LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS

ADMINISTRATIVE RECORD

Volume 11 of 19

2010

Bate Stamp Numbers

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Prepared for

Department of the Army
Longhorn Army Ammunition Plant

1976 – 2010

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

VOLUME 11 of 19

2010

A. Title: Report – (Continued) Final Feasibility Study, LHAAP-29, Former TNT Production Area, Group 2, Longhorn Army Ammunition Plant, Karnack, Texas, April 2010

Author(s): US Army Corps of Engineers

Recipient: USEPA

Date: April 30, 2010

Bate Stamp: 00091097 – 00091772

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FINAL
FEASIBILITY STUDY
LHAAP-29, FORMER TNT PRODUCTION AREA, GROUP 2
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

ON THE LINE

Shaw®

APRIL 2010

Shaw® Shaw Environmental, Inc.

Date: ***April 30, 2010***
Project No.:117591

TRANSMITTAL LETTER:

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

Re: Final Feasibility Study, LHAAP-29
Contract No. W912QR-04-D-0027/DS02

For: Review_____ As Requested _____ Approval_____ Corrections_____ Submittal_____ Other X_____

Item No:	*No. of Copies*	*Date:*	*Document Title*
1	2	April 2010	**Final Feasibility Study, LHAAP-29, Former TNT Production Area, Group 2, Longhorn Army Ammunition Plant, Karnack, Texas**

Aaron– Enclosed are two copies of Shaw's final version of the above-named document. Copies have been distributed as indicated below.

Please call with any questions or comments.

Sincerely:

Praveen Srivastav
Project Manager

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

DEPARTMENT OF DEFENSE
UNITED STATES OF AMERICA

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

April 30, 2010

DAIM-ODB-LO

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

Re: Final Feasibility Study, LHAAP-29, Former TNT Production Area, Group 2,
Longhorn Army Ammunition Plant, Karnack, Texas, April 2010
SUP 126

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

Sincerely,

Rose M. Zeiler

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

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

DEPARTMENT OF DEFENSE
UNITED STATES OF AMERICA

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

April 30, 2010

DAIM-ODB-LO

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

Re: Final Feasibility Study, LHAAP-29, Former TNT Production Area, Group 2, Longhorn Army Ammunition Plant, Karnack, Texas, April 2010

Dear Mr. Tzhone,

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

Sincerely,

Rose M. Zeiler

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

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

From: Tzhone.Stephen@epamail.epa.gov [mailto:Tzhone.Stephen@epamail.epa.gov]
Sent: Friday, April 30, 2010 9:01 AM
To: Zeiler, Rose Ms CIV USA OSA
Cc: Srivastav, Praveen; Jones, Greg N; Lambert, John R SWT; Everett, Kay; Watson, Susan; Fay Duke; Burton.Terry@epamail.epa.gov; Forsythe.Barry@epamail.epa.gov; Williams, Aaron K SWT
Subject: Longhorn: EPA Review of LHAAP-29 DF FS Track Changes and RTC Table for Review

Hi Rose:

The EPA has completed review of the Army *LHAAP-29 DF FS Track Changes and RTC Table for Review* (email 4/29/2010) and agrees with the submittal. Please proceed with finalization of the LHAAP-29 Feasibility Study.

Thanks,

Stephen L. Tzhone
Superfund Remedial Project Manager
USEPA Region 6 (6SF-RA)
214.665.8409
tzhone.stephen@epa.gov

From: Fay Duke [mailto:FDUKE@tceq.state.tx.us]
Sent: Thursday, April 29, 2010 3:04 PM
To: Srivastav, Praveen; Tzhone, Stephen
Cc: Everett, Kay; Jones, Greg N; Lambert, John R SWT; Watson, Susan; Wililams, Aaron; Zeiler, Rose Ms CIV USA OSA
Subject: Re: FW: LHAAP-29 DF FS Track Changes and RTC Table for Review

Rose/Praveen,

The TCEQ has completed its review of the Track Changes of the Draft Final Feasibility Study. We concur with the changes with one exception. However, it is our opinion that the issuance of the final FS need not be held up. The exception was due to TCEQ review oversight by not providing the comment regarding the shallow groundwater cleanup level for perchlorate at site LHAAP-29. As we have expressed in previous FS reports and proposed plans, because the groundwater at site LHAAP-29 has a potential to discharge to surface water, the residential MSC for groundwater must be the cleanup level for the shallow groundwater. We believe that this can be made clear in the proposed plan and finalize in the ROD and therefore, the final FS report need not be revised.

Please let me know if you should have any questions regarding this matter.

Thanks, fd

Fay Duke (MC-136)
Remediation Division, TCEQ
PO Box 13087
Austin, Texas 78711-3087
512-239-2443
512-239-2450 (Fax)

Comments on Draft Final Feasibility Study (published March 2009)
LHAAP-29, Former TNT Production Area, Group 2
Longhorn Army Ammunition Plant, Karnack, Texas

Reviewers: **USEPA, TCEQ, US Army, plus additional changes since April 2009 Meeting**
Respondents: Praveen Srivastav, Project Manager; Susan Watson, Shaw Environmental, Inc.

1. Respondent Concurs (C), Does Not Concur (D), Takes Exception (E), or Delete (X).
2. Commentor 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]	EPA Comments to RTCs	TCEQ Comments to RTCs	C, D[1], E or X	Response to EPA/TCEQ Comments on the RTCs	A or D[2]
Reviewer: Stephen L. Tzhone, Superfund Remedial Project Manager, USEPA Region 6 (6SF-RA), U.S. Environmental Protection Agency **Specific Comments**											
1	2-6	Section 2.3.2	The explanation for chromium from well casings is much improved over previous discussions and is acceptable to EPA.	C	Noted.	A					
2	2-6	Section 2.3.2	However, it is unclear to EPA how positive sample detections for nickel, mercury, and arsenic above MCLs can be discarded. For EPA, the arguments given are not convincing, please revise.	C	In Section 2.3.2 – Groundwater, Additional Sampling 2008 and 2009, replace the 4th, 5th and 7th paragraphs with the following: “Of the 80 nickel samples collected since 1993, nickel was detected above the GW-Ind of 2,000 μg/L in only 3 samples. Prior to 2008, the nickel concentration in only one well had an associated HQ greater than 1 (8,400 μg/L at 29WW11 in April 1995). The 2008 result from this well had a concentration of 40 μg/L. In 2008, the highest nickel concentration was found at 29WW07 with 3,190 μg/L and would have an HQ greater than 1.0. Previous results for 29WW07 were less than 40 μg/L in May 1995 and 600 μg/L in July 1998. Thus, high nickel concentrations in individual wells have not been repeatable or consistently detected. The isolated high nickel concentrations at 29WW07 and 29WW11 coincided with elevated chromium concentrations (i.e., above the MCL of 100 μg/L for chromium), indicating that corrosion of the stainless steel well material is a likely source of the high nickel concentrations. Since the nickel detections are isolated in each event, and appear to be related to corrosion of the stainless steel wells, nickel is not considered a COC.” “Of the 80 arsenic samples collected since 1993, arsenic was detected above the MCL of 10 μg/L in only 7 samples. Four of the elevated results (115, 29WW16, 29WW20, and 29WW25) were obtained in 1998 or before. It was suspected that the elevated concentrations could be a result of sampling methodology and/or turbid samples. In 2008, nineteen additional samples were collected including the two wells with the highest historic concentrations (59 μg/L at shallow well 29WW25 and	D	Increasing concentrations should require additional monitoring, not less. If the sample was performed incorrectly or is otherwise not representative of the subsurface, then the sample should be redone properly. Currently, it could be argued that the existing remedy is now allowing metals to be released to the environment, and thus is not protective. EPA recommends retaining nickel, arsenic, and mercury, given that their recent concentrations could also support a contention of increasing contamination. If the metals are not an issue, then future monitoring will verify that, and the sampling protocol can be revisited at a later time.	COCs that have been confirmed to have concentrations above MCL, MSC or risk-based standards must be retained for remedial action except in cases where samples taken recently have shown the concentrations are now below the cleanup levels. If the sample result that exceeds cleanup level is believed not to be a representative groundwater samples (i.e., turbidity), than a representative sample should be collected and re-analyzed. Additionally, With in-situ chemical oxidation as the potential remedy at this site, metals should be monitored to ensure metals are not mobilized as a result of the pH change.	C	Nickel, arsenic, and mercury will be added to the COC Table 2-5 with footnotes that they are isolated COCs limited to certain wells defined in Tables 2-2 and 2-3 and in Section 2.3.2. The following will be revised in Section 2.3.2 response: Nickel – last sentence will be replaced with the following: “Since the nickel detections are isolated in each event, and appear to be related to corrosion of the stainless steel wells, nickel is not considered a site-wide COC and will be considered a COC limited to shallow groundwater zone wells 29WW07 and 29WW11.” Arsenic – last sentence will be replaced with the following: “It is concluded that arsenic is not considered a site-wide COC since the arsenic detections have been sporadic, are not repeatable, and can be attributed to sampling methodology or natural occurrence in the deep zone. Thus, arsenic is an isolated COC limited to shallow groundwater zone wells 116, 29WW08, and 29WW25.” Mercury- last sentence will be replaced with the following: ”Thus, mercury is not considered a site-wide COC and will be an isolated COC limited to the shallow groundwater zone Well 118.” In Section 2.4.2, the following will be added to the shallow water groundwater discussion, paragraph 5: “Three metals, nickel, arsenic and mercury, had sporadic detections above clean	

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					44 µg/L at intermediate well 29WW16). The wells were redeveloped prior to sampling. In 2008, only 3 samples (116, 29WW08, and 29WW25) had arsenic concentrations above the MCL. The well with the highest concentration (29WW25) had high turbidity (237.1 NTUs) and was noted to be reddish brown. This sample result is questionable due to the high turbidity. The next highest sample (116) was qualified as an estimated value since the field duplicate relative percent difference criteria was exceeded. It should also be noted that the aluminum concentration was high at 430 µg/L. This sample result is also questionable due to QC issues. The third sample from deep well 29WW08 had arsenic concentrations of 40.1 µg/L with a high aluminum concentration of 713 µg/L. The high aluminum concentrations in the same sample indicates that the arsenic may be naturally occurring. Additionally, this deep well is clustered with a shallow well, 29WW07, and intermediate well, 29WW14, neither of which has had an arsenic detection. Thus, the contamination is not from vertical migration. It is concluded that arsenic is not considered a COC since the arsenic detections have been sporadic, are not repeatable, and can be attributed to sampling methodology or natural occurrence in the deep zone." "Of the 80 mercury samples collected since 1993, mercury has been detected only twice, both in shallow zone Well 118. The latest round from 2008 detected mercury at 6.1 µg/L in Well 118 – higher than the previous result of 3 µg/L in 1993. The MCL for mercury is 2 µg/L. In 1995 and 1998, mercury was not detected (less than detection limit of 0.2 µg/L) in Well 118. Mercury is not detected in any other well, and the detections are intermittent and appear to be isolated. Well 118 is located along the southern edge of the site, away from active industrial areas that are possible sources. Mercury was detected at low concentrations in					up goals in certain wells and do not define a plume in the groundwater. These metals have been included as COCs." Additionally, the notes on Tables 2-2 and 2-3 will be revised to note that arsenic and nickel are isolated COCs in certain shallow groundwater zone wells and are not site wide. The list of analytes to be monitored during the remedy (including metals potentially mobilized by in situ oxidation) will be addressed in the remedial design. The alternatives will be revised to include groundwater monitoring for these analytes for the wells defined in Section 2.3.2.	

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					three soil samples (29SB04, 29SB12 and 29SB55) and one sediment sample (29SD13), but all of these locations are more than 1,500 feet from Well 118. Sample results from wells located between the soil sample locations and Well 118 did not detect mercury. Soil and sediment samples near Well 118 (29SD08, 29SD09, 29SB71, and 29SB72) did not show any detectable mercury, so the mercury in groundwater is not related to the mercury in soil. Additionally, the Final Baseline Human Health and Screening Ecological Risk Assessment for Group 2 Sites (Jacobs, 2002) calculated a hazard index (HI) of 0.098 for mercury in groundwater using the maximum mercury value of 3 µg/L. Adjusting this HI for the new higher maximum of 6.1 µg/L gives an HI of 0.20, still less than 1.0. Thus, mercury is not considered a COC in groundwater."			**April 14, 2010 E-mail from Faye Duke to Rose Zeiler:** We cannot concur with the conclusion that the three metals: arsenic, mercury, and nickel are not considered site wide COC and will only be monitored in wells where these metal concentrations have exceeded the MCLs. We believe there are insufficient data to conclude that these metal contamination is limited in these wells currently and have not traveled since the last sampling event. We recommend that the monitoring locations and frequencies be assessed and determined during the remedial design after additional samples have been collected.		While we do not believe these metals are site-wide, we do agree that this can be further addressed during remedial design (RD). Therefore, the text will be modified to indicate that the extent of these inorganic COCs will be assessed at wells site-wide during the RD. Also, the RD will present a plan for subsequent monitoring locations and frequencies based on the latest assessment data in conjunction with historical groundwater monitoring results for inorganics at the site.	
3	2-9	Section 2.4.2 3rd para	The phrase "…concentrations less that the EPC…" should replace "that" with "than".	C	Text will be revised.	A					
4			Is the kinetics curves information given in Appendix C solely used to extrapolate future kinetics and determine whether the remedy (post excavation/oxidation) is working appropriately?	C	The kinetic curves were used to extrapolate future kinetics. Future results will serve to determine whether or not the chosen remedy is working appropriately. The curves will be re-evaluated after additional MNA data are obtained.	A					
Reviewer: Stephen L. Tzhone, Superfund Remedial Project Manager, USEPA Region 6 (6SF-RA), U.S. Environmental Protection Agency **General Comments**											
5		General	Please modify statements such as: "MNA ensures that ground water contamination is localized" or "MNA prevents human exposures". Allowing the natural healing processes of nature to work and keeping track of that progress is not the same as "ensuring" or "preventing".	C	Page ES-3 is the only place this phrasing appears. Executive Summary, Alternative 2 bullet, MNA sentence, will be revised as follows: *"Implementation of MNA in both the shallow and intermediate zones would ensure that groundwater contamination concentrations and plume stability/size are monitored as*	A	Note: new language is acceptable.				

Comments on Draft Final Feasibility Study (published March 2009)
LHAAP-29, Former TNT Production Area, Group 2
Longhorn Army Ammunition Plant, Karnack, Texas

Reviewers: **USEPA, TCEQ, US Army, plus additional changes since April 2009 Meeting**
Respondents: Praveen Srivastav, Project Manager; Susan Watson, Shaw Environmental, Inc.

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2. Commentor Agrees (A) with response, or Does not Agree (D) with response.

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					the plume degrades over time.” Executive Summary, Alternative 3 bullet, MNA sentence, will be revised as follows: *“Implementation of MNA in both the shallow and intermediate zones would ensure that groundwater contamination concentrations and plume stability/size are monitored as the plume degrades over time.”* Section 6.3.2.3.2, last sentence of 4th paragraph will be revised as follows: *“In both zones, long-term success will be verified by monitoring the progress of natural attenuation.”*						
Reviewer: Stephen L. Tzhone, Superfund Remedial Project Manager, USEPA Region 6 (6SF-RA), U.S. Environmental Protection Agency **Comments on additional materials presented April 28-29, 2009:**											
1			The screening data for anaerobic biodegradation and the geologic cross-sections are helpful and appreciated.	C	Noted.	A					
2	5-6	5.2.2.3	The criterion for ending the oxidation/extraction phase remains unclear. Are all MC expected to be remediated before the oxidation is completed, or is there a set figure which is expected to be attained?	C	Based on the treatability study (Appendix B), the MC concentrations will be reduced by approximately 75% through heat activated persulfate. MNA will be initiated after the formation has recovered from the oxidation treatment activities. Also, see 9B response.	A	Note: EPA agrees with Army that 75% reduction in Methylene Chloride concentrations for this site is sufficient to allow continued remediation by MNA.				
3		6.5	Discussed eliminating recommendation section.	C	The recommendation section will be deleted.	A					

Comment #	Page	Section/ Paragraph	Comment	C, D[1], E or X	Response	A or D[2]	TCEQ Comments to RTCs	C, D[1], E or X	Response to TCEQ Comments on the RTCs	A or D[2]
Reviewer: Fay Duke , Remediation Division, TCEQ **Comment received on May 1, 2009 via email at 6:40 p.m., RE: TCEQ Comments on LHAAP-17 FS**										
1		Table 3-3	Please note that comment No. 5 regarding action specific ARARs should also be considered a comment for LHAAP-29 FS. Comment 5 for LHAAP-17 FS - Section 3.2.4.1.2 (Waste and Disposal Activities) – It states that requirements for managing, storing and disposal will be conducted in accordance with ARAR listed in Table 3-3. However, we believe that the action specific ARARs discussion and requirements listed in Table 3-3 is incomplete. The discussion in this section is focus on the AOC concept, which applies mainly		CERCLA section 121(d) requires on-site Superfund remedial actions to comply with Federal, and more stringent State, environmental requirements that are determined to be applicable or relevant and appropriate requirements (ARARs); thus, even though requirements for off-site actions are not ARARs, they must be complied with. The following will be added to the second paragraph of Section 3.2.4.1.2: "Other requirements for hazardous waste such as manifesting for off-site disposal (40 CFR 262.20) and planning/implementing off-site	D	Despite recent clarifications from EPA, we believe that action specific ARARs table is still incomplete. 1. With in-situ chemical oxidation as one of the alternative, why is federal and state requirements for UIC not listed as a potential ARARs? 2. Please explain the rational for deleting Table 3-2, which addresses the location-specific ARARs?	C	The UIC is not listed as a potential action specific ARAR since it is only an administrative requirement. The other requirements for drilling the wells are already included in the action specific ARARs. Since Longhorn is a CERCLA site, a permit for a Class V injection well would not be required. The Army and USEPA are currently discussing the location-specific ARARs. For purposes of moving forward with the FS, the location-specific ARARs will	

00091106

Comments on Draft Final Feasibility Study (published March 2009)
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Respondents: Praveen Srivastav, Project Manager; Susan Watson, Shaw Environmental, Inc.

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			to on-site disposal. Please note the waste management and disposal requirements under RCRA are usually "appropriate and relevant" requirements for on-site disposal but these requirements are typically "applicable" for off-site disposal. Additionally, certain requirements such as procedures for planning and implementing off-site response action (40 CFR 300.440) are applicable to CERCLA response action waste. Please revise.		response action (40 CFR 300.440) will be complied with even though they are not considered an ARAR." Additionally - the ARAR discussion will be revised to address only environmental laws, and the potential location-specific Table 3-2 will be deleted; and the USEPA MCLs/TCEQ MSCs will be used for groundwater cleanup and the Texas Safe Drinking Water Act will be removed from the chemical-specific ARAR discussion.		**April 14, 2010 E-mail from Faye Duke to Rose Zeiler:** We concur that CERCLA permit exemption means that administrative requirements are exempt. We disagreed with your statement that TAC chapter 331 contains only administrative requirements. We believe that at a minimum, TAC chapter 331 Subchapter H must be included as action specific ARARs. Please also keep in mind that to ensure that the design meets the substantive requirements, the review and evaluation is deferred to the staff from the TCEQ UIC program for the review of the design documents. Please let me know if you should have any questions or concerns regarding these comments. If the final LHAAP-29 FS incorporates these changes, please proceed with the issuance of the final FS.		be retained as "potential" ARARs. Based on the outcome of these discussions, the appropriate ARARs will be included in the ROD. Text in Section 3.2.4 and Table 3-3 will be modified to indicate that substantive requirements of TAC Chapter 331 Subchapter H that are relevant and appropriate to installation of the injection points will be included as potential action-specific ARARs.	
Comments from the April 2009 meeting										
			From the meeting minutes: *On the 2nd day of the meeting, the log of deep well 29WW40 was examined, specifically with regard to PID readings versus depth. Reading dropped noticeably after the intermediate zone, but the group agreed that the readings are inconclusive given the method of drilling (mud rotary). F. Duke said that the TCEQ needed conclusive proof that the contamination was not in the Upper Deep zone. Shaw and Army preferred to install this well now rather than wait. P. Srivastav said it would take at least 6 weeks to install the well and get sample results. There was some discussion of the best location for the new well. It was decided that the well will be installed approximately 50 feet downgradient (northeast) of 29WW40. Data from this well will be evaluated to determine if the remedy for LHAAP-29 needs to be modified. C. Sanchez asked about the earlier TCEQ concern about the shallow zone, but F. Duke said that was not a problem since trends within the zone would be tracked.* The new well (29WW41) was installed, and a follow-up email was sent on July 2, 2009. The email contained the well location, boring log, groundwater sampling form, and lab results. This information relating to 29WW40 will be incorporated into the Feasibility Study as follows in Comments 1A through 6A:								
1A		Table 1-1			The following bullet will be added under Additional Investigations: • Installed new well, 29WW41, in the Upper Deep Zone and sampled the well for VOCs (**Appendix D**).					

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Reviewers: **USEPA, TCEQ, US Army, plus additional changes since April 2009 Meeting**
Respondents: Praveen Srivastav, Project Manager; Susan Watson, Shaw Environmental, Inc.

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2A		1.3			New next-to-last paragraph will be added as follows: "In June 2009, one new monitoring well (29WW41) was installed and sampled for VOCs to determine whether groundwater in the upper deep zone immediately below the highest MC concentration in the intermediate zone (at 29WW16) showed any evidence of contamination. Well 29WW41 was screened at a depth of 102.5 to 117.5 feet bgs. A groundwater sample was collected for VOC analysis."		The text should include the rationale for sampling only VOCs.	C	The following sentence will be added: "This deeper well was installed to evaluate the potential downward migration of contaminants in the intermediate zone. Only VOCs have been identified as COCs in the intermediate zone, and thus the sample was analyzed for VOCs."	
3A		2.3.2			The following will be added as a new 11th paragraph (before the paragraph beginning with "**Tables 2-2** and **2-3**) . . .": "A sample was collected from the newly installed well, 29WW41, in the upper deep zone and analyzed for VOCs, which were not detected in the sample. Therefore, groundwater in the upper deep zone is not affected by VOCs." The second sentence of the 12th paragraph will be revised as follows: **"Appendix D** contains the table of the results and analytical data reports from the October 2008, January 2009, and June 2009 sampling events."					
4A		2.4.3			A new last paragraph will be added as follows: "As demonstrated by previous sample results and sampling of new monitoring well 29WW41 in June 2009, the deep groundwater zone is not affected at LHAAP-29."					
5A		Figures 1-6, 1-7, 2-2, 2-3, and 2-4			29WW41 will be added as a deep well.					
6A		Appendix D			The title of Appendix D will be revised as follows: "Summary Table, Field Sheets, Well Log (29WW41), and Analytical Data Reports (October 2008, January 2009, and June 2009)"					
The following are in response to additional comments from the Army on May 27, 2009										
1B			Your response for LHAAP-29 that concentrations above MSCs in the cooling and waste lines will be immobilized by plugging the lines does not address Army's concern for the eventual leaching of the contamination via vertical percolation after the pipes have degraded. Shaw's response is also inconsistent with the response provided to Carlos Sanchez at the on-board review meeting to address Carlos's similar concern in leaving the contamination in the lines. The high concentrations in the lines need to be properly addressed.	C	Even though the plugging of the waste lines was discussed during the April 27-28, 2009 meeting, the proposed remedial action has been modified depending upon the type of the line and its history, as discussed below. A further review of historical information revealed that the wooden line was clear flushed, and the RCRA Facility Assessment recommended no further action for the wooden line. Investigations noted that the line was in poor condition, but analytical results for soil samples collected near the line did not indicate any contamination from the wooden pipeline. Thus, no further action will be proposed for the deteriorated wooden line.		TCEQ has a few questions and concerns regarding the new approach. 1. Were confirmation samples taken after the "clear flush?" What method was utilized to visually inspect the inside of the line? 2. We are concern that the decision making for the wooden line is depending upon the RFA. I spoke to my colleague in the RCRA program regarding the RFA and RFI process. It is my understanding that the RFA process is solely based on visual inspection. It is very typical that additional sample collection or a full-blown RFI is required even if the RFA recommends no		1. Unknown. 2. Soil samples were collected and results indicated that explosive levels in the soil did not exceed either the SAI-ind or the GWP-Ind. See revised Table 2-5. 3. There is only one transite pipe at the site and it is buried underground for the most part, except near the former pump location. As part of the remedial design, the line will be surveyed for deed recordation purposes and all exposed areas will be buried with at least 2 feet of soil. 4. The site-specific MSC and SAM modelling will be	

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					Some points within the transite line have been reported to contain a thick viscous semi-solid residue in the bottom. Material from within the line was tested by Shaw and exceeds both the GWP-Ind and SAI-Ind. The transite lines will be flushed with water to remove the residue. The rinsate water will be containerized, transported and treated at the on-site wastewater treatment plant or disposed of at an off-site facility based on analytical results for explosives. In the manholes of the gravity feed portion of the cooling water lines, explosives were detected in the solid residue and water at concentrations above the GWP-Ind and the GW-Ind, respectively. SAM modeling was conducted to estimate the potential impact of the solid residue remaining in the manholes to the groundwater if the line degraded in the future. The SAM modeling indicated that there would not be an impact from the solid residue in the manholes. The manholes should be low spots in the lines where solid residue would collect and minimal solid residue is expected to be found in the actual lines between the manholes. To determine if there is contaminated solid residue in the lines, field staff will attempt to collect solid residue samples during the remedial action from within the lines between the manholes with GWP-Ind exceedances. Where there is sufficient residue for such samples to be collected, they will be analyzed to determine if the residue is above the proposed cleanup levels (calculated site-specific medium-specific concentration [MSC] by SAM modeling). If there is no measurable amount of solid residue in the lines, no action will be taken. If there is a measurable amount of solid residue in the lines, but explosives are detected below the GWP-Ind or site-specific MSC, no action will be taken. If solid residue concentrations are found to be above the proposed cleanup levels in the lines (GWP-Ind or site-specific MSC), the affected segment of the line between two manholes will be flushed. The rinsate water will be containerized, transported and treated at the on-site groundwater treatment plant or disposed of off-site based on the explosives concentrations. The manholes will then be plugged. Comments 1B through 12B indicate the revisions to be made to the FS.		further action. Please also note that the RFA recommendation is made based on the conditions of the line ("structurally sound and bedded securely") at the time of the inspection. 3. Please note that transite pipes are considered a category II non-friable asbestos-containing material under the TCEQ rules, as such, must be managed so asbestos materials are not release when the pipes deteriorate. Please clarify whether these pipes are currently embedded or exposed. 4. We are concerned and question the applicability of using a calculated site specific MSC to determine the management method for the waste residual left in the pipes. Please note that the risk reduction standard No. 3 are typically applicable only for to contaminated media (e.g., soil) and not waste. The residuals are"waste-like" and therefore the residual should be classified in accordance with TAC 335 Subchaper R and the TCEQ guideline for the classification of industrial and hazardous waste. Waste must be managed in accordance with the substantive requirements of 30 TAC Subchapter A, B, C, E,and/or F. We believe that it is appropriate to leave the residual in place only if the waste residual is classified as nonhazardous; the concentrations of constituents are below Standard No. 2 MSCs for soil and the leachate is below groundwater protection standards. However, the location of the abandon pipe must be deed recorded.		removed. Text and table has been revised as indicated in the track-changed text attached to these RTCs. Please note that the cooling water lines are made of vitrified clay pipes. There are two cooling water lines (north and south). Historically, there has been very little residue in the cooling water lines as observed in the manholes. An attempt will be made to sample and analyze the residue and water in the cooling water lines as part of the RD phase. If there is not enough residue volume to sample or the concentrations in the sample are less than the GW-Ind (water) or GWP-Ind (solid) and the residue is nonhazardous, the pipe will be plugged and abandoned. No solid residue or liquid will be left in the pipe if the explosive constituents exceed the GWP-Ind (residue), the GW-Ind (water) or the solid or liquid is determined to be hazardous (residue or water). If explosive concentrations are above the GWP-Ind (residue) or GW-Ind (water) or the material is found to be hazardous, the line will be flushed before pluging and abandoning. The rinsate will be characterized for waste handling.. The FS cost estimates will be revised. The estimates will be based on the assumption that the north cooling water line and the transite wastewater line will be flushed before abandoning.	
2B		1.2.3.1			Section 1.2.3.1 – Operation Summary, 3rd paragraph, the second sentence will be replaced with the following: "The underground lines consisted of TNT wastewater (red liquor) lines and the cooling water (blue water) lines (Figure 1-3). The red liquor TNT		It is stated that the "transite pipe was in good condition when it was unearthed in 1993…" What is the current condition of the pipe? Is the pipe exposed?		It is assumed to still be in good condition. Please see response to Comment 1B above.	

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					wastewater line, originally SWMU LHAAP-30 and later included as part of IRP/DSERTS LHAAP-29, was originally installed as a wooden pipeline. The Addendum to the Phase 2 Work Plan noted that the transite waste line was added 5 feet north of the wooden line based on a modified drawing dated March 30, 1943 (Bate Stamp 12651). The transite material is a combination of cement and asbestos. The TNT red water line was clear-flushed in 1946 (Bate Stamp 001446, RCRA Facility Assessment, April 1988). The transite pipeline was in good condition when it was unearthed in 1993 at a location approximately 400 feet northwest of the pond and at the three locations sampled along the line as part of the Shaw additional investigation in 2006.“ 5th paragraph will be replaced with following: “Two blue cooling water lines exist at LHAAP-29, north and south (Figure 1-3), and range from 8 inches to 18 inches in diameter. These gravity fed lines are thought to be constructed of vitrified clay pipe with asbestos wicking. These lines collected water from each TNT washing area. Manholes exist along both the north and south cooling water lines. The northern line is connected to lines from each plant (approximately 280 feet of 10-inch-diameter pipe). The lines drain into a ditch along 16th street which eventually flows into Goose Prairie Creek.					
3B		2.3.3			Section 2.3.3, Process Lines, text will be replaced in its entirety and is attached.					
4B		2.4.1			The last paragraph of Section 2.4.1 will be deleted and a new section 2.4.3, Process Lines, will be added as follows: “Contaminated explosives residue remains within the transite TNT wastewater line at concentrations above the SAI-Ind and GWP-Ind, but access to the pipe is limited to the inlets and outlets unless the pipe is penetrated. Additionally, the line is deeper than the cleanup depth of 2 feet bgs for nonresidential use. The gravity flow portion of the line is approximately 3,000 linear feet. The pressurized portion of the line is approximately 1,000 linear feet. The line is in good condition. The wooden TNT wastewater line was flushed and abandoned. The results from soil samples collected near the line indicate there has not been a release to the surrounding soil. Further, the line is deeper than the near-surface soil depth of 2 feet bgs considered for nonresidential use (TAC335.559(g)). Furthermore, it was noted in site documentation that		See comments above.			

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<table>
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<tr><td></td><td></td><td></td><td></td><td></td><td>no additional action is necessary for the wooden TNT wastewater line (Bate Stamp 001446).
The north and south cooling water lines are accessible through manholes, and the liquid and solid residue contents from the manholes were sampled. The liquid and solid residues from the manholes are contaminated with explosives at concentrations that are above the GW-Ind (liquid) and the GWP-Ind (solid residue). There are approximately 5,000 feet of pipe in the main lines, approximately 1,680 linear feet of pipe from each production area to the main line, and 12 manholes.”</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>5B</td><td></td><td>3.1</td><td></td><td></td><td>Section 3.1, RAOs, 1st bullet will be replaced with the following:
“Protect the hypothetical future maintenance worker by preventing exposure to the contaminants in the soil, sediment, transite TNT wastewater line, cooling water lines, and groundwater.”</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>6B</td><td></td><td>3.3/
3.3.3</td><td></td><td></td><td>Section 3.3, second sentence will be replaced with the following:
“The cleanup levels for soil, groundwater, and solid residue in the cooling water lines at LHAAP-29 are determined with consideration of the risk to human health, the risk to ecological receptors, and the ARARs identified for the site in Section 3.2.2.”
Add New Section 3.3.3 Cooling Water Lines
“The cleanup levels for solid residue in the cooling water lines at LHAAP-29 are the site-specific MSCs calculated using the SAM model (Appendix E). Solid residue in the cooling water lines exceeded the site-specific MSC for 2,4-DNT in manholes 8 and 10. If similar thicknesses and concentrations of solid residue exist in the adjacent pipelines, then 2,4-DNT could potentially leach into groundwater at unacceptable concentrations if the pipe deteriorates. Table 3-6 summarizes the COCs and the proposed cleanup levels for solid residue in the lines using the site-specific MSCs .”
Table 3-6
Proposed Cleanup Levels for Target COCs in Cooling Water Lines
<table>
<tr><th>Explosive</th><th>Site-Specific MSC (mg/kg)</th></tr>
<tr><td>2,4,6-Trinitrotoluene</td><td>250</td></tr>
<tr><td>2,4-Dinitrotoluene</td><td>0.38</td></tr>
<tr><td>2,6-Dinitrotoluene</td><td>0.31</td></tr>
<tr><td>2-amino-4,6-Dinitrotoluene</td><td>160</td></tr>
</table></td><td></td><td>See comments regarding cleanup levels and waste classifications.</td><td></td><td>Revised response to reflect Comment1B.
Add New Section 3.3.3 Cooling Water Lines
“The cleanup levels for solid residue in the cooling water lines at LHAAP-29 are the GWP-Ind values. Solid residue in the cooling water lines exceeded the GWP-Ind for 2,4-DNT in manholes 8 and 10. If similar thicknesses and concentrations of solid residue exist in the adjacent pipelines, then 2,4-DNT could potentially leach into groundwater at unacceptable concentrations if the pipe deteriorates. Table 3-6 summarizes the COCs and the proposed cleanup levels for solid residue in the lines using the GWP-Ind values.”
Table 3-6
Proposed Cleanup Levels for Target COCs in Cooling Water Lines
<table>
<tr><th>Explosive</th><th>GWP-Ind (mg/kg)</th></tr>
<tr><td>2,4,6-Trinitrotoluene</td><td>5.1</td></tr>
<tr><td>2,4-Dinitrotoluene</td><td>0.042</td></tr>
<tr><td>2,6-Dinitrotoluene</td><td>0.042</td></tr>
<tr><td>2-amino-4,6-Dinitrotoluene</td><td>1.7</td></tr>
</table></td><td></td></tr>
</table>

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					4-amino-2,6-Dinitrotoluene 100 Abbreviations: mg/kg milligrams per kilogram MSC medium-specific concentration				4-amino-2,6-Dinitrotoluene 1.7 Abbreviations: GWP-Ind Soil MSC for industrial use based on groundwater protection mg/kg milligrams per kilogram MSC medium-specific concentration	
7B		4.4.1.3.1			Section 4.4.1.3.1, under Plug and Abandon Lines, "migration of sediment and residue" will be revised to "migration of solid residue"					
8B		5.1.2			Section 5.1.2, 1st sentence, will be revised as follows: "…sediment in the outfall ditch, and solid residue in the cooling water lines and manholes."					
9B		5.2.2.2 and 5.2.3.2			Sections 5.2.2.2 and 5.2.3.2, will be revised as follows: "The transite TNT wastewater line will be flushed with water to remove visual residue. The rinsate water will be containerized, transported and treated at the on-site wastewater treatment plant or disposed of off-site based on the explosive chemical concentrations. The inlets and outlets of the transite TNT wastewater line will be plugged with a bentonite slurry mix or equivalent. The cooling water lines showed no significant contamination except for 2,4-DNT in the solid residue in manholes 8 and 10. The cooling water lines will be inspected to determine if there is contaminated solid residue in the lines adjacent to manholes 8 and 10. An attempt will be made to collect samples from the solid residue within the lines adjacent to manholes 8 and 10, and samples will be analyzed to determine if 2,4-DNT concentrations in solid residue in the pipes is above the proposed cleanup level (site-specific MSC). If there is no measurable amount of residue in the lines, no action will be taken. If there is measurable amount of residue in the lines a sample will collected. If concentrations are below the site specific MSC, no action will be taken. If solid residue concentrations are found to be above the proposed cleanup level in the lines (site-specific MSC), the affected segment of the line will be flushed, the rinsate water will be containerized, transported and treated at the on-site wastewater treatment plant. The manholes will then be plugged with a bentonite slurry mix or equivalent."		Please note that method of handling the rinsate water would depend on the classification of the waste residue. It state attempts will be made to collect samples. If no samples are taken, the pipe must be flushed clean and rinsate collected to determine its waste classification.	E D	Rinsate will be handled based on the waste classification of the rinsate. Prior experience indicates that manholes are typically the accumulation points for solid residues. Previous field work by Shaw demonstrated that the cooling water lines are generally clean and very little residue exists in the manholes. Flushing is not considered necessary if there in no residue in the pipelines or if the residue amount is so little that it cannot be sampled. See response to Comment 1B, part 4. The following revisions will be made to the Sections 5.2.2.2 and 5.2.3.2 (see Response column) as follows: "Site-specific MSC" will be revised to "GWP-Ind". A new sentence will be added as follows: "Appropriate rinsate handling procedures will be followed based on the its waste classification."	
10B		5.2.2.3			Add to the end of Section 5.2.2.3: "Based on the Treatability Study (included in Appendix B), the MC concentrations will be reduced by approximately 75% through heat-activated persulfate application. MNA will be initiated after the formation has recovered from the					

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					oxidation treatment activities.”					
11B		Figures, Tables, and Appendix Lists			Due to adding Tables 2-4 through 2-7, existing Tables 2-4 and 2-5 become Tables 2-8 and 2-9. Table 3-6 is added. Due to adding Figure 2-5, existing Figures 2-5 and 2-6 become Figures 2-6 and 2-7. Original Appendix E in the Draft Final will be changed to Appendix F.				Original Appendix E in the Draft final will remain as Appendix E. The SAM modeling appendix attached to the RTCs will be removed.	
12B		In general			Figure 2-5 is attached. Appendix E, Soil Attenuation Model, is attached. Table 1-1, Additional Investigations, 5th bullet will be revised as follows: “Collected 8 solid residue samples from manholes…” And 8th bullet will be revised as follows: “…29SD49, 3 solid residue samples from the transite…” For clarity of meaning, the words “cleanup goals” will be changed to “cleanup levels” in the document. This occurs five times – on pages 3-4, 5-3, 5-6, 6-11, and 6-19. SAM Soil Attenuation Model will be added to the acronyms. Appendix A – references in text, tables and figures to “sediment samples” collected in the lines will be revised to “solid residue” samples. Section 1.1, Appendix E description will be added. “Deed recordation” language will be updated to “recordation notification with the county” in the following sections: • Section 3, Table 3-3, Land Use Controls when Hazardous Substances are Left in Place • Section 3.2.4.1.3, 2nd paragraph, 2nd sentence • Section 4.4.1.2.1, Covenants, 1st sentence, next to last sentence of Administrative Controls bullet. • Section 4.4.2.2.1, Covenants, 1st sentence, last		See comments above regarding the proposed cleanup levels.		See response to above comment concerning Appendix E.	

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					sentence of effectiveness bullet, next to last sentence of Administrative Controls bullet.					
13B		General FS consistency changes			The language in the LHAAP-29 FS will be revised to be consistent with the recent finalized FSs (LHAAP-46, LHAAP 50, and LHAAP-35A(58)), which include the following: The remedial action objectives will be revised as follows: "The Army recognizes USEPA's policy to return all groundwater to potential beneficial uses, based on the non-binding programmatic expectation in the NCP. The RAOs for LHAAP-29, which address contamination associated with the media at the site and take into account the future uses of LHAAP streams, land, and groundwater are: • Protect the hypothetical future maintenance worker by preventing exposure to the contaminants in the soil, sediment, transite TNT wastewater line, cooling water lines, and groundwater. • Prevent migration of contaminants to groundwater and surface water from potential sources in the soil, sediment and process lines (TNT wastewater and cooling water) • Protect ecological receptors by preventing exposure to the contaminated soil and sediment • Return groundwater to its potential beneficial uses, wherever practicable, within a reasonable time period given the particular site circumstances." Other changes include the following: • Throughout document, when discussing potential beneficial use of groundwater, "restore" will be revised to "return". • MNA sampling frequency will be revised to reflect the most recent schedule (i.e. two years of quarterly sampling, etc.). • Future maintenance worker will be changed to hypothetical future maintenance worker throughout the document.					

Section 2.3.3, Process Lines

At LHAAP-29 there are red liquor TNT wastewater lines (transite and wooden) and blue cooling water lines with manholes (north and south). It should be noted that the explosives sample results from Phase I and Phase II (29WL01 through 29WL11) were deemed unusable for environmental decision making per USEPA (Jacobs, 2002). Additional investigations were conducted for both lines since the risk assessment (**Appendices A** and **B**).

2.3.3.1 TNT Wastewater Lines

During the Phase I Remedial Investigation, the transite TNT wastewater line was found at 29WL04 and 32WL02 but was not found near 29WL01, 29WL02, and 29WL03. This investigation also noted that the wood stave line was found to be soft and severely weathered. Soil samples (29SB81 through 29SB85) were collected in 2004 along the wastewater line near the wash house sumps to check for contamination possibly leaking from the wooden wastewater line into the surrounding soil (**Appendix A**). In 2006, the transite line was found approximately 5-feet north of the wooden line location and sampled near original locations 29WL01 (2006 sample ID 20WL14), 29WL02 (2006 sample ID 29WL13), and 32WL02 (2006 sample ID 32WL05) (**Appendix B**).

The risk assessment contained soil EPC values for 2,4,6-TNT (190 mg/kg), 2-amino-4,6-DNT (25 mg/kg), and 4-amino-2,6-DNT (16 mg/kg). The other explosives were not detected. In 2006, the sample results for 2,4,6-TNT at 29WL13 was above the EPC. The results of the other two explosives were below their EPCs. For evaluation of the additional data collected in 2004 and 2006, the results were compared to SAI-Ind and GWP-Ind values. There were several explosives detected in the transite wastewater line that were above the GWP-Ind. Table 2-4 summarizes the solid residue sample results from within the TNT transite wastewater line that are above the GWP-Ind. Only two explosives (2,4,6-TNT and 2,4-DNT) had concentrations above the SAI-Ind in the solid residue from within the pipe. The explosive sample results above the SAI-Ind in the solid residue from within the transite pipe are shaded in **Table 2-5**. The sample locations are shown on **Figure 2-5**.

Table 2-5
Summary of Solid Residue Sample Results from Transite TNT Wastewater Line

Explosive	EPC from Risk Assessment (mg/kg)	SAI-Ind (mg/kg)	GWP-Ind (mg/kg)	Concentration* (mg/kg)	Sample location
2,4,6 TNT	190 (associated HI of 0.77)	510	5.1	526	29WL13
				58.4	29WL14
				17 JL	32WL05
2,4 DNT	--	4.2	0.042	5.15 JL	32WL05
				89	29WL13
				7.21	29WL14
2-amino-4,6-DNT	25 (associated HI of 0.33)	170	1.7	19 JH	29WL14
4-amino-2,6-DNT	16 (associated HI of 0.21)	170	1.7	13.3	29WL14
1,3-DNB	--	100	1	1.08	29WL13

Notes and Abbreviations:

* Concentrations included in table are above the GWP-Ind. Shaded concentrations are also above the SAI-Ind.

