency
Jacobs	Jacobs Engineering Group
LHAAP	Longhorn Army Ammunition Plant
MARC	Multiple Award Remediation Contract
µg/kg	micrograms per kilogram
PCB	polychlorinated biphenyls
Shaw	Shaw Environmental, Inc.
STEP	Solutions To Environmental Problems, Inc.
SVOC	semivolatile organic compounds
TO	task order
TPH	total petroleum hydrocarbons
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compounds

1.0 Introduction

This addendum outlines activities associated with soil sampling proposed for site LHAAP-04 at the former Longhorn Army Ammunition Plant (LHAAP). LHAAP-04 is the former Pilot Wastewater Treatment Plant. The objective of the soil sampling is to confirm existing residual perchlorate concentrations in soil at LHAAP-04 and evaluate whether soil continues to pose human health or ecological risks. If the data indicate that an unacceptable risk exists, then the results of the soil sampling will be used to design a remediation plan for LHAAP-04.

The U.S. Army Corps of Engineers (USACE), Tulsa District, has contracted Shaw Environmental, Inc. (Shaw) to perform this work at the former LHAAP, Karnack, Texas, under the Louisville District's Multiple Award Remediation Contract (MARC) No. W912QR-04-D-0027, Task Order (TO) DS02, with oversight by the USACE, Tulsa District. This document is an addendum to the *Final Installation Wide Work Plan, Longhorn Army Ammunition Plant, Karnack, Texas* (Shaw, 2006).

1.1 Site Description and History

The Pilot Wastewater Treatment Plant occupies less than 2 acres in the central portion of LHAAP at the northwest corner of 6th and 60th Streets adjacent to the former firehouse. Wastewater from sumps throughout LHAAP was treated at the plant. After settling, the wastewater was transferred to one of two storage tanks, and then pumped through a heat exchanger to an evaporation tower. Solids were shipped off site for disposal. Sludge from the settling tanks was blown down and drummed weekly, then burned at Burning Ground No. 3. The plant was closed in 1998 (Jacobs, 2002a). Previous studies have indicated perchlorate concentrations detected in surface and subsurface soil up to 163,000 micrograms per kilogram (µg/kg) (Solutions To Environmental Problems, Inc. [STEP], 2003) (Jacobs Engineering Group, Inc. [Jacobs], 2002b).

The soil at LHAAP-04 includes interbedded layers of silty clays and sands. In general, the groundwater flow direction at LHAAP-04 is thought to be from the southwest to the northeast (Jacobs, 2002c).

As part of the RCRA closure, demolition and disposal of the pilot wastewater treatment facility and its associated hazardous waste was completed in the summer of 1997. Three aboveground storage tanks (ASTs) were emptied, cleaned, and removed as part of the site closure by Anderson Columbia Environmental, Inc. (ACE) in September 1997 (see **Attachment 1**). As part of the ACE closure report, a total of 12 soil borings were advanced around the concrete pad and were collected at 12 inches below ground surface (bgs). Soil samples were also collected below the

pipe leading from the facility to the 40,000 gallon AST (approximately 6 feet bgs). Four samples were collected around the 40,000 gallon AST and analyzed for pesticides, herbicides, polychlorinated biphenyls (PCBs), and semivolatile organic compounds (SVOCs). These compounds were not detected in the soil samples. Metals, total petroleum hydrocarbon (TPH), and volatile organic compounds (VOCs) were detected in soil samples. VOC contamination was mostly acetone hits (ACE, 1997). The results have been compared to Texas Medium Specific Concentration (MSCs) and mercury exceeds these clean up values in soil boring SB-11. Soil borings SB-12, SB-13 and SB-10 were collected approximately 15 to 20 feet west and east of SB-11 and had non detect to 0.4 mg/kg of mercury. Samples collected from two soil borings associated with Sump 122 (LH-S122-02 and LH-S122-02) showed no mercury detected. Therefore, the area of mercury contamination appears to be localized to a small area.

As part of Phase III site investigations in 2000, 16 soil samples were collected from six locations adjacent to the Pilot Wastewater Treatment Plant and analyzed for perchlorate (Jacobs, 2002b). These included four samples collected in June 2000 from two locations (04SB01 and 04SB02) at depth intervals of 0 to 0.5 feet and 1 to 2 feet. Another twelve soil samples were collected in December 2000 from four locations (04SB03 through 04SB06) at depth intervals of 0 to 0.5 feet, 1 to 3 feet, and 3 to 5 feet.

Perchlorate was detected at all sampling locations. In the 0- to 0.5-foot sampling interval, the highest concentration of perchlorate detected was 45,400 µg/kg at sample location 04SB02, south of the facility. In the 1- to 2-foot or 1- to 3-foot sampling interval, the highest concentration detected was 144,000 µg/kg at 04SB01. Data review indicates that the samples collected from the 1- to 2- or 1- to 3-foot sampling interval contained the highest perchlorate concentrations. While perchlorate is only intermittently present at the deepest sampling interval of 3 to 5 feet, concentrations show no consistent variation with depth.

Historic sample locations and results are depicted on **Figure 1-1** and historic analytical data are summarized in **Table 1-1**.

A pilot study was conducted by Valentine Nzengung, K.C. Das, and James Kastner of the University of Georgia in 2000 and 2001. Three carbon sources (ethanol, and horse and chicken manure) were selected for pilot testing at the site and added to the top 12 inches of soil. Water was added to obtain saturation to 24 inches. After ten months, complete removal of perchlorate in the surface soil was observed and varied reduction was observed in the deeper layers. Sampling was conducted in three layers: 0 to 12 inches, 12 to 24 inches, and 24 to 36 inches. Approximate location of the pilot study plot is shown in **Figure 1-1**.

A subsequent plant-wide perchlorate investigation was performed to confirm the presence and concentrations of perchlorate contaminants, characterize releases that may have occurred, and

further delineate the extent of the perchlorate contamination in soil and groundwater (STEP, 2003). Field sampling for this investigation was conducted in two events to determine if seasonal fluctuations would affect the concentrations of perchlorate in the environment. Sampling for the wet season was conducted in March 2002 and sampling for the dry season was conducted in September 2002. Soil sampling was conducted on a 150-foot by 225-foot soil sampling grid (on 75-foot centers). Soil samples were collected from 0 to 0.5 feet and from 1 to 2 feet deep. Sampling locations STEP-04SS03 and STEP-04SS09 were placed near points sampled during previous investigations (04SB02 and 04SB01, respectively). An additional sample was collected at these two locations from a depth of 4 to 5 feet. To determine whether perchlorate was leaving the site due to surface flow, three additional sampling locations (STEP-04SS13, STEP-04SS14, and STEP-04SS15) were selected in the surface drainage paths from the site. The soil samples collected during the wet season sampling event confirmed high concentrations of perchlorate in the soil with a maximum of 163,000 µg/kg of perchlorate detected at STEP-04SS06. STEP concluded that the lateral extent of perchlorate contamination has been defined and that additional investigation is necessary to determine the vertical extent of soil contamination.