DNB	dinitrobenzene
DNT	dinitrotoluene
EPC	exposure point concentration
GWP-Ind	soil MSC for industrial use based on groundwater protection
HI	hazard index
JL	concentration is estimated and biased low
JH	concentration is estimated and biased high
mg/kg	milligrams per kilogram
MSC	medium-specific concentration
SAI-Ind	soil MSC for industrial use based on inhalation, ingestion and dermal contact
TNT	trinitrotoluene

Samples of soil (29SB81 – 29SB85) were collected near the wooden TNT wastewater line in 2004 and were analyzed for explosives (**Appendix A**). **Table 2-6** lists the detected explosive concentrations in the samples from the soil near the TNT wooden wastewater line. The concentrations were all below their associated EPC. These concentrations were also compared to both the SAI-Ind and GWP-Ind, and no exceedances were found in the soil near the wooden TNT wastewater line. The sample locations are shown on **Figure 2-5**.

Table 2-6
Explosive Compounds Detected in Soil Samples near Wooden TNT Wastewater Line

Explosive	EPC from Risk Assessment (mg/kg)	SAI-Ind (mg/kg)	GWP-Ind (mg/kg)	Concentration (mg/kg)	Sample Location	Associated Depth
2,4,6-TNT	190 (associated HI of 0.77)	510	5.1	0.43	29SB83	4-5 ft bgs
2-amino-4,6-DNT	25 (associated HI of 0.33)	170	1.7	0.23 J 0.9	29SB85 29SB85	4-5 ft bgs 8-9 ft bgs
4-amino-2,6-DNT	16 (associated HI of 0.21)	170	1.7	0.30 J	29SB85	8-9 ft bgs

Abbreviations:

DNT	dinitrotoluene
EPC	exposure point concentration
ft bgs	feet below ground surface
GWP-Ind	soil MSC for industrial use based on groundwater protection
HI	hazard index
J	concentration is estimated
mg/kg	milligrams per kilogram
MSC	medium-specific concentration
SAI-Ind	soil MSC for industrial use based on inhalation, ingestion and dermal contact
TNT	trinitrotoluene

2.3.3.2 Cooling Water Lines

LHAAP-29 was constructed with two vitrified clay cooling lines as shown on **Figure 2-5,** referred to as the north and south cooling water lines. These lines are accessible through manholes. Liquid and solid residue from these manholes were sampled in 2004 (**Appendix A**). 1,3,5-TNB; 2,4,6-TNT; 2,4-DNT; 2,6-DNT; 2-amino-4,6-DNT; and 4-amino-2,6-DNT were detected. None of the detected explosives were above the EPCs in the risk assessment. The detected results were also compared to the GWP-Ind. Several explosives were detected above the GWP-Ind in both the north and south cooling lines. The detected concentration of 1,3,5-TNB (0.440 mg/kg) at MH02 was less than the GWP-Ind of 310 mg/kg and is not shown on **Table 2-7**.

Table 2-7
Summary of Solid Residue Sample Results from Cooling Water Lines

Explosive	EPC from Risk Assessment (mg/kg)	GWP-Ind (mg/kg)	Concentration* (mg/kg)	Sample location	Associated line
2,4,6-TNT	190 (associated HI of 0.77)	5.1	11 7 5.5	MH02 MH10 MH08	S Cooling N Cooling N Cooling
2,4-DNT	--	0.042	0.71 1.1	MH08 MH10	N Cooling N Cooling
2,6-DNT	--	0.042	0.24 J 0.30 J	MH10 MH08	N Cooling N Cooling
2-amino-4,6-DNT	25 (associated HI of 0.33)	1.7	3.8 J 2.4 J 9	MH02 MH09 MH10	S Cooling N Cooling N Cooling
4-amino-2,6-DNT	16 (associated HI of 0.21)	1.7	2.6 J 2.5 J 7.8	MH02 MH09 MH10	S Cooling N Cooling N Cooling

Notes and Abbreviations:

* Concentrations included in table are above the GWP-Ind.

DNT	dinitrotoluene
EPC	exposure point concentration
GWP-Ind	soil MSC for industrial use based on groundwater protection
HI	hazard index
J	concentration is estimated
mg/kg	milligrams per kilogram
MSC	medium-specific concentration
TNT	trinitrotoluene

Liquid samples were also collected from the cooling water line manholes. The detected explosives in the water in the manholes of both the north and south lines included 1,3,5-TNB, 2,4,6-TNT, 2,4-DNT, 2,6-DNT, 2-amino-4,6-DNT, and 4-amino-2,6-DNT. **Table 2-8** lists the detected liquid samples that were above the GW-Ind. For MH09, there were two sets of samples collected (2004 and 2005). Though some of the results from the 2005 sampling round are lower than the GW-Ind, they have been included in **Table 2-8**. Both the north and south cooling lines have sample results that indicate the liquid within the cooling water lines are above the GW-Ind.”

Table 2-8
Explosive Compounds Detected in Liquid Samples from Cooling Water Lines

Explosive	EPC from Risk Assessment (µg/l)	GW-Ind (µg/l)	Concentration (µg/l)	Sample location	Associated line
2,4,6-TNT	--	51	250	MH01	South
			84.3 JL	MH05	South
			430	MH06	South
			5200	MH09 (12/04)	North
			20	MH09 (2/05)	North
2,4-DNT	530 (HI=2.6)	0.42	15	MH01	South
			0.8 J	MH09 (12/04)	North
			1.13	MH09 (2/05)	North
			1.05	MH10	North
			0.922 J	MH11	North
			0.934 J	MH12	North
2,6-DNT	530 (HI=5.2)	0.42	4.1	MH01	South
			27	MH09 (12/04)	North
			1.27	MH09 (2/05)	North
			1.35	MH10	North
			1.15	MH11	North
			1.31	MH12	North
2-amino-4,6-DNT	5.9 (HI=0.35)	17	220	MH09 (12/04)	North
			1.68	MH09 (2/05)	North
4-amino-2,6-DNT	5.9 (HI=0.35)	17	33	MH01	South
			290	MH09 (12/04)	North
			2.42	MH09 (2/05)	North

Abbreviations:

DNT	dinitrotoluene
EPC	exposure point concentration
GW-Ind	groundwater MSC for industrial use
HI	hazard index
J	concentration is estimated
JL	concentration is estimated and biased low
MSC	medium-specific concentration
TNB	trinitrobenzene
TNT	trinitrotoluene

FINAL
FEASIBILITY STUDY
LHAAP-29, FORMER TNT PRODUCTION AREA, GROUP 2
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Prepared for

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

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Acronyms and Abbreviations

°C	degrees Celsius
°F	degrees Fahrenheit
µg/L	micrograms per liter
AOC	area of contamination
AR	Administrative Record
ARARs	applicable or relevant and appropriate requirements
AST	aboveground storage tank
BERA	baseline ecological risk assessment
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
CLI	Caddo Lake Institute
COCs	contaminants of concern
COPECs	contaminants of potential ecological concern
CWA	Clean Water Act of 1972
cy	cubic yards
DCA	dichloroethane
DNAPL	dense non-aqueous phase liquid
DNT	dinitrotoluene
EcoPRG	ecological preliminary remediation goal
EEQ	ecological effects quotient
ELCR	excess lifetime cancer risk
EPC	exposure point concentration
ESA	environmental site assessment
FFA	Federal Facility Agreement
FR	Federal Register
FS	Feasibility Study
g/L	grams per liter
GAC	granulated activated carbon
GRAs	general response actions
GW-Ind	groundwater MSC for industrial use
GWP-Ind	soil MSC for industrial use based on groundwater protection
HI	hazard index
HMX	octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
HQ	hazard quotient

Acronyms and Abbreviations (continued)

IRP/DSERTS	Installation Restoration Program/Defense Site Environmental Restoration Tracking System
LHAAP	Longhorn Army Ammunition Plant
LOAEL	lowest-observed adverse effect level
LUCs	land use controls
MARC	Multiple Award Remediation Contract
MC	methylene chloride
MCLs	maximum contaminant levels
mg/kg	milligrams per kilogram
MNA	monitored natural attenuation
MSC	Medium-Specific Concentration
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAEL	no-observed adverse effect level
NPL	National Priorities List
O&M	operation and maintenance
OSHA	Occupational Safety and Health Administration
pH	hydrogen ion concentration
PP	Proposed Plan
PPE	personal protective equipment
PVC	polyvinyl chloride
RAOs	remedial action objectives
RCRA	Resource Conservation and Recovery Act
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SAI-Ind	soil MSC for industrial use based on inhalation, ingestion and dermal contact
Shaw	Shaw Environmental, Inc.
STEP	Solutions to Environmental Problems, LLC
SVOC	semivolatile organic compound
SWMU	solid waste management unit
TAC	Texas Administrative Code
TBC	to-be-considered
TCDD	tetrachlorodibenzo-p-dioxin
TCE	trichloroethene
TCEQ	Texas Commission on Environmental Quality
TNB	trinitrobenzene

Acronyms and Abbreviations (continued)

TNT	trinitrotoluene
TRV	toxicity reference value
TSD	treatment, storage, and disposal
USACE	U.S. Army Corps of Engineers
U.S. Army	U.S. Department of the Army
USC	United States Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Services
VOC	volatile organic compound
ZVM	zero-valence metals

Executive Summary

This Feasibility Study (FS) was prepared by Shaw Environmental, Inc. (Shaw), for the U.S. Army Corps of Engineers (USACE), Tulsa District, under the Louisville District's Multiple Award Remediation Contract (MARC) No. W912QR-04-D-0027, for remediation activities on the former Longhorn Army Ammunition Plant (LHAAP) in Karnack, Texas. This FS presents the analysis of remediation alternatives for the Former Trinitrotoluene (TNT) Production Area, designated as LHAAP-29, in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), and provides for the remedy selection consistent with the intended use of LHAAP as a national wildlife refuge.

LHAAP is an inactive, government-owned, formerly contractor-operated and maintained Department of Defense facility located in central-east Texas. LHAAP-29 is a heavily wooded, 85-acre site in the western-central portion of the LHAAP installation. The site is currently inactive, but once contained five active and one standby TNT production lines. The area still contains the foundations for the former production facilities and the underground pipe lines that were originally built for cooling water drainage and TNT wastewater conveyance.

The entire installation was under the control of the U.S. Department of the Army (U.S. Army) until May 5, 2004, when approximately two thirds of the property was transferred to the U.S. Department of Interior's Fish and Wildlife Service (USFWS). The U.S. Army Environmental Command provides funding for the environmental remedial activities. The Base Realignment and Closure Division is responsible for all aspects of LHAAP including the environmental programs, operations, and land transfer.

Surface runoff from the northern part of the site (about 40 percent of the site area) enters Goose Prairie Creek located approximately 1,500 feet to the north and east of the site. In the southern portion of the site (about 60 percent of the site), surface runoff flows into a tributary of Central Creek located near the southeast portion of the site. Via these two creeks, the runoff from LHAAP-29 eventually enters Caddo Lake.

There are three groundwater zones at LHAAP-29: shallow, intermediate and deep. The bottom of each of the zones is defined by a continuous or semi-continuous clay layer of varying thickness. The predominant flow of both the shallow and intermediate groundwater zones is to the east/northeast.

Sampling specific to LHAAP-29 media was conducted during several investigations prior to and after the human health risk assessment (Jacobs, 2002). The baseline human health risk assessment (Jacobs, 2002) indicates a hazard for the hypothetical future maintenance worker with a hazard index of 1 from soil and 3,000 from groundwater. There is no unacceptable cancer risk to the hypothetical future maintenance worker from soil at LHAAP-29, but the cancer risk from groundwater is 1.3×10^{-4}, which is outside the United States Environmental Protection Agency (USEPA) target risk range of 1×10^{-6} to 1×10^{-4} for the excess lifetime cancer risk.

Additional investigations were conducted after the risk assessment was completed. The additional data do not change the overall outcome of the risk assessment, but did change some of the contaminants of concern (COCs). Although COCs have been detected in the shallow and intermediate groundwater zones beneath LHAAP-29, the horizontal extent of contamination is not widespread and appears to be isolated to a few specific areas at the site. The COCs identified for soil are 2,4,6-TNT, 2,4-dinitrotoluene (DNT), and perchlorate. The COCs identified for the shallow groundwater zone are 1,2-dichloroethane (DCA), trichloroethene (TCE), 2,4-DNT, 2,6-DNT, 2-nitrotoluene, 3-nitrotoluene, 4-nitrotoluene, and perchlorate. The COCs in the intermediate zone are methylene chloride (MC), 1,2-DCA, and TCE.

An ecological conceptual exposure model was developed for various “sub-areas” throughout the LHAAP as part of the *Final Facility-Wide Baseline Ecological Risk Assessment* (BERA) (Shaw, 2007b). Ecological hazards were found to be acceptable for the Industrial Sub-Area that includes LHAAP-29; however, elevated concentrations of nitrotoluenes (TNT, 2,4-DNT and 2,6-DNT) were identified at one location at the site. Further data determined that analysis identified the nitrotoluenes at this one location and the adjacent area possibly represent a small area of highly elevated concentrations (i.e., a hot spot) that could pose a threat to small-range ecological receptors (Shaw, 2007b). Therefore, nitrotoluenes are considered as contaminants of potential ecological concern (COPECs) for the soil at LHAAP-29.

Explosive compound releases resulting from the manufacturing process of TNT, releases from process tanks and process pipelines, are the suspected contamination sources at LHAAP-29. From 1959 to the mid 1970’s, “soak-out” of out-of-specification motors was conducted at the site using MC, and these operations along with the MC storage tank could have all had releases. Potential sources of contamination at the site are co-located wood and transite TNT wastewater pipelines, cooling water lines and manholes, explosives compounds in stained soils around the foundation of Buildings 806-A and –D, isolated perchlorate-containing soils in the northeastern portion of LHAAP-29, and TNT-contaminated sediment in the cooling water outfall ditch.

The U.S. Army recognizes USEPA’s policy to return all groundwater to potential beneficial uses, based on the non-binding programmatic expectation in the National Contingency Plan. The remedial action objectives (RAOs) for LHAAP-29, which address contamination associated with the media at the site and take into account the future uses of LHAAP streams, land, and groundwater are:

- Protect the hypothetical future maintenance worker by preventing exposure to the contaminants in the soil, sediment, transite TNT wastewater line, cooling water lines, and groundwater.
- Prevent migration of contaminants to groundwater and surface water from potential sources in the soil, sediment and process lines (TNT wastewater and cooling water).
- Protect ecological receptors by preventing exposure to the contaminated soil and sediment.
- Return groundwater to its potential beneficial uses, wherever practicable, within a reasonable time period given the particular site circumstances.

The FS identifies and screens remedial technologies and associated process options that may be appropriate for satisfying the RAOs for LHAAP-29 with respect to effectiveness, implementability and cost. Select remedial technologies and process options were carried forward after the initial screening and were combined to develop the following remedial alternatives for LHAAP-29:

- **Alternative 1 – No action.** Leaves the contaminated soil, groundwater, waste water lines in place with no remedial action or additional measures to prevent exposure to the COCs or their migration, and serves as a baseline for comparison with the other alternatives. The ‘No action’ alternative is an evaluation requirement under CERCLA.
- **Alternative 2 – Excavation and off-site disposal for soil; plug waste lines; in situ chemical oxidation, Monitored Natural Attenuation (MNA) and Land Use Controls (LUCs) for intermediate zone groundwater, and MNA and LUCs for shallow zone groundwater.** Alternative 2 excavates the contaminated soil from LHAAP-29 and addresses the former TNT wastewater and cooling water lines by plugging and abandoning the lines and manholes. This alternative reduces contamination in the intermediate groundwater zone by in situ chemical oxidation with simultaneous extraction. Implementation of MNA in both the shallow and intermediate zones would ensure that groundwater contamination concentrations and plume stability/size are monitored as the plume degrades over time. Groundwater monitoring would continue until cleanup levels are met. LUCs will restrict use of groundwater until it is returned to beneficial use.
- **Alternative 3 – Excavation and off-site disposal for soil; plug lines; intermediate zone groundwater extraction, MNA and LUCs for groundwater.** As with Alternative 2, contaminated soil is removed, the lines and manholes are plugged and abandoned. Groundwater contamination is reduced in the intermediate zone via groundwater extraction, treatment at the existing LHAAP groundwater treatment plant, and discharge into surface water in accordance with plant permit. Implementation of MNA in both the shallow and intermediate zones would ensure that groundwater contamination concentrations and plume stability/size are monitored as the plume degrades over time. Similar to Alternative 2, LUCs will be maintained until groundwater is returned to beneficial use.

Each of the alternatives was evaluated against CERCLA criteria to provide a basis for selecting a preferred alternative to be published in Proposed Plan and Record of Decision documents.

Table ES-1 summarizes the comparative analysis of the alternatives presented in this study.

Table ES-1
Comparative Analysis of Alternatives

Criteria	Alternative 1 No Action	Alternative 2 Excavation and off-site disposal for soil; plug lines; in situ chemical oxidation, MNA and LUCs for intermediate zone groundwater; and MNA and LUCs for shallow zone groundwater	Alternative 3 Excavation and off-site disposal for soil; plug lines; groundwater extraction, MNA and LUCs for groundwater
Overall protection of human health and the environment	No protection. Does not achieve RAOs.	Achieves RAOs. Protection of human health and environment provided by soil removal and remediation of groundwater COCs to cleanup levels	Achieves RAOs. Protection of human health and environment provided by soil removal and remediation of groundwater COCs to cleanup levels.
Compliance with ARARs	No compliance with chemical-specific ARARs.	Complies with all ARARs.	Complies with all ARARs.
Long-term effectiveness and permanence	Is not effective at protection of human health and the environment and does not provide permanence.	In situ chem-ox for intermediate zone should be effective and permanent; however, uncertainty exists concerning the effectiveness of in situ treatment for reducing groundwater contaminant concentrations to cleanup levels. Treatability and pilot studies would be required to further assess the effectiveness of this treatment method and a pre-design would be required to determine the optimum extraction technique configuration. Evaluation of natural attenuation suggests that contaminants are degrading naturally. MNA sampling will be conducted to confirm its effectiveness. Land use controls would be effective and reliable so long as they are maintained. Excavation of soil is effective long-term and permanent as contamination would be removed from the site and placed in a permitted landfill.	Should be effective and permanent for intermediate zone via extraction and treatment, based on the efficiency exhibited by the current groundwater treatment system. A pre-design study would be required to determine the optimum extraction technique/configuration. Evaluation of natural attenuation suggests that contaminants are degrading naturally. MNA sampling will be conducted to confirm its effectiveness. Land use controls would be effective and reliable so long as they are maintained. Excavation of soil is effective long-term and permanent as contamination would be removed from the site and placed in a permitted landfill.
Reduction of toxicity, mobility, or volume through treatment	No reduction.	Provides permanent and irreversible reduction of intermediate zone. Provides active reduction of toxicity and volume of groundwater contaminants through biological degradation component of MNA.	Extraction and treatment of contaminated groundwater intermediate zone reduces toxicity, mobility, and volume of groundwater contaminants in this area outside of natural processes. Provides active reduction of toxicity and volume of groundwater contaminants through biological degradation component of MNA.

Table ES-1 (*continued*)
Comparative Analysis of Alternatives

Criteria	Alternative 1 No Action	Alternative 2 Excavation and off-site disposal for soil; plug lines; in situ chemical oxidation, MNA and LUCs for intermediate zone groundwater; and MNA and LUCs for shallow zone groundwater	Alternative 3 Excavation and off-site disposal for soil; plug lines; groundwater extraction, MNA and LUCs for groundwater
Short-term effectiveness	No short-term impacts.	Greater potential for impacts to the community or hypothetical future maintenance worker through off-site transportation of contaminated soil. Release to environment can be controlled during construction.	Greater potential for impacts to the community or hypothetical future maintenance worker through off-site transportation of contaminated soil. Release to environment can be controlled during construction.
Implementability	Inherently implementable.	Implementable, but uncertainty exists whether in situ chemical oxidation would lower contaminant concentrations to cleanup levels. Specialized knowledge required for implementation. Use of on-site storage tanks may limit storage capacity. A groundwater treatment system is already operating at LHAAP.	Implementable. Use of on-site storage tanks may limit storage capacity. A groundwater treatment system is already operating at LHAAP. Potential exists for limited groundwater recovery which may affect ability of system to remove contaminants to cleanup levels. A pre-design study would be required.
Cost* (present worth)			
Capital	$0	$2,109,000	$1,360,000
O&M	$0	$919,000	$1,558,000
Total	$0	$3,028,000	$2,918,000
State Acceptance	This criterion will be evaluated in the Proposed Plan after state agency comments are provided.		
Community Acceptance	This criterion will be evaluated in the Proposed Plan after community comments are provided.		

Notes and Abbreviations:

** Costs have been rounded to nearest $1,000.*

ARAR	*applicable or relevant and appropriate requirement*
COC	*contaminant of concern*
LHAAP	*Longhorn Army Ammunition Plant*
LUC	*land use controls*
MNA	*monitored natural attenuation*
O&M	*operation and maintenance*
RAO	*remedial action objective*

1.0 Introduction

This Feasibility Study (FS) was prepared by Shaw Environmental, Inc. (Shaw), for the U.S. Army Corps of Engineers (USACE), Tulsa District, under the Louisville District's Multiple Award Remediation Contract (MARC) No. W912QR-04-D-0027, for remediation activities at the former Longhorn Army Ammunition Plant (LHAAP) in Karnack, Texas. This FS presents an analysis of remediation alternatives for the Former Trinitrotoluene (TNT) Production Area, designated as LHAAP-29, in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

The U.S. Army Environmental Command provides funding for the environmental remedial activities at LHAAP. The Base Realignment and Closure Division is responsible for all aspects of LHAAP including the environmental program, operations, and land transfer.

1.1 Purpose and Organization of Report

Under CERCLA, environmental cleanup decision-making follows a prescribed sequence: Remedial Investigation (RI), FS, Proposed Plan (PP), and Record of Decision (ROD). The RI serves as the mechanism for collecting data to characterize site conditions, determining the nature and extent of the contamination, and assessing risks to human health and the environment from this contamination. The investigatory element of decision making for LHAAP-29 has been completed and documented in an RI report (Jacobs, 2001) and a baseline risk assessment report (Jacobs, 2002).

The FS takes the next step of identifying and evaluating remedial solutions to the environmental problems identified for LHAAP-29. This step begins with the formulation of viable alternatives, which involves defining remedial action objectives (RAOs), general response actions (GRAs), volumes or area of media to be addressed, and potentially applicable technologies and process options. After a reasonable number of appropriate alternatives have been formulated, the alternatives undergo a detailed analysis using nine established evaluation criteria. The detailed analysis evaluates individual alternatives against the criteria and compares them with each other to gauge their relative performance. Each alternative that makes it to this stage of the analysis, with the exception of the required "No Action" alternative, is expected to be protective of human health and compliant with applicable or relevant and appropriate requirements (ARARs) (unless a waiver is justified), both threshold requirements under CERCLA. The alternatives developed in this FS address the media and contaminants of concern (COCs) at LHAAP-29 through combinations of source control and groundwater actions.

The main text of this FS is composed of the following sections:

- **Section 2**, "Risk and Site Assessment," summarizes the risk assessment approach and conclusions. It also provides the conceptual site model for LHAAP-29 and discusses the LHAAP-29 media contamination assessment.
- **Section 3**, "Remedial Action Objectives and Cleanup Levels," presents the RAOs and a discussion of cleanup levels. The chemical-, location- and action-specific ARARs are presented in this section.
- **Section 4**, "Identification and Screening of Technologies and Process Options," summarizes the rationale for selecting technologies and process options for remediation of contamination to meet the RAOs.
- **Section 5**, "Development and Description of Alternatives," presents the rationale for developing a range of alternatives as well as a description of each alternative.
- **Section 6**, "Detailed Analysis of Alternatives," evaluates, compares, and contrasts the benefits and costs of the alternatives.
- **Section 7**, "References," presents the references cited in this document.

Appendix A presents the *Investigation Results – 2004 and 2005* which summarizes the activities and results of previous investigations performed at LHAAP-29 by Shaw and USACE during 2004 and 2005 and not previously included in the Administrative Record (AR).

Appendix B presents the *Additional Investigation Data Summary Report* for various sampling activities performed at LHAAP-29 between August 2006 and February 2008 to further delineate the extent of contamination and includes the activated persulfate oxidation study report.

Appendix C presents the *Natural Attenuation Evaluation Report* which provides an evaluation of natural attenuation of groundwater contaminants at LHAAP-29.

Appendix D presents tables and field documentation for sampling events in October 2008, January 2009, and June 2009.

Appendix E presents the cost estimates for the remedial action alternatives.

The preferred alternative for LHAAP-29 will be presented in the PP. The PP will briefly summarize the alternatives studied in this FS, highlighting the key factors that led to identifying the preferred alternative. The U.S. Department of the Army (U.S. Army) will submit the PP to the regulatory agencies, Texas Commission on Environmental Quality (TCEQ) and the U.S. Environmental Protection Agency (USEPA), and then the public for review. After this review, the U.S. Army will release a ROD that documents the selected remedy, certifies that the remedy selection process was carried out in accordance with CERCLA, and addresses public comments on the PP. Relevant documentation, including the RI, FS, and subsequent documents, are or will be available to the public in the AR for this project. The AR is housed at LHAAP and at the Marshall Public Library in Marshall, Texas.

1.2 Longhorn Army Ammunition Plant Background

1.2.1 Location

The LHAAP is an inactive, government-owned, formerly contractor-operated and -maintained industrial facility located in central-east Texas in the northeastern corner of Harrison County. The installation occupies nearly 8,416 acres between State Highway 43 at Karnack, Texas, and the western shore of Caddo Lake as shown in **Figure 1-1**.

The nearest cities are Marshall, Texas, approximately 14 miles to the southwest, and Shreveport, Louisiana, approximately 40 miles to the east. Caddo Lake, a large freshwater lake situated on the Texas-Louisiana border, bounds LHAAP to the north and east. The industries in the surrounding area consist of agriculture, timber, oil and natural gas production, and recreation.

1.2.2 History

LHAAP was established in December 1941, near the beginning of World War II, when the U.S. Army issued a contract to build a six-line production facility for manufacturing TNT. Various media have been contaminated 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 (TCE) and methylene chloride (MC). Waste management included sanitary wastewater treatment, industrial wastewater treatment, holding/evaporation ponds, storm water drainage, sanitary and contaminated waste landfills, and demolition/burning grounds. Discharges and releases to surface water, groundwater, and other secondary media have occurred from the historical operations and practices.

LHAAP was placed on the National Priorities List (NPL) August 9, 1990. A Federal Facility Agreement (FFA) among the USEPA, the U.S. Army, and the Texas Natural Resources Conservation Commission, now the TCEQ, became effective December 30, 1991. LHAAP became inactive in July 1997, and a year later the U.S. Army issued a contract to remove salvageable property. On May 5, 2004, the U.S. Army transferred approximately 5,032 acres to the U. S. Fish and Wildlife Service (USFWS) for management as the Caddo Lake National

Wildlife Refuge. Approximately 800 acres have been transferred to the USFWS since the initial transfer and the process will continue as response is completed at individual sites. The remaining land is under the U.S. Army's control and includes the Group 2 and 4 sites currently undergoing remedial investigation/feasibility study (RI/FS) studies. The U.S. Army intends to transfer this land to the USFWS after the environmental response is completed.

1.2.3 LHAAP-29 Site Summary

1.2.3.1 Operational History

LHAAP-29 was originally listed as an NPL site in the FFA due to threatened releases of hazardous substances, pollutants or contaminants. LHAAP-29 is a heavily wooded, 85-acre site in the western-central portion of the LHAAP installation **(Figure 1-2)**. The site is bounded by Avenue E on the southwest, Zeugner Drive (also known as 1st Street) on the northwest, and 18th Street on the southeast (**Figure 1-3**)**.** Avenue D serves as a portion of the northeastern boundary of LHAAP-29. LHAAP-29 includes the Former Bulk Toluene Storage Area, which is a wooded area that extends for approximately 500 feet northeast of Avenue D. The site is currently inactive, but once contained one standby and five regular TNT production lines. The area still contains the foundations of the former production facilities and the underground pipe lines that were originally built for cooling water drainage and TNT wastewater conveyance.

The production facilities at LHAAP-29 manufactured TNT from October 1942 to August 1945. The facility produced approximately 400 million pounds of flake TNT during its operation. Each production line was essentially the same and consisted of four main elements; an unloading area where acids and toluene were unloaded and held in aboveground storage tanks (ASTs) until use, a nitrating area where flake TNT was produced by nitrating toluene with nitric acid, a wash area where the flake TNT was washed to remove impurities and then dried, and an unloading area where cardboard-boxed flake TNT was loaded onto trucks (Jacobs, 2002).

The former production facilities at LHAAP-29 were served by a network of underground pipelines. The underground lines consisted of TNT wastewater (red liquor) lines and the cooling water (blue water) lines (**Figure 1-3**). The red liquor TNT wastewater line, originally solid waste management unit (SWMU) LHAAP-30 and later included as part of Installation Restoration Program/Defense Site Environmental Restoration Tracking System (IRP/DSERTS) LHAAP-29, was originally installed as a wooden pipeline. The Addendum to the Phase 2 Work Plan noted that the transite waste line was added 5 feet north of the wooden line based on a modified drawing dated March 30, 1943 (Bate Stamp 12651). The transite material is a combination of cement and asbestos. The TNT red water line was clear-flushed in 1946 (Bate Stamp 001446, Resource Conservation and Recovery Act (RCRA) Facility Assessment, April 1988). The transite pipeline was in good condition when it was unearthed in 1993 at a location approximately 400 feet northwest of the pond and at the three locations sampled along the line as part of the Shaw additional investigation in 2006. The gravity portion of the TNT wastewater line terminates in the pump house area near the intersection of 16th Street with Avenue D.

During TNT production, the wastewater was collected here and pumped through the pressure portion of the TNT wastewater line into storage tanks across Avenue D. The storage tanks and treatment facility are now known as LHAAP-32. As part of the closure, the TNT wastewater pipeline was clear flushed and abandoned in place (Plexus, 2005), and the pump house at LHAAP-29 was removed, and the soil beneath it was excavated. The excavated area subsequently filled with water, and a pond now exists at the former pump house location. The cooling wastewater was conveyed to the Neutralization House (Building 612-A) for neutralization and discharged to surface water.

Two blue cooling water lines exist at LHAAP-29, north and south (**Figure 1-3**), and range from 8 inches to 18 inches in diameter. These gravity fed lines are thought to be constructed of vitrified clay pipe with asbestos wicking. These lines collected water from each TNT washing area. Manholes exist along both the north and south cooling water lines. The northern line is connected to lines from each plant (approximately 280 feet of 10-inch-diameter pipe). The lines drain into a ditch along 16th street which eventually flows into Goose Prairie Creek.

The TNT production facility was inactive from August 1945 to 1959. In 1959, most of the buildings and ASTs were removed. The debris was burned or flashed at Burning Ground No. 2/Flashing Area (LHAAP-17). Concrete foundations, open-top concrete-lined pits, and most of the underground utilities still remain at the site.

Since the end of World War II, the only activity that has been documented to have occurred at LHAAP-29 is the “soak out” of out-of-specification rocket motors. This took place from 1959 to the mid-1970s and involved the use of Turco®, a MC-based industrial solvent, at tank 801-F. Waste from this operation was sent to LHAAP-18/24 (Jacobs, 2001).

1.2.3.2 Surface Water Hydrology

The terrain of the site generally slopes toward the east and south from a topographic high at the intersection of Zeugner Drive (1st Street) and Avenue E, near the location of former Production Line A. Most of the surface runoff is collected by ditches constructed in 1942 when the production facility was built. Separate drainage ways were constructed for each production line, and these drain to the southeast toward 18th Street. Surface runoff from the northern part of the site (about 40 percent of the site area) enters Goose Prairie Creek located approximately 1,500 feet to the north and east of the site. In the southern portion of the site (about 60 percent of the site), surface runoff flows into a tributary of Central Creek located near the southeast portion of the site (**Figure 1-2**). Via these two creeks, the runoff from LHAAP-29 eventually enters Caddo

Lake. Goose Prairie and Central Creeks, like all drainage systems at LHAAP, are intermittent (Jacobs, 2001).

1.2.3.3 Hydrogeology

Based on investigations, there are three groundwater zones at LHAAP-29: shallow, intermediate, and deep. Clay or silty clay layers separate the three groundwater zones. The shallow groundwater zone has wells that are screened at two depths (shallow and lower shallow); however, the wells have similar water level elevations and are all considered to be shallow zone wells. The depth of the shallow groundwater zone generally ranges from 17 to 45 feet below ground surface (bgs) because of variable ground surface elevations across the site. The intermediate zone is less defined, but its depth has been measured to approximately 88 feet bgs. The deep groundwater zone extends to a depth of approximately 155 feet bgs. The predominant flow of both the shallow and intermediate groundwater zones is to the east/northeast based on November 2007 water levels.

Groundwater in the deep zone under and near LHAAP is currently used as a drinking water source. There are currently five active water supply wells near LHAAP. Known depths of these wells range from 313 to 430 feet bgs and are at least 4,000 feet away from LHAAP. Water removal from these wells is not expected to affect groundwater flow at the site because of the remote locations of these wells from LHAAP and their depth of completion. In addition, there are several livestock and domestic wells located in the vicinity of LHAAP with depths averaging 250 feet. There are three water supply wells located on LHAAP, and they supply water to the buildings currently in use on the installation. None of these wells is used for drinking water. Two additional wells previously supplied water to the installation, but these have been plugged and abandoned. None of the potable water supply wells are associated with or are in imminent danger from the localized contaminated groundwater at any of the Group 2 sites, including LHAAP-29.

1.3 Sampling Investigations at LHAAP-29

The environmental media (soil, groundwater, surface water, sediment, and residue in process water lines) at LHAAP-29 have been the subject of numerous investigations to identify potential contamination and are summarized in **Table 1-1**. These include the Pre-RI investigations by Environmental Protection Systems in 1982 and 1987; the Phase I, Phase II, and Phase III RIs conducted by Jacobs in 1993, 1995, and 1998, respectively; the site-wide perchlorate investigation conducted by Solutions To Environmental Problems, Inc. (STEP) in 2002 and the Environmental Site Assessment (ESA) activities performed by Plexus in 2003. Additional samples were not collected in the ESA, but soil staining was noted around Buildings 806-A and 806-D (Plexus, 2005). Reports mentioned above are included in the AR for the LHAAP.

Between 2004 and 2005, several follow-up investigations at LHAAP-29 were performed by Shaw and USACE to further delineate the extent of contamination identified during the previous sample events. These sample events include the data gaps investigation by Shaw in the spring and summer of 2004 (Shaw, 2007a); additional explosives and perchlorate sampling by Shaw in December 2004 and February 2005 (**Appendix A**), and explosives sampling by USACE at a building foundation in February 2005 (**Appendix A**). A summary of activities and analytical results for the 2004 through 2005, Shaw and USACE sample events, is presented in the *Investigation Results – December 2004 and February 2005 (*(**Appendix A**).

Between August 2006 and February 2008, Shaw conducted additional investigation activities for various environmental media at LHAAP-29. The objective of this sampling event was to collect samples of the transite wastewater line residual contents, sediment samples along the former cooling water ditch, and groundwater from existing and newly installed monitoring wells to further delineate the extent of contamination at the site. A summary of activities and data results for these sample events are included in the *Additional Investigation Data Summary Report* (**Appendix B**).

In October 2008 and January 2009, additional groundwater samples were collected and analyzed for metals and volatile organic compounds (VOCs) in the shallow and intermediate zones.

In June 2009, one new monitoring well (29WW41) was installed and sampled for VOCs to determine whether groundwater in the upper deep zone immediately below the highest MC concentration in the intermediate zone (at 29WW16) showed any evidence of contamination. Well 29WW41 was screened at a depth of 102.5 to 117.5 feet bgs. A groundwater sample was collected for VOC analysis. This deeper well was installed to evaluate the potential downward migration of contaminants in the intermediate zone. Only VOCs have been identified as COCs in the intermediate zone, and thus the sample was analyzed for VOCs.

The sample locations from all phases of investigations performed at LHAAP-29 are presented on **Figures 1-4** through **1-7** for soil, sediment and surface water, and groundwater, respectively.

1.4 Additional Evaluations at LHAAP-29

The baseline ecological risk assessment (BERA) was completed in February 2007 (Shaw, 2007b). The BERA concluded there is an ecological impact in an isolated area at LHAAP-29, as discussed in **Section 2.2**.

Appendix B includes the Activated Persulfate Oxidation Treatability Study Report completed by Shaw in 2006 to evaluate the effectiveness of chemical oxidation using activated sodium persulfate to treat the MC groundwater plume in the intermediate zone. The treatability study concluded that heat- and alkaline-activated persulfate oxidation was the best treatment evaluated for the reduction of MC.

In February 2007, monitored natural attenuation (MNA) was evaluated by Shaw as a potential site remedy at LHAAP-29. The results and conclusions of the assessment are included in the *Natural Attenuation Evaluation* for LHAAP-29 presented in **Appendix C**.

In February 2007, Shaw issued a modeling report that concluded the VOC contaminants in the shallow zone will not reach Central Creek. The model indicates that even though perchlorate reaches the creek, the concentration in surface water will be below the surface water action level (Shaw, 2007c). Thus, there is no impact of surface water from the shallow groundwater at LHAAP-29.