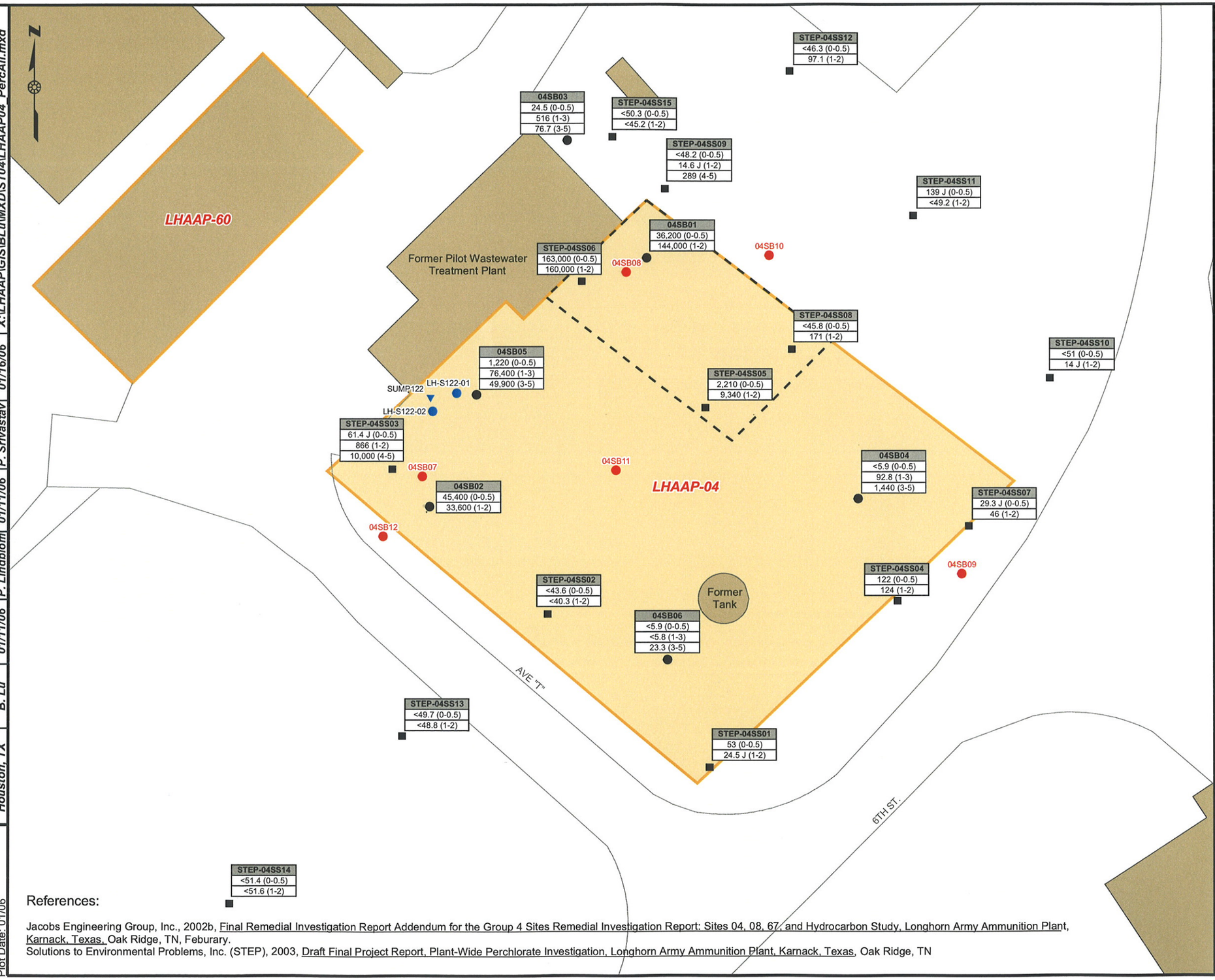
1.2 Project Objectives

The objective of this project is to collect additional data that would determine post-pilot study conditions, delineate the nature and extent of soil contamination at LHAAP-04, and determine if affected soil continues to pose human health or ecological risks. The results of the soil sampling will be used to design a remediation plan for LHAAP-04, which will likely include excavation of soils with perchlorate concentrations greater than the soil clean up goal.

00040491

FILE PATH	X:\LHAAP\GIS\BLu\MXD\ST04\LHAAP04_PercAll.mxd
APPROVED BY	P. Srivastav 01/16/06
CHECKED BY	P. Lindblom 01/11/06
DRAWN BY	B. Lu 01/11/06
OFFICE	Houston, TX

Plot Date: 01/06



Legend

- Sump
- Soil Boring Associated to Sump122
- 2002 Surface Soil Sample (STEP, 2003)
- 2000 Soil Boring (Jacobs, 2002b)
- Proposed Soil Sampling Location
- Road
- Building or Concrete Slab
- Approximate Location of Pilot Study Plot
- Site

Notes:

1. Perchlorate concentrations reported in micrograms per kilogram (µg/kg).
2. Depth intervals are in feet below ground surface.
3. Pilot study plot information is from "Pilot Scale In-Site Bioremediation of Perchlorate-Contaminated Soils at the Longhorn Army Ammunition Plant" by V. Nzengung, K. C. Das, and J. R. Kastner of University of Georgia, 2001.

0 15 30 60 Feet

References:

Jacobs Engineering Group, Inc., 2002b, Final Remedial Investigation Report Addendum for the Group 4 Sites Remedial Investigation Report: Sites 04, 08, 67, and Hydrocarbon Study, Longhorn Army Ammunition Plant, Karnack, Texas, Oak Ridge, TN, Feburary.

Solutions to Environmental Problems, Inc. (STEP), 2003, Draft Final Project Report, Plant-Wide Perchlorate Investigation, Longhorn Army Ammunition Plant, Karnack, Texas, Oak Ridge, TN

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

FIGURE 1-1

SAMPLE LOCATION MAP
LHAAP-04

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Table 1-1
LHAAP-04 Soil Analytical Results

Sample ID	Sample Date	Start Depth	End Depth	Result (µg/kg)
04SB01(0-0.5)	2-Jun-00	0	0.5	36,200
04SB02(0-0.5)	2-Jun-00	0	0.5	45,400
04SB03(0-0.5)	14-Dec-00	0	0.5	24.5
04SB04(0-0.5)	14-Dec-00	0	0.5	<5.9
04SB05(0-0.5)	14-Dec-00	0	0.5	1,220
04SB06(0-0.5)	14-Dec-00	0	0.5	<5.9
04SS01(0-0.5)-020310	10-Mar-02	0	0.5	53
04SS02(0-0.5)-020310	10-Mar-02	0	0.5	<43.6
04SS03(0-0.5)-020310	10-Mar-02	0	0.5	61.4 J
04SS04(0-0.5)-020311	11-Mar-02	0	0.5	122
04SS05(0-0.5)-020311	11-Mar-02	0	0.5	2,210
04SS06(0-0.5)-020311	11-Mar-02	0	0.5	163,000
04SS07(0-0.5)-020311	11-Mar-02	0	0.5	29.3 J
04SS08(0-0.5)-020311	11-Mar-02	0	0.5	<45.8
04SS09(0-0.5)-020311	11-Mar-02	0	0.5	<48.2
04SS10(0-0.5)-020311	11-Mar-02	0	0.5	<51
04SS11(0-0.5)-020311	11-Mar-02	0	0.5	139 J
04SS12(0-0.5)-020311	11-Mar-02	0	0.5	<46.3
04SS13(0-0.5)-020311	11-Mar-02	0	0.5	<49.7
04SS14(0-0.5)-020311	11-Mar-02	0	0.5	<51.4
04SS15(0-0.5)-020311	11-Mar-02	0	0.5	<50.3
04SB01(1-2)	2-Jun-00	1	2	144,000
04SB02(1-2)	2-Jun-00	1	2	33,600
04SS01(1-2)-020310	10-Mar-02	1	2	24.5 J
04SS02(1-2)-020310	10-Mar-02	1	2	<40.3
04SS03(1-2)-020310	10-Mar-02	1	2	866
04SS04(1-2)-020311	11-Mar-02	1	2	124
04SS05(1-2)-020311	11-Mar-02	1	2	9,340
04SS06(1-2)-020311	11-Mar-02	1	2	160,000
04SS07(1-2)-020311	11-Mar-02	1	2	46
04SS08(1-2)-020311	11-Mar-02	1	2	171
04SS09(1-2)-020311	11-Mar-02	1	2	14.6 J
04SS10(1-2)-020311	11-Mar-02	1	2	14 J
04SS11(1-2)-020311	11-Mar-02	1	2	<49.2
04SS12(1-2)-020311	11-Mar-02	1	2	97.1
04SS13(1-2)-020311	11-Mar-02	1	2	<48.8
04SS14(1-2)-020311	11-Mar-02	1	2	<51.6
04SS15(1-2)-020311	11-Mar-02	1	2	<45.2
04SB03(1-3)	7-Dec-00	1	3	516
04SB04(1-3)	6-Dec-00	1	3	92.8
04SB05(1-3)	6-Dec-00	1	3	7,6400
04SB06(1-3)	6-Dec-00	1	3	<5.8
04SB03(3-5)	6-Dec-00	3	5	76.7
04SB04(3-5)	6-Dec-00	3	5	1440
04SB05(3-5)	6-Dec-00	3	5	49,900
04SB06(3-5)	6-Dec-00	3	5	23.3
04SS03(4-5)-020311	11-Mar-02	4	5	10,000
04SS09(4-5)-020311	11-Mar-02	4	5	289

Notes and Abbreviations:

µg/kg micrograms per kilogram
J estimated value

2.0 Site Activities

2.1 Soil Sampling

In an effort to delineate the nature and extent of soil contamination at site LHAAP-04, Shaw will advance six soil borings in the area of known perchlorate soil contamination. Two of the soil borings will be advanced to the vadose zone/groundwater table interface with soil samples being collected at different depth intervals to define the vertical extent of contamination. In addition, four soil borings will be advanced to a depth of 4 feet bgs with soil samples being collected at specified intervals to verify the lateral extent and existing perchlorate concentrations. Soil samples will be analyzed for perchlorate using U.S. Environmental Protection Agency (EPA) Method 314.1. **Figure 1-1** illustrates historical sampling locations, the associated detected concentrations, and the proposed soil sampling locations. Rationale for the proposed soil sampling locations is presented in **Table 2-1**. Sample identification and depth of proposed samples is presented in **Table 2-2**.