Table 1-1
Summary of Investigations at LHAAP-29

Pre-Phase I (Jacobs, 2001)
LHAAP Plant Contamination Survey Environmental Protection System, June 1984
• Six monitoring wells were installed and sampled (114 to 119) • Four surface water and four sediment samples were collected (stations 005-008) • Eight soil samples were collected within the former TNT production area
Final Remedial Investigation Report for LHAAP, Karnack, Texas, Environmental Protection System, May 1988
• Six groundwater samples were collected from existing monitoring wells • Thirty-five soil boreholes were sampled at the 0-0.5’, 1-1.5’, 2-2.5’ and 3-3.5’ intervals • Four surface water and four sediment samples were collected
Phase I – Phase III (Jacobs, 2001)
Jacobs, Phase I, 1993
• Eighteen surface water and 18 sediment samples were collected (29SW01-29SW18 and 29SD01-29SD18) • Seventy-five soil samples were collected from borings 29SB01-29SB15 • Four waste line samples were collected • Groundwater samples were collected from the existing wells 114-119
Jacobs, Phase II, 1995
• Three surface water and three sediment samples were collected (29SW19-29SW21 and 29SD29-29SD21) • Forty-four soil samples were collected from borings 29SB53-29SB76 • Four waste line samples and six waste line associated soil samples were collected • Eleven monitoring wells were installed (29WW01 – 29WW11) and groundwater was collected from each new well and from six existing wells (114-119)
Jacobs, Phase III, 1998
• Ten surface water and ten sediment samples were collected (29SW22-29SW31 and 29SD22-29SD31) • Fourteen soil samples were collected from borings 29SS01 - 29SS08 • Twenty-two monitoring wells were installed (29WW12-29WW33) and groundwater was collected from each new well and from 17 existing wells (114-119 and 29WW01-29WW11)
Additional Investigations
• Collected 56 soil samples and 72 groundwater samples for perchlorate analysis in 2000 through 2002 (STEP, 2005) • Soil staining verified TNT through field tests at 2 locations (Plexus, 2005) • USACE sampling of stained soil (Appendix A, Table A-5) • Collected 10 soil samples from borings (29SB81-29SB85) for explosives, and 12 soil samples from borings (29SB86-29SB89) for perchlorate in 2004. (Appendix A) • Collected 8 solid residue samples from manholes and 3 sediment samples from ditches (up through 29SD46) for explosives analysis in 2004. (Shaw, 2007a) • Collected groundwater samples from 20 wells for explosives, VOCs and perchlorate in 2004. (Shaw, 2007a) • Collected groundwater samples from 41 wells for explosives, VOCs and perchlorate in 2005. (Shaw, 2007a) • Collected 3 sediment samples from ditches (29SD47-29SD49), 3 solid residue samples from the transite waste line for explosives analysis, and 1 deep soil sample (29WW40) for VOCs analysis in 2006. (Appendix B) • Six monitoring wells were installed (29WW35-29WW40) and 15 groundwater samples were collected for volatiles, 11 for general chemistry, and 2 for perchlorate in 2006. (Appendix B) • Collected 2 groundwater samples from 29WW37 and 29WW39 for VOCs analysis in February 2008. (Appendix B) Collected groundwater samples from 5 wells for natural attenuation evaluation (biological, VOCs, explosives, gases, general chemistry) in 2007. (Appendix C) • Collected 20 additional groundwater samples for metals and VOCs in 2008 (Appendix D) • Installed new well, 29WW41, in the upper deep zone and sampled the well for VOCs (Appendix D)

PLOT DATE: 1/10/08
FORMAT REVISION 5/13/02

IMAGE	X-REF	OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		DRAWING NUMBER
TYLER(250_000)	---	Houston, Texas	J. RDZ	1/10/08	D. CRISPO	1/10/08	P. SRIVASTAV	1/10/08	117591-A2

LEGEND:

🟥 LHAAP SITE BOUNDARY

MILES
0 5 10

REFERENCE:
U.S.G.S. QUADRANGLE OF
TYLER, TEXAS; LOUISIANA 1956, REVISED 1977
SCALE 1:250,000

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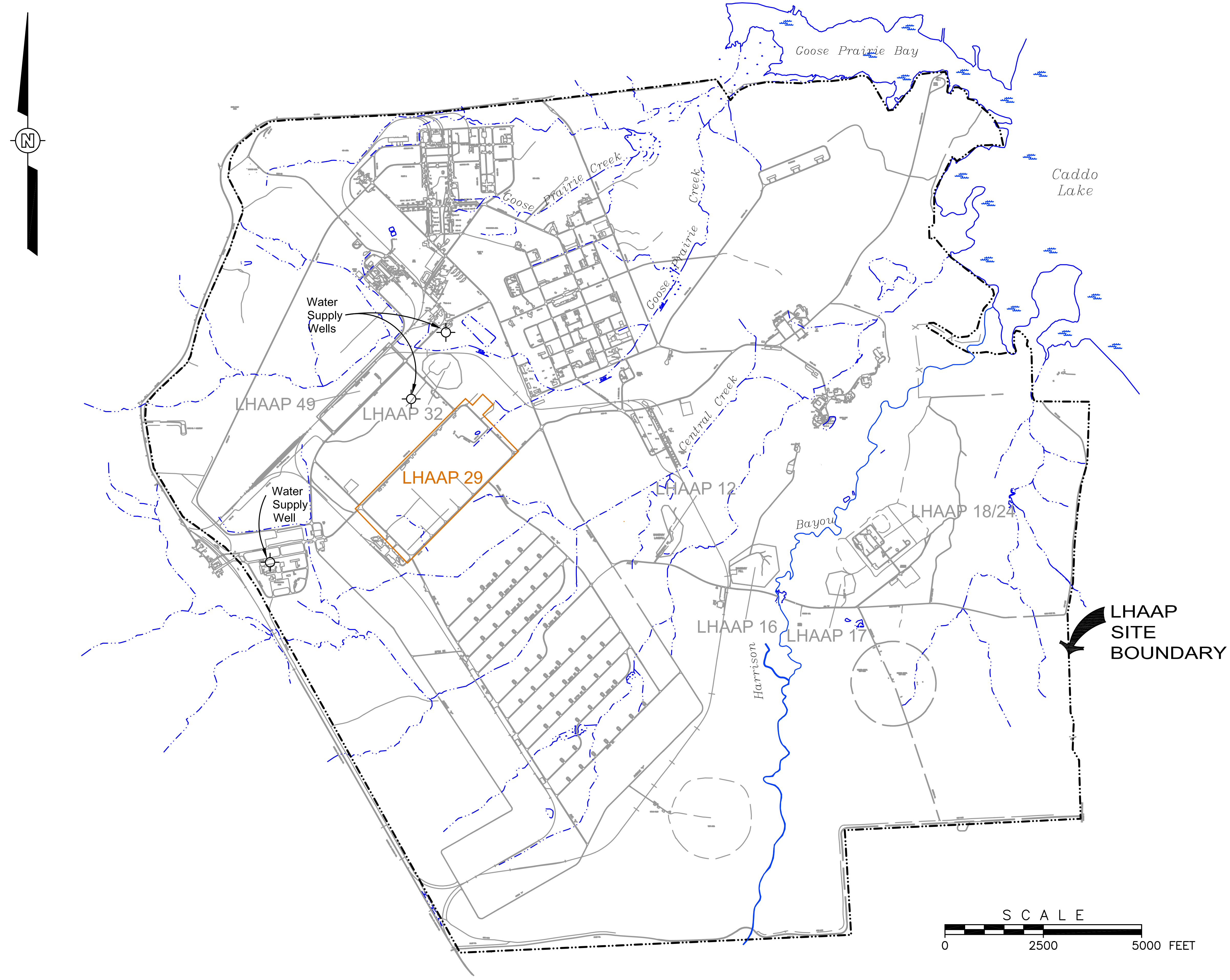
TULSA DISTRICT
TULSA, OKLAHOMA

FIGURE 1-1

LHAAP LOCATION MAP
LHAAP-29 FEASIBILITY STUDY

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS



LHAAP GROUP 2 SITES

LHAAP 12	LANDFILL 12
LHAAP 16	LANDFILL 16
LHAAP 17	BURNING GROUND No. 2 AND FLASHING AREA
LHAAP 18/24	BURNING GROUND No. 3/ UNLINED EVAPORATION POND
LHAAP 29	FORMER TNT PRODUCTION AREA
LHAAP 32	FORMER TNT WASTE DISPOSAL AREA
LHAAP 49	FORMER ACID STORAGE AREA

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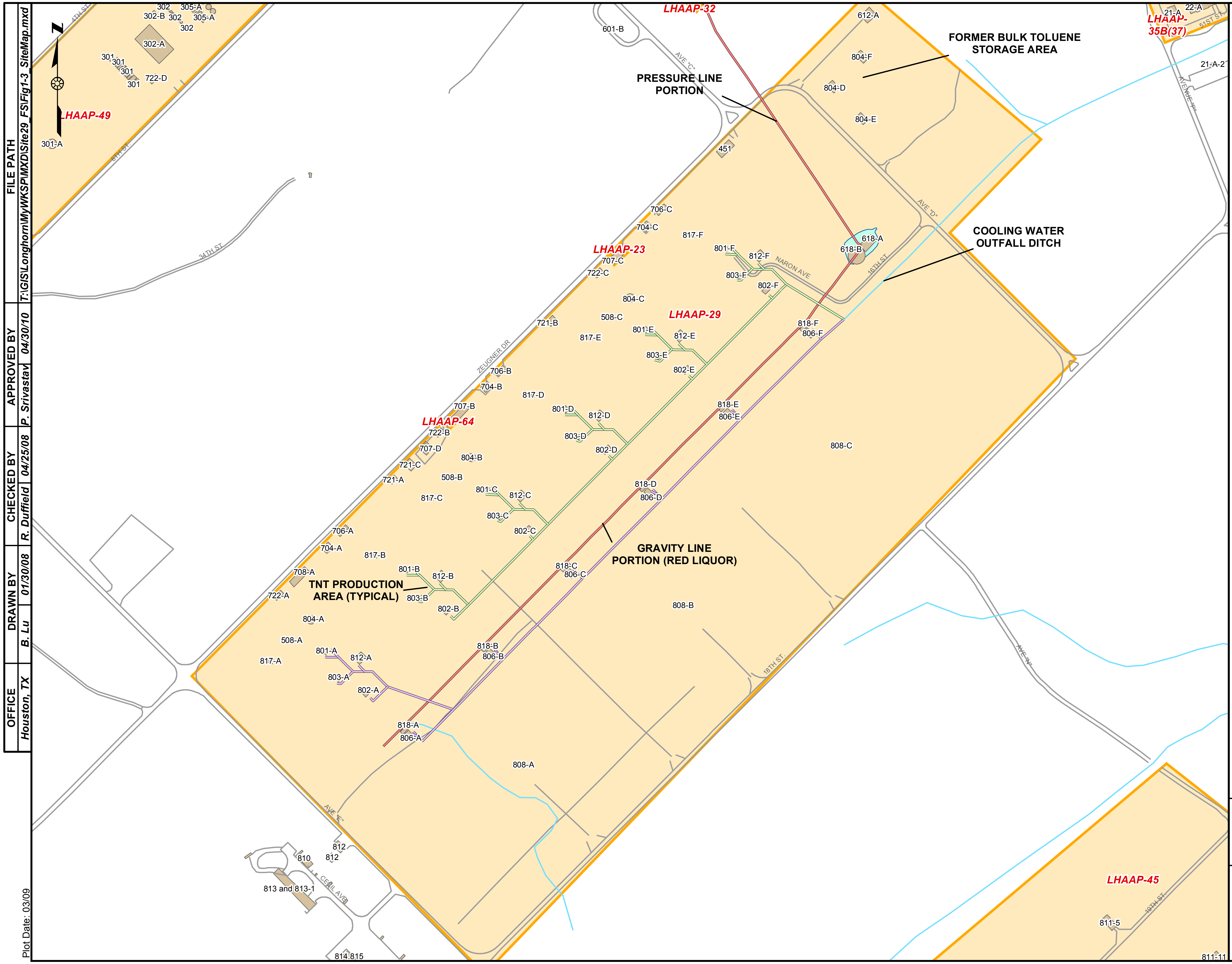
TULSA, OKLAHOMA

FIGURE 1–2
SITE LOCATION MAP–GROUP 2 SITES
LHAAP–29 FEASIBILITY STUDY
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

DRAWING NUMBER 117591–B1
APPROVED BY P. SRIVASTAV 03/09/09
CHECKED BY S. WATSON 03/09/09
DRAWN BY J. RDZ 1/23/06
OFFICE Houston, Texas
X–REF BASE
IMAGE ---

PLOT DATE: 1/10/08
FORMAT REVISION 3/25/99



LEGEND

🟪	TNT Cooling Water Drain Line (South)
🟩	TNT Cooling Water Drain Line (North)
🟥	TNT Wastewater Lines (Wood/Transite)
—	Stream
—	Road
▨	Former Building or Concrete Slab
▨	Pond
▨	Site

Former Buildings and Structures in or Adjacent to LHAAP-29

Structure or Building Number	Description	Materials Handled
Original Use (1942-1945)		
451	Compressed Air Plant	- - -
508-A to -C	Start-Up Mixed Acid Storage	Acids
612-A	Neutralization House	Cooling water from production (blue water)
618-A	Pump House	TNT waste water (red liquor)
618-B	Wooden Storage Tank	TNT waste water (red liquor)
704-A to -C	Supervisor's Office	- - -
706-A to -C	Solvent Storage Building and/or Powder Magazine	Solvents
707-B to -D	Change House	- - -
708-A	Garage Building	- - -
721-A to -C	Inspector's Office	- - -
722-A to -C	Paint Shop	- - -
801-A to -F	Mono-Nitrating House	Toluene, nitrotoluene, nitric acid, sulfuric acid
802-A to -F	Tri-Nitrating House	Dinitrotoluene, TNT, nitric acid, sulfuric acid
803-A to -F	Bi-Nitrating House	Nitrotoluene, dinitrotoluene, nitric acid, sulfuric acid
804-A to -C	Toluene Working Storage	Toluene
804-D to -F	Toluene Tank	Toluene
806-A to -F	Wash House	TNT, caustic soda, sellite, residual acids, TNT wastewater (red liquor), yellow liquor
808-A to -C	Nail House	TNT, boxes, nails
812-A to -F	Acid & Fume Recovery House	Nitric acid fumes, recovered acid
817-A to -F	Oleum Storage	Oleum
818-A to -F	Barricade	- - -
Subsequent Use		
707-C	General Purpose Warehouse	- - -
801-F	Rocket Motor Soak-Out Facility	Out-of-specification rocket motors containing composite propellants (e.g. polysulfide perchlorate), methylene chloride-based industrial solvent, liquid solvent waste, lubricants, polymers, fuels

- - - Not documented

Reference: *Environmental Site Assessment, Phase I and II Report* (Plexus, 2004)

Notes:

1. Manholes located along the TNT cooling water drain line.
2. 806 series buildings are wash houses and generated red liquor.

0 205 410 820
Feet

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TULSA, OKLAHOMA

FIGURE 1-3

SITE MAP
LHAAP-29 FEASIBILITY STUDY

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
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Plot Date: 03/09

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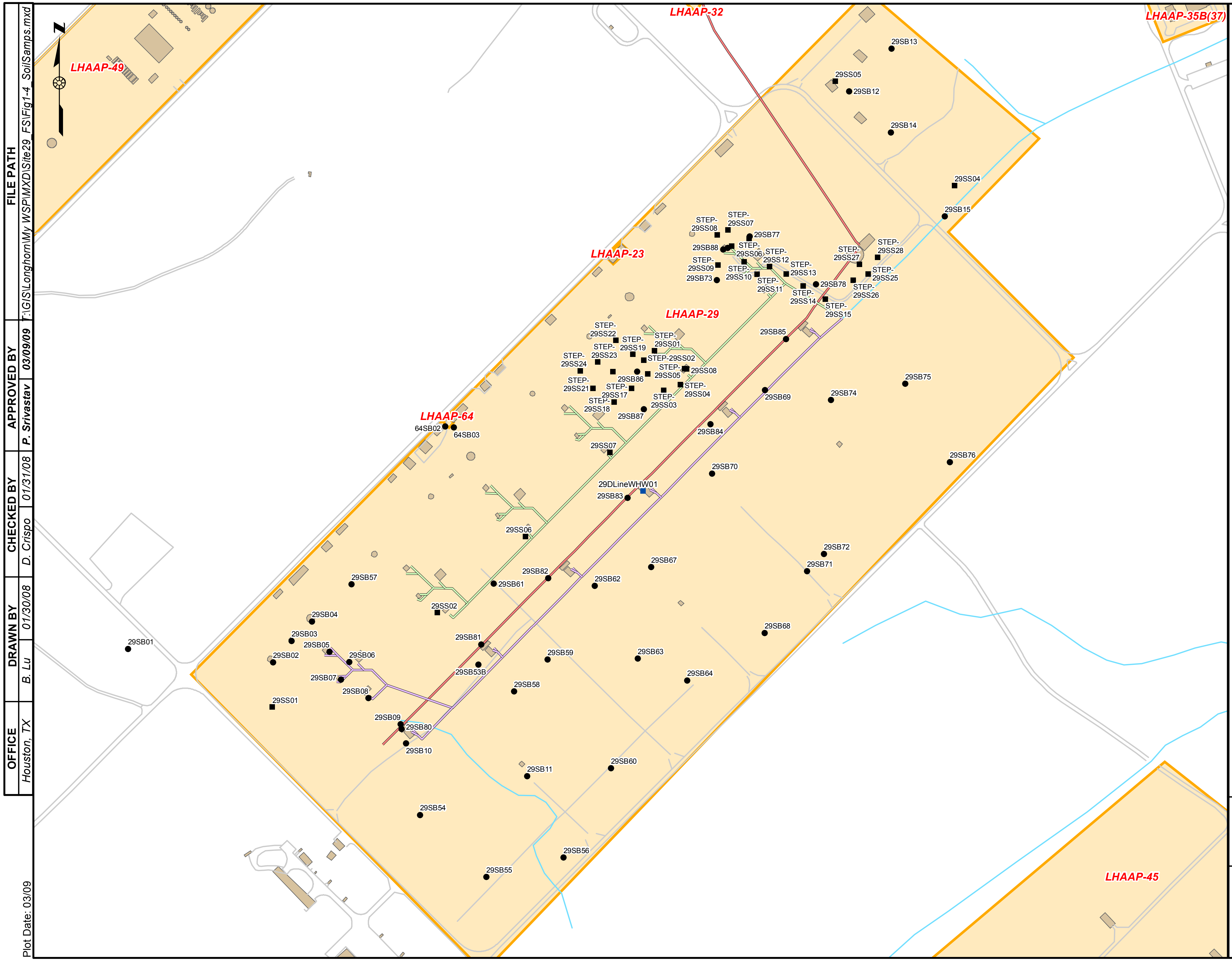

LEGEND

Sample Locations

● Soil Boring

■ Surface Soil

■ Approximate Surface Soil Sample Location

━ TNT Cooling Water Drain Line (South)

━ TNT Cooling Water Drain Line (North)

━ TNT Wastewater Line

━ Stream

━ Road

▨ Former Building or Concrete Slab

▨ Site

Note:

Soil sample locations from all investigation phases.

0 200 400 800
Feet

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FIGURE 1-4

SAMPLE LOCATIONS - SOIL
LHAAP-29 FEASIBILITY STUDY

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Plot Date: 03/09

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
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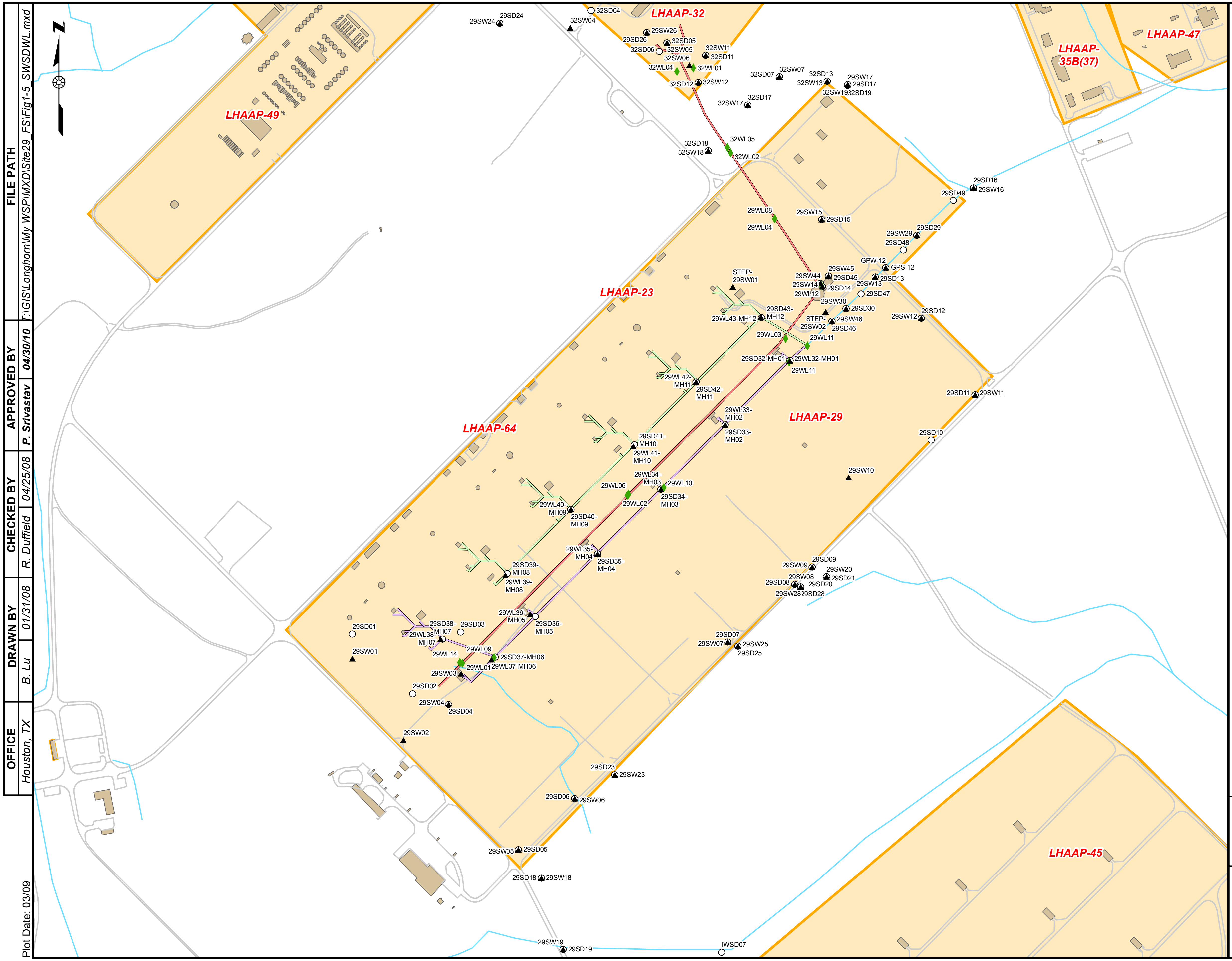
Plot Date: 03/09



LEGEND

▲	Surface Water Sample
○	Sediment Sample
◆	Water Line Sample
═	TNT Cooling Water Drain Line (South)
═	TNT Cooling Water Drain Line (North)
═	TNT Wastewater Line
─	Stream
─	Road
▨	Former Building or Concrete Slab
☐	Site

Note:

Sample locations from all investigation phases.

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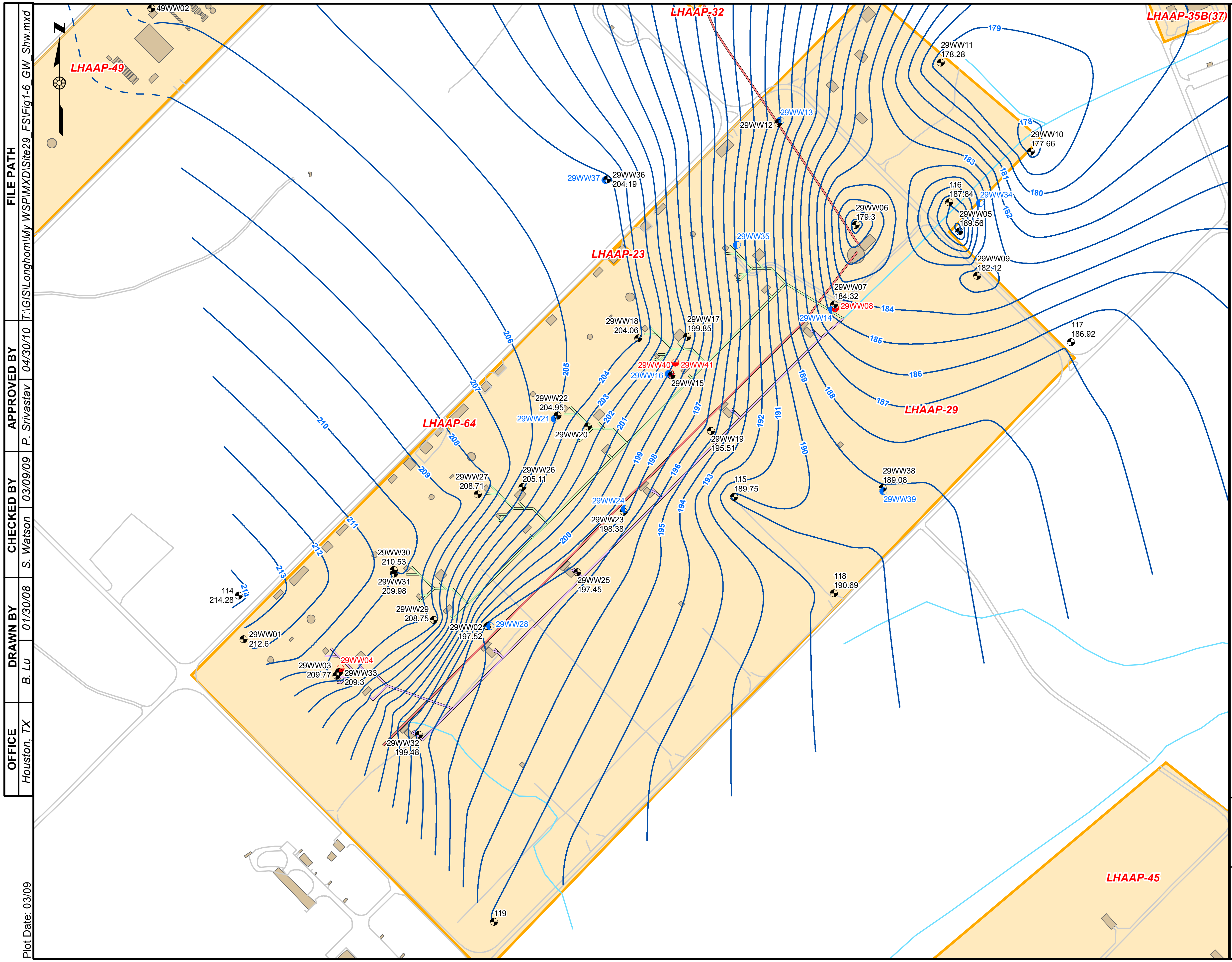
FIGURE 1-5

SAMPLE LOCATIONS - SURFACE WATER, SEDIMENT, AND WASTEWATER LINES
LHAAP-29 FEASIBILITY STUDY

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

00091149



LEGEND

◐	Shallow or Lower Shallow Monitoring Well
◐	Intermediate Monitoring Well
◐	Deep Monitoring Well
—	Groundwater Elevation Contour
- - -	Inferred Groundwater Elevation Contour
═	TNT Cooling Water Drain Line (South)
═	TNT Cooling Water Drain Line (North)
═	TNT Wastewater Line
—	Stream
—	Road
■	Former Building or Concrete Slab
□	Site

Note:

Groundwater contours are based on data collected November 29, 2007 through December 3, 2007.

0 205 410 820
Feet

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FIGURE 1-6
GROUNDWATER ELEVATION --
SHALLOW ZONE
LHAAP-29 FEASIBILITY STUDY
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

FILE PATH	APPROVED BY	CHECKED BY	DRAWN BY	OFFICE
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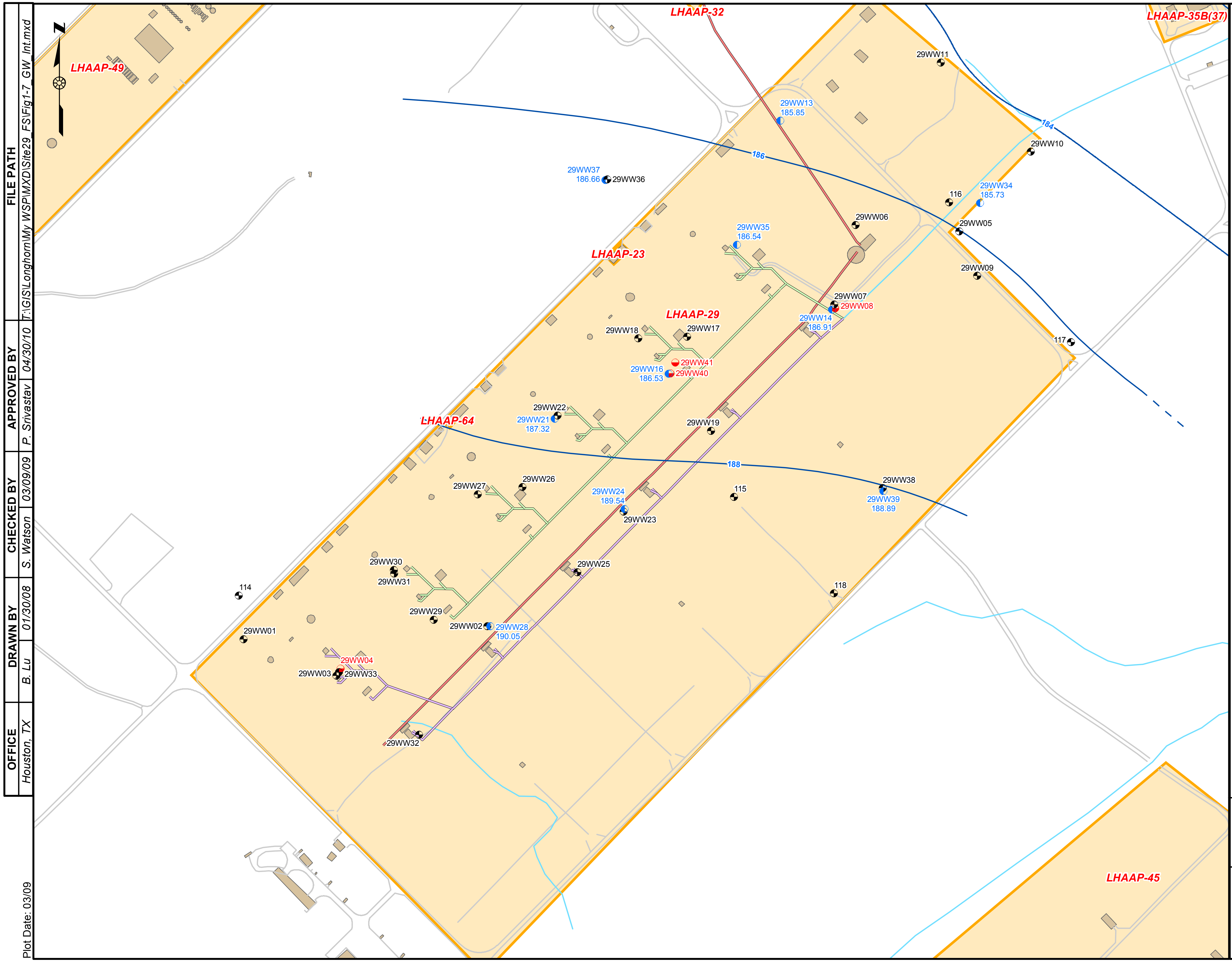
Plot Date: 03/09



LEGEND

●	Shallow or Lower Shallow Monitoring Well
●	Shallow/Intermediate Monitoring Well
◐	Intermediate Monitoring Well
●	Deep Monitoring Well
—	Groundwater Elevation Contour
- - -	Inferred Groundwater Elevation Contour
—	TNT Cooling Water Drain Line (South)
—	TNT Cooling Water Drain Line (North)
—	TNT Wastewater Line
—	Stream
—	Road
▨	Former Building or Concrete Slab
▭	Site

Note:

Groundwater contours are based on data collected November 29, 2007 through December 3, 2007.

0 205 410 820
Feet

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FIGURE 1-7

GROUNDWATER ELEVATION --
INTERMEDIATE ZONE
LHAAP-29 FEASIBILITY STUDY

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	FILE PATH
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Plot Date: 03/09

2.0 Risk and Site Assessment

This section summarizes the risk assessment approach, risk conclusions, media contamination evaluation, and the conceptual site model for LHAAP-29. Information in this section is based on data obtained from the following references:

- Group 2 Sites RI (Jacobs, 2001)
- Group 2 Sites Baseline Human Health Risk Assessment Report (Jacobs, 2002)
- Groups 2 and 4 Groundwater Data Gaps Investigation (Shaw, 2007a)
- Installation-Wide Baseline Ecological Risk Assessment (Shaw, 2007b)
- Environmental Site Assessment (Plexus, 2005)

2.1 Human Health Risk Assessment

This summary is based on the conclusions presented in the *Final Baseline Human Health and Screening Ecological Risk Assessment for the Group 2 Sites* (Jacobs, 2002). The Jacobs risk assessment presented the human health risks and hazards to a hypothetical future maintenance worker under an industrial scenario for soil and groundwater and a screening level ecological risk assessment. For the risk assessment, soil and groundwater data were used to calculate the aggregate risk values, which were then compared to the USEPA target risk range of 1×10^{-4} to 1×10^{-6} for the excess lifetime cancer risk (ELCR) and a hazard index (HI) of 1.

2.1.1 Soil

For the hypothetical future maintenance worker exposure to soil at LHAAP-29, the carcinogenic risk of 7.3×10^{-6} is within the USEPA target risk range of 1×10^{-4} to 1×10^{-6} ELCR, but the non-carcinogenic hazard has an HI of 1. Chemicals in soil with a hazard quotient (HQ) greater than 0.1 are listed in **Table 2-1**.

2.1.2 Groundwater

For the hypothetical future maintenance worker's exposure to the groundwater at LHAAP-29, the carcinogenic risk and non-carcinogenic hazard exceed the acceptable limits. Groundwater chemicals with unacceptable risk were also compared to their associated Safe Drinking Water maximum contaminant levels (MCLs), if applicable. The total carcinogenic risk from groundwater for a hypothetical future maintenance worker is 3.9×10^{-1}. The total HI is 3,000. Chemicals with a risk greater than 1×10^{-6}, and a HQ greater than 0.1 are listed in **Table 2-2** and **Table 2-3,** respectively. The data were evaluated to determine if the chemical should be retained as a COC as shown in **Table 2-2** and **Table 2-3**.

2.2 Ecological Risk Assessment

The *Final Installation-Wide Baseline Ecological Risk Assessment* (Shaw, 2007b) evaluated potential hazards to ecological resources at LHAAP by conducting a screening evaluation to identify initial contaminants of potential ecological concern (COPEC) in the individual sub-areas and watersheds. The potential of these COPECs to adversely affect communities was evaluated for (1) organisms that have direct contact with the COPECs (e.g., plants and earthworms growing and living in contaminated soil); and (2) organisms that may be exposed to the chemicals via food chain pathways (e.g., ingestion of an earthworm living in the contaminated soil by a shrew). Potential impacts to invertebrate and plant communities were evaluated by comparing COPEC concentrations to benchmark values available from multiple literature sources. For the food chain exposure assessment, a number of measurement receptors were selected as representative species for the various trophic levels in the food web that could be at risk from contaminants in site media. The measurement receptors that were selected and used in the food chain evaluation included the following:

- Deer Mouse
- Raccoon
- Modified Raccoon (as a surrogate for the Louisiana Black Bear)
- Short-Tailed Shrew
- Red Fox
- Muskrat
- River Otter
- Townsend’s Big-Eared Bat
- Common Snapping Turtle
- Bank Swallow
- American Woodcock
- Belted Kingfisher
- Red-Tailed Hawk

A food chain model was developed and used to estimate the total dose for each measurement receptor based on species-specific considerations such as diet, body weight, ingestion rates, etc., using conservative exposure estimates. Ecological hazard estimates were developed based on exposure to all media including soil in a particular sub-area and surface water and sediment from any watersheds present in the sub-areas. Two different soil depths were used for modeling exposure to ecological receptors: surface soil (0 to 0.5 foot) and total soil (0 to 3 feet). Each receptor was assumed to be exposed to one of the two depths based on its life history characteristics (e.g., burrowing animals were assumed to be exposed to total soil). Bioaccumulation of chemicals up the food chain was initially estimated using uptake factors obtained from available literature, and then refined using site-specific data obtained during the BERA.

Ecological effects quotients (EEQ) were developed for each of the measurement receptors. EEQs are similar to HQs for human health, and are calculated by dividing the total dose that the receptor is exposed to by the toxicity reference value (TRV), which is based on a no-observed adverse effect level (NOAEL) or the lowest-observed adverse effect level (LOAEL) concentration. If the EEQ exceeds 1 for a receptor (based on the NOAEL TRV), then that chemical is considered to have a realistic potential to cause adverse ecological impacts, and is identified as a final COPEC that should be addressed either through remediation or further investigation. As discussed in the BERA, there are several important uncertainties associated with the assumptions used in the EEQ process, and it should be noted that EEQs greater than 1 do not necessarily mean that ecological impacts have occurred, or are occurring.

For the Industrial Sub-Area (which includes LHAAP-29) four chemicals were selected as final COPECs: cadmium, chromium, zinc, and perchlorate. After that selection, additional sampling data became available, and further analysis was performed, leading to the calculation of ecological preliminary cleanup levels (EcoPRGs) for several chemicals in soil. The final COPECs that were initially selected were found to not be of concern and EcoPRGs were calculated for six other chemicals: barium, lead, 2,4-dinitrotoluene (DNT), 2,6-DNT, TNT, and 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD).

Ecological hazards were found to be acceptable for the Industrial Sub-Area that includes LHAAP-29; however, elevated concentrations of nitrotoluenes (TNT, 2,4-DNT and 2,6-DNT) were identified at one location at the site (Shaw, 2007a). Although nitrotoluenes were not selected in the Industrial Sub-Area as final COPECs due to low frequency of detection and other considerations, the BERA evaluated measurement receptors and included a spatial analysis at this sample location at LHAAP-29. The results of this analysis identified that the nitrotoluenes at this location and the adjacent areas may represent a small area of highly elevated concentrations (i.e., a hot spot) that could pose a threat to small-range ecological receptors either through acute toxicity, or as a source area for downgradient surface water transport of contamination (Shaw, 2007b). Therefore, the nitrotoluenes are considered as COPECs at LHAAP-29. The maximum nitrotoluene concentrations identified in the upper three feet of soil at LHAAP-29 are compared to EcoPRGs in **Table 2-4**.

With the exception of the nitrotoluene hot spot near sample location 29SD46 along the former cooling water outfall ditch, ecological hazard was determined to be within acceptable limits in the Industrial Sub-Area, and therefore within LHAAP-29. The soil in the former cooling water outfall ditch is thought to be contaminated as a result of deposition, spills, and/or runoff of contamination on the surface. This residual contamination poses a potential risk to ecological receptors due to the direct contact with soil and indirect (i.e., dietary) exposure routes. The principal ecological risk drivers for the soil in the ditch are TNT and its breakdown products.

2.3 Evaluation of Data Collected Since the Risk Assessment

The risk assessment was completed using data from the samples through February 2001 for groundwater and through 1998 for soil samples. Since that time, additional groundwater and soil samples have been collected and analyzed.

2.3.1 Soil

Additional soil samples were collected during the perchlorate investigation in 2002 (STEP, 2005), during the data gaps investigation in 2004 (Shaw, 2007a), and in the USACE 2005 sampling of stained soil at Wash Building 806-D (**Appendix A**). The following text discusses chemicals that were detected in the 2004 and 2008 investigations (after the risk assessment) with concentrations higher than their associated exposure point concentration (EPC) used in the risk assessment.

From the data gaps investigation, the maximum perchlorate concentration detected in soil was 8.6 milligrams per kilogram (mg/kg) in sample 29SB86-002 (Shaw, 2007a). This is greater than the EPC for perchlorate of 0.0703 mg/kg used in the risk assessment, with an associated HQ of 8.1×10^{-5} (Jacobs, 2002). Using ratios of the HQ to the perchlorate concentrations, the HQ for the maximum concentration of perchlorate detected since the risk assessment would yield a HQ of 0.0099. Thus, perchlorate in soil does not pose a hazard to human health. However, perchlorate is a contaminant in the groundwater. The most recent soil sample with a perchlorate concentration of 8.6 mg/kg exceeds the soil medium-specific concentration (MSC) for industrial use based on groundwater protection (GWP-Ind) (TCEQ, 2006) of 7.2 mg/kg for perchlorate. Thus, perchlorate in soil will be carried as a COC with the potential to migrate to groundwater.

The maximum 2-amino-4,6-DNT concentration detected in soil from the data gaps investigation was 48 mg/kg in sample 29SD46 (Shaw, 2007a). This is greater than the EPC for 2-amino-4,6-DNT of 25 mg/kg used in the risk assessment with an associated HQ of 0.33 (Jacobs, 2002). Using ratios of the HQ to the 2-amino-4,6-DNT concentrations, the HQ for the maximum concentration of 2-amino-4,6-DNT detected since the risk assessment would yield a HQ of 0.63, still less than 1.0 and not carried as a COC.

The maximum 2,4-DNT concentration detected in soil was 8,000 mg/kg in sample 29SD46 collected during the data gaps investigation (Shaw, 2007a). The risk assessment EPC for 2,4-DNT was 6.2 mg/kg, with an associated HQ of 0.0053 (Jacobs, 2002). Using ratios of the HQ to the 2,4-DNT concentrations, the HQ for the maximum concentration of 2,4-DNT detected since the risk assessment would yield a HQ of 6.8, which is unacceptable. Thus, 2,4-DNT will be carried as a COC for human health. The higher recent maximum also caused 2,4-DNT to be selected as a COPEC.

The additional detected soil sample results were less than the EPCs and do not change the conclusion of the risk assessment that soil poses an unacceptable total HI. The recent results indicate that 2,4-DNT and perchlorate should be added as COCs. **Figure 2-1** shows areas of soil contamination.

2.3.2 Groundwater

Additional groundwater samples have been collected since the risk assessment and analyzed for explosives, perchlorate, VOCs, semivolatile organic compounds (SVOCs), and attenuation parameters (**Appendices B** and **C**). No new chemicals were detected that would change the listed chemicals in **Table 2-2** or **Table 2-3**. Eight chemicals, (MC, 1,2-dichloroethane [DCA], 2,4-DNT, 2,6-DNT, arsenic, TCE, 2,3,7,8-TCDD, and chloroform) had a carcinogenic risk greater than 1×10^{-6}. Seventeen additional chemicals, (perchlorate, 4-nitrotoluene, 2-nitrotoluene, nickel, 3-nitrotoluene, aluminum, antimony, barium, selenium, manganese, vanadium, thallium, 2-amino-4,6-DNT, 4-amino-2,6-DNT, strontium, silver and cadmium) had an HQ greater than 0.1. **Figures 2-2** through **2-4** show areas of groundwater contamination.

The EPCs for 2,3,7,8-TCDD and chloroform were less than the MCLs and these chemicals were not retained as COCs.

Additional Sampling 2008 and 2009

In October 2008, groundwater samples were collected and analyzed for (1) VOCs in the intermediate wells within the VOC plume and (2) for metals in all three zones since the last sampling round for metals was conducted in 1998.

Four intermediate wells were sampled for VOCs. Prior to sampling, VOCs were found in two wells, but after the latest round only one well, 29WW16, had high VOC detections. Of the VOCs, MC has the highest concentration at 10,300,000 micrograms per liter (µg/L), which is approximately 50% of saturation. Thus, based on this data, the plume boundary in the intermediate zone is shrinking. **Figure 2-4** shows the plume in the intermediate zone.

Seventeen wells from all three groundwater zones were sampled for metals in October 2008. It was suspected that sampling methodology may have influenced the historic results showing elevated levels of metals. The 2008 results were generally lower than previous results and many of the chemicals were excluded as COCs, as noted on **Tables 2-2** and **2-3**. However, nickel, arsenic and selenium still indicated a risk or hazard, and mercury and chromium were detected at concentrations above their MCLs.

Of the 80 nickel samples collected since 1993, nickel was detected above the groundwater MSC for industrial use (GW-Ind) of 2,000 µg/L in only 3 samples. Prior to 2008, the nickel concentration in only one well had an associated HQ greater than 1 (8,400 µg/L at 29WW11 in April 1995). The 2008 result from this well had a concentration of 40 µg/L. In 2008, the highest nickel concentration was found at 29WW07 with 3,190 µg/L and would have an HQ greater than 1.0. Previous results for 29WW07 were less than 40 µg/L in May 1995 and 600 µg/L in July 1998. Thus, high nickel concentrations in individual wells have not been repeatable or consistently detected. The isolated high nickel concentrations at 29WW07 and 29WW11 coincided with elevated chromium concentrations (i.e., above the MCL of 100 µg/L for chromium), indicating that corrosion of the stainless steel well material is a likely source of the high nickel concentrations. The extent of nickel in groundwater will be assessed site-wide during remedial design.

Of the 80 arsenic samples collected since 1993, arsenic was detected above the MCL of 10 µg/L in only 7 samples. Four of the elevated results (115, 29WW16, 29WW20, and 29WW25) were obtained in 1998 or before. It was suspected that the elevated concentrations could be a result of sampling methodology and/or turbid samples. In 2008, nineteen additional samples were collected including the two wells with the highest historic concentrations (59 µg/L at shallow well 29WW25 and 44 µg/L at intermediate well 29WW16). The wells were redeveloped prior to sampling. In 2008, only 3 samples (116, 29WW08, and 29WW25) had arsenic concentrations above the MCL. The well with the highest concentration (29WW25) had high turbidity (237.1 nephelometric turbidity units) and was noted to be reddish brown. This sample result is questionable due to the high turbidity. The next highest sample (116) was qualified as an estimated value since the field duplicate relative percent difference criteria was exceeded. It should also be noted that the aluminum concentration was high at 430 µg/L. This sample result is also questionable due to quality control issues. The third sample from deep well 29WW08 had arsenic concentrations of 40.1 µg/L with a high aluminum concentration of 713 µg/L. The high aluminum concentrations in the same sample indicates that the arsenic may be naturally occurring. Additionally, this deep well is clustered with a shallow well, 29WW07, and intermediate well, 29WW14, neither of which has had an arsenic detection. Thus, the contamination is not from vertical migration. The extent of arsenic in groundwater will be assessed site-wide during remedial design.

Of the 80 selenium samples collected since 1993, selenium was only detected above the MCL of 50 µg/L in one shallow zone well, 118. The selenium concentrations have fluctuated over the years. The most recent concentration has an associated adjusted HQ of 0.15. Therefore, selenium is not considered a COC.

Of the 80 mercury samples collected since 1993, mercury has been detected only twice, both in shallow zone Well 118. The latest round from 2008 detected mercury at 6.1 µg/L in Well 118 –

higher than the previous result of 3 µg/L in 1993. The MCL for mercury is 2 µg/L. In 1995 and 1998, mercury was not detected (less than detection limit of 0.2 µg/L) in Well 118. Mercury is not detected in any other well, and the detections are intermittent and appear to be isolated. Well 118 is located along the southern edge of the site, away from active industrial areas that are possible sources. Mercury was detected at low concentrations in three soil samples (29SB04, 29SB12 and 29SB55) and one sediment sample (29SD13), but all of these locations are more than 1,500 feet from Well 118. Sample results from wells located between the soil sample locations and Well 118 did not detect mercury. Soil and sediment samples near Well 118 (29SD08, 29SD09, 29SB71, and 29SB72) did not show any detectable mercury, so the mercury in groundwater is not related to the mercury in soil. Additionally, the Final Baseline Human Health and Screening Ecological Risk Assessment for Group 2 Sites (Jacobs, 2002) calculated a HI of 0.098 for mercury in groundwater using the maximum mercury value of 3 µg/L. Adjusting this HI for the new higher maximum of 6.1 µg/L gives an HI of 0.20, still less than 1.0. The extent of mercury in groundwater will be assessed site-wide during remedial design.

Of the 84 chromium samples collected through January 2009, chromium has been detected several times. However, the higher concentrations that exceed the MCL are less frequent and are typically not reproducible in a well. Some of the wells sampled in 2008 with concentrations greater than the MCL were cloudy, murky or reddish/brown and four of these wells were resampled in January 2009. Of the four wells sampled, only one had a chromium concentration above the MCL. The wells at LHAAP-29 are stainless steel with stainless well screens. At three other LHAAP sites (LHAAP-12, LHAAP-49, and LHAAP-53) where chromium concentrations had isolated occurrences above the MCL, a collocated polyvinyl chloride (PVC) well was installed. In most cases, chromium concentrations in the PVC well were much lower and below MCLs. The isolated chromium concentrations above the MCL are not indicative of wide-spread contamination in the groundwater and could be attributable to well materials and sampling methodology. Additionally, no risk was identified from chromium. Thus, chromium is not considered a COC at LHAAP-29.

A sample was collected from the newly installed well, 29WW41, in the upper deep zone and analyzed for VOCs, which were not detected in the sample. Therefore, groundwater in the upper deep zone is not affected by VOCs.

Tables 2-2 and **2-3** have been revised to reflect the new data and adjusted HQs for individual chemicals. **Appendix D** contains the table of the results and analytical data reports from the October 2008, January 2009, and June 2009 sampling events.

The results obtained from the post risk assessment groundwater samples do not alter the risk assessment conclusion that groundwater poses risk. The results do remove some of the potential

COCs listed in the risk assessment and confirm the MC plume is stable. The post risk assessment data was used to determine the COCs as indicated on **Tables 2-2** and **2-3**.

2.3.3 Process Lines

At LHAAP-29 there are red liquor TNT wastewater lines (transite and wooden) and blue cooling water lines with manholes (north and south). It should be noted that the explosives sample results from Phase I and Phase II (29WL01 through 29WL11) were deemed unusable for environmental decision making per USEPA (Jacobs, 2002). Additional investigations were conducted for both lines since the risk assessment (**Appendices A** and **B**).

2.3.3.1 TNT Wastewater Lines

During the Phase I Remedial Investigation, the transite TNT wastewater line was found at 29WL04 and 32WL02 but was not found near 29WL01, 29WL02, and 29WL03. This investigation also noted that the wood stave line was found to be soft and severely weathered. Soil samples (29SB81 through 29SB85) were collected in 2004 along the wastewater line near the wash house sumps to check for contamination possibly leaking from the wooden wastewater line into the surrounding soil (**Appendix A**). In 2006, the transite line was found approximately 5-feet north of the wooden line location and sampled near original locations 29WL01 (2006 sample ID 20WL14), 29WL02 (2006 sample ID 29WL13), and 32WL02 (2006 sample ID 32WL05) (**Appendix B**).

The risk assessment contained soil EPC values for 2,4,6-TNT (190 mg/kg), 2-amino-4,6-DNT (25 mg/kg), and 4-amino-2,6-DNT (16 mg/kg). The other explosives were not detected. In 2006, the sample results for 2,4,6-TNT at 29WL13 was above the EPC. The results of the other two explosives were below their EPCs. For evaluation of the additional data collected in 2004 and 2006, the results were compared to soil MSC for industrial use (SAI-Ind) and GWP-Ind values. There were several explosives detected in the transite wastewater line that were above the GWP-Ind. **Table 2-5** summarizes the solid residue sample results from within the TNT transite wastewater line that are above the GWP-Ind. Only two explosives (2,4,6-TNT and 2,4-DNT) had concentrations above the SAI-Ind in the solid residue from within the pipe. The explosive sample results above the SAI-Ind in the solid residue from within the transite pipe are shaded in **Table 2-5**. The sample locations are shown on **Figure 2-5**.

Samples of soil (29SB81 – 29SB85) were collected near the wooden TNT wastewater line in 2004 and were analyzed for explosives (**Appendix A**). **Table 2-6** lists the detected explosive concentrations in the samples from the soil near the TNT wooden wastewater line. The concentrations were all below their associated EPC. These concentrations were also compared to both the SAI-Ind and GWP-Ind, and no exceedances were found in the soil near the wooden TNT wastewater line. The sample locations are shown on **Figure 2-5**.

2.3.3.2 Cooling Water Lines

LHAAP-29 was constructed with two vitrified clay cooling lines as shown on **Figure 2-5,** referred to as the north and south cooling water lines. These lines are accessible through manholes. Liquid and solid residue from these manholes were sampled in 2004 (**Appendix A**). 1,3,5-trinitrobenzene (TNB); 2,4,6-TNT; 2,4-DNT; 2,6-DNT; 2-amino-4,6-DNT; and 4-amino-2,6-DNT were detected. None of the detected explosives were above the EPCs in the risk assessment. The detected results were also compared to the GWP-Ind Several explosives were detected above the GWP-Ind in both the north and south cooling lines. The detected concentration of 1,3,5-TNB (0.440 mg/kg) at MH02 was less than the GWP-Ind of 310 mg/kg and is not shown on **Table 2-7**.

Liquid samples were also collected from the cooling water line manholes. The detected explosives in the water in the manholes of both the north and south lines included 1,3,5-TNB, 2,4,6-TNT, 2,4-DNT, 2,6-DNT, 2-amino-4,6-DNT, and 4-amino-2,6-DNT. **Table 2-8** lists the detected liquid samples that were above the GW-Ind. For MH09, there were two sets of samples collected (2004 and 2005). Though some of the results from the 2005 sampling round are lower than the GW-Ind, they have been included in **Table 2-8**. Both the north and south cooling lines have sample results that indicate the liquid within the cooling water lines was above the GW-Ind.

2.4 Media Contamination Assessment

Chemicals in the soil and groundwater at LHAAP-29 pose an unacceptable risk to human health. Chemicals in soil may also have the potential to leach into groundwater, or have an unacceptable risk to ecological receptors. Evaluation of data generated after the risk assessment did not identify any additional COCs with risks exceeding the USEPA target risk level of 1×10^{-4} or an HQ greater than 0.1 as shown on **Table 2-1**, **Table 2-2,** and **Table 2-3**.

2.4.1 Soil

Based on the human health risk assessment, soil at LHAAP-29 poses an unacceptable non-carcinogenic hazard to a hypothetical future maintenance worker at LHAAP under an industrial scenario.

Soil contaminants identified as having an HQ greater than 0.1 in the risk assessment are listed in **Table 2-1**. From the additional investigation, 2,4-DNT was detected at higher concentrations than the EPC and resulted in an HQ greater than 1. Soil contaminants identified as posing ecological risks are listed in **Table 2-4**. The emerging contaminant, perchlorate, was detected at concentrations higher than the GWP-Ind. Thus, the COCs and COPECs for the LHAAP-29 soil are three explosives (2,4,6-TNT, 2,4-DNT and 2,6-DNT) and perchlorate.

Soil contamination from explosives that pose human health risks (2,4,6-TNT and 2,4-DNT) at LHAAP-29 is shown on **Figure 2-1**. The area around 29SD46 is the only area to pose human health risks and has rough rectangular dimensions of 120 feet by 20 feet to a depth of 1 foot for a total volume of 90 cubic yards (cy).

The one perchlorate exceedance of the GWP-Ind is also plotted on **Figure 2-1** so that the correlation between perchlorate in soil and groundwater can be seen. The perchlorate area has rough dimensions of a 100 foot diameter circle around location 29SB86 to a depth of 10 feet for a total volume of 2,900 cy.

Soil contamination from three explosives that pose ecological risks (2,4,6-TNT, 2,4-DNT and 2,6-DNT) are shown on **Figure 2-1**. In addition to the area around location 29SD46, the following areas exceed the EcoPRGs:

- 60-foot diameter circular area around 29SB08 (Building 802-A)
- Stained soil area around Building 806-D (sample location 29DLineWHW01) and Building 806-A
- 150 foot by 20 foot area around locations 29SD13, 29SB15, and GPS-12 (cooling water ditch north of Avenue D)

The rough volume for these areas is 200 cy around 29SB08, 30 cy around 29DLineWHW01, and 440 cy around 29SD13, 29SB15, and GPS-12 for a total of 670 cy.

2.4.2 Groundwater

Based on the human health risk assessment, groundwater at LHAAP-29 poses an unacceptable carcinogenic risk and non-carcinogenic hazard to a hypothetical future maintenance worker at LHAAP under an industrial scenario.

Groundwater contaminants identified to have a risk greater than 1×10^{-6} are listed in **Table 2-2**. The COCs listed in **Table 2-2** for the LHAAP-29 groundwater are MC, 1,2-DCA, 2,4-DNT, 2,6-DNT, and TCE, due to their contribution to risk or exceedance of their respective MCLs. Other contaminants listed on **Table 2-2** are not considered COCs since the EPC or more recent data indicates lower concentrations that are below their MCL.

Groundwater contaminants with a HQ greater than 0.1 are listed in **Table 2-3**. Many detected chemicals have an MCL, but did not show unacceptable risk or hazard. For the chemicals without MCLs, the GW-Ind was used for evaluation. The COCs identified in **Table 2-3** for the LHAAP-29 groundwater are MC, perchlorate, 1,2-DCA, 4-nitrotoluene, 2-nitrotoluene, 2,6-DNT, TCE, 3-nitrotoluene, and 2,4-DNT due to the contribution to HI and exceedance of their respective MCLs. Other contaminants listed on **Table 2-3** are not considered COCs for various reasons including more recent data indicating concentrations less than the EPC or the MCL or newer data indicating a reduction in the HQ.

Thus, the COCs for groundwater at LHAAP-29 are three VOCs (MC, 1,2-DCA, and TCE), five explosives (2,4-DNT, 2,6-DNT, 4-nitrotoluene, 2-nitrotoluene, and 3-nitrotoluene), and perchlorate. **Table 2-9** lists these COCs and indicates their most recent maximum concentration in the shallow and intermediate zones. Based on the comparison of the maximum concentration to their associated MCL or GW-Ind, these COCs have been identified to be of concern in the shallow and/or intermediate groundwater zone.

In the shallow zone, VOCs (1,2-DCA and TCE) and perchlorate are COCs with their maximum concentration located at 29WW15. The associated plumes are shown on **Figure 2-2**. The estimated volume of the perchlorate plume is approximately 4 million gallons. The nitrotoluenes are also COCs in the shallow zone and are located near 29WW06 and 116 as shown on **Figure 2-3**. The volume of the nitrotoluene plume is estimated to be approximately 9 million gallons. Three metals, nickel, arsenic and mercury, had sporadic detections above cleanup levels in certain wells and do not define a plume in the groundwater. These metals have been included as COCs.

In the intermediate groundwater zone, the COCs are limited to VOCs (MC, 1,2-DCA, and TCE). The VOC groundwater plume in the intermediate zone has the maximum concentrations at 29WW16 as indicated on **Figure 2-4**. The estimated volume of the VOC plume is approximately 21 million gallons. Groundwater volumes were estimated using a porosity of 25 percent with a thickness ranging from 5 to 10 feet.

As demonstrated by previous sample results and sampling of new monitoring well 29WW41 in June 2009, the deep groundwater zone is not affected at LHAAP-29.

2.4.3 Process Lines

Contaminated explosives residue remains within the transite TNT wastewater line at concentrations above the SAI-Ind and GWP-Ind, but access to the pipe is limited to the inlets and outlets unless the pipe is penetrated. Additionally, the line is deeper than the cleanup depth of 2 feet bgs for nonresidential use. The gravity flow portion of the line is approximately 3,000 linear feet. The pressurized portion of the line is approximately 1,000 linear feet. The line is in good condition.

The wooden TNT wastewater line was flushed and abandoned. The results from soil samples collected near the line indicate there has not been a release to the surrounding soil. Further, the line is deeper than the near-surface soil depth of 2 feet bgs considered for nonresidential use (TAC335.559(g)). Furthermore, it was noted in site documentation that no additional action is necessary for the wooden TNT wastewater line (Bate Stamp 001446).

The north and south vitrified clay cooling water lines are accessible through manholes, and the liquid and solid residue contents from the manholes were sampled. The liquid and solid residues from the manholes are contaminated with explosives at concentrations that are above the GW-Ind (liquid) and the GWP-Ind (solid residue). There are approximately 5,000 feet of pipe in the main lines, approximately 1,680 linear feet of pipe from each production area to the main line, and 12 manholes.

2.5 Conceptual Site Model

Figure 2-6 illustrates the overall conceptual site model for LHAAP-29. The model presents the human health pathways that are complete and being considered for remediation. Those pathways that are likely to be incomplete or have negligible impact are not being considered for remediation as discussed below. The ecological conceptual model for LHAAP-29 (**Figure 2-7**) is similar to the one presented for human health in terms of the origin and fate and transport mechanisms of the contaminants present at the site. However, only exposure pathways and routes associated with soil are relevant for ecological risk assessment.

Explosive compound releases resulting from the manufacturing process of TNT as well as releases from process tanks and process waste pipelines are the suspected contamination sources at LHAAP-29. The remaining potential sources of contamination at the site are the gravity line “red liquor” portions of the co-located wood and transite TNT wastewater pipelines that transported LHAAP-29 process wastes to the former pump house, explosives compounds in stained soils around the foundation of Buildings 806-A and 806-D, isolated perchlorate-containing soils in the northeastern portion of LHAAP-29 at a depth of eight (8) feet bgs, and TNT contaminated sediment in the cooling water outfall ditch at a depth of seven (7) feet bgs. Low-levels of explosives were identified in both the cooling water “blue water” drain line and the “red liquor” TNT wastewater line to be a hazard.

Contamination in the form of explosive compounds, VOCs, and perchlorate is present in groundwater at LHAAP-29 and poses potential risk to the hypothetical future maintenance worker. Explosive compounds in the shallow groundwater at LHAAP-29 are intermittent and dispersed across the site. Perchlorate and VOC concentrations have been detected consistently throughout the shallow groundwater zone. Concentrations of VOCs were detected in the intermediate groundwater zones. The most significant contaminant result is MC in the intermediate zone. The MC concentrations at 29WW16 are at approximately half the solubility, which indicates a potential for the presence of dense non-aqueous phase liquid (DNAPL). In the general vicinity of 29WW16, however, DNAPL has not been encountered. The horizontal extent of contamination in the shallow and intermediate groundwater zones appears to be isolated to a few specific locations as presented in **Figures 2-2, 2-3** and **2-4**.

The soil and groundwater at LHAAP-29 may pose a risk for the hypothetical future maintenance workers. However, no impact to surface water from groundwater was determined (Shaw, 2007c). Thus the only pathways considered for remediation are soil, soil to groundwater, and future industrial groundwater use.

Table 2-1
Chemicals with Hazard Quotient Greater than 0.1 in Soil

Chemical	Baseline Risk Assessment			Data Through 2008			Comparison Level		Retained as COC ?
	Soil Hazard Quotient [a]	EPC (mg/kg)	Soil Sample Location	Adjusted Hazard Quotient [b]	Maximum (mg/kg)	Soil Sample Location	SAI-Ind (mg/kg)	GWP-Ind (mg/kg)	
2,4,6-Trinitrotoluene	0.77	190	29SD13	105	26,000	29SD46	510	5.1	Yes, 2
2-Amino-4,6-dinitrotoluene	0.33	25	29SD13	0.63	48	29SD46	170	1.7	No, 1
4-Amino-2,6-dinitrotoluene	0.21	16	29SD13	0.21	16	29SD13	170	1.7	No, 1
2,4-Dinitrotoluene	0.0053	6.2	29SB15	6.8	8,000	29SD46	4.2	0.042	Yes, 3
Perchlorate [c]	8.1×10^{-5}	0.0703	Max from Table 3-66	0.0099	8.6	29SB86	950	7.2	Yes, 4

Notes and Abbreviations:

1. *Not identified as contaminant of concern (COC) because HQ is less than 1.0.*

2.. *Identified as COC because risk assessment HQ is almost 1 and most recent sample concentration is greater than the SAI-Ind GWP-Ind.*

3. *Identified as COC because EPC is above the SAI-Ind and GWP-Ind values and Hazard Quotient is greater than 1.0.*
4. *Identified as COC because contaminant is COC in groundwater and exceeds the GWP-Ind.*

[a] *HQ from Baseline Risk Assessment Table C-68 (Jacobs, 2002)*

[b] *calculated HQ based on the most recent maximum concentration.*

[c] *Even though HI <0.1, listed because recent maximum concentration is greater than EPC*

EPC	*Exposure Point Concentration from Baseline Risk Assessment (Jacobs, 2002)*
GWP-Ind	*Soil medium-specific concentration for industrial use based on groundwater protection*
HQ	*hazard quotient*
mg/kg	*milligrams per kilogram.*
SAI-Ind	*Soil medium-specific concentration for industrial use based on inhalation, ingestion, and dermal contact*

Table 2-2
Chemicals Contributing to Carcinogenic Risk in Groundwater

Chemical	Baseline Risk Assessment			Data Since Risk Assessment			Comparison Levels		Retained as COC ?
	Cancer Risk Groundwater [a]	EPC (µg/L)	Well	Maximum (µg/L)	Well	Adjusted Risk	MCL (µg/L)	TCEQ GW-Ind (µg/L)	
Methylene chloride	3.6×10^{-1}	6,600,000	29WW16	10,300,000	29WW16	5.6×10^{-1}	5	5	Yes, 1
1,2-Dichloroethane	2.9×10^{-2}	14,000	29WW15	<12,500	29WW16	--	5	5	Yes, 1
2,4-Dinitrotoluene	1.3×10^{-3}	530	29WW20	50.9 32.4	29WW05 29WW20	1.2×10^{-4}	--	0.42	Yes, 2
2,6-Dinitrotoluene	1.3×10^{-3}	530	29WW20	239 112	116 29WW20	5.9×10^{-4}	--	0.42	Yes, 2
Arsenic	3.1×10^{-4}	59	29WW25	141	29WW25	7.4×10^{-4}	10	10	Yes, 5
Trichloroethene	2.3×10^{-4}	1,200	29WW15	<12,500	29WW16	--	5	5	Yes, 1
2,3,7,8-TCDD	6.1×10^{-5}	1.25×10^{-5}	29WW03	NR	--	--	3.0×10^{-5}	--	No, 4
Chloroform	2.1×10^{-5}	14	29WW21	9.75 ND	29WW15 29WW21	1.5×10^{-5}	80 [b]	1,000	No, 4

Notes and Abbreviations:

1. *Identified as COC because most recent maximum concentration is above the MCL.*
2. *Identified as COC because carcinogenic risk is >10^{-4}.*
3. *Excluded because detections are isolated.*
4. *Excluded because EPC is below the MCL.*
5. *Identified as a COC subject to further verification.*

[a] *From Baseline Risk Assessment Table C-71 (Jacobs, 2002)*

[b] *MCL for total trihalomethanes was used for chloroform.*

µg/L	*micrograms per liter*
COC	*contaminant of concern*
EPC	*exposure point concentration*
MCL	*Safe Drinking Water Act maximum contaminant level*
MSC	*medium specific concentration from Updated Examples of Risk Reduction Standard No. 2, Appendix II*
NR	*not resampled for this constituent since Baseline Risk Assessment*
TCEQ GW-Ind	*Texas Commission of Environmental Quality Groundwater MSC for Industrial Use*

Table 2-3
Chemicals with Hazard Quotient Greater than 0.1 in Groundwater

Chemical	Baseline Risk Assessment			Data Since Risk Assessment			Comparison Levels		Retained as COC ?
	Hazard Quotient Groundwater [a]	EPC [a] (µg/L)	Well	Maximum (µg/L)	Well	Adjusted Hazard Quotient	MCL (µg/L)	TCEQ GW-Ind (µg/L)	
Methylene chloride	1500	6,600,000	29WW16	7,110,000	29WW16	1600	5		Yes, 1
Perchlorate	960	88,000	29WW15	16,800	29WW15	180		72	Yes, 2
1,2-Dichloroethane	490	14,000	29WW15	5,520	29WW15	190	5		Yes, 1
4-Nitrotoluene (p-)	35	2,100	29WW20	1,400 374	116 29WW20	23		1,000	Yes, 2
Chloroform	8.0	14	29WW21	9.75 ND	29WW15 29WW21	5.6	80 [b]		No, 3
2-Nitrotoluene (o-)	7.3	4,400	116	8,140	116	14		1,000	Yes, 2
2,6-Dinitrotoluene	5.2	530	29WW20	239 112	116 29WW20	2.3		0.42	Yes, 2
Trichloroethene	4.6	1,200	29WW15	344	29WW15	1.3	5		Yes, 1
Nickel	4.1	8,400	29WW11	3,190 40	29WW07 29WW11	1.6 <0.1		2,000	Yes, 9
3-Nitrotoluene (m-)	4.0	240	29WW05	451 123	116 29WW05	7.5		1,000	Yes, 2
2,4-Dinitrotoluene	2.6	530	29WW20	50.9 32.4	29WW05 29WW20	0.33		0.42	Yes, 5
Arsenic	1.9	59	29WW25	141	29WW25	4.5	10		Yes, 9
Aluminum	1.3	130,000	115	713	29WW08 [c]	<0.1		100,000	No, 6
Antimony	1.3	52	29WW09	1.45	29WW08	<0.1	6		No, 7
Barium	0.91	6,500	116	1,100 48.5 J	115 116	0.15 <0.1	2,000		No, 6
Selenium	0.68	350	118	75.3	118	0.15	50		No, 4
Manganese	0.50	2,410	115	1,310	114 [c]	0.27		14,000	No, 8
Vanadium	0.50	360	115	7.5 J	29WW04 [c]	<0.1		720	No, 8
Thallium	0.37	3.0	29WW03	0.339 J	29WW25 [c]	<0.1	2		No, 7
2-Amino-4,6-dinitrotoluene	0.35	5.9	29WW05	ND	29WW05	-		17	No, 8
4-Amino-2,6-dinitrotoluene	0.35	5.9	29WW05	16.3	29WW05	0.97		17	No, 8
Strontium	0.31	19,000	119	NR	-	-		61,000	No, 8
Silver	0.16	80	29WW09	ND	All wells resampled [c]	-		510	No, 8
Cadmium	0.12	6.23	119	1.2 1.12	115 116	<0.1 <0.1	5		No, 6

Table 2-3 *(continued)*
Chemicals with Hazard Quotient Greater than 0.1 in Groundwater

Notes and Abbreviations:

1. *Identified as COC because EPC is above the MCL*
2. *Identified as COC because HQ is > 1.0*
3. *Excluded because EPC is below the MCL*
4. *Excluded as COC because elevated concentrations are isolated. See Section 2.3.2 for further explanation*
5. *Already identified as a COC due to carcinogenic risk (Table 2-2)*
6. *More recent sample results indicate lower concentrations of chemical, reducing HQ to <1.0*
7. *More recent sample results indicate lower concentrations of chemical below the MCL*
8. *Excluded because EPC and/or most recent maximum is below the TCEQ GW-Ind MSC and HQ is <1.0*
9. *Identified as a COC subject to further verification.*

[a] *From Baseline Risk Assessment Table C-68 (Jacobs, 2002)*

[b] *MCL for total trihalomethanes was used for chloroform*

[c] *Well with maximum in Baseline Risk Assessment was dry in most recent sampling event and the identified well has the most recent maximum*

COC	*contaminant of concern*
EPC	*exposure point concentration*
HQ	*hazard quotient*
MSC	*medium specific concentration from Updated Examples of Risk Reduction Standard No. 2, Appendix II*
TCEQ GW-Ind	*Texas Commission of Environmental Quality Groundwater MSC for Industrial Use*
MCL	*Safe Drinking Water Act maximum contaminant level*
NR	*chemical not resampled in most recent sampling event*
µg/L	*micrograms per liter*

Table 2-4
Chemicals in Soil Compared to EcoPRGs

Chemical	SS EcoPRG[a] (mg/kg)	TS EcoPRG[a] (mg/kg)	Maximum[b] (mg/kg)	Retained as Contaminant of Potential Ecological Concern?
2,4,6-Trinitrotoluene	6.1	4.7	26,000	Yes
2,4-Dinitrotoluene	—	12	8,000	Yes
2,6-Dinitrotoluene	2.7	6.8	15	Yes

Notes and Abbreviations:

[a] *From Baseline Ecological Risk Assessment Table 16-1 (Shaw, 2007b).*

[b] *Maximum soil concentrations from samples collected in the upper 3 feet of soil at 29SD46 collected (Shaw, 2007a)*

EcoPRG	*Ecological Preliminary Cleanup level*
mg/kg	*milligrams per kilogram.*
SS	*surface soil from 0-0.5 feet (applicable to deer mouse)*
TS	*total soil form 0-3 feet (applicable to short-tailed shrew)*

Table 2-5
Summary of Solid Residue Sample Results from Transite TNT Wastewater Line

Explosive	EPC from Risk Assessment (mg/kg)	SAI-Ind (mg/kg)	GWP-Ind (mg/kg)	Concentration* (mg/kg)	Sample Location
2,4,6 TNT	190 (associated HI of 0.77)	510	5.1	526 58.4 17 JL	29WL13 29WL14 32WL05
2,4 DNT	--	4.2	0.042	5.15 JL 89 7.21	32WL05 29WL13 29WL14
2-amino-4,6-DNT	25 (associated HI of 0.33)	170	1.7	19 JH	29WL14
4-amino-2,6-DNT	16 (associated HI of 0.21)	170	1.7	13.3	29WL14
1,3-DNB	--	100	1	1.08	29WL13

Notes and Abbreviations:

* *Concentrations included in table are above the GWP-Ind. Shaded concentrations are also above the SAI-Ind.*

DNB	*dinitrobenzene*
DNT	*dinitrotoluene*
EPC	*exposure point concentration*
GWP-Ind	*soil MSC for industrial use based on groundwater protection*
HI	*hazard index*
JL	*concentration is estimated and biased low*
JH	*concentration is estimated and biased high*
mg/kg	*milligrams per kilogram*
MSC	*medium-specific concentration*
SAI-Ind	*soil MSC for industrial use based on inhalation, ingestion and dermal contact*
TNT	*trinitrotoluene*

Table 2-6
Explosive Compounds Detected in Soil Samples near Wooden TNT Wastewater Line

Explosive	EPC from Risk Assessment (mg/kg)	SAI-Ind (mg/kg)	GWP-Ind (mg/kg)	Concentration (mg/kg)	Sample Location	Associated Depth
2,4,6-TNT	190 (associated HI of 0.77)	510	5.1	0.43	29SB83	4-5 ft bgs
2-amino-4,6-DNT	25 (associated HI of 0.33)	170	1.7	0.23 J 0.9	29SB85 29SB85	4-5 ft bgs 8-9 ft bgs
4-amino-2,6-DNT	16 (associated HI of 0.21)	170	1.7	0.30 J	29SB85	8-9 ft bgs

Abbreviations:

DNT	*dinitrotoluene*
EPC	*exposure point concentration*
ft bgs	*feet below ground surface*
GWP-Ind	*soil MSC for industrial use based on groundwater protection*
HI	*hazard index*
J	*concentration is estimated*
mg/kg	*milligrams per kilogram*
MSC	*medium-specific concentration*
SAI-Ind	*soil MSC for industrial use based on inhalation, ingestion and dermal contact*
TNT	*trinitrotoluene*

Table 2-7
Summary of Solid Residue Sample Results from Cooling Water Lines

Explosive	EPC from Risk Assessment (mg/kg)	GWP-Ind (mg/kg)	Concentration* (mg/kg)	Sample location	Associated line
2,4,6-TNT	190 (associated HI of 0.77)	5.1	11 7 5.5	MH02 MH10 MH08	S Cooling N Cooling N Cooling
2,4-DNT	--	0.042	0.71 1.1	MH08 MH10	N Cooling N Cooling
2,6-DNT	--	0.042	0.24 J 0.30 J	MH10 MH08	N Cooling N Cooling
2-amino-4,6-DNT	25 (associated HI of 0.33)	1.7	3.8 J 2.4 J 9	MH02 MH09 MH10	S Cooling N Cooling N Cooling
4-amino-2,6-DNT	16 (associated HI of 0.21)	1.7	2.6 J 2.5 J 7.8	MH02 MH09 MH10	S Cooling N Cooling N Cooling

Notes and Abbreviations:

* Concentrations included in table are above the GWP-Ind.

DNT	dinitrotoluene
EPC	exposure point concentration
GWP-Ind	soil MSC for industrial use based on groundwater protection
HI	hazard index
J	concentration is estimated
mg/kg	milligrams per kilogram
MSC	medium-specific concentration
TNT	trinitrotoluene

Table 2-8
Explosive Compounds Detected in Liquid Samples from Cooling Water Lines

Explosive	EPC from Risk Assessment (µg/l)	GW-Ind (µg/l)	Concentration (µg/l)	Sample location	Associated line
2,4,6-TNT	--	51	250 84.3 JL 430 5200 20	MH01 MH05 MH06 MH09 (12/04) MH09 (2/05)	South South South North North
2,4-DNT	530	0.42	15	MH01	South
	(HI=2.6)		0.8 J	MH09 (12/04)	North
			1.13	MH09 (2/05)	North
			1.05	MH10	North
			0.922 J	MH11	North
			0.934 J	MH12	North
2,6-DNT	530	0.42	4.1	MH01	South
	(HI=5.2)		27	MH09 (12/04)	North
			1.27	MH09 (2/05)	North
			1.35	MH10	North
			1.15	MH11	North
			1.31	MH12	North
2-amino-4,6-DNT	5.9	17	220	MH09 (12/04)	North
	(HI=0.35)		1.68	MH09 (2/05)	North
4-amino-2,6-DNT	5.9	17	33	MH01	South
	(HI=0.35)		290	MH09 (12/04)	North
			2.42	MH09 (2/05)	North

Abbreviations:

DNT	*dinitrotoluene*
EPC	*exposure point concentration*
GW-Ind	*groundwater MSC for industrial use*
HI	*hazard index*
J	*concentration is estimated*
JL	*concentration is estimated and biased low*
MSC	*medium-specific concentration*
TNB	*trinitrobenzene*
TNT	*trinitrotoluene*

Table 2-9
COCs by Groundwater Zone

COCs	MCL (µg/L)	Shallow Zone Max (µg/L)	Shallow Zone Well ID of Max	Shallow Zone COC?	Intermediate Zone Max (µg/L)	Intermediate Zone Well ID of Max	Intermediate Zone COC?
Methylene Chloride	5	3	29WW15	No	7,110,000	29WW16	Yes
1,2-Dichloroethane	5	5,520	29WW15	Yes	14.3	29WW16	Yes
Trichloroethene	5	344	29WW15	Yes	4,340	29WW16	Yes
Arsenic	10	141	29WW25	Yes	44	29WW16	Yes
Mercury	2	6.1	118	Yes	not detected	--	No
	GW-Ind (µg/L)						
2,4-Dinitrotoluene	0.42	50.9	29WW05	Yes	not detected	--	No
2,6-Dinitrotoluene	0.42	239	116	Yes	not detected	--	No
2-Nitrotoluene	1,000	8,140	116	Yes	not detected	--	No
3-Nitrotoluene	1,000	451	116	Yes [1]	not detected	--	No
4-Nitrotoluene	1,000	1,400	116	Yes	not detected	--	No
Perchlorate	72	16,800	29WW15	Yes	21.5	29WW35	No
Nickel	2,000	8,400	29WW11	Yes	120	29WW24	No

Notes and Abbreviations:

Max is the maximum concentration of that COC from the most recent sample round.

[1] *Identified as a COC because hazard quotient value >1.*

COC	*contaminant of concern*
GW-Ind	*Texas Commission on Environmental Quality groundwater medium specific concentration for industrial use*
MCL	*Safe Drinking Water Act maximum contaminant level*
µg/L	*micrograms per liter*

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
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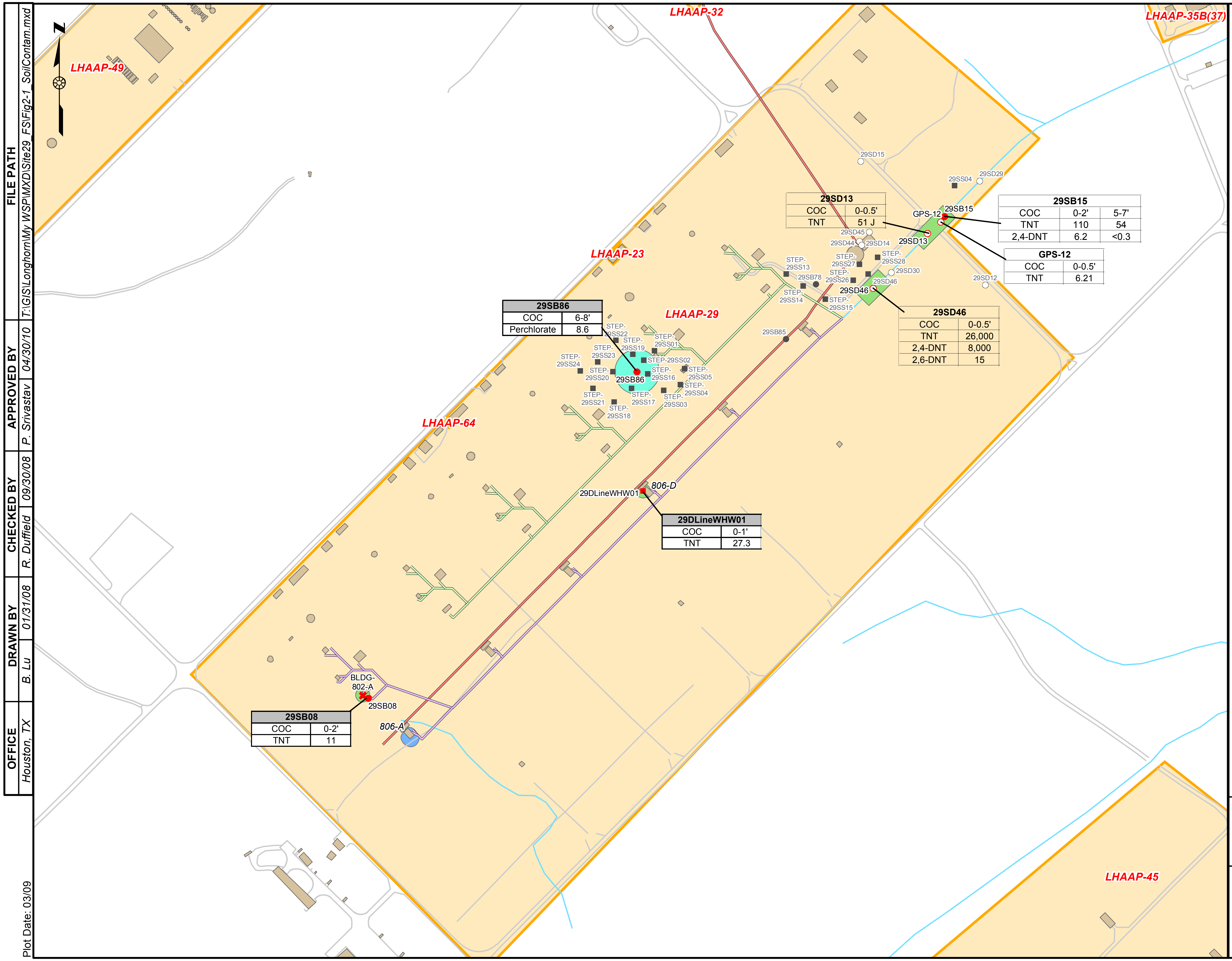
Plot Date: 03/09



29SD13	
COC	0-0.5'
TNT	51 J

29SB15		
COC	0-2'	5-7'
TNT	110	54
2,4-DNT	6.2	<0.3

GPS-12	
COC	0-0.5'
TNT	6.21

29SD46	
COC	0-0.5'
TNT	26,000
2,4-DNT	8,000
2,6-DNT	15

29SB86	
COC	6-8'
Perchlorate	8.6

29DLineWHW01	
COC	0-1'
TNT	27.3

29SB08	
COC	0-2'
TNT	11

LEGEND

Soil Contamination

- ✖ Former Building
- ● Soil Boring
- ○ Sediment
- ■ Surface Soil

Sample Locations

- ■ Surface Soil
- ● Soil Boring
- ○ Sediment
- ▨ Former Building or Concrete Slab
- ▭ Site
- — TNT Cooling Water Drain Line (South)
- — TNT Cooling Water Drain Line (North)
- — TNT Wastewater Line
- — Stream
- — Road

Locations of Excavations

see Section 2.4.1 for estimated excavation areas and volumes

- 🟩 Explosive
- 🟩 Perchlorate
- 🟦 Stained Soil (Plexus)

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

0 200 400 800
Feet

Shaw®

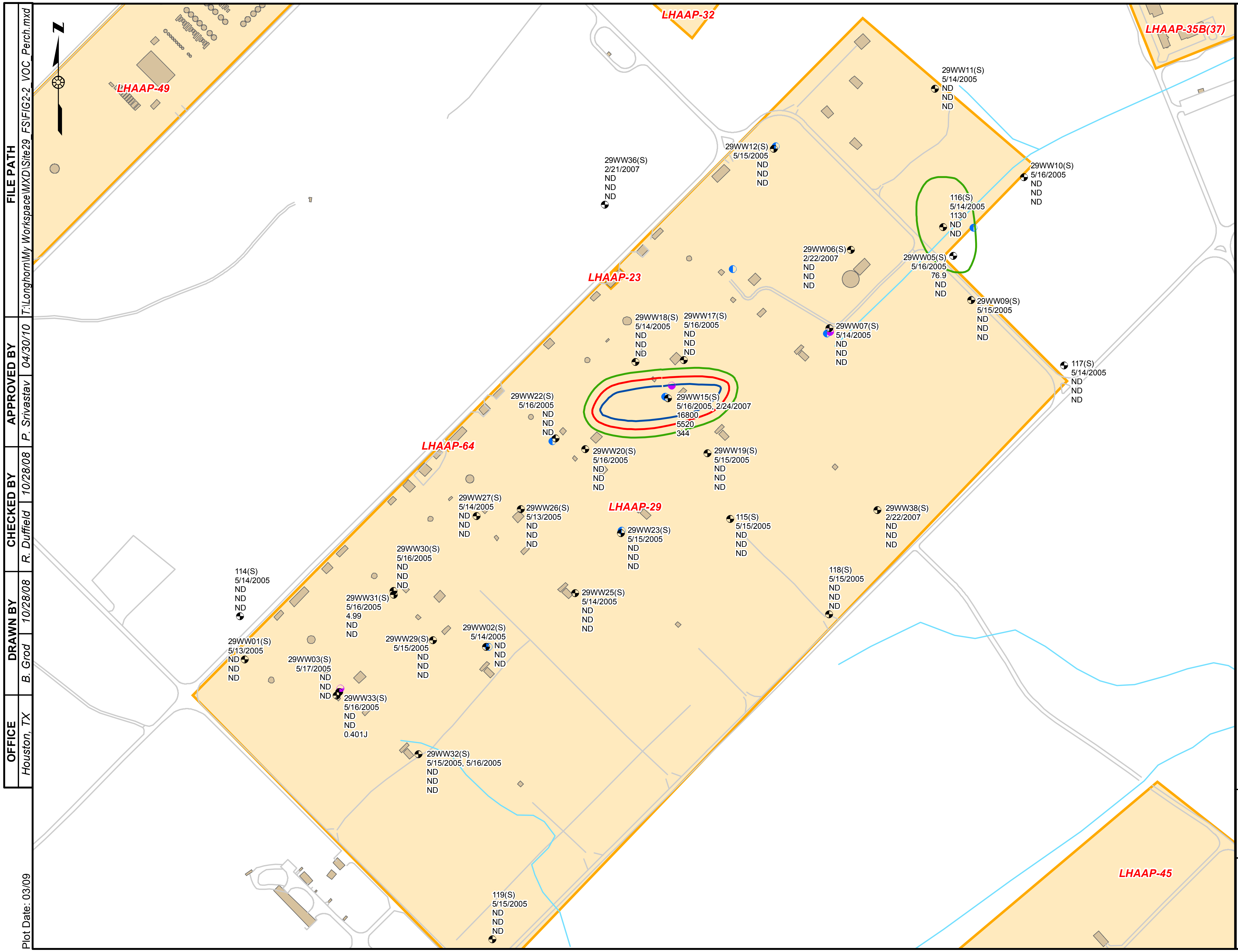
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA

FIGURE 2-1

SOIL CONTAMINATION
LHAAP-29 FEASIBILITY STUDY

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

00091173



LEGEND

●	Shallow Groundwater Monitoring Well (S)
◐	Intermediate Groundwater Monitoring Well (I)
◓	Deep Groundwater Monitoring Well (D)
—	Perchlorate Plume in Shallow Groundwater Zone (GW-Ind = 72 µg/L)
—	1,2-Dichloroethane Plume in Shallow Groundwater Zone (MCL= 5 µg/L)
—	Trichloroethene Plume in Shallow Groundwater Zone (MCL= 5 µg/L)
—	Stream
—	Road
▨	Former Building or Tank Location
▨	Site

Notes:

1. All concentrations in the intermediate and deep zones are below the GW-Ind, therefore, no plume exists at these intervals.
2. All concentrations are reported in micrograms per liter (µg/L).
3. ND - non detect.
4. TCEQ GW-Ind - groundwater MSC for industrial use.
5. MCL = Maximum Contaminant Level.
6. Results listed in this order;
   Perchlorate
   1,2-Dichloroethane
   Trichloroethene

0 205 410 820
Feet

Shaw

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

FIGURE 2-2
VOCs AND PERCHLORATE
IN SHALLOW GROUNDWATER
LHAAP-29 FEASIBILITY STUDY

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

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APPROVED BY
P. Srivastav 04/30/10