2.2 Sampling Methods and Procedures

2.2.1 Soil Boring Advancement and Sampling

Soil borings will be advanced using a direct push technology rig. Soil samples will be collected at varying depths from each boring location. Two soil borings will be advanced to the vadose zone/groundwater table interface in an effort to determine the vertical extent of the perchlorate contamination. These soil borings will be advanced in the vicinity of previous soil sample locations that had elevated perchlorate concentration at depth (STEP-04SS06 and 04SB01; and STEP-04SS03 and 04SB02). Soil samples in these two borings will be collected from the surface interval (0 to 0.5 feet bgs), from 1 to 3 feet bgs, and from immediately above the water table.

Four soil borings will be advanced to a depth of 4 feet in an effort to delineate the horizontal extent of the surface soil contamination and determine post pilot-study concentrations. Soil samples will be collected from 0 to 0.5 feet bgs and 3 to 4 feet bgs. These surface soil samples will be collected around the edge of the site. If the location of the pilot study is visually apparent in the field, then a minimum of one soil boring should be advanced in this area (04SB11 would be moved to within the pilot study area).

In the event that a soil boring location is inaccessible by the direct push technology rig, a hand auger with appropriate extensions will be used to obtain the samples. The direct push technology method will involve the use of a high-capacity hydraulic ram mounted on an all-terrain vehicle to advance a drive sampler attached to steel push rods. Soil samples will be collected continuously

Table 2-1
LHAAP-04 Boring Rationale

Boring ID	Location	Installation Rationale	Depth
04SB07	Near STEP-04SS03 and 04SB02	Advancement of proposed boring would assist in vertically delineating perchlorate contamination and verify post-pilot-study concentrations.	To groundwater ~10 feet
04SB08	Near STEP-04SS06 and 04SB 01	Advancement of proposed boring would assist in vertically delineating perchlorate contamination and verify post-pilot-study concentrations.	To groundwater ~10 feet
04SB09	Southeast of LHAAP-04	Advancement of proposed boring would assist in horizontally delineating perchlorate contamination and verify post-pilot-study concentrations.	4 feet
04SB10	Northeast of LHAAP-04	Advancement of proposed boring would assist in horizontally delineating perchlorate contamination and verify post-pilot-study concentrations.	4 feet
04SB11	Near the middle of LHAAP (may be moved to within the pilot study plot area)	Advancement of proposed boring would assist in horizontally delineating perchlorate contamination and verify post-pilot-study concentrations.	4 feet
04SB12	Southwest of LHAAP-04	Advancement of proposed boring would assist in horizontally delineating perchlorate contamination and verify post-pilot-study concentrations.	4 feet

Table 2-2
Sample Identification and Depth of Proposed Soil Samples at LHAAP-04

Sample ID	04SB07	04SB08	04SB09	04SB10	04SB11	04SB12
Sample Depth (feet)	0-0.5 1-3 Immediately above groundwater	0-0.5 1-3 Immediately above groundwater	0-0.5 3-4	0-0.5 3-4	0-0.5 3-4	0-0.5 3-4

during drilling using a 24- to 36-inch-long sampler with a disposable liner. The exact total depths of the borings will be based on the groundwater depth and will be determined during drilling. The procedures for sampling each boring are summarized as follows:

- Execute work in accordance with Shaw and other applicable site-specific health and safety plan.
- Set up portable sample table and cover with plastic sheeting.
- Calibrate field analytical and health and safety instruments.
- Don a new pair of disposable sample gloves between sampling intervals to prevent cross-contamination.
- Decontaminate the sampling equipment as described in Section 4.5 in the Chemical Data Acquisition Plan, Appendix C of the Work Plan (Shaw, 2006).
- Observe the drilling operations to verify that proper safety, sampling, and drilling methods are being instituted.
- When soil sample is received from the driller, open the soil-filled sampler, remove the sample liner from the barrel, cut open the liner, and place the sample liner and sample on the plastic sheeting.
- Describe the length of the sample according to ASTM D2488-93, *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)* and record on the Shaw Drilling Log Form.
- After determining the appropriate sampling intervals based on the lithology, collect composite soil samples for laboratory analysis by filling the appropriate number and types of sample containers specified by the laboratory.
- Samples will be composited by collecting representative portions of soil from the designated interval, placing in a decontaminated stainless steel bowl or disposable container for mixing, and placing in the appropriate laboratory-supplied sample jar.
- Label each sample container as described in Section 4.6.2 of Appendix C of the Work Plan (Shaw, 2006), enclose each container in a sealable plastic bag, and place in a cooler containing ice.
- Repeat the above sequence of procedures for each interval to the total boring depth.
- Record the drilling activities and sampling procedures on a Field Sampling Report or logbook. Complete chain-of-custody documentation.

2.2.2 Field Screening Methods

Health and safety screening methods are described in the Health & Safety Plan, Appendix A of the Work Plan (Shaw, 2006).

Sample screening addressed here is limited to screening of soil samples for total volatile organic compounds.

3.0 References

Anderson Columbia Environmental, Inc. (ACE), 1997. *Closure Report, Pilot Wastewater Treatment Plant, Longhorn Army Ammunition Plant, Karnack Texas, EPD ID No. TX6213820529, Solid Waste Registration No. 30990.* September.

Jacobs Engineering Group, Inc. (Jacobs), 2002a, *Final Remedial Investigation Volume 1: Report for the Group 4 Sites, Site 35A, 35B, 35C, 46, 47, 48, 50, 60, & Goose Prairie Creek,* Oak Ridge, Tennessee, January.

Jacobs, 2002b, *Final Remedial Investigation Report Addendum for the Group 4 Sites Remedial Investigation Report: Sites 04, 08, 67, and Hydrocarbon Study, Longhorn Army Ammunition Plant, Karnack, Texas,* Oak Ridge, Tennessee, February.

Jacobs, 2002c, *Draft Feasibility Study for the Group 4 Sites, Site 04, 08, 35A, 35B, 35C, 46, 47, 48, 50, 60, Goose Prairie Creek, Saunders Branch, Central Creek, and Caddo Lake,* Oak Ridge, Tennessee, August.

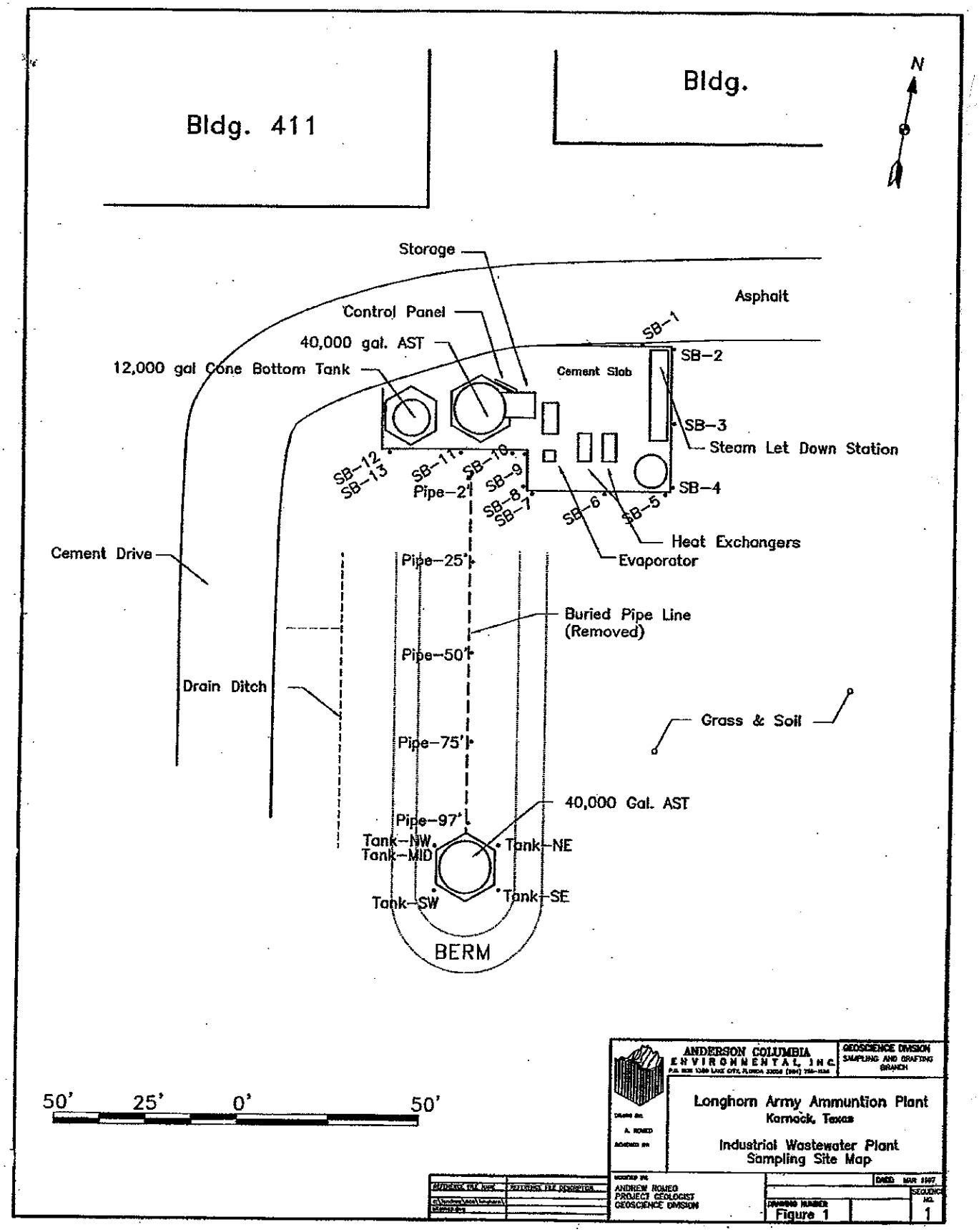
Shaw Environmental, Inc., 2006, *Final Installation-Wide Work Plan, Longhorn Army Ammunition Plant, Karnack, Texas,* Houston, Texas, January.

Solutions To Environmental Problems, Inc. (STEP), 2003, *Draft Final Project Report, Plant-Wide Perchlorate Investigation, Longhorn Army Ammunition Plant, Karnack, Texas,* Oak Ridge, Tennessee, March.

Valentine A. Nzengung, K. C. Das and James R. Kastner of the University of Georgia, 2001, *Pilot Scale In-Situ Bioremediation Of Perchlorate-Contaminated Soils at The Longhorn Army Ammunition Plant.*

Attachment 1

LHAAP-04 RCRA Closure Data


Bldg. 411
Bldg.
N
Storage
Asphalt
Control Panel
40,000 gal. AST
12,000 gal Cone Bottom Tank
Cement Slab
SB-1
SB-2
SB-3
Steam Let Down Station
SB-4
SB-5
SB-6
SB-7
SB-8
SB-9
SB-10
SB-11
SB-12
SB-13
Pipe-2'
Heat Exchangers
Evaporator
Cement Drive
Pipe-25'
Buried Pipe Line
(Removed)
Pipe-50'
Drain Ditch
Grass & Soil
Pipe-75'
40,000 Gal. AST
Pipe-97'
Tank-NW
Tank-MID
Tank-NE
Tank-SW
Tank-SE
BERM
50'
25'
0'
50'
ANDERSON COLUMBIA ENVIRONMENTAL, INC.
GEOSCIENCE DIVISION
SAMPLING AND DRAFTING BRANCH
Longhorn Army Ammunition Plant
Karnack, Texas
Industrial Wastewater Plant
Sampling Site Map
ANDREW ROMEO
PROJECT GEOLOGIST
GEOSCIENCE DIVISION
DRAWING NUMBER
Figure 1
SEQUENCE NO.
1

Parameter	Total Metals (RCRA)								SPLP Metals (Prep Method 1312)							
	As	Ba	Cd	Cr	Pb	Hg	Se	Ag	As	Ba	Cd	Cr	Pb	Hg	Se	Ag
Method	6010	6010	6010	6010	6010	7471	6010	6010	7060	6010	6010	6010	7421	7470	7740	6010
Unit	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg
SB-1	<2.5	150.0	2.4	13.0	31.0	<0.1	<4	<1	<.005	0.68	<.005	<.01	0.021	<.001	<.005	<.01
SB-2	3.2	40.0	1.4	16.0	38.0	<0.1	<4	<1	NOT TESTED							
SB-3	<2.5	84.0	2.8	12.0	63.0	<0.1	<4	<1	<.005	10	0.005	0.02	0.17	<.001	<.005	<.01
SB-4	<2.5	39.0	1.5	11.0	33.0	<0.1	<4	<1	NOT TESTED							
SB-5	<2.5	44.0	1.0	7.5	26.0	<0.1	<4	<1								
SB-6	<2.5	75.0	1.0	7.6	16.0	<0.1	<4	<1								
SB-7	<2.5	66.0	0.9	9.0	19.0	<0.1	<4	<1								
SB-8	3.0	140.0	1.1	9.1	21.0	<0.1	<4	<1	0.009	7.8	<.005	0.03	0.04	<.001	<.005	<.01
SB-9	<2.5	320.0	1.2	16.0	35.0	<0.1	<4	<1	0.009	0.88	<.005	0.04	0.033	<.001	<.005	<.01
SB-10	<2.5	160.0	1.4	21.0	22.0	<0.1	<4	<1	0.006	0.89	<.005	0.07	0.118	<.001	<.005	<.01
SB-11	<2.5	2100.0	1.6	73.0	50.0	89.0	<4	<1	0.005	0.47	<.005	0.03	0.016	0.027	<.005	<.01
SB-12	<2.5	72.0	1.6	12.0	20.0	0.3	<4	<1	NOT TESTED							
SB-13	<2.5	93.0	1.8	13.0	28.0	0.4	<4	<1								
PIPE-2'	<2.5	20.0	1.1	4.6	10.0	<0.1	<4	<1								
PIPE-25'	<2.5	34.0	0.8	3.5	9.9	<0.1	<4	<1								
PIPE-50'	<2.5	30.0	0.7	4.7	10.0	<0.1	<4	<1								
PIPE-75'	<2.5	47.0	1.3	7.0	18.0	<0.1	<4	<1								
PIPE-97'	<2.5	45.0	1.1	5.6	25.0	<0.1	<4	<1								
TANK-NE	3.6	100.0	1.4	8.1	19.0	<0.1	<4	<1								
TANK-NW	4.1	95.0	1.8	13.0	18.0	<0.1	<4	<1								
TANK-MID	2.6	92.0	1.4	9.4	17.0	<0.1	<4	<1								
TANK-SE	9.4	88.0	1.2	8.6	17.0	<0.1	<4	<1								
TANK-SW	3.4	98.0	1.7	12.0	17.0	<0.1	<4	<1								

00040500

Parameter	Total Cyanide	TRPH	PCB/Pesticides	Herbicides	Semivolatiles	Volatiles
Method	9010	9071	8080	8150	8270	8260
Unit	mg/Kg	mg/Kg	mg/Kg	ug/Kg	mg/Kg	mg/Kg
SB-1	<0.5	310	BDL	BDL	BDL	4.8
SB-2	<0.5	570	BDL	BDL	BDL	0.054
SB-3	<0.5	60	BDL	BDL	BDL	BDL
SB-4	0.99	38	BDL	BDL	BDL	0.58
SB-5	<0.5	<10	BDL	BDL	BDL	1
SB-6	1.5	79	BDL	BDL	BDL	4.4
SB-7	2.6	110	BDL	BDL	BDL	0.2
SB-8	8.6	<10	BDL	BDL	BDL	1.7
SB-9	2.4	700	BDL	BDL	BDL	1.6
SB-10	0.93	400	BDL	BDL	BDL	0.25
SB-11	10.5	570	BDL	BDL	BDL	BDL
SB-12	2.5	200	BDL	BDL	BDL	1.4
SB-13	1.7	380	BDL	BDL	BDL	0.37
PIPE-2'	<0.5	<10	BDL	BDL	BDL	BDL
PIPE-25'	<0.5	<10	BDL	BDL	BDL	BDL
PIPE-50'	<0.5	<10	BDL	BDL	BDL	BDL
PIPE-75'	<0.5	<10	BDL	BDL	BDL	BDL
PIPE-97'	<0.5	<10	BDL	BDL	BDL	BDL
TANK-NE	<0.5	<10	BDL	BDL	BDL	BDL
TANK-NW	<0.5	38	BDL	BDL	BDL	BDL
TANK-MID	<0.5	45	BDL	BDL	BDL	BDL
TANK-SE	<0.5	<10	BDL	BDL	BDL	BDL
TANK-SW	<0.5	<10	BDL	BDL	BDL	BDL

NOTES

1. Most of the hits for volatile organics are acetone.
2. The QC has been reviewed; some values were out of control limits, but it is of no consequence to the results. Case narratives will be included in the analytical package that will be contained in the Final Closure report.