CHECKED BY
R. Duffield 10/28/08

DRAWN BY
B. Grod 10/28/08

OFFICE
Houston, TX

Plot Date: 03/09

FILE PATH
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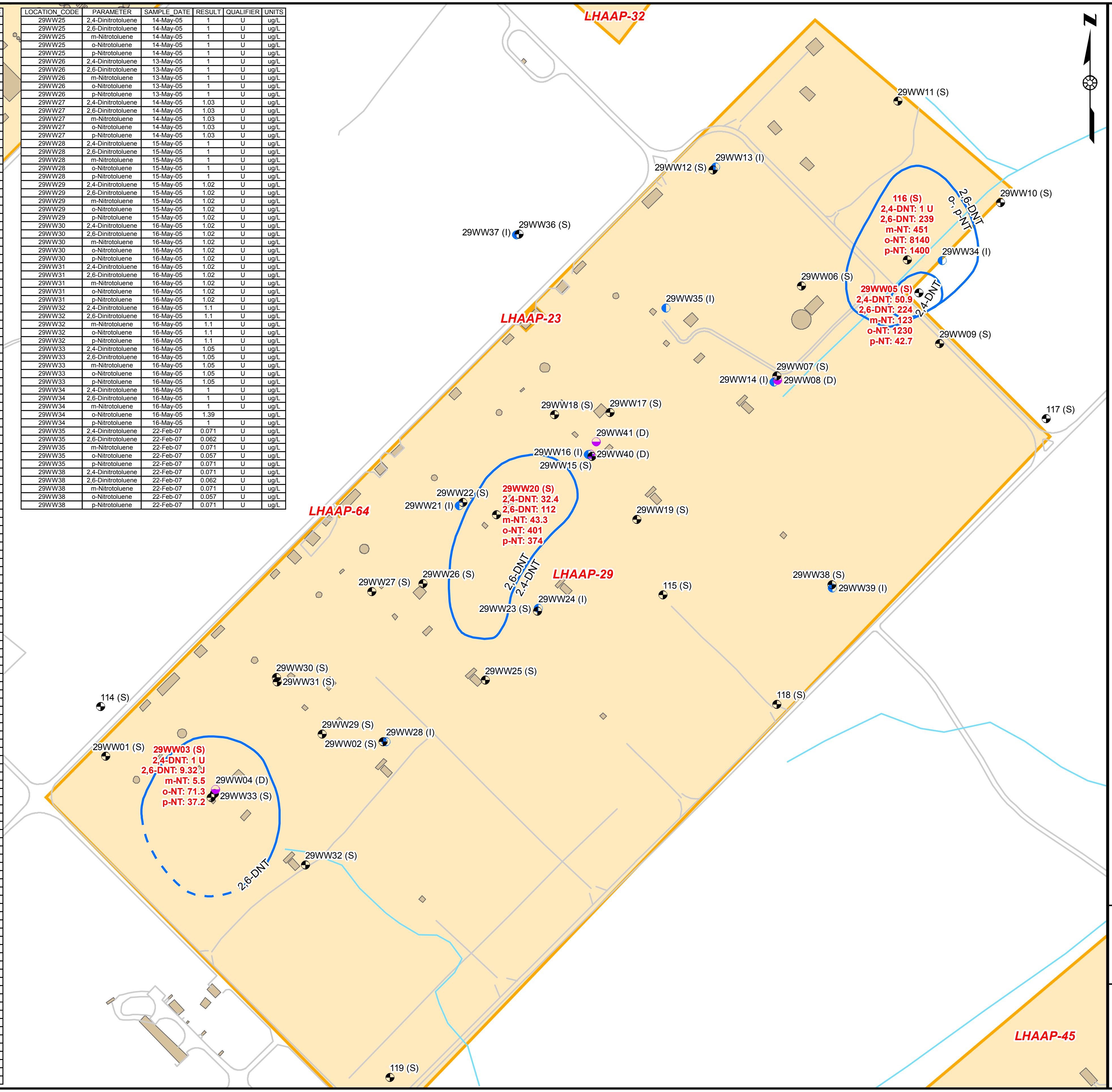
APPROVED BY
P. Srivastav 04/30/10
CHECKED BY
R. Duffield 10/01/08
DRAWN BY
B. Lu 05/07/08
OFFICE
Houston, TX
Plot Date: 03/09

LOCATION_CODE	PARAMETER	SAMPLE_DATE	RESULT	QUALIFIER	UNITS
114	2,4-Dinitrotoluene	14-May-05	1.03	U	ug/L
114	2,6-Dinitrotoluene	14-May-05	1.03	U	ug/L
114	m-Nitrotoluene	14-May-05	1.03	U	ug/L
114	o-Nitrotoluene	14-May-05	1.03	U	ug/L
114	p-Nitrotoluene	14-May-05	1.03	U	ug/L
115	2,4-Dinitrotoluene	15-May-05	1	U	ug/L
115	2,6-Dinitrotoluene	15-May-05	1	U	ug/L
115	m-Nitrotoluene	15-May-05	1	U	ug/L
115	o-Nitrotoluene	15-May-05	1	U	ug/L
115	p-Nitrotoluene	15-May-05	1	U	ug/L
117	2,4-Dinitrotoluene	14-May-05	1	U	ug/L
117	2,6-Dinitrotoluene	14-May-05	1	U	ug/L
117	m-Nitrotoluene	14-May-05	1	U	ug/L
117	o-Nitrotoluene	14-May-05	1	U	ug/L
117	p-Nitrotoluene	14-May-05	1	U	ug/L
118	2,4-Dinitrotoluene	15-May-05	1.02	U	ug/L
118	2,6-Dinitrotoluene	15-May-05	1.02	U	ug/L
118	m-Nitrotoluene	15-May-05	1.02	U	ug/L
118	o-Nitrotoluene	15-May-05	1.02	U	ug/L
118	p-Nitrotoluene	15-May-05	1.02	U	ug/L
119	2,4-Dinitrotoluene	15-May-05	1.06	U	ug/L
119	2,6-Dinitrotoluene	15-May-05	1.06	U	ug/L
119	m-Nitrotoluene	15-May-05	1.06	U	ug/L
119	o-Nitrotoluene	15-May-05	1.06	U	ug/L
119	p-Nitrotoluene	15-May-05	1.06	U	ug/L
29WW01	2,4-Dinitrotoluene	13-May-05	1.03	U	ug/L
29WW01	2,6-Dinitrotoluene	13-May-05	1.03	U	ug/L
29WW01	m-Nitrotoluene	13-May-05	1.03	U	ug/L
29WW01	o-Nitrotoluene	13-May-05	1.03	U	ug/L
29WW01	p-Nitrotoluene	13-May-05	1.03	U	ug/L
29WW02	2,4-Dinitrotoluene	14-May-05	1	U	ug/L
29WW02	2,6-Dinitrotoluene	14-May-05	1	U	ug/L
29WW02	m-Nitrotoluene	14-May-05	1	U	ug/L
29WW02	o-Nitrotoluene	14-May-05	1	U	ug/L
29WW02	p-Nitrotoluene	14-May-05	1	U	ug/L
29WW04	2,4-Dinitrotoluene	17-May-05	1	U	ug/L
29WW04	2,6-Dinitrotoluene	17-May-05	1	U	ug/L
29WW04	m-Nitrotoluene	17-May-05	1	U	ug/L
29WW04	o-Nitrotoluene	17-May-05	1	U	ug/L
29WW04	p-Nitrotoluene	17-May-05	1	U	ug/L
29WW06	2,4-Dinitrotoluene	22-Feb-07	0.16	J	ug/L
29WW06	2,6-Dinitrotoluene	22-Feb-07	0.062	U	ug/L
29WW06	m-Nitrotoluene	22-Feb-07	0.071	U	ug/L
29WW06	o-Nitrotoluene	22-Feb-07	0.057	U	ug/L
29WW06	p-Nitrotoluene	22-Feb-07	0.071	U	ug/L
29WW07	2,4-Dinitrotoluene	14-May-05	1.02	U	ug/L
29WW07	2,6-Dinitrotoluene	14-May-05	1.02	U	ug/L
29WW07	m-Nitrotoluene	14-May-05	1.02	U	ug/L
29WW07	o-Nitrotoluene	14-May-05	1.02	U	ug/L
29WW07	p-Nitrotoluene	14-May-05	1.02	U	ug/L
29WW08	2,4-Dinitrotoluene	14-May-05	1.03	U	ug/L
29WW08	2,6-Dinitrotoluene	14-May-05	1.03	U	ug/L
29WW08	m-Nitrotoluene	14-May-05	1.03	U	ug/L
29WW08	o-Nitrotoluene	14-May-05	1.03	U	ug/L
29WW08	p-Nitrotoluene	14-May-05	1.03	U	ug/L
29WW09	2,4-Dinitrotoluene	15-May-05	1	U	ug/L
29WW09	2,6-Dinitrotoluene	15-May-05	1	U	ug/L
29WW09	m-Nitrotoluene	15-May-05	1	U	ug/L
29WW09	o-Nitrotoluene	15-May-05	1	U	ug/L
29WW09	p-Nitrotoluene	15-May-05	1	U	ug/L
29WW10	2,4-Dinitrotoluene	16-May-05	1	U	ug/L
29WW10	2,6-Dinitrotoluene	16-May-05	1	U	ug/L
29WW10	m-Nitrotoluene	16-May-05	1	U	ug/L
29WW10	o-Nitrotoluene	16-May-05	1	U	ug/L
29WW10	p-Nitrotoluene	16-May-05	1	U	ug/L
29WW11	2,4-Dinitrotoluene	14-May-05	1	U	ug/L
29WW11	2,6-Dinitrotoluene	14-May-05	1	U	ug/L
29WW11	m-Nitrotoluene	14-May-05	1	U	ug/L
29WW11	o-Nitrotoluene	14-May-05	1	U	ug/L
29WW11	p-Nitrotoluene	14-May-05	1	U	ug/L
29WW12	2,4-Dinitrotoluene	15-May-05	1.03	U	ug/L
29WW12	2,6-Dinitrotoluene	15-May-05	1.03	U	ug/L
29WW12	m-Nitrotoluene	15-May-05	1.03	U	ug/L
29WW12	o-Nitrotoluene	15-May-05	1.03	U	ug/L
29WW12	p-Nitrotoluene	15-May-05	1.03	U	ug/L
29WW13	2,4-Dinitrotoluene	15-May-05	1	U	ug/L
29WW13	2,6-Dinitrotoluene	15-May-05	1	U	ug/L
29WW13	m-Nitrotoluene	15-May-05	1	U	ug/L
29WW13	o-Nitrotoluene	15-May-05	1	U	ug/L
29WW13	p-Nitrotoluene	15-May-05	1	U	ug/L
29WW14	2,4-Dinitrotoluene	14-May-05	1	U	ug/L
29WW14	2,6-Dinitrotoluene	14-May-05	1	U	ug/L
29WW14	m-Nitrotoluene	14-May-05	1	U	ug/L
29WW14	o-Nitrotoluene	14-May-05	1	U	ug/L
29WW14	p-Nitrotoluene	14-May-05	1	U	ug/L
29WW15	2,4-Dinitrotoluene	24-Feb-07	0.13	U	ug/L
29WW15	2,6-Dinitrotoluene	24-Feb-07	0.11	U	ug/L
29WW15	m-Nitrotoluene	24-Feb-07	0.13	U	ug/L
29WW15	o-Nitrotoluene	24-Feb-07	0.1	U	ug/L
29WW15	p-Nitrotoluene	24-Feb-07	0.13	U	ug/L
29WW16	2,4-Dinitrotoluene	16-May-05	1.02	U	ug/L
29WW16	2,6-Dinitrotoluene	16-May-05	1.02	U	ug/L
29WW16	m-Nitrotoluene	16-May-05	1.02	U	ug/L
29WW16	o-Nitrotoluene	16-May-05	1.02	U	ug/L
29WW16	p-Nitrotoluene	16-May-05	1.02	U	ug/L
29WW17	2,4-Dinitrotoluene	16-May-05	1.02	U	ug/L
29WW17	2,6-Dinitrotoluene	16-May-05	1.02	U	ug/L
29WW17	m-Nitrotoluene	16-May-05	1.02	U	ug/L
29WW17	o-Nitrotoluene	16-May-05	1.02	U	ug/L
29WW17	p-Nitrotoluene	16-May-05	1.02	U	ug/L
29WW18	2,4-Dinitrotoluene	14-May-05	1.02	U	ug/L
29WW18	2,6-Dinitrotoluene	14-May-05	1.02	U	ug/L
29WW18	m-Nitrotoluene	14-May-05	1.02	U	ug/L
29WW18	o-Nitrotoluene	14-May-05	1.02	U	ug/L
29WW18	p-Nitrotoluene	14-May-05	1.02	U	ug/L
29WW19	2,4-Dinitrotoluene	15-May-05	1	U	ug/L
29WW19	2,6-Dinitrotoluene	15-May-05	1	U	ug/L
29WW19	m-Nitrotoluene	15-May-05	1	U	ug/L
29WW19	o-Nitrotoluene	15-May-05	1	U	ug/L
29WW19	p-Nitrotoluene	15-May-05	1	U	ug/L
29WW21	2,4-Dinitrotoluene	16-May-05	1	U	ug/L
29WW21	2,6-Dinitrotoluene	16-May-05	1	U	ug/L
29WW21	m-Nitrotoluene	16-May-05	1	U	ug/L
29WW21	o-Nitrotoluene	16-May-05	1	U	ug/L
29WW21	p-Nitrotoluene	16-May-05	1	U	ug/L
29WW22	2,4-Dinitrotoluene	16-May-05	1	U	ug/L
29WW22	2,6-Dinitrotoluene	16-May-05	1	U	ug/L
29WW22	m-Nitrotoluene	16-May-05	1	U	ug/L
29WW22	o-Nitrotoluene	16-May-05	1	U	ug/L
29WW22	p-Nitrotoluene	16-May-05	1	U	ug/L
29WW23	2,4-Dinitrotoluene	15-May-05	1	U	ug/L
29WW23	2,6-Dinitrotoluene	15-May-05	1	U	ug/L
29WW23	m-Nitrotoluene	15-May-05	1	U	ug/L
29WW23	o-Nitrotoluene	15-May-05	1	U	ug/L
29WW23	p-Nitrotoluene	15-May-05	1	U	ug/L
29WW24	2,4-Dinitrotoluene	15-May-05	1.02	U	ug/L
29WW24	2,6-Dinitrotoluene	15-May-05	1.02	U	ug/L
29WW24	m-Nitrotoluene	15-May-05	1.02	U	ug/L
29WW24	o-Nitrotoluene	15-May-05	1.02	U	ug/L
29WW24	p-Nitrotoluene	15-May-05	1.02	U	ug/L

LOCATION_CODE	PARAMETER	SAMPLE_DATE	RESULT	QUALIFIER	UNITS
29WW25	2,4-Dinitrotoluene	14-May-05	1	U	ug/L
29WW25	2,6-Dinitrotoluene	14-May-05	1	U	ug/L
29WW25	m-Nitrotoluene	14-May-05	1	U	ug/L
29WW25	o-Nitrotoluene	14-May-05	1	U	ug/L
29WW25	p-Nitrotoluene	14-May-05	1	U	ug/L
29WW26	2,4-Dinitrotoluene	13-May-05	1	U	ug/L
29WW26	2,6-Dinitrotoluene	13-May-05	1	U	ug/L
29WW26	m-Nitrotoluene	13-May-05	1	U	ug/L
29WW26	o-Nitrotoluene	13-May-05	1	U	ug/L
29WW26	p-Nitrotoluene	13-May-05	1	U	ug/L
29WW27	2,4-Dinitrotoluene	14-May-05	1.03	U	ug/L
29WW27	2,6-Dinitrotoluene	14-May-05	1.03	U	ug/L
29WW27	m-Nitrotoluene	14-May-05	1.03	U	ug/L
29WW27	o-Nitrotoluene	14-May-05	1.03	U	ug/L
29WW27	p-Nitrotoluene	14-May-05	1.03	U	ug/L
29WW28	2,4-Dinitrotoluene	15-May-05	1	U	ug/L
29WW28	2,6-Dinitrotoluene	15-May-05	1	U	ug/L
29WW28	m-Nitrotoluene	15-May-05	1	U	ug/L
29WW28	o-Nitrotoluene	15-May-05	1	U	ug/L
29WW28	p-Nitrotoluene	15-May-05	1	U	ug/L
29WW29	2,4-Dinitrotoluene	15-May-05	1.02	U	ug/L
29WW29	2,6-Dinitrotoluene	15-May-05	1.02	U	ug/L
29WW29	m-Nitrotoluene	15-May-05	1.02	U	ug/L
29WW29	o-Nitrotoluene	15-May-05	1.02	U	ug/L
29WW29	p-Nitrotoluene	15-May-05	1.02	U	ug/L
29WW30	2,4-Dinitrotoluene	16-May-05	1.02	U	ug/L
29WW30	2,6-Dinitrotoluene	16-May-05	1.02	U	ug/L
29WW30	m-Nitrotoluene	16-May-05	1.02	U	ug/L
29WW30	o-Nitrotoluene	16-May-05	1.02	U	ug/L
29WW30	p-Nitrotoluene	16-May-05	1.02	U	ug/L
29WW31	2,4-Dinitrotoluene	16-May-05	1.02	U	ug/L
29WW31	2,6-Dinitrotoluene	16-May-05	1.02	U	ug/L
29WW31	m-Nitrotoluene	16-May-05	1.02	U	ug/L
29WW31	o-Nitrotoluene	16-May-05	1.02	U	ug/L
29WW31	p-Nitrotoluene	16-May-05	1.02	U	ug/L
29WW32	2,4-Dinitrotoluene	16-May-05	1.1	U	ug/L
29WW32	2,6-Dinitrotoluene	16-May-05	1.1	U	ug/L
29WW32	m-Nitrotoluene	16-May-05	1.1	U	ug/L
29WW32	o-Nitrotoluene	16-May-05	1.1	U	ug/L
29WW32	p-Nitrotoluene	16-May-05	1.1	U	ug/L
29WW33	2,4-Dinitrotoluene	16-May-05	1.05	U	ug/L
29WW33	2,6-Dinitrotoluene	16-May-05	1.05	U	ug/L
29WW33	m-Nitrotoluene	16-May-05	1.05	U	ug/L
29WW33	o-Nitrotoluene	16-May-05	1.05	U	ug/L
29WW33	p-Nitrotoluene	16-May-05	1.05	U	ug/L
29WW34	2,4-Dinitrotoluene	16-May-05	1	U	ug/L
29WW34	2,6-Dinitrotoluene	16-May-05	1	U	ug/L
29WW34	m-Nitrotoluene	16-May-05	1	U	ug/L
29WW34	o-Nitrotoluene	16-May-05	1.39		ug/L
29WW34	p-Nitrotoluene	16-May-05	1	U	ug/L
29WW35	2,4-Dinitrotoluene	22-Feb-07	0.071	U	ug/L
29WW35	2,6-Dinitrotoluene	22-Feb-07	0.062	U	ug/L
29WW35	m-Nitrotoluene	22-Feb-07	0.071	U	ug/L
29WW35	o-Nitrotoluene	22-Feb-07	0.057	U	ug/L
29WW35	p-Nitrotoluene	22-Feb-07	0.071	U	ug/L
29WW38	2,4-Dinitrotoluene	22-Feb-07	0.071	U	ug/L
29WW38	2,6-Dinitrotoluene	22-Feb-07	0.062	U	ug/L
29WW38	m-Nitrotoluene	22-Feb-07	0.071	U	ug/L
29WW38	o-Nitrotoluene	22-Feb-07	0.057	U	ug/L
29WW38	p-Nitrotoluene	22-Feb-07	0.071	U	ug/L



LEGEND

◐	Shallow Groundwater Monitoring Well (S)
◐	Intermediate Groundwater Monitoring Well (I)
◓	Deep Groundwater Monitoring Well (D)
━	COC Plume
╌	Inferred COC Plume
━	Stream
━	Road
▨	Former Building or Tank Location
▢	Site

NOTES:

1. All concentrations in the intermediate and deep zones are below the TCEQ GW-Ind of 1000 micrograms per liter (µg/L) for the m-, o-, and p-nitrotoluene isomers and 0.42 micrograms per liter (µg/L) for 2,4-DNT and 2,6-DNT; therefore no plumes exist at these zones.
2. All concentrations are reported in µg/L.
3. COC - Contaminant of concern
   DNT - Dinitrotoluene
   NT - Nitrotoluene
4. TCEQ GW-Ind - groundwater MSC for industrial use.

0 205 410 820
Feet

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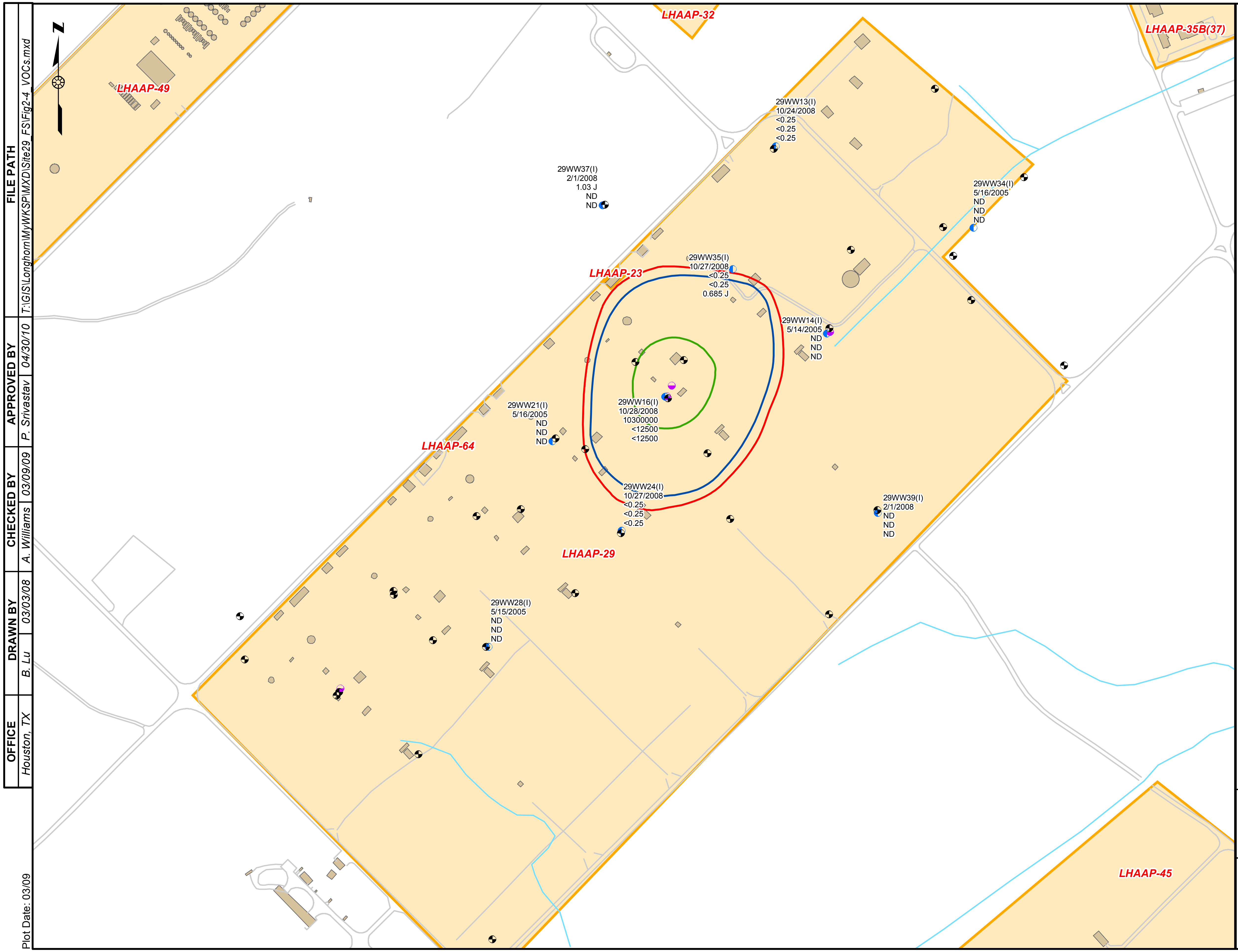
TULSA, OKLAHOMA

FIGURE 2-3

NITROTOLUENES
IN SHALLOW GROUNDWATER
LHAAP-29 FEASIBILITY STUDY

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS



LEGEND

◕	Shallow Groundwater Monitoring Well (S)
◐	Intermediate Groundwater Monitoring Well (I)
◒	Deep Groundwater Monitoring Well (D)
—	Methylene Chloride Plume in Intermediate Groundwater Zone (MCL = 5 µg/L)
—	1,2-Dichloroethane Plume in Intermediate Groundwater Zone (MCL = 5 µg/L)
—	Trichloroethene Plume in Intermediate Groundwater Zone (MCL = 5 µg/L)
—	Stream
—	Road
▨	Former Building or Tank Location
▭	Site

Notes:

1. All concentrations are reported in micrograms per liter (µg/L).
2. Results listed in this order;
   Methylene Chloride
   1,2-Dichloroethane
   Trichloroethene
3. ND - non detect.
4. MCL - maximum contaminant level.
5. Due to historic results and the high detection limits at 29WW16, it has been assumed that concentrations of 1,2-dichloroethane and trichloroethene still exceed their MCLs.

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Feet

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FIGURE 2-4

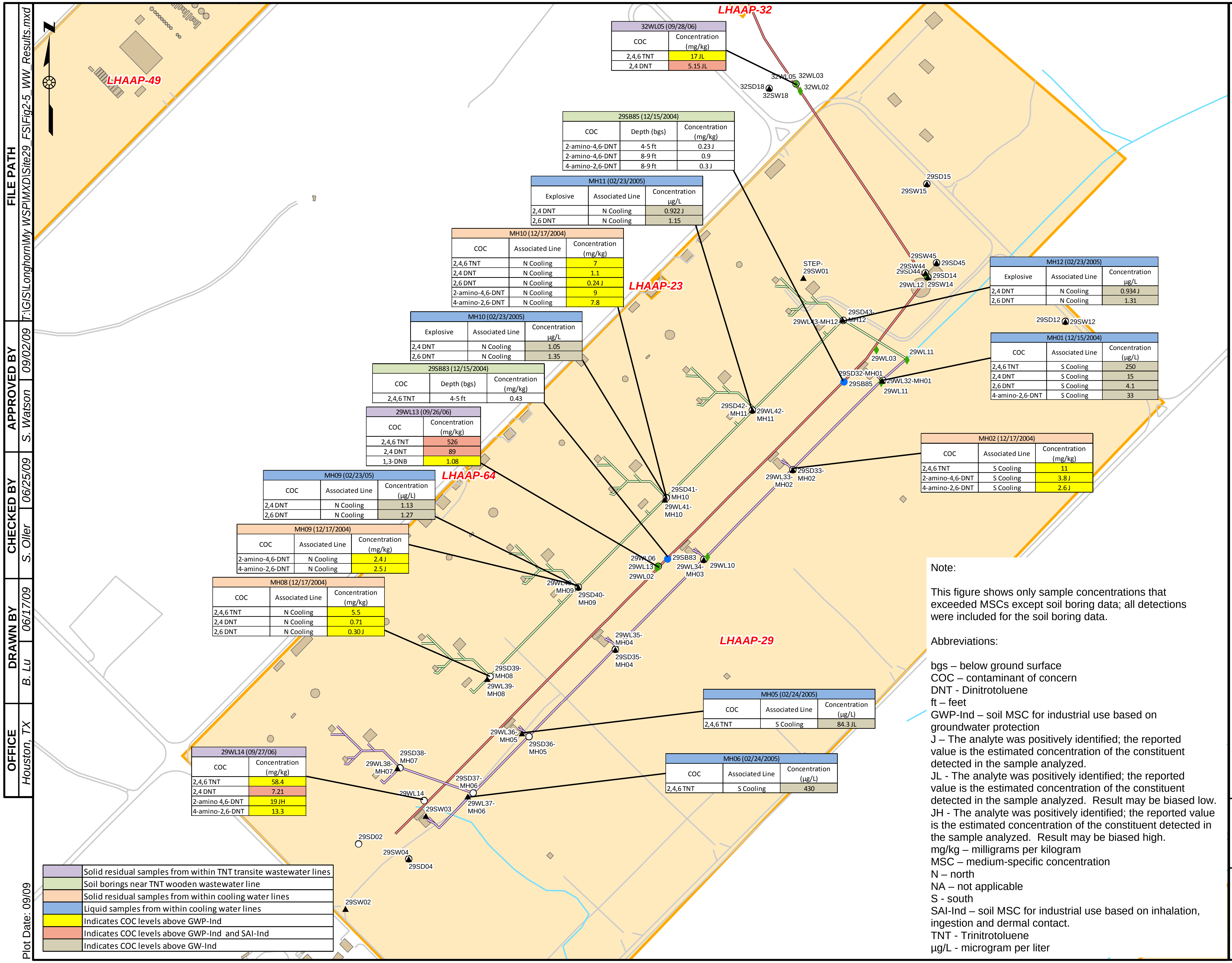
VOCs IN INTERMEDIATE GROUNDWATER
LHAAP-29 FEASIBILITY STUDY

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	FILE PATH
Houston, TX	B. Lu 03/03/08	A. Williams 03/09/09	P. Srivastav 04/30/10	T:\GIS\Longhorn\MyWKSP\MXD\Site29 FS\Fig2-4 VOCs.mxd

Plot Date: 03/09

00091176



32WL05 (09/28/06)	
COC	Concentration (mg/kg)
2,4,6 TNT	17 JL
2,4 DNT	5.15 JL

29SB85 (12/15/2004)		
COC	Depth (bgs)	Concentration (mg/kg)
2-amino-4,6-DNT	4-5 ft	0.23 J
2-amino-4,6-DNT	8-9 ft	0.9
4-amino-2,6-DNT	8-9 ft	0.3 J

MH11 (02/23/2005)		
Explosive	Associated Line	Concentration µg/L
2,4 DNT	N Cooling	0.922 J
2,6 DNT	N Cooling	1.15

MH10 (12/17/2004)		
COC	Associated Line	Concentration (mg/kg)
2,4,6 TNT	N Cooling	7
2,4 DNT	N Cooling	1.1
2,6 DNT	N Cooling	0.24 J
2-amino-4,6-DNT	N Cooling	9
4-amino-2,6-DNT	N Cooling	7.8

MH10 (02/23/2005)		
Explosive	Associated Line	Concentration µg/L
2,4 DNT	N Cooling	1.05
2,6 DNT	N Cooling	1.35

29SB83 (12/15/2004)		
COC	Depth (bgs)	Concentration (mg/kg)
2,4,6 TNT	4-5 ft	0.43

29WL13 (09/26/06)	
COC	Concentration (mg/kg)
2,4,6 TNT	526
2,4 DNT	89
1,3-DNB	1.08

MH09 (02/23/05)		
COC	Associated Line	Concentration (µg/L)
2,4 DNT	N Cooling	1.13
2,6 DNT	N Cooling	1.27

MH09 (12/17/2004)		
COC	Associated Line	Concentration (mg/kg)
2-amino-4,6-DNT	N Cooling	2.4 J
4-amino-2,6-DNT	N Cooling	2.5 J

MH08 (12/17/2004)		
COC	Associated Line	Concentration (mg/kg)
2,4,6 TNT	N Cooling	5.5
2,4 DNT	N Cooling	0.71
2,6 DNT	N Cooling	0.30 J

29WL14 (09/27/06)	
COC	Concentration (mg/kg)
2,4,6 TNT	58.4
2,4 DNT	7.21
2-amino 4,6-DNT	19 JH
4-amino-2,6-DNT	13.3

MH12 (02/23/2005)		
Explosive	Associated Line	Concentration µg/L
2,4 DNT	N Cooling	0.934 J
2,6 DNT	N Cooling	1.31

MH01 (12/15/2004)		
COC	Associated Line	Concentration (µg/L)
2,4,6 TNT	S Cooling	250
2,4 DNT	S Cooling	15
2,6 DNT	S Cooling	4.1
4-amino-2,6-DNT	S Cooling	33

MH02 (12/17/2004)		
COC	Associated Line	Concentration (mg/kg)
2,4,6 TNT	S Cooling	11
2-amino-4,6-DNT	S Cooling	3.8 J
4-amino-2,6-DNT	S Cooling	2.6 J

MH05 (02/24/2005)		
COC	Associated Line	Concentration (µg/L)
2,4,6 TNT	S Cooling	84.3 JL

MH06 (02/24/2005)		
COC	Associated Line	Concentration (µg/L)
2,4,6 TNT	S Cooling	430

🟪	Solid residual samples from within TNT transite wastewater lines
🟩	Soil borings near TNT wooden wastewater line
🟧	Solid residual samples from within cooling water lines
🟦	Liquid samples from within cooling water lines
🟨	Indicates COC levels above GWP-Ind
🟥	Indicates COC levels above GWP-Ind and SAI-Ind
▨	Indicates COC levels above GW-Ind

Note:

This figure shows only sample concentrations that exceeded MSCs except soil boring data; all detections were included for the soil boring data.

Abbreviations:

bgs – below ground surface
COC – contaminant of concern
DNT - Dinitrotoluene
ft – feet
GWP-Ind – soil MSC for industrial use based on groundwater protection
J – The analyte was positively identified; the reported value is the estimated concentration of the constituent detected in the sample analyzed.
JL - The analyte was positively identified; the reported value is the estimated concentration of the constituent detected in the sample analyzed. Result may be biased low.
JH - The analyte was positively identified; the reported value is the estimated concentration of the constituent detected in the sample analyzed. Result may be biased high.
mg/kg – milligrams per kilogram
MSC – medium-specific concentration
N – north
NA – not applicable
S - south
SAI-Ind – soil MSC for industrial use based on inhalation, ingestion and dermal contact.
TNT - Trinitrotoluene
µg/L - microgram per liter

LEGEND

●	Soil Boring
▲	Water Sample from Line or Man Hole
○	Solid residual Sample from Line or Man Hole
♦	Phase I or II Water Line Sample (deemed unusable by USEPA)
═	TNT Cooling Water Drain Line (South)
═	TNT Cooling Water Drain Line (North)
═	TNT Wastewater Lines (Transite and Wooden)
─	Stream/Ditch
─	Road
▨	Former Building or Concrete Slab
▭	Site

COC	GWP-Ind (mg/kg)	SAI-Ind (mg/kg)	GW-Ind (µg/L)
1,3,5-TNB	310	31,000	3100
1,3-DNB	1	100	10
2,4,6 TNT	5.1	510	51
2,4 DNT	0.042	4.2	0.42
2,6 DNT	0.042	4.2	0.42
2-amino-4,6-DNT	1.7	170	17
4-amino-2,6-DNT	1.7	170	17

0 180 360 720
Feet

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TULSA, OKLAHOMA

FIGURE 2-5
WASTEWATER AND COOLING WATER LINES
SAMPLE RESULTS
LHAAP-29 FEASIBILITY STUDY
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

FILE PATH	T:\GIS\Longhorn\My WSP\MXD\Site29_FS\Fig2-5_WW_Results.mxd
APPROVED BY	S. Watson 09/02/09
CHECKED BY	S. Oller 06/25/09
DRAWN BY	B. Lu 06/17/09
OFFICE	Houston, TX

Plot Date: 09/09

PLOT DATE: 10/22/08
FORMAT REVISION 5/13/02

IMAGE	X-REF	OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		DRAWING NUMBER
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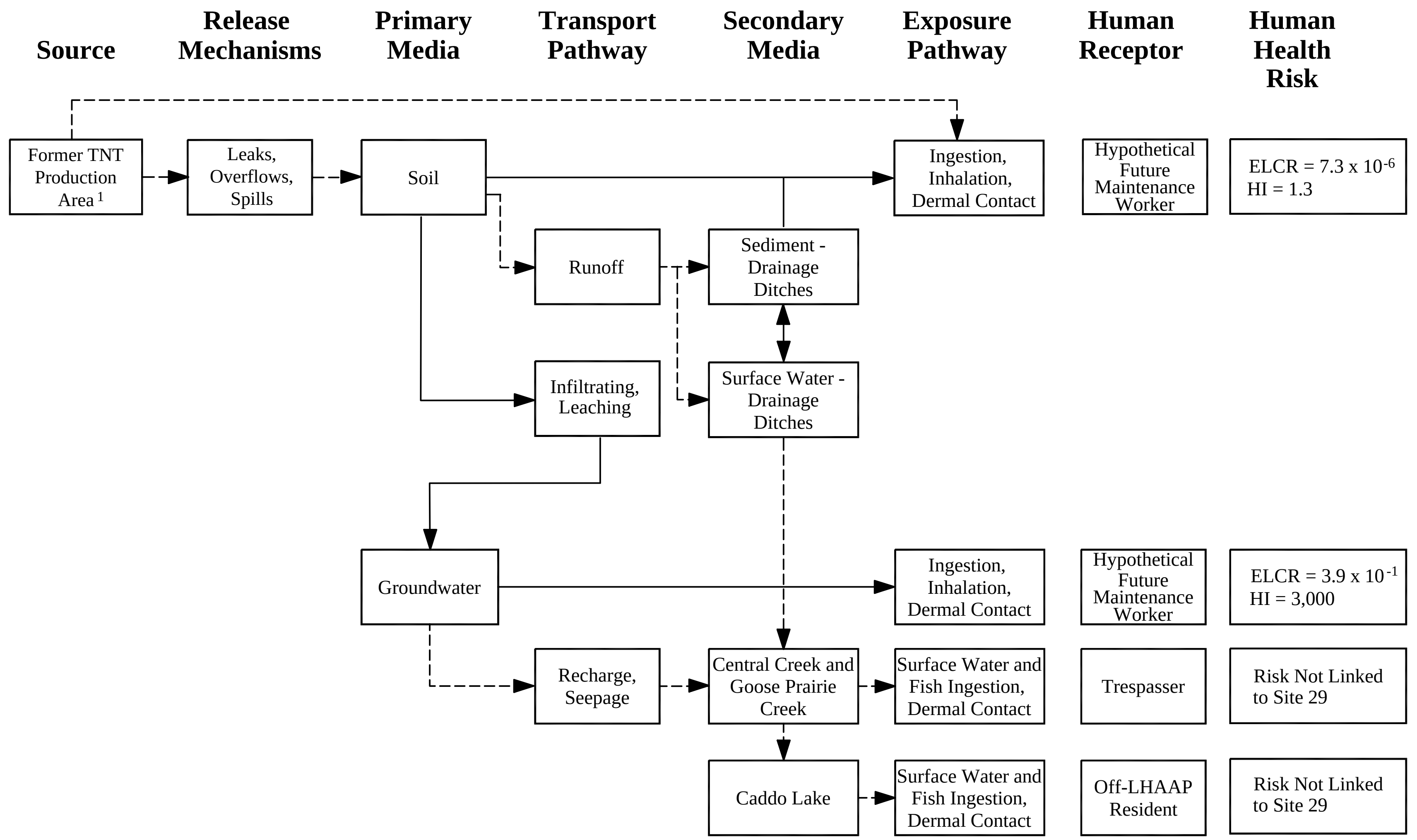

⟶ Pathway considered for remediation

⇢ Pathway *not* considered for remediation

Notes:

1. Most above ground structures have been removed
2. ELCR - Estimated Life-time Cancer Risk
3. HI - Hazard Index
4. ELCR and HI values are from risk assessment (Jacobs, 2002)

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Tulsa, Oklahoma

Figure 2-6

Human Health Conceptual Site Model LHAAP-29 Feasibility Study

Longhorn Army Ammunition Plant
Karnack, Texas

PLOT DATE: 1/30/06
FORMAT REVISION 5/13/02

IMAGE	X-REF	OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		DRAWING NUMBER
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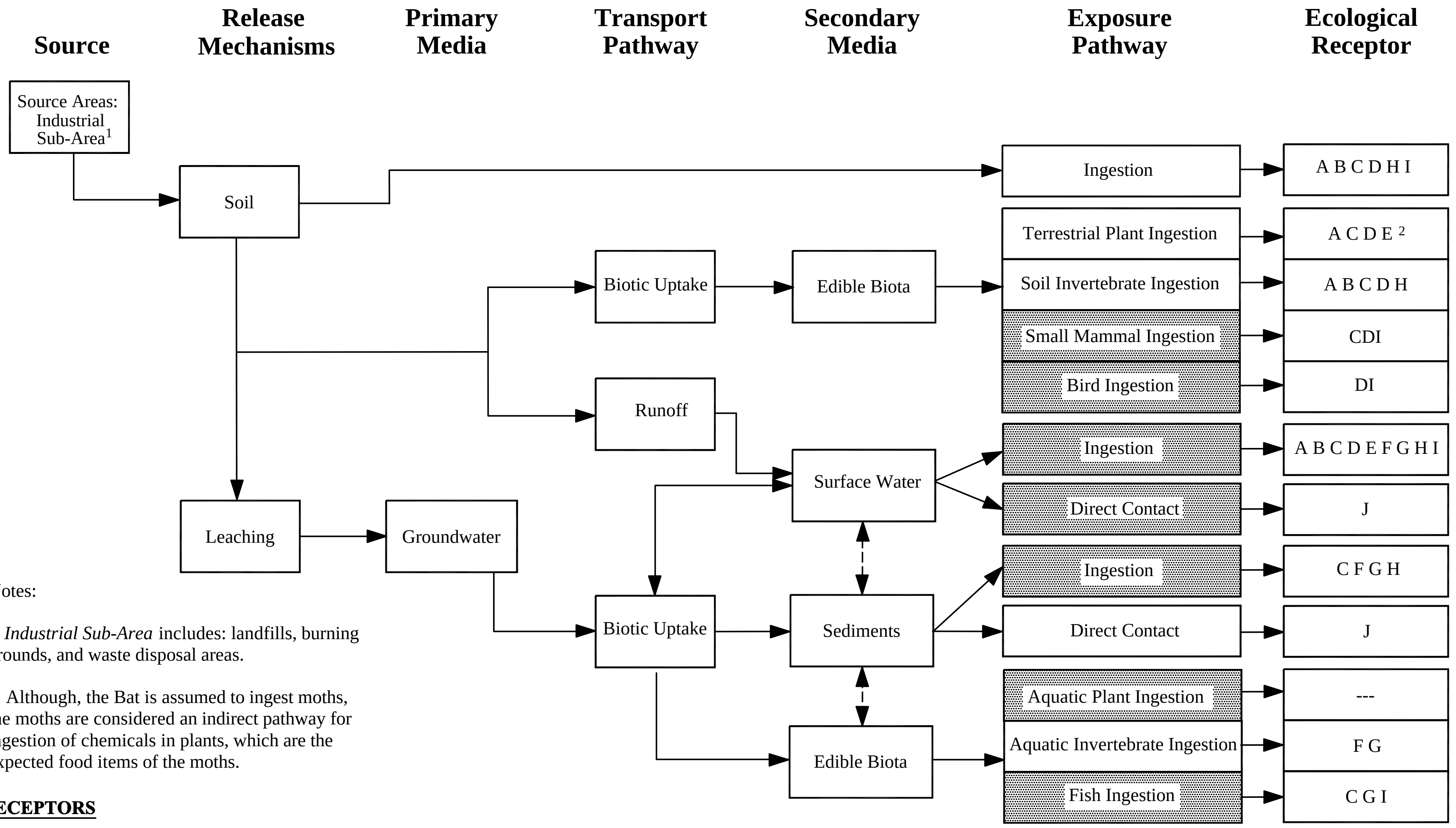

Notes:

1. *Industrial Sub-Area* includes: landfills, burning grounds, and waste disposal areas.