00040501

00040502

Shaw® Shaw Environmental, Inc.

Date: ***June 2, 2006***

Project No.:117591

TRANSMITTAL LETTER:

To: Mr. Cliff Murray

Address**:** US Army Corps of Engineers - Tulsa

CESWT-PP-M
1645 South 101st East Ave
Tulsa, Oklahoma 74128

Re: **Final Addendum 4 Soil Sampling at LHAAP-07 and LHAAP-51 to Final Installation-Wide Work Plan**
Longhorn Army Ammunition Plant - Karnack, Texas

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

For: Review ____ As Requested ____ Approval ____ Corrections ____ Submittal **X** Other ____

Item No:	***No. of Copies***	***Date:***	***Document Title***
1	3	June 2006	**Final Addendum 4 Soil Sampling at LHAAP-07 and LHAAP-51 to Final Installation-Wide Work Plan**

Enclosed are three copies of the above-named document for your use. Please distribute to interested parties. Copies have also been sent as indicated on distribution list below.

Please call if any questions or comments.

Sincerely:

David P. Cobb

CC: See attached page

100 Technology Center Drive Stoughton, MA 02072 ***Phone: (617) 589-8000/Fax: (617) 589-2160***

Distribution List:

Mr. Rick Smith, USACE, Tulsa (sent to C. Murray for distribution)
Mr. Ken Kebbel, USACE, Tulsa (sent to C. Murray for distribution)
Mr. Chris Villearreal, USEPA, Dallas
Ms. Fay Duke, TCEQ, Austin
Mr. Tom Erny, TCEQ, Tyler
Mr. Paul Bruckwicke, USFWL
Mr. Jeff Armstrong - AEC
Ms. Rose Zeiler – BRAC-LHAAP

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

June 2, 2006

DAIM-BD-LO

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

Re: Final Addendum 4 Soil Sampling at LHAAP-07 and LHAAP-51, Final Installation-Wide Work Plan, Longhorn Army Ammunition Plant, Karnack, Texas, June 2006

Dear Mr. Villarreal,

The above-referenced document is being transmitted to you for your files. 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 document has also been posted on Shaw's LHAAP Project Portal.

The point of contact for this action is the undersigned. I ask that David Cobb, 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, Ph.D.
Longhorn AAP Site Manager

Copies furnished:
Fay Duke, TCEQ, Austin, TX
Paul Bruckwicki, Caddo Lake NWR, TX
Cliff Murray, COE – Tulsa District, OK
Richard P. Smith, COE – Tulsa District, OK
David Cobb, Shaw – Stoughton, MA
P. Srivastav, Shaw – Houston, TX (for project files)

00040504

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

June 2, 2006

DAIM-BD-LO

Ms. Fay Duke
Texas Commission on Environmental Quality
TCEQ Environmental Cleanup Section II MC-221
12100 Park 35 Circle
Austin, TX 78753

Re: Final Addendum 4 Soil Sampling for LHAAP-07 and LHAAP-51, Final Installation-Wide Work Plan, Longhorn Army Ammunition Plant, Karnack, Texas, June 2006

Dear Ms. Duke,

The above-referenced document is being transmitted to you for your files. 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 document has also been posted on Shaw's LHAAP Project Portal.

The point of contact for this action is the undersigned. I ask that David Cobb, 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, Ph.D.
Longhorn AAP Site Manager

Copies furnished:

Chris Villarreal, USEPA Region 6, Dallas, TX
Paul Bruckwicki, Caddo Lake NWR, TX
Cliff Murray, COE – Tulsa District, OK
Richard P. Smith, COE – Tulsa District, OK
David P. Cobb, Shaw – Stoughton, MA
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Response to Comments on
Draft Final Addendum 4, Soil Sampling at LHAAP-07 (Former Drum Processing Building 50G)
and LHAAP-51 (Photographic Laboratory Building 60B)
(March 2006)
Final Installation-Wide Work Plan
Longhorn Army Ammunition Plant, Karnack, Texas

May 2006

Reviewer: USEPA, Region 6; TCEQ
Respondents: Shaw Environmental, Inc.

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

Comment #	Page	Section/ Paragraph	Comment	C, D[1], E or X	Response	A or D[2]
Comments from EPA received 4/19/06						
LHAAP-07						
1	1-5	Section 1.2 (Project Objectives)	The text is very specific on the purpose of this sampling: "The objective of the sampling proposed in this work plan addendum is to confirm or deny the presence of contamination at LHAAP-07…" The introduction (Section 1.0) also indicates that the data will be used to determine "whether the soil poses human health or ecological risk." Confirming or denying the presence of contamination requires a more robust sampling effort than is described in the plan, and assessing risk even more so. The following comments are based on this expectation.		Noted.	
2		Figure 1-1 (Soil Sample Location Map)	The drawing does not indicate the suspected or known locations of the wash-down and drum emptying areas or waste pad. Neither the drawing nor site description (Section 1.1) note the presence of any containment, curbing or access and egress points for the subject materials, which would allow biasing sampling efforts toward the most likely areas of release, deposition and contamination.	C	The former "contaminated waste trench and sump" is located near previous soil samples LHS-3-02 and LH-S70-01. The approximate location will be shown on Figure 1-1. Soil sample 07SB01 is proposed in this general area. This would be expected to be the likely area of contamination. Figure 1-1 has been revised.	

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Comment #	Page	Section/ Paragraph	Comment	C, D[1], E or X	Response	A or D[2]
3	2-1	Section 2.1 (Soil Sampling)	It is unclear whether data collected from the proposed drainage ditch sample (07SB06) can be confidently related to the suspected source (Building 50G). For example, is enough known about potential cross-contamination sources and flow characteristics to make these data meaningful? From Section 1.1.1: "The presence or absence of soil contamination is not established at Building 50G." Based on the stated lack of knowledge and the goal of confirming or denying the presence of contamination, additional sampling locations seem warranted. Consider relocating 07SB02 and 07SB04 either north or south along the existing axes and adding an additional sample on each of those sides. This would provide a more reasonable sample spacing along the along the 100-foot lengths. All potential sample locations should be evaluated in relation to known or suspected site conditions as described in comment #2, with that evaluation noted in the proposal. There is no discussion of the condition of the concrete pad or whether contamination beneath the building footprint is suspected. Has this been considered regarding potential sampling points and data interpretation?	C	The former trench and sump was located north of the building. Analytical data exists in this area and further sampling is proposed. Due to the likelihood of contamination being north of the building (location of source area), it is believed that the proposed sampling for areas east, west, and south of the building are sufficient. Sample location 07SB06 is meant to define any downgradient migration of contamination from previously sampled location 47SB23. The drum washing area was located north of the building and outside the building. Contamination is not expected beneath the building slab.	

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Comment #	Page	Section/ Paragraph	Comment	C, D[1], E or X	Response	A or D[2]
4	2-1	Section 2.2.1 (Soil Boring Advancement and Placement)	Discuss the rationale for excluding the 1-3 foot interval from sample collection. How will this be addressed in data interpretation, for example where the upper sample interval may be found to be contaminated, but the lower interval is not?	C	The 0-1 foot interval is collected for a surface soil sample for ecological purposes. The 3-5 foot interval is proposed for subsurface conditions. If contamination at a different depth is apparent based on field observation this depth can be changed. For assessment purposes it is believed that 0-1 and 3-5 foot intervals will be sufficient. If surface soil (0-1 foot) is found to be contaminated and the 3-5 foot sample is not, then the contamination will be assumed to extend to midway between the two sample intervals.	
LHAAP-51						
1	1-5	Section 1.2 (Project Objectives)	The text is very specific on the purpose of this sampling: "The objective of the sampling proposed in this work plan addendum is to confirm or deny the presence of contamination at… LHAAP-51." The introduction (Section 1.0) also indicates that the data will be used to determine "whether the soil poses human health or ecological risk." Confirming or denying the presence of contamination may require a more robust sampling effort than is described in the plan, and assessing risk even more so. The following comments are based on this expectation.		Noted.	