2. Although, the Bat is assumed to ingest moths, the moths are considered an indirect pathway for ingestion of chemicals in plants, which are the expected food items of the moths.

RECEPTORS

A. Deer Mouse
B. Short-Tailed Shrew
C. Racoon (& Racoon [Louisiana Black Bear])
D. Red Fox
E. Townsend's Big-Eared Bat
F. Bank Swallow
G. Belted Kingfisher
H. American Woodcock
I. Red-Tailed Hawk
J. Aquatic Life (benthic invertebrates)

--- = All receptors exposed to this pathway were determined not to be of concern.

Shaded cells indicate pathways that were not identified as significant, are background related, or were refined via site-specific investigations.

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Figure 2-7
Ecological Conceptual Exposure Model
LHAAP-29 Feasibility Study

Longhorn Army Ammunition Plant
Karnack, Texas

3.0 Remedial Action Objectives and Cleanup Levels

This section identifies the LHAAP-29 RAOs **(Section 3.1)**, potential chemical-, location- and action-specific ARARs **(Section 3.2)**, and cleanup levels **(Section 3.3)**. The RAOs identify the general goals or end points that the remediation will accomplish, while the cleanup levels identify specific cleanup standards for each medium of concern based on risk or ARARs. The cleanup levels may be applied to individual contaminants.

3.1 Remedial Action Objectives

RAOs are established to protect human health and the environment while also meeting ARARs. The identification of RAOs must consider the environmental issues at the site and the receptors that are affected. As identified in the conceptual site models (**Section 2.5**), the primary environmental issues at LHAAP-29 are:

- Groundwater that poses an unacceptable risk or hazard to the hypothetical future maintenance worker from contamination by VOCs (MC, 1,2-DCA, and TCE), perchlorate, and explosives (2,4-DNT, 2,6-DNT, 2-nitrotoluene, 3-nitrotoluene, and 4-nitrotoluene) and has the potential to adversely impact human health.
- Soil near 29SB86 that has concentrations of perchlorate in excess of the TCEQ GWP-Ind concentration and has the potential to be a source of groundwater contamination.
- Surface soil that has concentrations of explosives that pose a risk to ecological receptors (near 29SB08 [Building 802-A], 29DLineWHW01, 29SD13, 29SB15, GPS-12, and the stained soil near Building 806-A) and a hazard to hypothetical future maintenance workers (near 29SD46).
- Buried TNT wastewater lines and cooling water lines/manholes that have residual explosive contaminants remaining in the line. If a hypothetical future maintenance worker came into contract with the residual contamination in the buried lines or in the manholes, it could pose risk. However, contact with the buried lines is unlikely since the lines are at least 3 feet bgs. If water is allowed to gain entrance into these pipes and flow through them to surface water outlets, the residual contamination could be transported out of the pipes. Thus, the primary concerns are direct contact with the residual contamination in the cooling water manholes and the potential transport of contaminants by water that enters the TNT wastewater and cooling water lines.

The future use of the entire LHAAP facility is as a national wildlife refuge. A hypothetical future maintenance worker has been proposed as a conservative human receptor scenario for this land use, and ecological risk is also a concern at LHAAP-29. The U.S. Army recognizes USEPA's policy to return all groundwater to potential beneficial uses, based on the non-binding programmatic expectation in the National Oil and Hazardous Substances Pollution Contingency

Plan (NCP). The RAOs for LHAAP-29, which address contamination associated with the media at the site and take into account the future uses of LHAAP streams, land, and groundwater are:

- Protect the hypothetical future maintenance worker by preventing exposure to the contaminants in the soil, sediment, transite TNT wastewater line, cooling water lines, and groundwater
- Prevent migration of contaminants to groundwater and surface water from potential sources in the soil, sediment and process lines (TNT wastewater and cooling water)
- Protect ecological receptors by preventing exposure to the contaminated soil and sediment
- Return groundwater to its potential beneficial uses, wherever practicable, within a reasonable time period given the particular site circumstances.

3.2 Applicable or Relevant and Appropriate Requirements

The NCP, 40 Code of Federal Regulations (CFR) 300.430(f)(1)(ii)(B) states that on-site remedial actions conducted under CERCLA must attain, or have waived, legally applicable ARARs under federal or more stringent state environmental or facility citing laws identified at the time of the ROD signature. This section provides a preliminary identification and evaluation of potential federal and State of Texas chemical-, location-, and action-specific ARARs for the remediation of LHAAP-29 under CERCLA.

3.2.1 Definitions and Methods

Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site (40 CFR 300.5). A requirement is applicable if all the jurisdictional and site-specific prerequisites of the requirement are met; that is, a requirement is applicable if it directly and fully addresses the situation at the site.

Relevant and appropriate requirements are those substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable, address problems or situations sufficiently similar to those encountered at the CERCLA site so that their use is well suited to the particular site (40 CFR 300.5). The criteria for determining relevance and appropriateness are listed at 40 CFR 300.400(g)(2). A relevant and appropriate requirement must be complied with to the same extent as an applicable requirement.

To qualify as a state ARAR mandating cleanup standards under 40 CFR 300.400(g)(4) of the NCP, a state requirement must be (1) promulgated (of general applicability and legally enforceable), (2) an environmental or facility citing law or regulation, (3) substantive (not procedural or administrative), (4) more stringent than a comparable federal requirement, (5) identified by the state in a timely manner, and (6) consistently applied throughout the state. Pursuant to USEPA guidance (USEPA, 1989a), where USEPA has delegated to a state the authority to implement a federal program, the state regulations replace the equivalent federal requirements as the potential ARARs.

ARARs are generally divided into chemical-, location-, and action-specific requirements. Chemical-specific ARARs are usually promulgated health- or risk-based numerical values or methods used to determine acceptable concentrations of chemicals that may be found in, or discharged to, the environment. Location-specific ARARs restrict actions or contaminant concentrations in certain environmentally sensitive areas. Action-specific ARARs are usually technology- or activity-based requirements or limitations on actions taken with respect to hazardous wastes.

An on-site action need not comply with administrative parts of requirements identified as ARARs. According to USEPA guidance (USEPA, 1988a), administrative requirements are mechanisms that facilitate the implementation of the related substantive requirements of a statute or regulation (e.g., approval of or consultation with administrative bodies, documentation, permit issuance, reporting, record keeping, and enforcement).

The NCP at 40 CFR 300.400(e)(1) exempts on-site actions from having to obtain federal, state, or local permits and defines “on-site” as meaning “the aerial extent of contamination and all suitable areas in very close proximity to the contamination necessary for the implementation of the response action.” However, on-site actions must still be in compliance with any substantive permit requirements. Off-site actions must not only comply with requirements that are legally applicable, but they must comply with both the substantive and the administrative parts of those requirements. Permits, if required, must be obtained for all remedial activities conducted off site (40 CFR 300.400[e][2]). Statutory waivers of ARARs (40 CFR 300.430[f][1][ii][C]) may not be used for off-site actions.

The USEPA has noted in its CERCLA guidance that if attainment of a numerical value that is a potential chemical-specific ARAR is impossible because the background level of the chemical subject to CERCLA authority is higher than that of the potential ARAR, the numeric criterion would not be considered an ARAR (USEPA, 1991).

ARARs include only federal or more stringent state environmental laws and regulations and do not include occupational safety regulations. The USEPA requires compliance with the Occupational Safety and Health Administration (OSHA) standards and other worker protection requirements under Section 300.150 of the NCP, not through the ARARs process. Therefore, none of the promulgated OSHA regulations (e.g., 29 CFR 1926, 29 CFR 1910) are addressed here as ARARs.

In addition to ARARs, 40 CFR 300.400(g)(3) states that federal or state nonpromulgated advisories or guidance may be identified as to-be-considered (TBC) guidance for contaminants, conditions, and/or actions at the site. TBCs include non-promulgated criteria, advisories, guidance, and proposed standards. TBCs are not ARARs because they are neither promulgated nor enforceable. TBCs may be used to interpret ARARs and to determine preliminary cleanup levels when ARARs do not exist for particular contaminants or are not sufficiently protective to develop cleanup levels. TBCs, such as guidance or policy documents, developed to implement regulations may be considered and used where necessary to ensure protectiveness. Potential TBCs evaluated as part of this investigation are listed in **Tables 3-1, 3-2,** and **3-3** and are discussed herein.

Chemical-specific requirements are discussed in **Section 3.2.2**; **Table 3-1** includes a narrative listing of chemical-specific ARARs/TBCs for LHAAP-29. Location-specific ARARs/TBCs for the sensitive resources potentially identified at LHAAP are discussed in **Section 3.2.3** and listed in **Table 3-2**. Action-specific ARARs/TBCs are discussed in **Section 3.2.4** and are listed and grouped by component action in **Table 3-3**.

3.2.2 Potential Chemical-Specific ARARs

This section identifies the potential chemical-specific ARARs that apply to surface/subsurface soils groundwater at LHAAP-29. These ARARs are summarized in **Table 3-1**.

3.2.2.1 Potential Chemical-Specific ARARs for Soil

There are no federal promulgated chemical-specific ARARs for soil. The TCEQ Texas Risk Reduction Rules are promulgated state standards for this site. It is anticipated that removal of perchlorate and explosives contaminated soils above the TCEQ GWP-Ind concentrations will prevent contamination of the groundwater at the site.

3.2.2.2 Potential Chemical-Specific ARARs for Air

Proposed remedial action alternatives (other than a “no action” alternative) developed during the FS stage may involve excavation activities that may release fugitive particulate matter into the ambient air. Contaminants emitted into the air during remediation must meet certain chemical-specific requirements for fugitive particulate matter and opacity; because these requirements; however, are triggered by a proposed action, they are addressed as action-specific ARARs in **Section 3.2.4**.

3.2.2.3 Potential Chemical-Specific ARARs for Surface Water

Section 121(d)(2) of CERCLA states that every remedial action shall require a level of control which at least attains surface water quality criteria established under Sections 304 or 303 of the Clean Water Act of 1972 (CWA). Therefore, surface water quality criteria are ARARs for surface water cleanup. The considered alternatives in this FS do not address surface water; however, measures will be implemented during construction to prevent off-site migration of contaminants to surface waters.

3.2.2.4 Potential Chemical-Specific ARARs for Groundwater

The human health risk assessment (Jacobs, 2002) indicated that the contaminated groundwater at LHAAP-29 presented an unacceptable hazard and risk to a hypothetical future maintenance worker. For the groundwater COCs at LHAAP-29, Safe Drinking Water Act MCLs are available and are considered relevant and appropriate because LHAAP-29 is an NPL site. Thus, MCLs are proposed as the preliminary cleanup levels in this FS for the groundwater at LHAAP-29. If MCLs are not available for certain COCs, MSCs provided under Texas RRR (Title 30 Texas Administrative Code [TAC] 335.551 through 335.569) will be used.

3.2.3 Potential Location-Specific ARARs

This section identifies the location-specific ARARs that may apply to LHAAP-29. These ARARs are summarized in **Table 3-2**.

3.2.3.1 Prehistoric and Historic Archaeological Sites and Paleontological Resources

In the event that significant archaeological or paleontological resources are discovered during remedial action activities at LHAAP-29, the federal National Historic Preservation Act (16 United States Code [USC] 470 et seq.) and Texas regulations for the protection of archaeological and cultural resources (13 TAC 15 and 13 TAC 25) would provide location-specific ARARs. These ARARs are included in **Table 3-2** to address this contingency. Texas regulations require that such discovered resources be surveyed, designated, and protected in accordance with relevant federal rules, regulations, standards, and guidelines.

Although highly unlikely, in the event that any historic cemeteries are discovered at LHAAP-29, certain provisions of Title 8, Texas Health and Safety Code, Chapters 711–715, may provide location-specific ARARs. For example, if an unknown or abandoned cemetery is discovered, Chapter 711.010 prohibits further construction or activity until the disturbed human remains are removed. Because the existence of cemeteries at LHAAP-29 is highly unlikely, cemetery protection laws are not included as location-specific ARARs in **Table 3-2**. If such resources are discovered during further investigation of these sites, the cemetery protection laws will be re-evaluated as ARARs in future decision documents.

3.2.3.2 Traditional Resources

A preliminary survey for significant Native American resources within the boundary of LHAAP has been conducted and indicates the presence of Native American resources on the property. Members of the Caddo Lake Indian Tribe have visited LHAAP, attended meetings, and expressed interest in and concern for the Native American resources on the site. In addition, discussions were held about establishing Native American educational displays covering the historical aspects of LHAAP property. The federal Native American Graves Protection and Repatriation Act (25 USC Section 3001) and it's implementing regulations (43 CFR 10.4[c]) are location-specific ARARs for the protection of such resources. These regulations require that activities in any area where such resources are discovered be stopped and reasonable effort be taken to secure and protect the objects discovered.

3.2.3.3 Threatened and Endangered Species

No federally endangered species are known to occur on the installation. There are 22 animal species that could potentially be present on or near LHAAP that appear on federal or state threatened and endangered species lists. The historic details regarding the number and date of species sightings are presented in the Caddo Lake Institute (CLI) report (CLI, 1995). Of the 22 animal species that could potentially be present, information received (USFWS, 2003) (Texas Department of Parks and Wildlife, 2003) identified the following list of threatened species and ecological communities of concern that are known or suspected to occur in the vicinity of LHAAP (species that have been confirmed are listed in italics) (Shaw, 2007b).

- **Federal Listed Threatened Species:**
  - *Bald Eagle*
  - Louisiana Black Bear

- **State Listed Threatened Species:**
  - Louisiana Black Bear
  - *Rafinesque's Big-Eared Bat*
  - *Alligator Snapping Turtle*
  - Timber Rattlesnake
  - Bluehead Shiner

- **State Species of Concern:**
  - Southern Lady's Slipper

- **State Special Features/Natural Communities/Managed Areas:**
  - Colonial Waterbird Rookeries
  - Bald Cypress-Water Tupelo Series
  - Shortleaf Pine-Oak Series
  - Water Oak-Willow Oak Series
  - Caddo Lake State Park

Some conflicting evidence is available regarding the potential presence of the Timber Rattlesnake at Longhorn. This State-listed species is described in historical site documents as being confirmed present on the site, but there is no recent documented evidence of this species being present on site (Shaw, 2007b). Therefore, it is assumed for the ARAR evaluation that the Timber Rattlesnake is potentially present, along with the Alligator Snapping Turtle as well as the Bald Eagle and the Rafinesque's Big-Eared Bat. Timber rattlesnakes prefer moist lowland forests and hilly woodlands or thickets near permanent water sources such as rivers, lakes, ponds, streams and swamps where tree stumps, logs and branches provide refuge. Alligator snapping turtles prefer deep waters of ponds, canals, lakes, streams, or swamps where they spend most of their time concealed by mud. Bald eagles in Texas may either represent breeding populations or wintering populations, and tend to roost on large lakes and rivers with tall trees for nesting and unobstructed flight paths to food sources (typically fish). Although Rafinesque’s big-eared bats roost in cave entrances, abandoned buildings and under bridges, the preferred roosting sites for these bats are large, dead, hollow trees. Timber Rattlesnakes have not been observed at the Installation by resident wildlife experts, and large water bodies with deep pools required by alligator snapping turtles are not present at this site. Common bat roosting locations, such as dead tree snags and abandoned buildings are not features at this site, and no bald eagle nests are documented as being present in this area. Furthermore, although the site may be used occasionally by bald eagles or Rafinesque’s big-eared bats during migration or as part of a foraging territory, this site is too small (85 acres) for regular exposure to occur for these species, which have home ranges of hundreds of acres. The potential for these threatened species to be present at LHAAP-29 is low.

Thus, based on current information, potential remedial action alternatives are not expected to harm any federal- or state-listed threatened or endangered species or their critical habitat. The requirements of the federal Endangered Species Act (16 USC 1531 et seq.), the federal Bald Eagle Protection Act (16 USC 668 et seq.), and the Texas Resource Protection Act (31 TAC 69, Subchapters A and B, and 31 TAC 65, Subchapter G) would be location-specific ARARs in the event that such species or habitats could be impacted by any proposed remedial alternatives. These ARARs are included in **Table 3-2** in the event that such threatened and endangered species/habitats are identified at LHAAP-29 in the future.

3.2.3.4 Sensitive Habitats

A sensitive habitat is defined within the CERCLA hazard ranking system (40 CFR 300, Appendix A) as one that contains an important biological resource or a particularly fragile resource. Wetlands are specifically included as a type of sensitive habitat. Other sensitive habitats include plant communities of unusual or limited distribution and important seasonal-use areas for wildlife (e.g., migration routes, breeding areas, or crucial winter habitat).

The Fish and Wildlife Coordination Act (16 USC 661 et seq.) requires that the effects of water-related projects that modify, divert, or control waters, including drainage activities, be considered with a view to preventing loss of and damage to such resources. This act may provide ARARs if groundwater diversion or treatment activities will impact groundwater-to-surface-water drainage patterns such that fish or wildlife may be adversely affected.

The Caddo Lake National Wildlife Refuge lies adjacent to LHAAP. The expected future use of LHAAP-29 is to be part of that refuge. In light of this future use, the National Wildlife Refuge System Act (50 CFR 35) would be a potential ARAR for impacted areas that will become part of the designated national wildlife refuge system.

Although there are low-lying wetland areas associated with Goose Prairie Creek, Central Creek, Saunder’s Branch, and Harrison Bayou, no formal wetlands survey has been conducted at the LHAAP specifically (USACE, 1992; Jacobs, 2001). Nearby Caddo Lake, however, into which LHAAP surface waters flow is part of the Big Cypress Bayou, which is considered a wetland of international significance. Adverse impacts to any identified wetlands located at LHAAP or to the Caddo Lake/Big Cypress Bayou wetland system from remedial actions at LHAAP-29 must be avoided to the extent practicable. If identified wetlands will be impacted and wetland mitigation is required, Title 12, Chapter 221 (*Wetlands Mitigation*) of the Texas Code, as well as the federal standards for wetland mitigation, may provide location-specific ARARs. These requirements will be evaluated during the final ROD stage as further site-specific data are collected and the preferred alternative is proposed and evaluated.

3.2.3.5 Floodplains

Executive Order 11988 *(Floodplain Management*, May 24, 1997) requires evaluation of potential effects of actions in floodplains, consideration of flood hazards, and that floodplain management is ensured. If action is taken in floodplains, the order requires consideration of alternatives that avoid adverse effects and incompatible development and minimize potential harm. This order, as summarized in **Table 3-2**, is TBC guidance for LHAAP-29 remedial activities if such activities should impact identified floodplains.

3.2.4 Potential Action-Specific ARARs

Action-specific ARARs include operation, performance and design requirements or limitations based on the waste types, media, and remedial activities. This section provides a preliminary identification and evaluation of potential federal and state of Texas action-specific ARARs for the proposed remediation of LHAAP-29.

Pursuant to USEPA guidance, there are no action-specific ARARs for the required no action alternative (USEPA, 1991). The action-specific ARARs for the activities common to the remedial action to be conducted at LHAAP-29 are discussed in **Section 3.2.4.1** below. All action-specific ARARs are listed in **Table 3-3** and are grouped by component action.

Each of the proposed remedial action alternatives will involve several of the following activities: waste generation, characterization, management, storage, and disposal activities; land use controls (LUCs) and long-term monitoring; and water treatment. Action-specific ARARs are discussed here for the activities common to the remedial activities to be proposed for LHAAP-29.

3.2.4.1 Site Preparation, Construction, and Excavation Activities

Certain on-site preparation, construction, and/or excavation activities will be necessary under all remediation actions to prepare the site for remediation, including the soil-moving or site-grading activities. Control of fugitive emissions and storm water runoff during implementation of these activities will be required.

Airborne particulate matter resulting from construction or excavation activities is subject to the fugitive dust and opacity limits listed in 30 TAC 111, Subchapter A. No person may cause, suffer, allow, or permit visible emissions from any source to exceed an opacity of 30 percent for any 6-minute period [30 TAC 111.111(a)]. Reasonable precautions must also be taken to achieve maximum control of dust to the extent practicable, including the application of water or suitable chemicals or the complete covering of materials (30 TAC 111.143 and 30 TAC 111.145).

Texas has also promulgated general nuisance rules for air contaminants mandating that no person shall discharge from any source whatsoever one or more air contaminants, or combinations thereof, in such concentration and of such duration as are or may tend to be injurious to or to adversely affect human health or welfare, animal life, vegetation, or property, or as to interfere with the normal use and enjoyment of animal life, vegetation, or property (30 TAC 101.4).

Storm water discharges from construction activities that disturb equal to or greater than one acre of land must comply with the substantive requirements of a USEPA National Pollutant Discharge Elimination System general permit (40 CFR 122.26; 30 TAC 205, Subchapter A; and 30 TAC 308.121), depending on the amount of acreage disturbed. Substantive requirements include implementation of good construction management techniques; phasing of large construction projects; minimal clearing; and sediment, erosion, structural, and vegetative controls to mitigate runoff and ensure that discharges meet required parameters.

3.2.4.2 Waste Generation, Characterization, Management, Storage, and Disposal Activities

The processes of monitoring, intercepting, or treating contaminated groundwater may generate a variety of primary and secondary waste streams (e.g., soil, personal protective equipment [PPE], and dewatering and decontamination fluids). These waste streams are expected to be non-hazardous waste. All solid waste (defined as any solid, liquid, semisolid, or contained gaseous material intended for discard [40 CFR 261.2]) generated during remedial activities must be appropriately characterized to determine whether it contains RCRA hazardous waste (40 CFR 262.11; 30 TAC 335.62; 30 TAC 335.503[a][4]; 30 TAC 335.504). All wastes must be managed, stored, treated (if necessary), and disposed of in accordance with the ARARs for waste management listed in **Table 3-3** for the particular type of waste stream or contaminants in the waste.

Excavated environmental media including soil excavated during the installation of monitoring/ extraction wells would be sent off site for disposal or, in the case of non-hazardous trenching or well construction soil, redeposit within the area of contamination (AOC). The USEPA defines "onsite" as the aerial extent of contamination and all suitable areas in close proximity to the contamination necessary for the implementation of the CERCLA response action and notes that such contamination may contain varying types and concentrations of hazardous substances (53 FR 51444; 55 FR 8758). The soil generated from remedial activities at LHAAP-29 is expected to be hazardous. ARARs for the management of such media at the site of generation (i.e., within the AOC) are listed in **Table 3-3**. Other requirements for hazardous waste such as manifesting for off-site disposal (40 CFR 262.20) and planning/implementing off-site response action (40 CFR 300.440) will be complied with even though they are not considered an ARAR.

The USEPA has stated that excavation and redeposition of contaminated soil within an AOC does not constitute "generation"; therefore, the requirements of 40 CFR 262.11 and 268.7 to characterize generated wastes are not applicable (Office of Solid Waste and Emergency Response Directive 9441.1992[16], June 11, 1992). Consolidation of waste between AOCs for treatment or disposal, however, or excavation and treatment with subsequent disposal in the same AOC or off-site disposal constitute "placement." In these situations, RCRA Subtitle C requirements for the generation, handling, treatment, and disposal of such wastes are applicable if the waste/media is determined to contain RCRA hazardous waste (Volume 55, Federal Register [FR], page 8758).

3.2.4.3 Land Use Controls and Long-Term Monitoring

Some combination of restrictive covenants, administrative controls, physical barriers, physical surveillance or other controls, in combination with long-term monitoring of groundwater, would be necessary under all remedial alternatives to restrict access to contamination and protect human health and the environment because none of the actions will completely remove all of contamination to levels that would allow unrestricted access and use of the site.

When engineering or LUC measures are required to protect human health and the environment, 30 TAC 335.565 requires compliance with the identified post-closure care requirements and deed recordation of the facility in accordance with Sections 335.566(b) through (e). The deed recordation must include a description of post-closure measures required and any LUCs placed on the future use of the property, as well as a metes and bounds description of the tract of land. Since there is no deed for federal land, when the U.S. Army transfers the land to the USFWS, a recordation of the LUC, as required by the State of Texas, will accompany the transfer. If the land is transferred from a federal entity to a non-federal entity, it is transferred by deed. Some or all of these requirements may be ARARs for this remedial action; the specific combination of controls negotiated for this action would be listed in a signed ROD.

3.2.4.4 Well Construction

All of the proposed alternatives, other than the no action alternative, may involve the placement, use, or eventual plugging and abandonment of some type of groundwater monitoring, injection, and/or extraction wells, either for in situ treatment or extraction of the contaminated groundwater or for long-term monitoring of the groundwater. Available standards for well construction and plugging/abandonment would provide ARARs for such actions.

Texas has promulgated technical requirements in Chapter 76 of Title 16 of the TAC applicable to construction, operation, and plugging/abandonment of water wells. In particular, 16 TAC 76.1000 (*Locations and Standards of Completion for Wells*), 16 TAC 76.1002 (*Standards for Wells Producing Undesirable Water or Constituents*) (LHAAP-29 contaminated groundwater could be considered “undesirable water” defined pursuant to Section 76.10[36] as “water that is injurious to human health and the environment or water that can cause pollution to land or other waters”), 16 TAC 76.1004 (*Standards for Capping and Plugging of Wells and Plugging Wells that Penetrate Undesirable Water or Constituent Zones*), and 16 TAC 76.1008 (*Pump Installation*) may provide ARARs for the placement, construction, and eventual plugging/abandonment of groundwater injection or extraction wells or the placement and long-term operation of groundwater monitoring wells for proposed groundwater remedial strategies.

Texas has promulgated technical requirements in 30 TAC 331 applicable to construction and abandonment of Class V injection wells. The temporary wells to be used in applying chemical oxidants to the plume of MC in the intermediate groundwater zone fit the category of Class V injection wells.

3.2.4.5 Water Treatment

Contaminated groundwater and wastewaters collected during well drilling, groundwater extraction or decontamination activities could be transported to the on-site water treatment facility constructed as a component of the previous interim remedial action at other LHAAP sites (LHAAP-18/24) and would subsequently be discharged in compliance with the CWA outfall limits for the facility as listed in the ROD. Such waters would be characterized, as required, before transport and managed accordingly in compliance with requirements for the type of waste contaminating the water. To assure compliance with the water treatment plant's discharge limits, the incoming water must meet the waste acceptance criteria for the facility. On-site wastewater treatment units (as defined in 40 CFR 260.10) that are part of a wastewater treatment facility that is subject to regulation under Section 402 or Section 307(b) of the CWA are not subject to RCRA Subtitle C hazardous waste management standards (40 CFR 270.1[c][2][v]; 40 CFR 264.1[g][6]; 30 TAC 335.42[d][1]). The USEPA has clarified that this exemption applies to all tanks, conveyance systems, and ancillary equipment, including piping and transfer trucks, associated with the wastewater treatment unit (53 FR 34079, September 2, 1988).

3.3 Preliminary Cleanup Levels

Cleanup levels are the concentrations for individual chemicals in soil and groundwater above which some response action (e.g., treatment, LUCs) would be required. The cleanup levels for soil, groundwater, and solid residue in the cooling water lines at LHAAP-29 are determined with consideration of the risk to human health, the risk to ecological receptors, and the ARARs identified for the site in **Section 3.2.2**.

3.3.1 Soil

Perchlorate was not identified as a COC in the risk assessment; however, it has been carried forward as a COC in this document because perchlorate is present in groundwater at LHAAP-29 at concentrations that represent a potential non-carcinogenic human health hazard and perchlorate in on-site soils is considered as the primary source. Perchlorate will be remediated to the more stringent of the SAI-Ind and GWP-Ind standards, which is GWP-Ind.

Target COPECs above the risk-based EcoPRGs are co-located with the soil and sediments containing explosives in the cooling water outfall ditch. Removal of the soils at this location will address ecological risk concerns presented in the BERA as well as human health concerns. **Table 3-4** presents the applicable cleanup level for the target contaminants.

3.3.2 Groundwater

The cleanup levels for groundwater at LHAAP-29 are the MCLs (when available) and the TCEQ GW-Ind (TCEQ, 2006) for chemicals without MCLs. Groundwater at LHAAP-29 has unacceptable risk or hazard primarily due to MC, TCE and perchlorate. Some of the chemicals (e.g., TCE) have degradation products with MCLs, and those degradation products have also been identified as COCs. **Table 3-5** summarizes the COCs and the proposed cleanup levels for groundwater using the MCLs and GW-Ind. The metals COCs are retained as provisional COCs based on preliminary data. The extent of these inorganic COCs will be assessed at wells site wide during the Remedial Design.

3.3.3 Cooling Water Lines

The cleanup levels for solid residue in the cooling water lines at LHAAP-29 are the GWP-Ind values. Solid residue in the cooling water lines exceeded the GWP-Ind for 2,4-DNT in manholes 8 and 10. If similar thicknesses and concentrations of solid residue exist in the adjacent pipelines, then 2,4-DNT could potentially leach into groundwater at unacceptable concentrations if the pipe deteriorates. **Table 3-6** summarizes the COCs and the proposed cleanup levels for solid residue in the lines using the GWP-Ind values."

Table 3-1
Potential Chemical-Specific ARARs/TBCs

Citation	Activity or Prerequisite/Status	Requirement
Surface/Subsurface Soils		
TCEQ Texas Risk Reduction Rules 30 TAC 335.558 and 335.559(d)(2)	Ensures adequate protection of human health and the environment from potential exposure to contaminants associated with releases – **relevant and appropriate** for remediation of contaminated soil for cross-media contamination pathways such as soil to groundwater and for hypothetical future maintenance workers.	Near surface (i.e., 0-2 feet bgs) non-residential (industrial) soils shall conform to the non-residential soil MSCs (SAI-Ind) based upon worker ingestion of soil, inhalation of particulates and volatiles and the non-residential soil-to-groundwater cross media protection concentration. The concentration of contamination in soil shall not exceed the non-residential soil-to-groundwater cross media (GWP-Ind). See **Table 3-4** for specific numeric criteria.
Groundwater		
Federal Safe Drinking Water Act MCLs/Non-Zero MCLGs 40 CFR 141	Applicable to drinking water at the tap—**relevant and appropriate** for water that could potentially be used for human consumption.	Must not exceed MCLs/non-zero MCLGs for water designated as a current or potential source of drinking water. See **Table 3-5** for specific numeric criteria.
TCEQ Texas Risk Reduction Rules 30 TAC 335	Applicable to industrial groundwater—**relevant and appropriate** for hypothetical future maintenance worker exposure to groundwater	If no maximum contaminant level has been promulgated, groundwater must not exceed the industrial medium-specific concentration. See **Table 3-5** for specific numeric criteria.

Abbreviations:

ARAR	*applicable or relevant and appropriate requirement*	*MSC*	*medium-specific concentration*
bgs	*below ground surface*	*SAI-Ind*	*soil MSC for industrial use based on inhalation, ingestion, and dermal contact*
GWP-Ind	*soil MSC for industrial use base on groundwater protection*	*TAC*	*Texas Administrative Code*
MCL	*maximum contaminant level*	*TBC*	*to-be-considered [guidance]*
MCLG	*maximum contaminant level goal*	*TCEQ*	*Texas Commission on Environmental Quality*

Table 3-2
Potential Location-Specific ARARs/TBCs

Resource/Citation	Activity or Prerequisite Status	Requirement
Preservation of Archaeological and Paleontological Artifacts National Historic Preservation Act (16 USC 470 et seq.); 43 CFR 7.5(b)(1); 36 CFR 800; 13 TAC 15; 13 TAC 25	Excavation activities that inadvertently discover such archaeological or paleontological resources—**applicable** if such resources are discovered. No known archeological or paleontological resources exist at LHAAP-29.	Action must avoid irreparable harm, loss, or destruction of such resources if discovered. Such resources must be surveyed, designated, and protected in accordance with relevant federal rules and regulations, standards, and guidelines, as these are adopted by the Texas Historical Commission.
Preservation of Native American Artifacts Native American Graves Protection and Repatriation Act (25 USC Section 3001); 43 CFR 10.4(c) and (d)	Excavation activities that inadvertently discover such Native American resources—**applicable** if such resources are discovered. No known Native American resources exist at LHAAP-29.	Activities in the area of the discovery must be stopped and reasonable effort taken to secure and protect the objects discovered.
Protection of Threatened and Endangered Species (as listed in Table 3-5) Endangered Species Act (16 USC 1531 et seq.); 50 CFR 402; Bald Eagle Protection Act (16 USC 668 et seq.); Texas Resource Protection Act, 31 TAC 69 Subchapters A and B, and 31 TAC 65 Subchapter G	Activities that may adversely impact any state- or federally-listed, threatened or endangered species or their habitat—**applicable** if such species and/or habitats are impacted	Actions that jeopardize the existence of a listed species or result in the destruction or adverse modification of critical habitat must be avoided, or reasonable and prudent mitigation measures must be taken. No person may take, possess, propagate, transport, export, sell or offer for sale, or ship any species of fish, wildlife, or native plant listed by the Texas Parks and Wildlife Department as endangered or threatened. The Department shall actively seek full restitution for and/or restoration of such a native plant, fish, or wildlife, or habitat loss occurring as a result of human activities.
Protection of Fish and Wildlife Resources Fish and Wildlife Coordination Act (16 USC 661 et seq.)	Action that impounds, modifies, diverts, or controls waters, including navigation and drainage activities—**applicable**	The effects of water-related projects on fish and wildlife resources and their habitat should be considered with a view to the conservation of fish and wildlife resources by preventing loss of and damage to such resources.
Protection of Caddo Lake National Wildlife Refuge System National Wildlife Refuge System Act (16 USC 668dd-668ee); 50 CFR 35; 31 TAC 69.19	Activities that may adversely impact or cause harm/loss of protected fish, wildlife and/or habitat in such protected areas—**relevant and appropriate** to impacted areas that will become part of the designated national wildlife refuge system	The taking, disturbance, injury, or damage to any protected plant or animal on a national wildlife refuge is prohibited. The disposal of waste except at designated/approved points or locations or the polluting of any waters, streams, or other areas within any national wildlife refuge is prohibited. Restitution for and/or restoration of fish, wildlife, and habitat loss occurring as a result of human activities is required; appropriate measures include, but are not limited to, direct replacement of fish, wildlife, and/or habitat destroyed.
Protection of Wetlands Section 404 of the Clean Water Act (33 USC 1344); 40 CFR 230.10(a) and (d); Swampbuster Provision of the Food Security Act; Executive Order 11990, "Protection of Wetlands"	Actions that involve the discharge of dredged or fill material into jurisdictional wetlands or actions that have a potential adverse impact to, or take place within, wetlands—**applicable** if delineated wetlands are present at the site and will be adversely impacted by the action. No known delineated wetlands are located at LHAAP-29.	No discharge of dredged or fill material into an aquatic ecosystem is permitted if there is a practicable alternative that would have less adverse impact. No discharge of dredged or fill material shall be permitted unless appropriate and practicable steps per 40 CFR 230.70 et seq. have been taken, which will minimize potential impacts of the discharge on the aquatic ecosystem.

Table 3-2 *(continued)*
Potential Location-Specific ARARs/TBCs

Resource/Citation	Activity or Prerequisite Status	Requirement
Protection of Floodplains Executive Order 11988 (*Floodplain Management*, May 24, 1997)	Activities which involve federally undertaken, financed, or assisted construction and improvements or which involve conducting federal activities and programs affecting land use - **applicable** if floodplains will be impacted by the remedial action. Floodplains should not be impacted by the remedial action at LHAAP-29.	Action shall be taken to reduce the risk of flood loss, minimize the impact of floods on human safety, health and welfare, and restore and preserve the natural and beneficial values of floodplains. The potential effects of actions in floodplains shall be evaluated, and consideration of flood hazards and floodplain management ensured. Most of LHAAP-29 is not within the 100-year floodplain.

Abbreviations:

ARAR	*applicable or relevant and appropriate requirement*
CFR	*Code of Federal Regulations*
TAC	*Texas Administrative Code*
TBC	*to-be-considered (guidance)*
USC	*United States Code*

Table 3-3
Potential Action-Specific ARARs/TBCs

Citation	Activity or Prerequisite/Status	Requirement
General Site Preparation, Construction, and Excavation Activities		
Air Contaminants – General Nuisance Rules 30 TAC 101.4	Emissions of air contaminants—**applicable**.	No person shall discharge from any source whatsoever one or more air contaminants or combinations thereof, in such concentration and of such duration as are or may tend to be injurious to or to adversely affect human health or welfare, animal life, vegetation, or property, or as to interfere with the normal use and enjoyment of animal life, vegetation, or property.
Opacity Standard 30 TAC 111.111(a)(8)(A)	Fugitive emissions from land-disturbing activities (e.g., excavation, construction)—**applicable**.	Visible emissions shall not be permitted to exceed opacity of 30% for any 6-minute period from any source.
Fugitive Particulate Matter Standard 30 TAC 111.145	Fugitive emissions from land-disturbing activities (e.g., excavation, construction)—**applicable**.	No person may cause, suffer, allow, or permit a structure, road, street, alley or parking area to be constructed, altered, repaired, or demolished, or land to be cleared without taking at least the following precautions to achieve control of dust emissions: • Use of water or of suitable oil or chemicals for control of dust in the demolition of structures, in construction operations, in work performed on a road, street, alley, or parking area, or in the clearing of land; and • Use of adequate methods to prevent airborne particulate matter during sandblasting of structures or similar operations.
Storm water Runoff Controls 40 CFR 122.26; 30 TAC 205, Subchapter A; 30 TAC 308.121	Storm water discharges associated with construction activities—**applicable** to disturbances of equal to or greater than 1 acre of land.	Good construction management techniques, phasing of construction projects, minimal clearing, and sediment, erosion, structural, and vegetative controls shall be implemented to mitigate storm water run-on/runoff.
Waste Generation, Management, and Storage		
Characterization of Solid Waste 40 CFR 262.11 30 TAC 335.62 30 TAC 335.504 30 TAC 335.503(a)(4)	Generation of solid waste, as defined in 30 TAC 335.1—**applicable**.	Must determine whether the generated solid waste is RCRA hazardous waste by using prescribed testing methods or applying generator knowledge based on information regarding material or process used. If the waste is determined to be hazardous, it must be managed in accordance with 40 CFR 262–268. After making the hazardous waste determination as required, if the waste is determined to be nonhazardous, the generator shall then classify the waste as Class 1, Class 2, or Class 3 (as defined in Section 335.505 through Section 335.507) using one or more of the methods listed in Section 335.503(a)(4) and Section 335.508 and manage the waste in accordance with the requirements of Chapter 335 of the TAC for industrial solid waste.
Characterization of Hazardous Waste 40 CFR 264.13(a)(1); 40 CFR 268.7 30 TAC 335.504(3) 30 TAC 335.509 30 TAC 335.511	Generation of a RCRA hazardous waste for treatment, storage, or disposal—**applicable** if hazardous waste is generated (e.g., PPE).	Must obtain a detailed chemical and physical analysis of a representative sample of the waste(s) that at a minimum contains all the information that must be known to treat, store, or dispose of the waste in accordance with 40 CFR 264 and 268. Must also determine whether the waste is restricted from land disposal under 40 CFR 268 et seq. by testing in accordance with prescribed methods or use of generator knowledge of waste.

Table 3-3 *(continued)*
Potential Action-Specific ARARs/TBCs

Citation	Activity or Prerequisite/Status	Requirement
National Oil and Hazardous Substances Pollution Contingency Plan 40 CFR 300.440	Procedure for planning and implementing off-site response actions.	USEPA will determine the acceptability under the selection of any facility selected for the treatment, storage, or disposal of CERCLA waste.
Management of RCRA Hazardous Waters—Wastewater Treatment Unit Exclusion 40 CFR 264.1(g)(6) 40 CFR 270.1(c)(2) 30 TAC 335.41(d)(1)	Treatment/disposal of wastewater containing RCRA hazardous waste—**applicable** to management of contaminated groundwater if it is determined to contain RCRA characteristically hazardous waste.	On-site wastewater treatment units, as defined in 40 CFR 260.10, that are part of a wastewater treatment facility subject to regulation under Section 402 or Section 307(b) of the CWA are excluded from the requirements of RCRA Subtitle C (Note: USEPA has clarified that this exemption applies to all tank systems, conveyance systems, and ancillary equipment, including transfer trucks, associated with the wastewater treatment unit [53 FR 34079, September 2, 1988]).
Requirements for Temporary Storage of Hazardous Waste in Accumulation Areas 40 CFR 262.34(a) and (c)(1) 30 TAC 335.69(a) and (d)	On-site accumulation of 55 gallons or less of RCRA hazardous waste for 90 days or less at or near the point of generation—**applicable** if hazardous waste is generated (e.g., PPE) and stored in an accumulation area.	A generator may accumulate hazardous waste at the facility provided that • Waste is placed in containers that comply with 40 CFR 264.171 to 264.173 (Subpart I); and • Container is marked with the words “hazardous waste”; or • Container may be marked with other words that identify the contents.
Requirements for the Use and Management of Containers 40 CFR 264.171–264.173 30 TAC 335.69(e) 30 TAC 335.152(a)(7)	On-site storage/treatment of RCRA hazardous waste in containers for greater than 90 days—**applicable** if hazardous waste is generated (e.g., PPE) and is stored in containers.	Design and operating standards of 40 CFR 264.175(c) and 40 CFR 264.171, 264.172, and 264.173(a) and (b) must be met for the use and management of hazardous waste in containers.
Well Construction Standards—Monitoring or Injection Wells 16 TAC 76.1000	Construction of water wells—**applicable** to construction of new monitoring or injection wells, if needed.	Wells shall be completed in accordance with the technical requirements of Section 76.1000, as appropriate.
Class V Injection Wells 30 TAC 331, Subchapter H	Installation, operation, and closure of injection wells for in situ chemical oxidation fall in the category of Class V Injection Wells – **relevant and appropriate**.	Injection wells shall be constructed to the required specifications for isolation casing, surface completion, prevention of commingling, and confinement of undesirable groundwater to its zone of origin. Closure shall be accomplished by removing all of the removable casing and the entire well shall be pressure filled via a tremie pipe with cement from bottom to the land surface, or closure shall be performed by the alternative method for Class V Wells completed in zones of undesirable groundwater. Groundwater concentrations at time of well closure will determine the appropriate method of abandonment.

Table 3-3 *(continued)*
Potential Action-Specific ARARs/TBCs

Citation	Activity or Prerequisite/Status	Requirement
Well Construction Standards—Extraction Wells 16 TAC 76.1000(a) and (c) through (h) 16 TAC 76.1002(a) through (c) 16 TAC 76.1008(a) through (c)	Construction of water wells—**applicable** to construction of extraction (recovery) wells.	Wells shall be completed in accordance with the technical requirements of Section 76.1000, as appropriate. Water wells completed to produce undesirable water shall be cased to prevent the mixing of water or constituent zones. The annular space between the casing and the wall of the borehole shall be pressure grouted with cement or bentonite grout to the land surface. Bentonite grout may not be used if a water zone contains chloride water above 1500 ppm or if hydrocarbons are present. Wells producing undesirable water or constituents shall be completed in such a manner that will not allow undesirable fluids to flow onto the land surface. During installation of a water well pump, installer shall make a reasonable effort to maintain integrity of groundwater and to prevent contamination by elevating the pump column and fittings, or by other means suitable under the circumstances. Pump shall be constructed so that no unprotected openings into the interior of the pump or well casing exist.
Treatment/Disposal		
Disposal of Wastewater (e.g., contaminated groundwater, dewatering fluids, decontamination liquids) 40 CFR 268.1(c)(4)(i) 30 TAC 335.431(c)	RCRA-restricted characteristically hazardous waste intended for disposal—**applicable** if extracted groundwater is determined to be RCRA characteristically hazardous .	Disposal is not prohibited if such wastes are managed in a treatment system subject to regulation under Section 402 of the CWA that subsequently discharges to waters of the United States.
Closure		
Requirements for Closure of a RCRA Container Storage Area 40 CFR 264.111 40 CFR 264.178 30 TAC 335.152(a)(5) 30 TAC 335.152(a)(7)	Closure of a RCRA-permitted container storage area—**applicable** if hazardous waste is generated (e.g., PPE) and is stored in containers.	Must close unit in a manner that • Minimizes the need for further maintenance; • Controls, minimizes, or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated runoff, or hazardous waste decomposition products to ground or surface waters or to the atmosphere; and • Complies with closure requirements of 40 CFR 178. All hazardous waste and residues must be removed from containment system. Remaining containers, liners, bases, and soil containing or contaminated with hazardous waste or residues must be decontaminated or removed.

Table 3-3 *(continued)*
Potential Action-Specific ARARs/TBCs

Citation	Activity or Prerequisite/Status	Requirement
Standards for Plugging Wells that Penetrate Undesirable Water or Constituent Zones 16 TAC 76.1004(a) through (c)	Plugging and abandonment of wells—**applicable** to plugging and closure of monitoring and/or extraction wells.	If a well is abandoned, all removable casing shall be removed and the entire well pressure filled via a tremie pipe with cement from bottom up to the land surface. In lieu of this procedure, the well shall be pressure-filled via a tremie tube with bentonite grout of a minimum 9.1 lb/gal weight followed by a cement plug extending from land surface to a depth of not less than 2 feet. Undesirable water or constituents or the freshwater zone(s) shall be isolated with cement plugs.
Post-Closure Care and Land Use Controls		
Warning Signs in Contaminated Areas 30 TAC 335.443-448	Hazardous substances left in place on contaminated property—**relevant and appropriate.**	Placement of warning signs on property contaminated with hazardous substances is required when such contamination presents a danger to public health or safety. Warning signs can be removed when it is determined that the remedial action on the contaminated property is complete and that no further hazard to the public health and safety exists.
Land Use Controls when Hazardous Substances are Left in Place 30 TAC 335.565 30 TAC 335.566	Hazardous substances left in place on contaminated property—**relevant and appropriate.**	Where engineering or land use control measures are required to protect human health and the environment, they must comply with the identified post-closure care requirements and recordation notification with the county for the facility in accordance with Section 335.566. Must make recordation notification with the county or counties in which the activities take place the information specified in Sections 335.566(b) through (e): • Description of post-closure measures required, • Description of any land use or legal controls placed on the future use of the property, • Metes and bounds description of the tract of land, and • Statement that pertinent information and documents are available for inspection.

Abbreviations:

ARAR	*applicable or relevant and appropriate requirement*
CFR	*Code of Federal Regulations*
CWA	*Clean Water Act of 1972*
USEPA	*U.S. Environmental Protection Agency*
FR	*Federal Register*
lb/gal	*pound per gallon*
%	*percent*
PPE	*personal protective equipment*
ppm	*part per million*
RCRA	*Resource Conservation and Recovery Act of 1976*
TAC	*Texas Administrative Code*
TBC	*to be considered (guidance)*

Table 3-4
Proposed Cleanup Levels for Target COCs/COPECs in Soil

COCs / COPECs Targeted for Remediation	SAI-Ind (mg/kg)	GWP-Ind (mg/kg)	SS Eco PRG (mg/kg)	TS Eco-PRGs (mg/kg)	Proposed Cleanup Level[a] (mg/kg)
	0-2 feet	Vadose Zone	0 -0.5 feet	0-3 feet	
2,4,6-Trinitrotoluene	510	5.1	6.1	4.7	4.7[b] 5.1[c]
2,4-Dintrotoluene	4.2	0.042	--	12	0.042
2,6-Dinitrotoluene	4.2	0.042	2.7	6.8	0.042
2-Amino-4,6-dinitrotoluene	170	1.7	--	--	1.7
4-Amino-2,6-dinitrotoluene	170	1.7	--	--	1.7
Perchlorate	950	7.2	--	--	7.2

Notes and Abbreviations:

[a] *Unless otherwise noted, cleanup level applies to soil from surface to groundwater interface*

[b] *Applies from 0 to 3 feet below ground surface*

[c] *Applies from 3 feet below ground surface to groundwater interface*

COC	*contaminant of concern*
COPEC	*contaminant of potential ecological concern*
EcoPRG	*Ecological Preliminary Cleanup level*
GWP-Ind	*soil medium specific concentration for industrial use based on groundwater protection*
mg/kg	*milligrams per kilogram*
SAI-Ind	*soil medium specific concentration for industrial use based on inhalation, ingestion, and dermal contact*
SS	*surface soil*
TS	*total soil*

Table 3-5
Proposed Cleanup Levels for Target COCs in Groundwater

COCs Targeted for Remediation	TCEQ RRS2 MSC GW-Ind (µg/L)	MCL (µg/L)
Explosives		
2,4-Dinitrotoluene	0.42	--
2,6-Dinitrotoluene	0.42	--
2-Nitrotoluene (o)	1,000	--
3-Nitrotoluene (m)	1,000	--
4-Nitrotoluene (p)	1,000	--
Anions		
Perchlorate	72	--
Volatile Organic Compounds		
1,2-Dichloroethane	--	5
Methylene Chloride	--	5
Trichloroethene (TCE)	--	5
1,1-Dichloroethene (TCE degradation product)	--	7
1,2-Dichloroethene (TCE degradation product)	--	5
Vinyl Chloride (TCE degradation product)	--	2
Metals		
Arsenic	--	10
Mercury	--	2
Nickel	2,000	--

Notes and Abbreviations:

GW-Ind	*groundwater MSC for industrial use*	*MSC*	*medium specific concentration*
MCL	*Safe Drinking Water Act maximum contaminant level*	*RRS2*	*Risk Reduction Rule Standard No. 2*
µg/L	*micrograms per liter*	*TCEQ*	*Texas Commission on Environmental Quality*

Table 3-6
Proposed Cleanup Levels for Target COCs in Cooling Water Lines

Explosive	GWP-Ind (mg/kg)
2,4,6-Trinitrotoluene	5.1
2,4-Dinitrotoluene	0.042
2,6-Dinitrotoluene	0.042
2-amino-4,6-Dinitrotoluene	1.7
4-amino-2,6-Dinitrotoluene	1.7

Abbreviations:

mg/kg	*milligrams per kilogram*
GWP-Ind	*soil MSC for industrial use based on groundwater protection*
MSC	*medium-specific concentration*

4.0 Identification and Screening of Technologies and Process Options

The primary objective of identifying, screening, and evaluating potentially applicable technology types and process options for the LHAAP-29 FS is to identify an appropriate range of remedial technologies and process options to be developed into remediation alternatives. This screening process consists of a series of analytical steps that include the following:

- Identify volumes or areas of media of concern, and the associated COCs (**Section 4.1**)
- Identify GRAs (**Section 4.2**)
- Identify and screen remedial technologies and process options (**Section 4.3**)
- Evaluate and select representative process options (**Section 4.4**)

These steps are outlined in the USEPA RI/FS guidance (USEPA, 1988b) and the NCP.

4.1 Contaminants and Media Volumes of Concern

Section 2.0 presents detailed site conditions at LHAAP-29. Based on available sampling data, soil, sediment, groundwater, and residual contamination in the former wastewater and cooling water lines at LHAAP-29 have been identified as media of concern because these media pose an unacceptable carcinogenic risk and non-carcinogenic hazard to a hypothetical future maintenance worker. These contaminated media include:

- TNT in soils adjacent to the foundation of the former process buildings 802-A (29SB08), 806-A (stained) and 806-D (29DLineWHW01) are contributing to ecological risks as well as having the potential for migration into groundwater. Contamination in this area is primarily present in the top one (1) foot of soil with an estimated volume of 230 cy.

- Residual explosive compounds remain in the former TNT wastewater and cooling water drain lines and manholes.

- Explosives in sediment and surface soils in the cooling water outfall ditch (29SD46) and immediately adjacent to the north of Avenue D (29SD13, 29SB15, and GPS-12) that are contributing to unacceptable health and ecological risks, respectively. The maximum depth of contamination is 7 feet bgs. Maximum depths of excavation will be 3 feet bgs for an ecological receptor for a total volume of 760 cy.

- Isolated perchlorate-containing soils in the northeastern portion of LHAAP-29 (sample location 29SB86) at a maximum depth of 8 feet bgs or approximately 2,900 cy.

- Dissolved plumes of VOCs, explosive compounds, and perchlorate contamination exist in groundwater at LHAAP-29 that pose an unacceptable cancer risk and health hazard. The extent of the contamination has been determined. Perchlorate, VOCs, and nitrotoluene contamination exists in the shallow zone and has contaminated approximately 9 million gallons. A VOC plume in the intermediate zone is approximately 21 million gallons (based on MC).

4.2 General Response Actions

GRAs are large groups of remedial actions that typically satisfy the RAOs. The GRAs include no action, LUCs, containment, removal, treatment, and disposal. These GRAs may be combined to form remediation alternatives that meet the RAOs. The following are descriptions of the GRAs:

- **No Action—**The no action GRA is retained throughout the FS process as required by the NCP. The no action alternative provides a comparative baseline against which other alternatives can be evaluated. Under this alternative no remedial action will be taken. The site is considered to be left "as is," with no LUCs, containment, removal, treatment, or other mitigating actions.

- **Land Use Controls—**LUCs include institutional and administrative controls that would reduce or eliminate access to the site. The volume, mobility, and toxicity of the contaminants are not reduced through the application of LUCs. LUCs are generally combined with other GRAs to meet the RAOs.

- **Containment—**Another method of reducing risk to receptors is through containment, which reduces access to the contaminated medium or the migration potential of the contaminated medium. The contaminated medium must be isolated from the primary transport mechanisms such as precipitation migration through the soil column and groundwater flow. This isolation may be accomplished through capping of contaminated soils or the installation of subsurface barriers to prevent groundwater migration.

- **Removal—**Removal GRAs extract the contaminated medium from its present location and move it to an alternative location for treatment and/or disposal. These removal technologies can be selected to reduce exposure to receptors and can be used in conjunction with treatment processes.

- **In Situ Treatment—**In situ treatment GRAs or process options reduce the toxicity, mobility, or volume of the contaminated medium. Chemicals are added, physical properties of the medium are changed, or biological activity of the medium is modified without removal.

- **Ex Situ Treatment—**Ex situ treatment GRAs involve the reduction of toxicity, mobility, or volume of contaminated medium. Ex situ treatment processes are typically coupled with removal and disposal process options.

- **Disposal—**Disposal GRAs involve the discharge of the contaminated medium. Disposal process options are typically coupled with removal and treatment process options.

4.3 Screening of Technologies

This section presents the approach to technology and process option screening. In the technology screening process, GRAs are identified that, by themselves or in combination with other GRAs, could be implemented to meet the RAOs established for LHAAP-29. Technologies associated with each GRA and process options associated with each technology are identified. Process options that are not technically feasible for the site are eliminated (screened out) from further consideration. If all of the process options under a given technology are screened out, the entire technology is eliminated.

The technologies and process options are initially screened for technical applicability to identify those to be carried forward for further evaluation. The screening process reduces the number of possible process options for a given technology to a number that is appropriate for consideration at LHAAP-29. The following are the two general criteria used to determine if a technology or process option should be retained for further evaluation:

- Applicability to the type and combination of contaminants
- Applicability to the site's physical conditions

Figures 4-1 and **4-2** present the technologies and process options considered for LHAAP-29 soil and groundwater, respectively. Process options not considered technically applicable were not retained for further evaluation; the rationale for their elimination is shown in these figures.

4.4 Evaluation and Selection of Representative Process Options

In this section, each of the process options retained from the initial screening in **Section 4.3 (Figures 4-1** and **4-2)** are further evaluated and screened, further reducing the list of process options that are developed into alternatives in **Section 5.0**. Process options are evaluated using three criteria: effectiveness, implementability, and cost. Based on these criteria, representative process options are selected for each technology. The representative process options provide a basis for developing alternatives in the FS.

The general descriptions of the process options retained from the screening, along with the relevant aspects of effectiveness, implementability, and cost, are discussed. The effectiveness evaluation considers the following: (1) the potential effectiveness of process options in handling the estimated areas or volumes of the medium; (2) the contribution toward meeting any of the goals identified in the RAOs; (3) the potential impacts to humans and the environment during the construction and implementation phase; and (4) how proven and reliable the process is with respect to the contaminants and conditions at the site.

The implementability evaluation considers both the technical and administrative feasibility of implementing a process option. Implementability concentrates on the difficulty of implementing the option, including the number of treatability studies required, the extent of innovative design required, and the extent of site preparation needed. Unusual equipment or unusual conditions for standard equipment may decrease the ease of implementation. The institutional aspects of implementability such as permitting and availability of services are also considered.

The cost evaluation focuses on the relative capital and operation and maintenance (O&M) costs required. A ranking of high, medium, or low relative to other similar process options is given; each ranking considers both capital and O&M costs. Based on this evaluation, one or more representative process options are selected for each response action to be carried forward into the development of alternatives. The selection of representative process options for the development of alternatives does not eliminate the remaining process options from future consideration. Those process options not carried forward may be reconsidered during the development of the PP, ROD, or remedial design.

4.4.1 Soil/Sediment

The soil process options will be evaluated to address residual explosives in the drain lines, soil, and sediment, and perchlorate in the soil. The risks and hazards posed to hypothetical future maintenance workers and ecological receptors as well as the potential migration of contaminants to groundwater from residual contamination will be addressed.

4.4.1.1 No Action

The "no action" process option does not provide additional remediation, maintenance, or security activities at contaminated soil or sediment areas at LHAAP-29. The lack of a remedial action can lead to receptor exposure to the contaminated soil or sediment. This process option is retained as a baseline with which other remediation alternatives are compared.

- **Effectiveness—**This response action could have negative long-term impacts on human health and the environment. Industrial use at LHAAP-29 would result in risks to humans from exposure to contaminated soil and sediment.
- **Implementability—**No implementation is required.
- **Cost—**None.

4.4.1.2 Land Use Controls

LUCs would be implemented to regulate access to soil and groundwater and include covenants/deed restrictions, administrative controls, and physical mechanisms. This process option controls exposure by restricting access and use of the contaminated soil and groundwater and also provides information needed to assess future conditions at the site. The LUC process option is applicable to the soil and groundwater at LHAAP-29. Notification of industrial/recreational use will accompany all transfer documents and will be recorded in the County Courthouse. Five-year reviews will be performed to document that the land use remains consistent with the industrial/recreational exposure scenario evaluated in the risk assessment.

4.4.1.2.1 Access Controls

Access controls would be implemented to regulate access to the contaminated soil and sediment areas. The process options for access controls include covenants, administrative controls, and physical barriers/security.

Covenants. To protect human health, restrictions can be placed on the use of the contaminated site through modifications to the property deed or transfer documents. Deed restrictions would be needed only if the U.S. Army releases the property to a non-federal entity. These restrictions are only effective as long as they are enforced by the property owners and local authorities. The U.S. Army is ultimately responsible for the enforcement of LUCs.

- **Effectiveness—**Covenants are effective, if enforced, in controlling human activities such as construction activities. These actions can limit or prevent exposure to contaminants remaining on the site after remediation and can be implemented on a temporary basis. However, their effectiveness declines with time as institutional knowledge is lost.
- **Implementability—**These options can be readily implemented.
- **Cost—**Low.

Administrative Controls. Administrative controls consist of the use of procedures to limit access to sites to control access to both surface and subsurface contamination. Permits for subsurface penetration or excavation can be used. Notices can be filed with local authorities defining the presence of hazardous waste. These are controls the U.S. Army can use while they maintain control of the site.

- **Effectiveness—**Administrative controls are effective in controlling human intrusion into contaminated areas during and after remediation. Procedures that limit certain activities in the vicinity of the wastes and access to the site which limits exposure. However, it is not effective for controlling the soil-to-groundwater pathway or for ecological receptors. Administrative controls can be used in conjunction with barriers and deed restrictions. This option is effective only while the administrative controls are enforced.
- **Implementability—**Procedures are readily available and implemented. They may need to be modified for LHAAP-29.
- **Cost—**Low.

Physical Mechanisms. Physical mechanisms include physical barriers intended to limit access to property, such as fences or signs. However, the future use of the site is to be a part of a national wildlife refuge under the USFWS. It is anticipated that restrictions and administrative controls will be adequate to control access to the contaminated groundwater and physical mechanisms will not be required.

- **Effectiveness—**Physical barriers and security are effective in controlling human intrusion into contaminated areas during and after remediation. This option is effective only as long as the barriers and security mechanisms are maintained. However, it is not effective for controlling the soil-to-groundwater pathway or for ecological receptors.
- **Implementability—**This option is readily implemented with available equipment and personnel.
- **Cost** - Low.

4.4.1.2.2 Monitoring

Monitoring is used to assess the performance of remedial actions and verify compliance with the established RAOs. Process options for monitoring are physical surveillance and long-term media monitoring.

Physical Surveillance. Visual and physical inspections of engineered remedial action components can detect physical changes (e.g., cracks in caps, erosion, unwanted vegetation, holes in fences, etc.) that may ultimately lead to the failure or unsatisfactory performance of that component. Repairs and/or revised maintenance activities can be implemented as a result of these inspections. However, it is not effective for controlling the soil-to-groundwater pathway or for ecological receptors.

- **Effectiveness—**Physical surveillance is effective in determining the continued integrity of engineered systems and the need for repairs and/or replacement. Physical surveillance needs to be used with contaminant monitoring to assess the impact of integrity failure.
- **Implementability—**Physical surveillance is easily implemented. It requires experienced, but readily available, personnel to make regular visits to the site for inspections. Existing engineered controls at LHAAP are currently being inspected.
- **Cost—**Low.

4.4.1.2.3 Summary of Land Use Control Process Options

Since LUCs will not prevent soil-to-groundwater contamination or exposure of ecological receptors, LUCs are not retained as a process option.

4.4.1.3 Containment

The containment GRA consists of technologies that limit the migration of contaminants and the associated potential for exposure, but they do not reduce contaminant mobility, toxicity, or volume. The technologies considered are soil, asphalt or multilayer capping.

4.4.1.3.1 Capping

The capping technology is intended to minimize (1) infiltration of surface water/precipitation and subsequent leachate generation caused by percolation of water through the waste, (2) mobilization of contaminants through wind or water erosion, or (3) direct contact with surface or subsurface contamination by intruders or biota. The capping process options considered are soil covers, asphalt caps, and multilayer caps.

Soil Cover. Soil covers consist of a layer of soil placed over contamination. Vegetation is generally encouraged to limit erosion. The purpose of the cover is to prevent access or exposure to the contamination, but the cover does not control infiltration of water through the contamination. It is best used on contamination that is relatively insoluble or in combination with a treatment technology that renders the contamination insoluble.

- **Effectiveness—**A soil cover can be very effective at preventing access to explosives in surface soil. It is not applicable to deeper soil that already has a layer of clean soil between the contamination and the receptor.
- **Implementability—**Soil covers are easy to implement. Standard earthmoving equipment can move local soil over the contaminated areas. Portions of LHAAP-29 may require some initial clearing. Soil cover maintenance to limit large vegetative growth that could disrupt the cover and to control erosion would be needed. Frequent maintenance (mowing) would be required.
- **Cost—**Low.

Asphalt Cap. Asphalt caps control infiltration of rainwater or run-on water through the installation of impermeable asphalt. This process option is particularly useful if the site is to be used as a parking lot or other light industrial use.

- **Effectiveness—**Asphalt caps can be effective at reducing infiltration if sufficient maintenance occurs. Asphalt can quickly develop cracks and holes that need to be filled, and maintenance will be needed to repair them as they occur. These caps are most effective if the area needs to be asphalted for another use that will promote its long-term maintenance.
- **Implementability—**Asphalt caps are easy to install. As with other caps to control infiltration, they need to be sloped to encourage runoff during rain events. Frequent maintenance is less necessary than with multilayer caps as the asphalt does not require

mowing. However, asphalt cracks easily and this must be controlled to maintain effectiveness.

- **Cost—**Low.

Multilayer Cap. A multilayer cap is an engineered cover that can consist of various layers of soil, clay, membranes and other materials. Multilayer caps control infiltration of rainwater or run-on water through the installation of impermeable layer materials and can prevent access or exposure to the contamination.

- **Effectiveness—**Multilayer caps can be effective at reducing infiltration if sufficient maintenance occurs. Long-term maintenance would be required for ensure cracks and holes do not develop. Maintenance will be needed to repair them as they occur.
- **Implementability—**A multilayer cap is more difficult to implement than a soil or asphalt cap due to the design and installation requirements. As with other caps to control infiltration, they need to be sloped to encourage runoff during rain events. More maintenance is necessary with a multilayer cap than an asphalt cap as frequent mowing is required. The multilayer cap must be inspected and maintained to ensure its long-term effectiveness.
- **Cost—**High.

Plug and Abandon Lines. Plugging and abandoning lines consists of completely filling the piping or plugging the inlets and outlets (e.g., with a cementitious grout). Plugging and abandoning can prevent migration of solid residue from the lines, minimize contact between contaminants and surrounding groundwater, and prevent access or exposure to the contamination.

- **Effectiveness—**Plugging and abandoning lines can be effective against migration and leaching if occasional maintenance is performed. Maintenance would be required to ensure the inlets and outlet plugs remain intact, or to repair them as needed.
- **Implementability—**Plugging and abandoning lines is relatively simple to implement. Inlets and outlets may be filled in and/or covered with clean local soil or concrete. For greater resistance to leaching, some form of grout or flowable material may be used to fill the interior of the pipe lines before plugging the inlets and outlets.
- **Cost—**Moderate.

4.4.1.3.2 Summary of Containment Process Options

The soil cover alternative is a representative process option for addressing the relatively insoluble explosive contamination in the surface soil and sediments. It provides the least expensive option that meets the needs of a containment option. However, the capping options do not prevent the contaminated soil from continuing to impact groundwater and thus would be less protective of human health and the environment than other alternatives. Therefore, the containment process options for soil and sediment are removed from further consideration.

Plugging and abandoning lines is a generally effective and efficient method of addressing buried piping. Therefore, the containment process option of plugging and abandoning lines is retained for further consideration.

4.4.1.4 Removal

The removal GRA consists of technologies that remove contaminated media or waste material to either relocate it or prepare it for treatment and/or disposal. The removal technology considered is excavation with a process option of conventional excavation.

4.4.1.4.1 Excavation

Conventional Excavation. This excavation method uses a variety of conventional excavation equipment to remove debris, soil, and other buried waste. The equipment can include excavators, track loaders, bulldozers, and tool carriers of differing sizes with attachments or manipulators suitable for dealing with a varied waste profile. This equipment can be used individually or together as circumstances dictate. It is considered applicable to the pipelines and contaminated soil and sediments at LHAAP-29. It can be used for both shallow and deep soil.

- **Effectiveness—**Conventional excavation equipment is applicable to the LHAAP-29 soils. The equipment has consistently proven reliable and effective for soil and other media in hazardous and non-hazardous applications for decades. Various attachments can increase the versatility of the equipment, allowing their use with a wide range of wastes. Ancillary equipment for screening, sorting, and segregation can be effectively integrated with conventional excavation equipment.

  The hazards to operators, in addition to the normal excavation hazards, come from exposure to contaminated media. Misting or fixative agents can reduce fugitive dust emissions during excavation. Buried piping and any residual contents in the piping, can also pose hazards to both human health and the environment when pipes are broken or disturbed during excavation. PPE can reduce or eliminate exposure from inhalation/ingestion or dermal contact. The potential for releasing contamination (from residual contamination inside the lines, clay pipe with asbestos wicking, and transite asbestos containing pipe) during removal of the pipelines is likely.

- **Implementability—**Conventional excavation is readily implemental, and the equipment, attachments, and operators are widely available. The equipment can be readily adapted to the material and conditions at the site. Special handling and disposal considerations would apply to any transite piping that is excavated.

- **Cost—**Moderate.

4.4.1.4.2 Summary of the Removal Process Option

Conventional excavation equipment is carried forward as the representative process option for soil removal because of its effective application for a wide range of wastes, its equipment availability, and its widespread use in environmental restoration activities. Excavation of piping is not carried forward due to potential to disturb the asbestos containing materials during removal.

4.4.1.5 Ex Situ Treatment

Ex situ treatment technologies provide varying levels of waste treatment following removal of the waste. These technologies are applied to reduce the volume, mobility, or toxicity of the waste. The ex situ treatment technologies considered are physical/chemical, thermal, and biological treatment. Ex situ treatment could be considered if excavated material requires treatment before disposal to meet waste acceptance criteria or if complete treatment could be achieved so remaining material is clean.

4.4.1.5.1 Thermal Treatment

Thermal treatment destroys and/or removes organic and volatile metal contaminants. The process option considered is incineration.

Incineration. Incineration is an ex situ thermal destruction process in which organic compounds is destroyed by exposure to extremely high temperatures. It is considered applicable to the source problems at LHAAP-29. Many different systems are available: rotary dryer systems, indirect-fired systems, direct-fired systems, screw-type systems, and asphalt plant aggregate driers. Each system uses the same basic principle of operation, which is a furnace to remove and destroy organic compounds in the waste feed. One of the more common systems, a rotary kiln incinerator, feeds the waste material into the upper end of a sloped rotating kiln. The slope and the rotating action conveys the waste to the low end of the kiln, exposing the waste to the heated gases (up to 1,800 degrees Fahrenheit [°F]) in the kiln and vaporizing and destroying the contaminants. The combustion gases are then drawn through an afterburner (2,200ºF) and scrubbing system before discharge to the atmosphere.

- **Effectiveness—**Incinerators have been effectively used for years on organic-contaminated media and are the Best Demonstrated Available Technology for many RCRA organics. It is applicable to most, if not all, of the organic- and explosives-contaminated wastes at LHAAP-29. The destruction capabilities of an incinerator allow the achievement of relatively low cleanup levels. Incineration is a robust technology that can handle a wide variety of organic compounds and concentrations because of its high temperatures. The disadvantages of incineration are that some organics generate toxic products of incomplete combustion, some materials are not incinerable, the capital and operating costs are high, and supplemental fuel is often required. If the ash contains heavy metals, the ash may have to be stabilized before disposal as a RCRA waste.

- **Implementability—**Incineration systems are available for both on- and off-site use. The off-gas stream may require additional treatment and may produce a residue that requires disposal. Thermal treatment systems are generally not well received by the public because of concerns with air emissions.

- **Cost—**High.

4.4.1.5.2 Biological Treatment

Biological treatment process options use biological processes to degrade or destroy contaminants. The ex situ process evaluated is composting.

Composting. Composting is a controlled biological process by which organic contaminants (e.g., VOCs) are converted by microorganisms (under aerobic and anaerobic conditions) to innocuous, stabilized byproducts. Typically, thermophilic conditions (54–65 degrees Celsius [°C]) must be maintained to properly compost soil contaminated with hazardous organic contaminants. The increased temperatures result from heat produced by microorganisms during the degradation of the organic material in the waste. In most cases, this is achieved by the use of indigenous microorganisms. Soil is excavated and mixed with bulking agents and organic amendments, such as wood chips, and animal and vegetative wastes, to enhance the porosity of the mixture to be decomposed. Maximum degradation efficiency is achieved through maintaining oxygenation (e.g., daily windrow turning), irrigation as necessary, and closely monitoring moisture content and temperature. There are three process designs used in composting: aerated static pile composting (compost is formed into piles and aerated with blowers or vacuum pumps), mechanically agitated in-vessel composting (compost is placed in a reactor vessel where it is mixed and aerated), and windrow composting (compost is placed in long piles known as windrows and periodically mixed with mobile equipment). Windrow composting is usually considered to be the most cost-effective composting alternative. Meanwhile, it may also have the highest fugitive emissions. If VOC or SVOC contaminants are present in soil, off-gas control may be required.

- **Effectiveness—**The composting process may be applied to soil contaminated with biodegradable organic compounds. Pilot and full-scale projects have demonstrated that aerobic, thermophilic composting is able to reduce the concentration of VOCs, polyaromatic hydrocarbons, and explosives [TNT, hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), and octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)]. The addition of amendments will increase the volume of the waste. Windrow composting has been demonstrated as an effective technology for treatment of explosives-contaminated soil.

- **Implementability—**All materials and equipment used for composting are commercially available. Substantial space may be required for composting.

- **Cost—**Low.

4.4.1.5.3 Summary of Ex Situ Treatment Process Options

Currently the chemicals at LHAAP-29 that are considered to potentially require treatment are the explosives in soil and sediment (potential characteristic hazardous waste). Perchlorate contaminated soils have not been considered for ex situ treatment since it is non-hazardous. The thermal treatment option is effective for permanent destruction of explosives in the soil and is carried forward for consideration. Biological treatment by composting is less developed for LHAAP-29 conditions and is removed from further consideration.

4.4.1.6 Disposal

The disposal GRA consists of those technologies that provide for the disposal of removed wastes at new or existing, permitted disposal facilities. Both on-site and off-site facilities are evaluated. A selection of on-site facilities versus off-site facilities is made for developing alternatives.

4.4.1.6.1 Off-Site Disposal

Off-site disposal options include off-site treatment and disposal facilities, a RCRA disposal facility, or an industrial landfill. The selection of the disposal facility depends on the waste characteristics and although all are evaluated here, none are selected to represent other off-site options.

Treatment, Storage, Disposal Facility. A Treatment, Storage, Disposal (TSD) facility is a commercial, permitted, off-site facility that is licensed to treat, store, and/or dispose of a variety of waste streams. There are numerous such facilities all over the country offering broad ranges of treatment options, many of which could effectively treat and dispose of the LHAAP-29 waste and soils. This option would be used if treatment before disposal is needed to meet ARARs.

- **Effectiveness—**A TSD facility is effective at treating and disposing of treated wastes in a permitted, off-site disposal facility.
- **Implementability—**Numerous facilities exist that have and are treating wastes similar to those found at LHAAP-29. These facilities are already permitted and licensed to operate. Wastes have to meet the waste acceptance criteria of the receiving TSD facility.
- **Cost—**Moderate.

RCRA Disposal Facility. This process option consists of any number of existing disposal facilities that use engineered features such as multilayer liners and caps, leachate detection and collection systems, run-on/-off controls, and intrusion barriers to isolate wastes from human and environmental receptors.

- **Effectiveness—**Disposal involves permanent disposition of the RCRA-generated contaminated soil in a manner that protects human health and the environment. Off-site disposal would include the transportation of excavated soils to an approved and licensed facility.

- **Implementability—**Implementation is moderate if the waste acceptance criteria can be met.
- **Cost—**Moderate.

Industrial Landfill. An existing industrial landfill can be used to dispose of that debris or refuse that is not a RCRA waste or has been decontaminated to acceptable levels. Such a facility is a Class II lined facility permitted to receive industrial, commercial, institutional, land-clearing, and construction/demolition waste. The facility does not accept RCRA-hazardous waste or free liquids. This option would be used to dispose of waste that is considered hazardous to human health and the environment but is not a RCRA-hazardous waste.

- **Effectiveness—**Industrial landfills are effective in isolating low hazard wastes from the environment and human receptors because the waste acceptance criteria severely restrict the type and concentrations of waste that may be disposed.
- **Implementability—**Disposal of the excavated clean wastes or treated wastes would involve transportation and compliance with waste acceptance criteria.
- **Cost—**Moderate.

4.4.1.6.2 On-Site Disposal

On-site consolidation is considered as the technology process option for on-site disposal.

Consolidation. Consolidation involves placing treated LHAAP-29 soil and sediment back into LHAAP areas. The waste is excavated, partially treated on the site if needed, and then placed elsewhere on LHAAP. The contaminants in the treated waste would have to have been rendered immobile, making the treated waste better suited for placement. This option precludes the need to transport the treated waste to an off-site disposal facility. A single or multilayer cap would then be placed over the waste. If the waste is fully treated, no special disposal process option is needed.

- **Effectiveness—**Consolidation is effective in isolating the very low hazard wastes from human receptors and the environment. It can limit the area requiring long-term institutional controls.
- **Implementability—**Consolidation is used at other hazardous waste sites around the country where off-site disposal options are unavailable or undesirable and where the continued on-site presence of treated waste is not problematic. Given the potential future land uses at the LHAAP, there may be regulatory and public reluctance to moving the waste around the LHAAP.
- **Cost—**Low compared to off-site disposal.

4.4.1.6.3 Summary of Disposal Process Options

All off-site disposal process options are carried forward for additional consideration until waste streams and volumes are more clearly identified in the alternative development process. The on-site disposal option of consolidation is not retained because of the potential regulatory and public concerns about leaving waste on the site after having already removed it, the potential future land uses, and the widespread availability of off-site treatment and disposal facilities.

4.4.1.7 Summary of Representative Soil/Sediment Process Options

Figure 4-3 is presented to illustrate the process options that have been selected for remedial alternative development for soils at LHAAP-29. The following remedial alternatives are developed from the retained representative GRAs, technologies or process options:

- No action
- Removal, off-site disposal
- Plug and abandon pipe lines

Detailed analyses of these remedial alternatives are included in **Section 5.0**.

4.4.2 Groundwater

In the following subsections, process options are evaluated to address shallow groundwater contaminated with VOCs, explosives and perchlorate; and intermediate groundwater contaminated with MC.

4.4.2.1 No Action

The "no action" process option provides no groundwater remedial activities. No monitoring of the groundwater or surface water conditions occurs under this process option. This process option is retained as a baseline with which other remediation alternatives are compared.

- **Effectiveness—**Without access controls or remediation, the groundwater from LHAAP-29 could result in a future unacceptable risk to humans if the groundwater is ingested.
- **Implementability—**No implementation is required.
- **Cost—**None.

4.4.2.2 Land Use Controls

This LUC process option would be implemented to regulate access and use of the contaminated groundwater at LHAAP-29. The U.S. Army will perform notification of industrial/recreational use which will accompany all transfer documents and will be recorded in the Harrison County Courthouse. Five-Year Reviews will be performed to document that the land use remains consistent with the industrial/recreational exposure scenario evaluated in the risk assessment.

4.4.2.2.1 Access Controls

Access controls would be implemented to regulate access to the groundwater. The process options for access controls include covenants/deed restrictions, administrative controls, and physical mechanisms.

Covenants/Deed Restrictions. Restrictions to the groundwater can be accomplished through modifications to the property deed or agreements about land use. Legal restrictions can be placed on the installation of groundwater extraction wells not only to prevent access to the contamination, but also to minimize the possibility of moving the contamination toward a future user. A recordation of the LUCs (including restriction to groundwater use) will accompany the transfer documentation from the U.S. Army to the USFWS. Deed restrictions would be needed only if the U.S. Army releases the property to a non-federal entity. These restrictions are effective only as long as the property owners and local authorities enforce them. The U.S. Army is ultimately responsible for the enforcement of the LUCs.

- **Effectiveness –** Covenants/deed restrictions are effective, if enforced, in controlling human activities such as potable well construction. These actions can limit or prevent exposure to contaminants remaining on the site after remediation and can be implemented on a temporary basis. The 5-year reviews will ensure that the covenants/deed restrictions are enforced and remain effective.
- **Implementability –** These options can be readily implemented.
- **Cost –** Low.

Administrative Controls. Administrative controls consist of the use of training or procedures to limit access to the site and reduce the risk to human health posed by site contamination at LHAAP-29. These measures may include internal notices and site inspections to serve as a reminder of the existence of LUCs, a site approval process to review land-use changes at LHAAP-29 to ensure the LUCs are followed, training of site personnel regarding the existence and care of the LUCs, and regular inspection and maintenance of the LUCs. These are controls the U.S. Army can use while it maintains control of the site.

- **Effectiveness –** Administrative controls are effective in controlling human intrusion into contaminated areas during and after remediation. The training required for access to the site limits potential exposure to the contaminated groundwater. Administrative controls can be used in conjunction with physical mechanisms and deed restrictions. This option is effective only while LUCs are maintained.
- **Implementability –** Training and procedures are readily available and implemented. They may need to be modified for LHAAP.
- **Cost –** Low.

Physical Mechanisms. Physical mechanisms include various engineered remedies to contain or reduce contamination and/or physical barriers intended to limit access to property, such as fences or signs. It is anticipated that covenants and administrative controls will be adequate to control access to the contaminated groundwater and physical mechanisms will not be required.

4.4.2.2.2 Monitoring

Monitoring and surveillance are used to assess the performance of remedial actions and verify compliance with the established RAOs. Process options for monitoring are physical surveillance and long-term media monitoring.

Physical Surveillance. Visual and physical inspections of engineered remedial action components can detect physical changes (e.g., iron deposition and pipeline cracks) that may ultimately lead to the failure or unsatisfactory performance of that component. Repairs and/or revised maintenance activities can be implemented as a result of these inspections.

- **Effectiveness** – Physical surveillance is effective in determining the continued integrity of engineered systems and the need for repairs and/or replacement. Physical surveillance needs to be used with contaminant monitoring to assess the impact of integrity failure.
- **Implementability** – Physical surveillance is easily implemented and requires experienced, but readily available personnel to make regular visits to the site for inspections.
- **Cost –** Low.

Long-Term Media Monitoring. Environmental media (e.g., groundwater) can be monitored after the implementation of the remedial action to determine the effect the remedy has had on the level of contamination. Long-term media monitoring can detect a potential failure of the action to meet the RAOs. Monitoring can also be used to detect changes in expected site conditions or changes in the expected effectiveness of the remedy, and indicate whether additional actions should be implemented.

- **Effectiveness –** Long-term media monitoring would be successful in evaluating the effectiveness of a remedial alternative. The effectiveness of the monitoring system depends on the design of the monitoring plan.
- **Implementability** – Equipment and personnel are readily available. The site is readily accessible, and most monitoring techniques have already been implemented at LHAAP. Multiple groundwater-monitoring wells are already in place, and there is a reasonable baseline of groundwater conditions.
- **Cost –** Moderate due to labor and analytical costs.

4.4.2.2.3 Summary of Land Use Controls Process Options

Covenants, administrative controls, physical surveillance, and long-term media monitoring are carried forward as representative process options for the LUCs GRA. Notification of industrial/recreational use will accompany all transfer documents and will be recorded in the Harrison County Courthouse. The covenants would only be used if the U.S. Army releases the land to a non-federal entity. All of these process options could be combined with other process options to meet the RAOs.

4.4.2.3 Removal

The removal GRA consists of technologies that remove groundwater to either relocate it or prepare it for treatment. The removal technology considered is groundwater collection/removal.

4.4.2.3.1 Groundwater Collection/Removal

Groundwater collection and removal is accomplished by either extraction wells, interception trenches, or horizontal wells.

Extraction Wells. These are vertically installed wells designed to collect and extract clean or contaminated groundwater to contain a plume or to reduce contaminant mass in the plume.

- **Effectiveness—**Extraction wells are considered the most effective groundwater removal technology applicable over a wide range of site conditions. However, proper locations need to be selected to provide for effective extraction and long-term operation.
- **Implementability—**This process is the single most commonly used method to remove groundwater in a very wide range of conditions. Some site predesign characterization may be needed to site new wells. Extraction wells are easy to install at all depths that might be required at LHAAP-29. Existing monitoring wells at LHAAP-29 could be converted to extraction wells.
- **Cost—**Low to moderate.

Interception Trenches. An interception trench is a high permeability subsurface trench that collects contaminated groundwater. It is constructed and operates very much like a vertical French drain with the exception that the collected groundwater is actively pumped from the trench for ex-situ treatment. The trench can be installed across the entire width of a shallow plume to more effectively capture contaminated groundwater.

- **Effectiveness—**Interception trenches are very effective at collecting groundwater. The trench functions like a continuous line of extraction wells. The trenches are also only applicable to shallow zone contamination.
- **Implementability—**Interception trenches are relatively easy to install with conventional construction equipment. The process requires long-term maintenance to

ensure that the permeable media and collection piping do not become clogged. Interception trenches are difficult to install at depths to intercept the intermediate flow zone.

- **Cost—**Moderate.

Horizontal Wells. Horizontal wells are similar to vertical wells with the exception that they are installed horizontally and are typically screened their entire length. They function like drains and offer a water removal capability that exceeds that of a similarly sized vertical well. Horizontal wells could be installed under source areas to remove contaminated groundwater or collect migrating leachate.

- **Effectiveness—**Horizontal wells are very effective at removing large volumes of contaminated groundwater in applications where vertical wells cannot be used. Wells up to 12 inches in diameter and 10–500 feet deep can be installed over 1,000-foot lengths. A single horizontal well is generally equivalent to five vertical wells in sandy soil and ten vertical wells in clayey soil.
- **Implementability—**Although this process is commonly used in the oil industry, it is still in the demonstration phase in environmental restoration. It would likely be used underneath a source area to collect contaminated groundwater or leachate.
- **Cost—**High.

4.4.2.3.2 Summary of Removal Process Options

Horizontal wells are not retained as a representative groundwater removal process option because of their limited use in environmental restoration actions and because of their high costs. Interception trenches are effective at removing groundwater though typically at a higher cost than extraction wells. Because extraction well systems are flexible, robust, and effective in a wide range of hydrogeologic conditions, the extraction well process option will be retained for remedial alternative development in this FS. This option may be used to extract the localized, highly contaminated groundwater from the intermediate zone. Interception trenches could be considered during the implementation of the remedial action, should the results of pre-design studies warrant their use.

4.4.2.4 In Situ Treatment

In situ treatment technologies provide varying levels of groundwater treatment without prior removal of the groundwater, and reduce the mobility or toxicity of the contaminants in groundwater. The in situ treatment technologies under consideration are physical/chemical and biological treatments.

4.4.2.4.1 Physical/Chemical Treatment

MNA, air sparging/soil vapor extraction, in situ oxidation, and permeable reactive barriers are process options considered potentially applicable to the groundwater at LHAAP-29.

Monitored Natural Attenuation. MNA is a remedial process option that will achieve the cleanup levels over time. Natural subsurface processes such as dilution, volatilization, biodegradation, adsorption, and chemical reactions with subsurface materials are monitored to confirm their progress in reducing contaminant concentrations. **Appendix C** provides an evaluation of the ongoing natural attenuation at LHAAP.

The VOCs and perchlorate are amenable to MNA.