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Comment #	Page	Section/ Paragraph	Comment	C, D[1], E or X	Response	A or D[2]
2		Figure 1-2 (Soil Sample Location Map)	The onsite and downgradient areas contaminated with silver as described in Section 1.1.2 are not illustrated.		The exact location of the onsite and downgradient areas contaminated with silver is not known, although the samples were believed to be in the area to the south and east of the building. The data is, however, used as a reason for further sampling as it shows a possible source at the site.	
3	1-2	Section 1.1.2 (LHAAP-51)	There is no data summary for the referenced samples indicating silver contamination, such as was given for LHAAP-07 in Table 1-1. Depending on the suspected point(s) of discharge and other conditions affecting deposition of waste materials around the building, the proposed sampling density, depth and single parameter might be adequate for the intended purposes. However, without the information referenced here and in comment #1, this is difficult to determine.		The data of soil samples indicating silver contamination is unknown. The possible silver contamination is mentioned as reason for sampling at LHAAP-51 due to the possible presence of a silver contamination source.	
4	2-1	Section 2.1 (Soil Sampling)	The proposed sample points will provide no information regarding the outlying areas bounded by the "site" line in Figure 1-2. Consider additional sampling points or discuss the rationale for no need to do so as warranted by site conditions and existing data. All potential sample locations should be evaluated in relation to known or suspected site conditions, with that evaluation noted in the proposal.		No previous sampling data is available for LHAAP-51. It is believed that likely contamination would be near the building and in areas to the south and east of the building where the surface run off is expected to be a migration pathway. Therefore the proposed sampling is considered by Shaw to be sufficient. The site boundary shown in Figure 1-2 includes areas to the west and south of the building. These outlying areas, however, have no documented history of use. These areas will be sampled only if contamination is detected near the building.	
5	2-1	Section 2.2.1 (Soil Boring Advancement and Placement)	Please discuss the rationale for excluding the 1-3 foot interval from sample collection for 51SB01-03. How will this be addressed in data interpretation, for example where the upper sample interval may be found to be contaminated, but the lower interval is not?	C	The 0-1 interval is collected for a surface soil sample for ecological purposes. The 3-5 foot interval is proposed for subsurface conditions. If contamination at a different depth is apparent based on field observation this depth can be	

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			Discuss the rationale for limiting the sample interval for 51SB04-05 to one foot.		changed. For assessment purposes it is believed that 0-1 and 3-5 foot intervals will be sufficient. If surface soil (0-1 foot) is found to be contaminated and the 3-5 foot sample is not, then the contamination will be assumed to extend to midway between the two sample intervals. 51SB04 and 51SB05 are located in a ditch and therefore contamination is not expected deeper than 1 foot.	
Comments from TCEQ received 5/17/06						
LHAAP-07 and LHAAP-51						
1			No comments.		Noted.	

FINAL
ADDENDUM 4
SOIL SAMPLING AT
LHAAP-07 (FORMER DRUM PROCESSING BUILDING 50G) AND
LHAAP-51 (PHOTOGRAPHIC LABORATORY BUILDING 60B)
TO
FINAL
INSTALLATION-WIDE WORK PLAN
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.
3010 Briarpark Drive, Suite 4N
Houston, Texas 77042

MARC No. W912QR-04-D-0027, Shaw Project No. 117591
Task Order No. DS02

June 2006

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Acronyms and Abbreviations

ASTM	ASTM International (formerly American Society for Testing and Materials)
bgs	below ground surface
EPA	U.S. Environmental Protection Agency
LHAAP	Longhorn Army Ammunition Plant
NFA	No Further Action
MARC	Multiple Award Remediation Contract
µg/kg	micrograms per kilogram
PA	Preliminary Assessment
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RFA	RCRA Facility Assessment
Shaw	Shaw Environmental, Inc.
TCE	trichloroethylene
TO	task order
TPH	total petroleum hydrocarbons
TWC	Texas Water Commission
USACE	U.S. Army Corps of Engineers

1.0 Introduction

This work plan addendum outlines activities associated with soil sampling proposed for sites LHAAP-07 and LHAAP-51 at the former Longhorn Army Ammunition Plant (LHAAP). LHAAP-07 (former Drum Processing Building 50G) was a wash-down area for empty drums and casting equipment used in the production of ammunition. LHAAP-51 (former Photographic Laboratory Building 60B) was used for the processing of X-ray film. Low levels of perchlorate were detected in soil at LHAAP-07 but soil contamination is not well defined (Jacobs, 2003). Silver was previously detected in soil at LHAAP-51 but contamination is not well characterized (Jacobs, 2002). Sediment sampling downgradient indicated a possible source at LHAAP-51 (Jacobs, 2002). The objective of the sampling proposed in this work plan addendum is to determine the presence or absence of soil contamination at LHAAP-07 and LHAAP-51. The data will be used to determine if soil has been contaminated at these sites and, if so, whether the soil poses human health or ecological risk.

The U.S. Army Corps of Engineers (USACE), Tulsa District, has contracted Shaw Environmental, Inc. (Shaw) to perform this work at the former LHAAP, Karnack, Texas, under the Louisville District's Multiple Award Remediation Contract (MARC) No. W912QR-04-D-0027, Task Order (TO) DS02, with oversight by the USACE, Tulsa District. This document is an addendum to the *Final Installation Wide Work Plan, Longhorn Army Ammunition Plant, Karnack, Texas* (Shaw, 2006).

1.1 Site Description and History

1.1.1 LHAAP-07

Beginning in 1985, Building 50G had a separate bay, 20 by 30 feet in size, to empty drums and casting equipment used in the production of ammunition. Building 50G was a wooden frame building 30 by 100 feet in size, set on a concrete pad. The Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA) (Texas Water Commission [TWC], 1988) described the wash-down area as an abovegrade concrete vault where empty drums were rinsed with hot water and spent sulfuric acid neutralized with limestone. Washdown water drained to a 3,000-gallon sump outside, Sump 070, which is reportedly removed. Empty drums were either reused or flashed at the Air Curtain Destructor and sent to Building 49W for disposal as scrap. Wastes handled included oils and organic liquids, which include the chemical propellant Hycar/methyl ethyl ketone, acid, acid/silver, solvents, polymers, paint residue, diesel fuel and water mixture, antifreeze, diacetyl pentamethylene tetramine, and non-polychlorinated biphenyl oil. The RFA identifies a waste pad outside Building 50G and describes the pad as a 4 by 12 foot concrete pad with no roofing or concrete curbing (TWC, 1988). This site ceased operation in 1995 and has been designated LHAAP-07.

Sump 070 is being addressed as part of LHAAP-35. Soil samples were collected in the vicinity of Sump 070 as part of the Phase I Remedial Investigation (RI) in 1993 and Phase II RI in 1994 and 1995. These assessment activities include soil samples from locations LH-S70-01 and LH-S70-02, and LHS-3-02. Results of these assessment activities will be discussed as part of LHAAP-35.

In 2000, 132 soil samples were collected and analyzed for perchlorate as part of LHAAP-47 assessment activities. Two of these soil samples were collected from soil boring 47SB23, which is located near LHAAP-07. The soil samples were collected from 0 to 0.5 feet below ground surface (bgs) and 1 to 2 feet bgs, and analyzed for perchlorate. Perchlorate was detected in the surface soil sample 47SB23 (0 to 0.5 foot interval) at 19.6 micrograms per kilogram (µg/kg). Perchlorate was not detected in the soil sample collected from 1 to 2 feet bgs in this same soil boring 47SB23. Soil boring 475B23 is located approximately 100 feet northwest of Building 50G. The presence or absence of soil contamination is not established at Building 50G.

LHAAP-07 is within the boundaries of LHAAP-47. LHAAP-47 includes groundwater plumes of trichloroethylene (TCE) and perchlorate (Jacobs, 2002). Groundwater contaminants at LHAAP-07 will be addressed as part of LHAAP-47.

Historic sample locations and proposed soil boring locations at LHAAP-07 are depicted on **Figure 1-1.** Historic analytical soil data for LHAAP-07 are summarized in **Table 1-1**.

1.1.2 LHAAP-51

Photographic Laboratory Building 60B was used for processing of X-ray film. The building has since been demolished and the site designated LHAAP-51. LHAAP-47 encompasses LHAAP-51 (see **Figure 1-2**). The building had a concrete floor without a floor drain. Spent developing waste was drummed and transferred to Building 31W for disposal. Findings from the Army's Preliminary Assessment (PA) conducted in 1988 concluded that No Further Action (NFA) is necessary (Maley, 1988). According to the Environmental Site Assessment Phase I and II (Plexus Scientific Corporation, 2005), spent developer (about 5 liters per day) was discharged to the sanitary sewer and spent fixer (7 to 8 liters per day) was discharged to surface drainage after silver recovery. The discharge occurred from at least 1970 through 1980. Soil sampling performed by LHAAP personnel in 1997 indicated the presence of silver in the soil at LHAAP-51. Sediment samples collected downgradient of LHAAP-51 contained high levels of silver indicating a possible source at LHAAP-51. Groundwater is not expected to be affected at LHAAP-51. If groundwater contaminants are encountered, they will be addressed as part of LHAAP-47.

Proposed sample locations are depicted on **Figure 1-2.**

00040515

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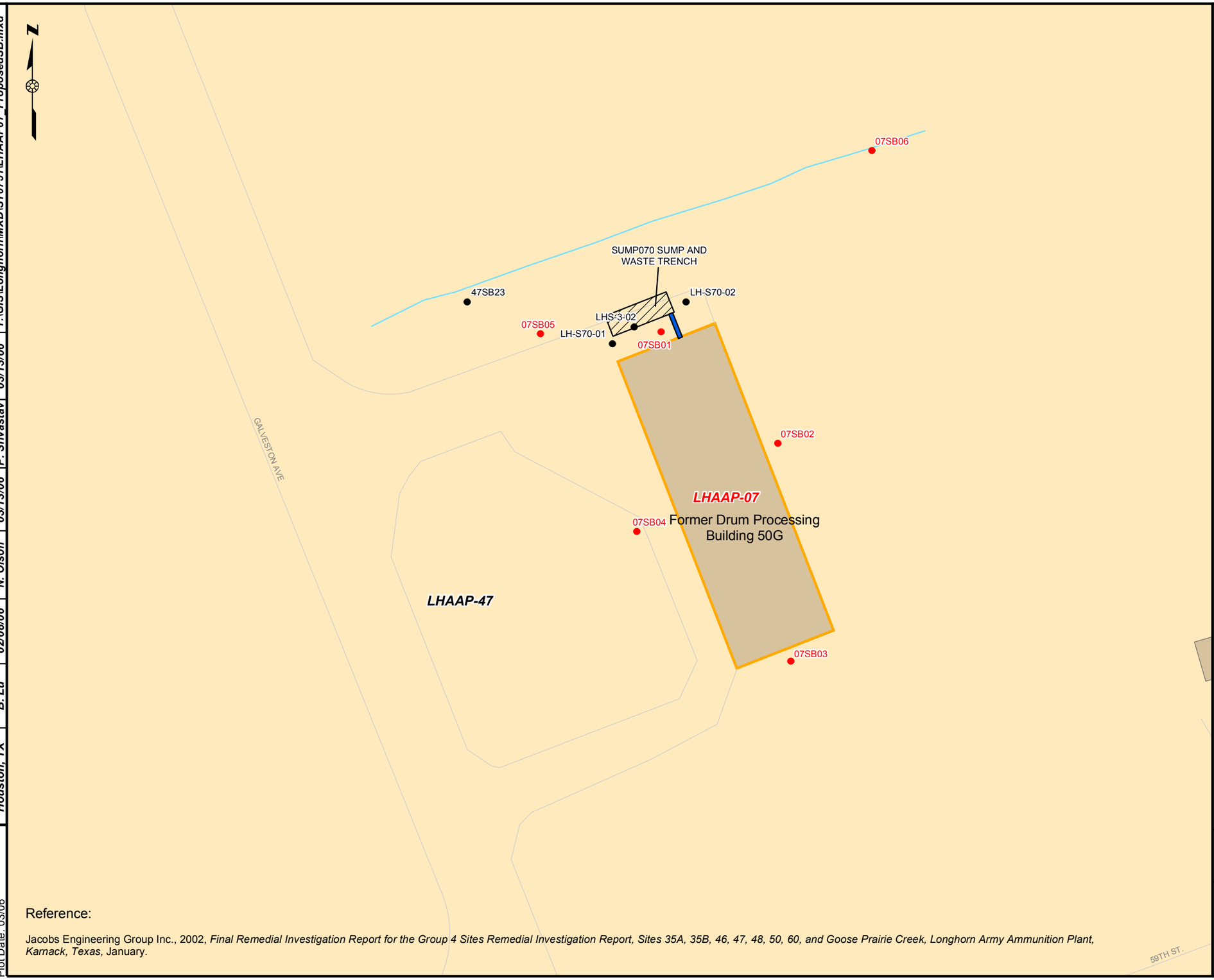
APPROVED BY	
P. Srivastav	03/13/06

CHECKED BY	
N. Olson	03/13/06

DRAWN BY	
B. Lu	02/08/06

OFFICE
Houston, TX

Plot Date: 03/06



Legend

- Proposed Soil Boring
- Historic Soil Boring
- Drainage Ditch
- Road
- Building or Concrete Slab
- Site

Note:

LHAAP-07 is located within the LHAAP-47 boundary.

0 15 30 60 Feet

Reference:

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

Shaw®

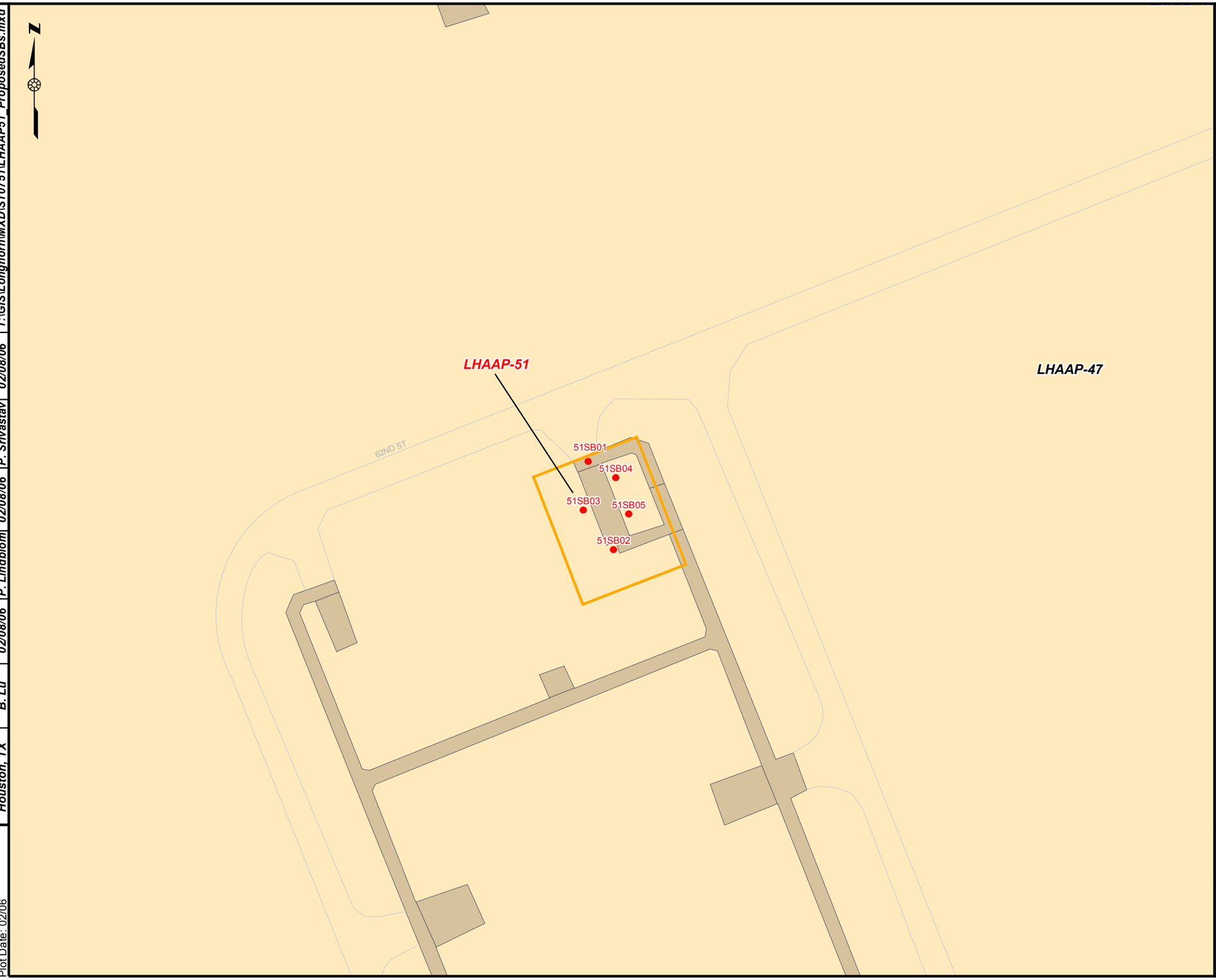
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA

FIGURE 1-1

SOIL SAMPLE LOCATION MAP
LHAAP-07

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

00040516



Legend

- Proposed Soil Boring
- Road
- Building or Concrete Slab
- Site

Note:

LHAAP-51 is located within the LHAAP-47 boundary.

0 30 60 120 Feet

FILE PATH	T:\GIS\Longhorn\MXD\ST0751\LHAAP51_ProposedSBs.mxd
APPROVED BY	P. Srivastav 02/08/06
CHECKED BY	P. Lindblom 02/08/06
DRAWN BY	B. Lu 02/08/06
OFFICE	Houston, TX

Plot Date: 02/06

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

FIGURE 1-2

SOIL SAMPLE LOCATION MAP
LHAAP-51

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Table 1-1
LHAAP-07 Historic Perchlorate Soil Analytical Results

Sample ID	Sample Date	Start Depth	End Depth	Result (µg/kg)
47SB23	6/3/00	0	0.5	19.6
47SB23	6/3/00	1	2	<6.42

Notes and Abbreviations:
Jacobs Engineering Group Inc., 2002, *Final Remediation Report for the Group 4 Sites Remedial Investigation Report, Sites 35A, 35B, 35C, 46, 47, 50, 60, and Goose Prairie Creek, Longhorn Army Ammunition Plant*, Karnack, Texas, January.
µg/kg = micrograms per kilogram

1.2 Project Objectives

The objective of the sampling proposed in this work plan addendum is to confirm or deny the presence of contamination at LHAAP-07 and LHAAP-51.

2.0 Site Activities

2.1 Soil Sampling

In an effort to determine the presence or absence of soil contamination at site LHAAP-07, Shaw will advance four soil borings around Building 50G (one on each side), one soil boring between the building and soil sample 47SB23, and one soil boring at the east end of the drainage ditch (**Figure 1-1**). Soil borings will be advanced to a depth of 4 feet bgs. Soil samples will be analyzed for volatile organic compounds, semivolatile organic compounds, total petroleum hydrocarbons (TPH), silver, and perchlorate using U.S. Environmental Protection Agency (EPA) methods. The soil sample collected between the building and 47SB23 will be analyzed for perchlorate only.

In an effort to determine the presence or absence of soil contamination at LHAAP-51, Shaw will advance three soil borings around Building 60B and collect two surface soil samples along the east side of Building 60G. A ditch is located east of Building 60G and therefore subsurface contamination is not expected in this area. Soil samples will be analyzed for total silver using EPA Method 6010.

Figures 1-1 and **1-2** illustrate historical sampling locations and the proposed soil sampling locations at sites LHAAP-07 and -51. Rationale for the proposed soil sampling locations is presented in **Table 2-1**. Sample identification and depth of proposed samples is presented in **Table 2-2**.

2.2 Sampling Methods and Procedures

2.2.1 Soil Boring Advancement and Sampling

Soil borings will be advanced using a direct push technology rig or a hand auger. Soil borings will be advanced to 4 feet bgs and soil samples will be collected from the surface interval (0 to 1 feet bgs) and from the subsurface interval (3 to 4 feet bgs). If contamination is apparent at a depth other than 3 to 4 feet bgs based on field observation then the soil sample should be collected where apparent contamination is observed. Two surface soil samples (0 to 1 feet bgs) will be collected at LHAAP-51.

In the event that a soil boring location is inaccessible by the direct push technology rig, a hand auger with appropriate extensions will be used to obtain the samples. The direct push technology method will involve the use of a high-capacity hydraulic ram mounted on an all-terrain vehicle to advance a drive sampler attached to steel push rods. Soil samples will be collected continuously during drilling using a 24- to 36-inch-long sampler with a disposable liner. The total depths of

Table 2-1
LHAAP-07 and LHAAP-51 Boring Rationale

Boring ID	Location	Installation Rationale	Depth
LHAAP-07			
07SB01	North side of Building 50G	Determine the absence or presence of soil contaminants	4 feet
07SB02	East side of Building 50G	Determine the absence or presence of soil contaminants	4 feet
07SB03	South side of Building 50G	Determine the absence or presence of soil contaminants	4 feet
07SB04	West side of Building 50G	Determine the absence or presence of soil contaminants	4 feet
07SB05	Between Building 50G and 47SB23	Determine the absence or presence of perchlorate between Building 50G and 47SB23	4 feet
07SB06	East end of drainage ditch	Determine the absence or presence of soil contaminants	4 feet
LHAAP-51			
51SB01	North side of Building 60B	Determine the absence or presence of soil contaminants	4 feet
51SB02	South side of Building 60B	Determine the absence or presence of soil contaminants	4 feet
51SB03	West side of Building 60B	Determine the absence or presence of soil contaminants	4 feet
51SB04	East side of Building 60B	Determine the absence or presence of soil contaminants	1 foot
51SB05	East side of Building 60B	Determine the absence or presence of soil contaminants	1 foot

Table 2-2
Sample Identification and Depth of Proposed Soil Samples at LHAAP-07 and LHAAP-51

Sample ID	07SB01	07SB02	07SB03	07SB04	07SB05	07SB06	51SB01	51SB02	51SB03	51SB04	51SB05
Sample Depth (feet)	0-1 3-4	0-1 3-4	0-1 3-4	0-1 3-4	0-1 3-4	0-1 3-4	0-1 3-4	0-1 3-4	0-1 3-4	0-1	0-1

the borings will be based on the groundwater depth and will be determined during drilling. The procedure for sampling each boring is summarized as follows:

- Execute work in accordance with Shaw and other applicable site-specific health and safety plan.

- Set up portable sample table and cover with plastic sheeting.
- Calibrate field analytical and health and safety instruments.
- Don a new pair of disposable sample gloves between sampling intervals to prevent cross-contamination.
- Decontaminate the sampling equipment as described in Section 4.5 in the Chemical Data Acquisition Plan, Appendix C of the Work Plan (Shaw, 2006).
- Observe the drilling operations to verify that proper safety, sampling, and drilling methods are being instituted.
- When soil sample is received from the driller, open the soil-filled sampler, remove the sample liner from the barrel, cut open the liner, and place the sample liner and sample on the plastic sheeting.
- Describe the length of the sample according to ASTM International (ASTM) D2488-93, "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)," and record on the Shaw Drilling Log Form.
- After determining the appropriate sampling intervals based on the lithology, collect composite soil samples for laboratory analysis by filling the appropriate number and types of sample containers specified by the laboratory.
- Label each sample container as described in Section 4.6.2 of Appendix C of the Work Plan (Shaw, 2006), enclose each container in a sealable plastic bag, and place in a cooler containing ice.
- Repeat the above sequence of procedures for each interval to the total boring depth.
- Record the drilling activities and sampling procedures on a Field Sampling Report or logbook. Complete chain-of-custody documentation.

2.2.2 *Field Screening Methods*

Health and safety screening methods are described in the Health & Safety Plan, Appendix A of the Work Plan (Shaw, 2006).

3.0 References

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

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

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Shaw Environmental, Inc., 2006, *Installation-Wide Work Plan, Longhorn Army Ammunition Plant, Karnack, Texas*, Houston, Texas, January.

Texas Water Commission, 1988, *RCRA Facility Assessment Conducted by Texas Water Commission*, April 8.