- **Effectiveness—**MNA is considered under CERCLA on a case-by-case basis. USEPA guidance has been developed to aid in the selection of this process option for VOCs. MNA has been selected for a number of CERCLA sites. MNA is effective when source term releases have been mitigated, off-site releases of contaminants at unacceptable levels are not occurring, and it can be demonstrated that natural attenuation mechanisms are occurring. Regular monitoring must be conducted throughout the process to confirm that attenuation is occurring in accordance with cleanup objectives. The MNA evaluation for LHAAP-29 (see **Appendix C**) demonstrated that natural attenuation was occurring and is effectively controlling COCs in the shallow groundwater zone. Vinyl chloride, a common degradation product of TCE has been detected in the intermediate zone at well 29WW16 where the highest VOC concentrations have been detected indicating that natural attenuation is occurring. However, the high MC concentration at 29WW16 (7,110,000 µg/L) exceeds the tolerant range for microorganism activities and limits the effectiveness of the natural attenuation in the intermediate zone.
- **Implementability—**Significant groundwater sampling and analyses must be performed to confirm that conditions are suitable for natural attenuation and to establish a monitoring network. It must also be confirmed that additional source releases and unacceptable off-site releases are not occurring.
- **Cost—**Low to moderate.

Air Sparging/Soil Vapor Extraction. This process option is designed to remove VOCs from the groundwater by volatilizing these contaminants through the introduction of air. Air is introduced into the groundwater, assisting in the volatilization of those organics in solution in the groundwater. Extraction wells are installed into the vadose zone and a vacuum is drawn on these wells. The extraction system draws off the organic-laden air that was bubbled through the groundwater in addition to any vapors that exist in the soil pore spaces. The volatilized contaminants can then be drawn from these extraction wells and treated. This process can be used in those areas where VOCs exist in the groundwater and the vadose zone above this groundwater is relatively permeable.

- **Effectiveness—**This process is very effective on highly volatile contaminants (e.g., TCE) and highly permeable formations. It is incompatible with certain soil types, and high humic content inhibits volatilization of contaminants. Implementation at LHAAP-29 is complicated by high clay content soil that may limit the effectiveness of air sparging by retarding the movement of air and vapors through the soil column. The presence of discontinuous high-permeability zones can result in preferential air flow paths, limiting the effectiveness.
- **Implementability—**Vapor extraction and air sparge equipment is readily available and commercial vendors are available to design and operate these systems. This process has been used at many hazardous waste sites in relatively homogeneous media. Organics that are removed from the vapor extraction wells require ex situ treatment. Site characterization and modeling are required to determine the proper location of the injection and extraction wells and extraction rates.
- **Cost—**Low to moderate.

In Situ Oxidation. Contaminated media are treated through the addition of oxidizers, such as potassium permanganate, hydrogen peroxide or activated persulfate, which convert the contaminants to a less mobile or toxic form. This process option is applicable to VOCs such as MC and TCE. A treatability study was conducted at LHAAP-29 to evaluate the effectiveness of in situ chemical oxidation (see **Appendix B**) using activated sodium persulfate to treat the MC and concluded that combined heat and alkaline activated persulfate oxidation appeared to be the best treatment option.

- **Effectiveness—**In situ oxidation is effective on contaminants in a relatively homogeneous and porous medium. The approximately 17 to 45-foot clay to silty-clay layer between the shallow and the intermediate zones constitutes a barrier that will keep the passive reduction process of the shallow zone from being affected by the oxidative process occurring in the intermediate zone. Based on the treatability study (see **Appendix B**), combined heat (40^{o}C) and alkaline persulfate oxidation appeared to the best treatment option of the MC in the intermediate zone; however, the long-term effectiveness is uncertain as a change in chemistry could mobilize or change the chemical behavior of the previously oxidized or reduced constituents. Chemical oxidation is most effective for VOCs (particularly TCE) and is considered a suitable approach for the primary COC at LHAAP-29, MC. Chemical oxidation is not effective for treatment of chlorinated alkanes such as 1,2-DCA.
- **Implementability—**This process option may be difficult to implement in situ because of concerns regarding delivery and sufficient exposure of the contaminants to the chemical agents. An additional concern is the release of excess reactants or byproducts to the environment. There have been limited applications of these processes, which are generally more readily implemented in the ex situ mode. A recent USEPA evaluation by their Technology Innovation Office concluded that the application of in situ oxidation is highly dependent upon the delivery system.
- **Cost—**Low to moderate.

Permeable Reactive Barriers. Permeable reactive barriers can be a physical/chemical or biological treatment option. A reactive barrier or gate is a permeable wall containing reactive media that is constructed across the path of a contaminant plume. As contaminated water passes through the wall, the contaminants are removed or degraded, allowing uncontaminated water to emerge on the downgradient side. Reactive barriers are usually installed through adaptation of conventional construction methods for impermeable barriers such as open trenches, polymer slurry trenches, and overlapping caissons. Reactive barriers may be constructed from a variety of materials including zero-valence metals (ZVM), granulated activated carbon (GAC), biological material, and other sorbents. These materials treat contaminants through a combination of mechanisms, including adsorption, chemical reduction, and biodegradation.

ZVM works by chemically reducing contaminants, thus either causing their degradation or limiting their mobility. A variety of metals can be used as reducing agents such as silver, gold, palladium, copper, zinc, aluminum, manganese, and iron. In situ reactive gates require high volumes of ZVM, making the application of precious metals such as silver, gold, and palladium impractical. The most practical metal for this technology is iron, because of its relative abundance, low cost, and low toxicity. However, more effective and more expensive forms of iron (palladized iron) may be necessary, depending on the contaminant.

GAC is the most widely used adsorbent and filter medium because of its effectiveness on a variety of contaminants. GAC is chemically stable and will not produce secondary contaminants. The surface area of the carbon and the pH of the solution flowing through the medium determine the rate and effectiveness of GAC in adsorbing contaminants. In addition, different contaminants are adsorbed according to different ionic natures and kinetics.

- **Effectiveness—**The effectiveness of this process depends greatly on the contaminants, the reactive media, site hydrology, and site geochemistry. Reactive media clogging and exhaustion causes the need for periodic replacement. The gates are generally limited to shallower applications because of the difficulties in installing and monitoring the media at depth. There are concerns over the longevity of the reactive media given uncertain and changing chemical and physical conditions.
- **Implementability—**Permeable reactive barriers require adequate site and contaminant characterization and monitoring to determine effectiveness. This process requires treatability testing before full-scale implementation to determine potential physical and chemical interactions with surrounding materials, location within the aquifer, and criteria for replacement. Long-term maintenance requirements may be significant.
- **Cost—**Moderate.

4.4.2.4.2 Biological Treatment

Biological treatment process options use living organisms such as bacteria or fungi to detoxify or immobilize contaminants in waste. These process options are primarily used to convert organic contaminants into nontoxic products.

Enhanced Bioremediation. This general process option covers a wide range of individual biological process options that rely on microbial transformation of organic contaminants under aerobic or anaerobic conditions into benign forms to obtain energy or carbon. Excessively high concentrations of contaminants could be toxic to microbes. Many organic contaminants, including some of the COCs at LHAAP-29, can be biodegraded under anaerobic (without oxygen) conditions. The activity of microorganisms is greatly affected by pH, redox potential, temperature, oxygen content, and most importantly, nutrient availability. These conditions can be manipulated to achieve optimal conditions for microbial activity, accelerating the biodegradation of the target contaminants. The conditions are manipulated through the addition of nutrients or electron acceptors or donors.

- **Effectiveness—**In situ biodegradation is effective in either low oxygen conditions or high oxygen and methane conditions in a permeable media that enhances the continuing delivery of nutrients to the bacteria. The primary challenge for in situ biological treatment is to effectively introduce the bacteria and nutrients to the affected areas and ensure adequate mixing and contact. The rate of destruction is typically slower than other competing processes, but fewer and less toxic byproducts result. The vast amount of chloride ions that would be produced through enhanced bioremediation would likely reduce the effectiveness of biodegradation.
- **Implementability—**Enhancing the biological activity may be difficult in some of the low permeability soil at LHAAP-29 because of complications associated with the delivery of nutrients and oxygen. Equipment and expertise are readily available, but significant treatability testing would be required.
- **Cost—**Low to moderate.

4.4.2.4.3 Summary of In Situ Treatment Process Options

There are numerous in situ groundwater treatment process options available. In the shallow zone, a significant reduction in perchlorate, explosives and VOC concentrations detected during the various rounds of groundwater monitoring indicates that natural attenuation is effectively occurring. However, that is not currently the case for the intermediate groundwater zone at LHAAP-29 primarily due to the high MC concentration at well location 29WW16. Therefore, MNA alone is not expected to be effective in the intermediate zone. MNA is retained as a remediation option in the shallow zone and for further consideration for the post-treatment period in the intermediate zone. The effectiveness of the air sparging/soil vapor extraction and permeable reactive barrier process options for treatment of LHAAP-29 groundwater may be limited by site geology or hydraulic conditions, contaminant characteristics, or the degree of required long-term maintenance. In situ chemical oxidation is considered a fast and efficient process with respect to the COCs in LHAAP-29 groundwater and a treatability study performed for the groundwater at the site identified this option as a viable alternative and in situ oxidation will, therefore, be retained for remedial alternative development. Although enhanced bioremediation will not be retained for remedial alternative development due to the excessive MC concentrations which could ultimately be toxic to the microbes introduced through the bioremediation process; this option may be considered an alternative to chemical oxidation once MC concentrations are reduced.

4.4.2.5 Ex Situ Treatment

Ex situ treatment technologies provide varying levels of water treatment following extraction or collection of the water. These technologies are applied to reduce the volume, mobility, or toxicity of recovered groundwater. Although ex situ treatment technologies considered are physical/chemical, thermal, and biological, they have been grouped into two process options under an on-site treatment technology – the existing treatment system and a new mobile or skid-mounted system near the extraction point.

4.4.2.5.1 New Treatment Plant

A small, skid-mounted or mobile treatment plant could be built near the point of groundwater extraction. The treatment system would be designed for removal of the COCs from the extracted groundwater. GAC or air stripping could remove the COCs. The new treatment plant may require a pretreatment system (e.g., precipitation) if iron and other interfering metals are present in the groundwater.

- **Effectiveness—**All of the considered technologies are proven effective and are even used at an existing treatment plant at LHAAP. Smaller units have less operational flexibility and may expect deviations more often. However, this option would be effective.
- **Implementability—**The implementation of this option is more difficult than that of the existing treatment plant. A few studies would be needed to design the plant to meet the site conditions. This option is still reasonably easy to implement.
- **Cost—**Moderate. The capital costs of this option are considerably greater than that of the existing plant. However, there is a potential that the operational costs could be minimized.

4.4.2.5.2 Burning Ground No. 3 Groundwater Treatment Plant

This facility, which is currently processing contaminated groundwater from other LHAAP sites (LHAAP-18/24 and LHAAP-16), includes unit operations such as neutralization, precipitation, and air stripping. The effluent from the plant is discharged to Harrison Bayou.

- **Effectiveness—**The existing plant is currently treating groundwater. The hydraulic capacity of the plant has not been met yet, so additional flow could be effectively handled. The discharge requirements are routinely met, indicating an effective operation.
- **Implementability—**The existing plant is already operational. It is operating below current design capacity. Depending on the composition of the site water sent to the plant, it is possible that no revisions to the plant would be necessary. However, LHAAP-29 is located approximately 1.5 miles from the existing plant and that distance makes the implementability of direct pumping to the plant impractical. A series of on-site holding tanks would be required.
- **Cost—**Frequent transport of the contaminated groundwater from on-site holding tanks to the plant makes this option cost moderate to high in comparison to other alternatives.

4.4.2.5.3 Summary of Ex Situ Treatment Process Options

The utilization of the existing LHAAP groundwater treatment plant will be retained for remedial alternative development. It is already effectively operational, and the capital costs for construction of the plant have already been spent. Currently, groundwater from other LHAAP sites provides the majority of the water that is treated by the plant. Because of its proven effectiveness and lower costs, the current treatment system is used to develop alternatives.

4.4.2.6 Summary of Representative Groundwater Process Options

Figure 4-4 is presented to illustrate the process options that have been selected for remedial alternative development. The following representative GRAs, technologies or process options are retained.

- No action
- LUCs
- Groundwater extraction and follow-up in situ chemical oxidation in the intermediate groundwater zone
- Groundwater extraction and ex situ treatment
- MNA (shallow groundwater zone and intermediate groundwater zone after in situ or ex situ treatment)

Development of the remedial alternatives is included in **Section 5.0**.

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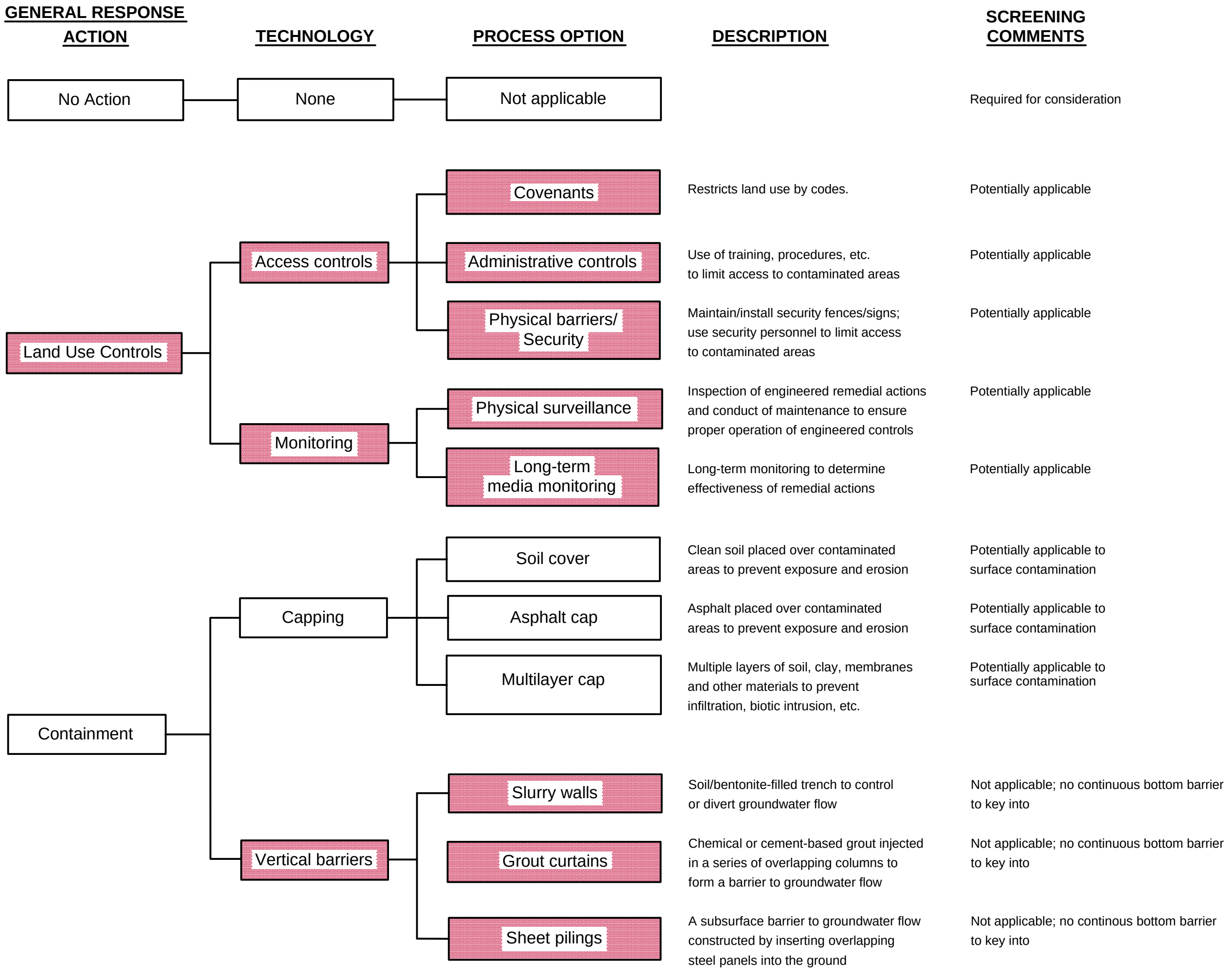

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
No Action	None	Not applicable		Required for consideration
▨ Land Use Controls	▨ Access controls	▨ Covenants	Restricts land use by codes.	Potentially applicable
		▨ Administrative controls	Use of training, procedures, etc. to limit access to contaminated areas	Potentially applicable
		▨ Physical barriers/ Security	Maintain/install security fences/signs; use security personnel to limit access to contaminated areas	Potentially applicable
	▨ Monitoring	▨ Physical surveillance	Inspection of engineered remedial actions and conduct of maintenance to ensure proper operation of engineered controls	Potentially applicable
		▨ Long-term media monitoring	Long-term monitoring to determine effectiveness of remedial actions	Potentially applicable
Containment	Capping	Soil cover	Clean soil placed over contaminated areas to prevent exposure and erosion	Potentially applicable to surface contamination
		Asphalt cap	Asphalt placed over contaminated areas to prevent exposure and erosion	Potentially applicable to surface contamination
		Multilayer cap	Multiple layers of soil, clay, membranes and other materials to prevent infiltration, biotic intrusion, etc.	Potentially applicable to surface contamination
	▨ Vertical barriers	▨ Slurry walls	Soil/bentonite-filled trench to control or divert groundwater flow	Not applicable; no continuous bottom barrier to key into
		▨ Grout curtains	Chemical or cement-based grout injected in a series of overlapping columns to form a barrier to groundwater flow	Not applicable; no continuous bottom barrier to key into
		▨ Sheet pilings	A subsurface barrier to groundwater flow constructed by inserting overlapping steel panels into the ground	Not applicable; no continous bottom barrier to key into

▨ Process option screened out

☐ Process option retained

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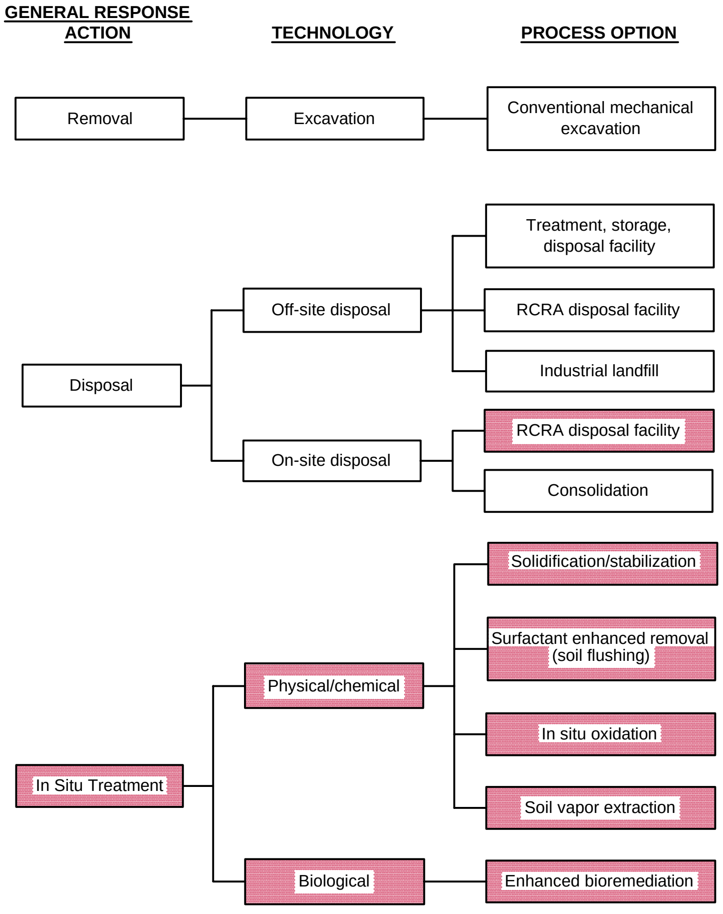
Figure 4-1 (1 of 3)

Soil Technology Screening
LHAAP-29 Feasibility Study

Longhorn Army Ammunition Plant
Karnack, Texas

PLOT DATE: 10/16/08
FORMAT REVISION 5/13/02

IMAGE	X-REF	OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		DRAWING NUMBER
---	---	STOUGHTON, MA	D. CRISPO	01/17/06	R. DUFFIELD	10/16/08	P. SRIVASTAV	03/09/09	117591-A34



GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
Removal	Excavation	Conventional mechanical excavation	Ordinary earthmoving equipment such as backhoes, loaders, and bulldozers	Potentially applicable
Disposal	Off-site disposal	Treatment, storage, disposal facility	Contaminated media sent to an off-site facilty for treatment and/or disposal	Potentially applicable
		RCRA disposal facility	RCRA hazardous waste disposed in an off-site RCRA Subtitle C facility	Potentially applicable
		Industrial landfill	Nonhazardous waste disposed in an off-site RCRA Subtitle D landfill	Potentially applicable
	On-site disposal	🟥 RCRA disposal facility	RCRA hazardous waste disposed in an on-site RCRA Subtitle C facility	On-site RCRA facility not available
		Consolidation	Consolidate waste with other waste	Potentially applicable
🟥 In Situ Treatment	🟥 Physical/chemical	🟥 Solidification/stabilization	Stabilization or solidification agent either fills void spaces or fixes contaminants	More applicable for immobilizing inorganics.
		🟥 Surfactant enhanced removal (soil flushing)	Solvents/surfactants flushed through waste/soil to remove contaminants	Results are uncertain. Undesired byproducts are a potential result.
		🟥 In situ oxidation	Chemical oxidants added in situ to contaminated soil to convert organics to less toxic form	Limited development for explosives.
		🟥 Soil vapor extraction	Air induced through a contaminated media to remove VOCs	Not applicable to explosives.
	🟥 Biological	🟥 Enhanced bioremediation	Microbes and nutrients are injected into the subsurface to biologically degrade organics, explosives	Cannot be implemented during winter. Not cost effective for small quantities.

🟥 Process option screened out

☐ Process option retained

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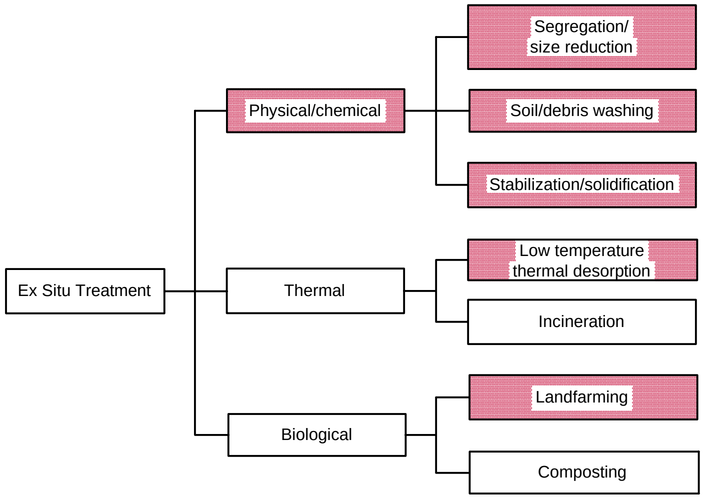
Figure 4-1 (2 of 3)

Soil Technology Screening
LHAAP-29 Feasibility Study

Longhorn Army Ammunition Plant
Karnack, Texas

PLOT DATE: 10/16/08
FORMAT REVISION 5/13/02

IMAGE	X–REF	OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		DRAWING NUMBER
---	---	*STOUGHTON, MA*	*D. CRISPO*	*01/17/06*	*R. DUFFIELD*	*10/16/09*	*P. SRIVASTAV*	*03/09/09*	117591–A35



GENERAL RESPONSE ACTION	**TECHNOLOGY**	**PROCESS OPTION**	**DESCRIPTION**	**SCREENING COMMENTS**
Ex Situ Treatment	▨ Physical/chemical	▨ Segregation/ size reduction	Debris is physically separated by size, material, hazard, etc. and reduced in size to aid in handling and treatment	Potentially applicable to debris
		▨ Soil/debris washing	Soil and debris are washed to remove bulk contamination	Less effective for VOCs and explosives.
		▨ Stabilization/solidification	Stabilization or solidification agents added to wastes to immobilize contaminants	Potentially applicable to fill void spaces. Not applicable to organics
	☐ Thermal	▨ Low temperature thermal desorption	Heat is used to remove organic contaminants from a waste stream	Potentially applicable to more volatile contaminants
		☐ Incineration	Thermal destruction of organic contaminants in a combustion chamber	Potentially applicable
	☐ Biological	▨ Landfarming	The application of contaminated media to lined beds, natural biodegradation occurs	Not applicable to explosive contaminated soils.
		☐ Composting	Introduction of microbes and food source to pile of contaminated soil	Effective for explosive containing soils

▨ Process option screened out

☐ Process option retained

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Figure 4-1 (3 of 3)

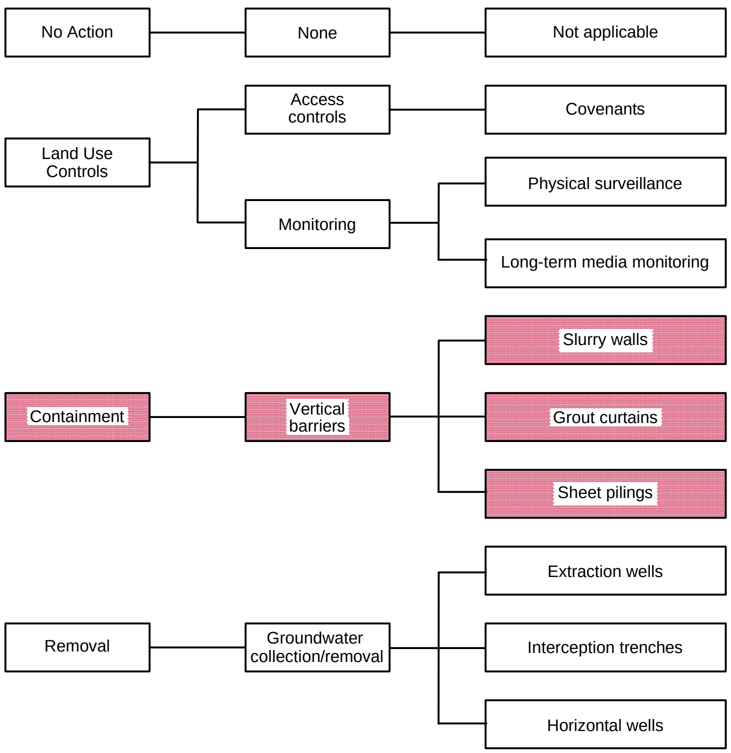
Soil Technology Screening
LHAAP-29 Feasibility Study

Longhorn Army Ammunition Plant
Karnack, Texas

00091229

PLOT DATE: 10/16/08
FORMAT REVISION 5/13/02

IMAGE	X-REF	OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		DRAWING NUMBER
---	---	STOUGHTON, MA	D. CRISPO	01/17/06	R. DUFFIELD	10/16/09	P. SRIVASTAV	03/09/09	117591-A36



GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
No Action	None	Not applicable		Required for consideration
Land Use Controls	Access controls	Covenants	Restricts land use or zoning	Potentially applicable
	Monitoring	Physical surveillance	Inspection of engineered remedial actions and conduct of maintenance to ensure proper operation of engineered controls	Potentially applicable
		Long-term media monitoring	Long-term groundwater monitoring used to determine effectiveness of remedial actions	Potentially applicable
Containment	Vertical barriers	Slurry walls	Soil/bentonite-filled trench to control or divert groundwater flow	Not applicable; no continuous bottom barrier to key into
		Grout curtains	Chemical or cement-based grout injected in a series of overlapping columns to form a barrier to groundwater flow	Not applicable; no continuous bottom barrier to key into
		Sheet pilings	A subsurface barrier to groundwater flow constructed by inserting overlapping steel panels into the ground	Not applicable; no continuous bottom barrier to key into
Removal	Groundwater collection/removal	Extraction wells	Groundwater extraction wells designed to remove contaminated groundwater	Potentially applicable
		Interception trenches	Trench filled with permeable media used to intercept and collect shallow groundwater	Potentially applicable to shallow, dissolved phase
		Horizontal wells	Wells installed horizontally beneath a waste area to collect groundwater and leachate	Potentially applicable

▨ Process option screened out

☐ Process option retained

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Figure 4-2 (1 of 2)

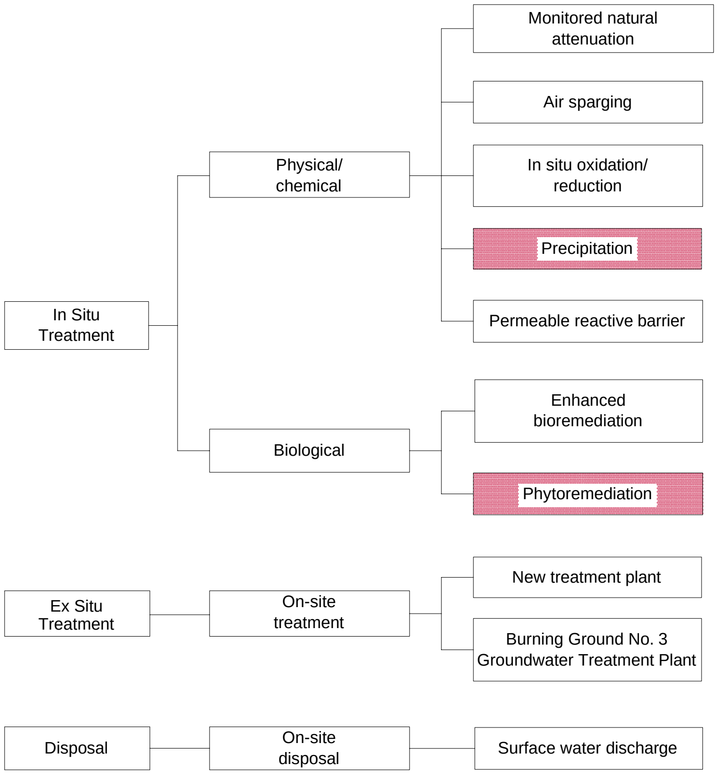
Groundwater Technology Screening
LHAAP-29 Feasibility Study

Longhorn Army Ammunition Plant
Karnack, Texas

00091230

PLOT DATE: 10/16/08
FORMAT REVISION 5/13/02

IMAGE	X-REF	OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		DRAWING NUMBER
---	---	STOUGHTON, MA	D.CRISPO	01/17/06	R. DUFFIELD	10/16/09	P. SRIVASTAV	03/09/09	117591-A37



GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
In Situ Treatment	Physical/ chemical	Monitored natural attenuation	The monitored degradation of contaminants through natural biological and chemical processes	Potentially applicable to dissolved phase
		Air sparging	Air injected into saturated matrices to remove contaminants through volatilization	Potentially applicable to dissolved VOCs
		In situ oxidation/ reduction	Chemical oxidants or reducers added in situ to convert organics to less toxic form	Potentially applicable
		🟥 Precipitation	Injection of chemicals that cause contaminants to precipitate in place	Not applicable to VOCs or perchlorate
		Permeable reactive barrier	A trench filled with a reactive or sorbent material designed to treat groundwater as it passes through the trench	Potentially applicable to both dissolved VOCs and perchlorate
	Biological	Enhanced bioremediation	Microbes and nutrients are injected into the subsurface to biologically degrade organics	Potentially applicable to both VOCs and perchlorate
		🟥 Phytoremediation	Plants are used to remove, transfer, stabilize, or destroy contaminants	Takes too long and contaminated groundwater is too deep
Ex Situ Treatment	On-site treatment	New treatment plant	Mobile or skid-mounted system near extraction point	Potentially applicable
		Burning Ground No. 3 Groundwater Treatment Plant	Treatment processes at existing water treatment plant are precipitation, air stripping, and fluidized bed reactor	Potentially applicable
Disposal	On-site disposal	Surface water discharge	Discharge of treated groundwater to surface water	Potentially applicable after treatment

🟥 Process option screened out

☐ Process option retained

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Figure 4-2 (2 of 2)

Groundwater Technology Screening
LHAAP-29 Feasibility Study

Longhorn Army Ammunition Plant
Karnack, Texas

00091231

PLOT DATE: 1/30/06
FORMAT REVISION 5/13/02

IMAGE	X-REF	OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		DRAWING NUMBER
---	---	*STOUGHTON, MA*	*D. CRISPO*	*01/17/06*	*S. WATSON*	*03/09/09*	*P. SRIVASTAV*	*03/09/09*	117591-A40

GENERAL RESPONSE ACTION	**TECHNOLOGY**	**PROCESS OPTION**	**EFFECTIVENESS**	**IMPLEMENTABILITY**	**COST**
No Action	None	Not applicable	Does not achieve RAOs.	Not acceptable to USEPA	None
▨ Land Use Controls	▨ Access controls	▨ Covenants	Effective as long as property owners and local authorities enforce them. Does not reduce contamination and is not effective to protect groundwater or ecological receptor.	Readily implemented but has legal and authority requirements	Low cost to document land use restrictions
		▨ Administrative controls	Effective as long as LUCs are implemented. Does not reduce contamination and is not effective to protect groundwater or ecological receptor.	Training and procedurs are available and readily implemented.	Low cost to implement training and routine inspection and maintenance of LUCs.
		▨ Physical barriers/ Security	Effective as long as physical mechanisms are maintained. Does not reduce contamination and is not effective to protect groundwater or ecological receptor.	Readily implemented. Fencing and signs are commercially available items.	Low cost to install fences and signage.
	▨ Monitoring	▨ Physical surveillance	Effective but needs to be used with contaminant monitoring to assess impact of integrity failure. Does not reduce contamination and is not effective to protect groundwater or ecological receptor.	Readily implemented but requires experienced persons to make routine inspections.	Low cost to implement; however, depends on frequency of inspections.
		▨ Long-term media monitoring	Effectiveness depends on the design of the monitoring plan. Does not reduce contamination and is not effective to protect groundwater or ecological receptor.	Readily implemented. The site is accessible and groundwater monitoring wells exist onsite.	Moderate costs due to labor and analytica costs.
Containment	Capping	▨ Soil cover	Effective, susceptible to cracking, but has self healing properties. Requires maintenance and long-term monitoring	Easily implemented. Restrictions on future land use in capped areas.	Medium capital, low maintenance.
		▨ Asphalt cap	Effective but susceptible to weathering and cracking. Requires maintenance and long-term monitoring.	Easily implemented. Restrictions on future land use in capped areas.	Medium capital, high maintenance.
		▨ Multilayer cap	Effective, least susceptible to cracking.	Moderate implementability. Restrictions on future land use in capped areas.	High capital, high maintenance.
Removal	Excavation	Conventional mechanical excavation	Effective for permanent removal of contaminants. Removed solids require treatment or disposal.	Easily implemented. Conventional soil removal equipment is widely available.	Medium capital, no maintenance.

▨ Process option screened out

☐ Selected representative process option

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Figure 4-3 (1 of 2)

Selection of Representative Soil Process Options
LHAAP-29 Feasibility Study

Longhorn Army Ammunition Plant
Karnack, Texas

00091232

PLOT DATE: 10/16/08
FORMAT REVISION 5/13/02

IMAGE	X-REF	OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		DRAWING NUMBER
---	---	*STOUGHTON, MA*	*D. CRISPO*	*01/17/06*	*R. DUFFIELD*	*10/16/08*	*P. SRIVASTAV*	*03/09/09*	117591–A38

GENERAL RESPONSE ACTION	**TECHNOLOGY**	**PROCESS OPTION**	**EFFECTIVENESS**	**IMPLEMENTABILITY**	**COST**
Disposal	Off-site disposal	Treatment, storage disposal facility	Effective at treating and disposing of treated wastes in a permitted, off-site dispoal facility.	Easily implemented. Numerous facilities exist that treat similar site waste.	Medium capital, no maintenance.
		RCRA disposal facility	Effective at isolating wastes from the environment due to engineering design requirements.	Moderate implementability if the waste criteria can be met. Requires frequent waste sampling.	Medium capital, no maintenance.
		Industrial landfill	Effective at isolating low hazard wastes from the environment due to waste restrictions.	Easily implemented if waste criteria is below acceptable levels for landfill disposal.	Medium capital, no maintenance.
	🟥 On-site disposal	🟥 Consolidation	Effective for low hazard waste only.	Difficult to implement due to regulatory and public reluctance to dispose waste at LHAAP.	Low cost, high maintenance.
🟥 Ex Situ Treatment	🟥 Thermal	🟥 Incineration	Effective for permanent destruction of VOCs and explosives.	Readily implemented; however, offgas may require additional treatment. Public may have concerns with emissions.	High capital, no maintenance.

🟥 Process option screened out

☐ Selected representative process option

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Tulsa, Oklahoma

Figure 4-3 (2 of 2)

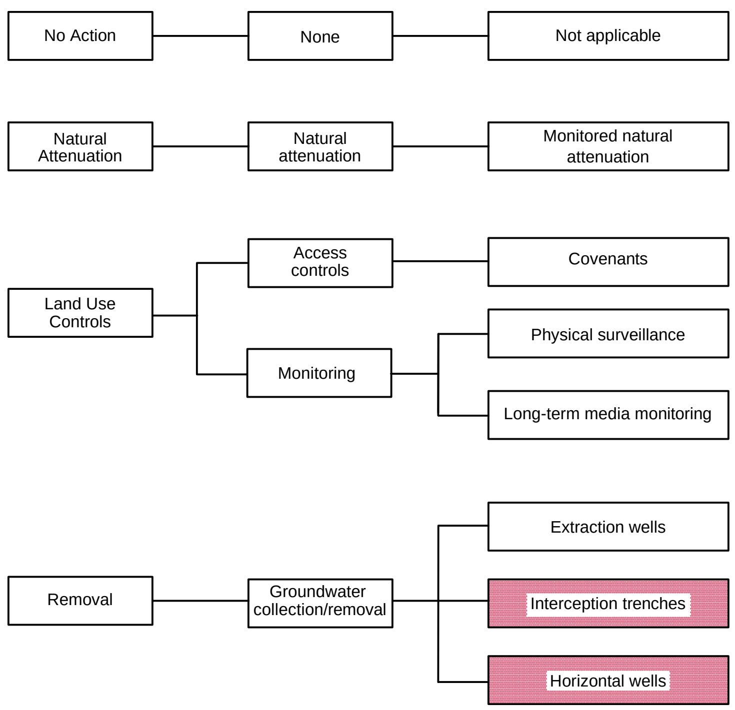
Selection of Representative Soil Process Options LHAAP-29 Feasibility Study

Longhorn Army Ammunition Plant
Karnack, Texas

00091233

PLOT DATE: 1/30/06
FORMAT REVISION 5/13/02

IMAGE	X-REF	OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		DRAWING NUMBER
---	---	STOUGHTON, MA	D. CRISPO	03/20/06	R. DUFFIELD	10/16/09	P. SRIVASTAV	03/09/09	117591-A44



GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	EFFECTIVENESS	IMPLEMENTABILITY	COST
No Action	None	Not applicable	Does not achieve RAOs.	Not acceptable to USEPA	None
Natural Attenuation	Natural attenuation	Monitored natural attenuation	Effective when sources have been mitigated and a determination that MNA is occurring.	Requires significant groundwater sampling. No significant detection of degradation products (cis-1,2-DCE or vinyl chloride).	Moderate cost due to sample requirements.
Land Use Controls	Access controls	Covenants	Effective as long as propery owners and local authorities enforce them. Does not reduce contamination.	Readily implemented but has legal and authority requirements	Low cost to document land use restrictions
	Monitoring	Physical surveillance	Effective but needs to be used with contaminant monitoring to assess impact of integrity failure.	Readily implemented but requires experienced to make routine inspections.	Low cost to implement; however, depends on frequency of inspections.
		Long-term media monitoring	Effectiveness depends on the design of the monitoring plan.	Readily implemented. The site is accessible and groundwater monitoring wells exist onsite.	Moderate costs due to labor and analytica costs.
Removal	Groundwater collection/removal	Extraction wells	Considered most effective groundwater removal method.	Easily implemented. Extraction wells are easy to install and existing wells are easily modified.	Low to moderate capital.
		▨ Interception trenches	Effective at collecting groundwater in shallow groundwater zone.	Difficult to implement. May be difficult to install and requires long-term maintenance.	Medium capital, high maintenance.
		▨ Horizontal wells	Effective at removing large volumes of contaminmated groundwater.	Medium difficulty to implement but this method is still in the demonstration phase in environmental restoration.	High capital, high maintenance.

▨ Process option screened out

☐ Selected representative process option

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Tulsa, Oklahoma

Figure 4-4 (1 of 2)

Selection of Representative Groundwater Process Options LHAAP-29 Feasibility Study

Longhorn Army Ammunition Plant
Karnack, Texas

00091234

PLOT DATE: 10/16/08 FORMAT REVISION 5/13/02	IMAGE	X-REF	OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		DRAWING NUMBER
	---	---	STOUGHTON, MA	D.CRISPO	01/17/06	S. WATSON	03/09/09	P. SRIVASTAV	03/09/09	117591-A39

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	EFFECTIVENESS	IMPLEMENTABILITY	COST
In Situ Treatment	Physical/ chemical	🟥 Air sparging	Effective at removing highly volatile contaminats but loses effectiveness in impermeable soil types (high clay).	Easily implemented. Commercial vendors are available to design and operate systems.	Low to moderate capital, high maintenance.
		In situ oxidation/ reduction	Long-term effectiveness is unknown and is mainly effective in relatively homogeneous and porous media.	Medium difficulty to implement. There are uncertainties regarding system performance	Low to moderate capital, high maintenance.
		🟥 Permeable reactive barrier	Effectiveness depends greatly upon the contaminants, the reactive media, hydrology and geochemistry.	Difficult to implement. Requires a treatability study and long-term maintenance.	Low to moderate capital, low maintenance.
	Biological	Enhanced bioremediation	Effective when adequate mixing of bacteria and nutrients occurs.	Difficult to implement. Treatability study would be needed and right conditions are required.	Low to moderate capital, low maintenance.
Ex Situ Treatment	On-site treatment	🟥 New treatment plant	Would be effective at removing volatiles and perchlorate.	May be difficult to implement. A design and treatability study would be required.	Moderate cost; however, operation cost could be less than existing treatment plant.
		Burning Ground No. 3 Groundwater Treatment Plant	Current treatment plant is effectively treating groundwater and hydraulic capacity has not yet been met.	The treatment plant is already operational.	Low cost compared to a new treatement plan.
				Easily implementable as discharge limits have already been selected for the current discharge point.	Low cost.

🟥 Process option screened out

☐ Process option retained

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Tulsa District
Tulsa, Oklahoma

Figure 4-4 (2 of 2)

Selection of Representative Groundwater Process Options LHAAP-29 Feasibility Study

Longhorn Army Ammunition Plant
Karnack, Texas

5.0 Development and Description of Alternatives

Section 5.1 presents the development of a range of alternatives based on the key assumptions regarding site and contaminant conditions **(Section 2.0)**, the RAOs and applicable ARARs **(Section 3.0)**, and the representative process options **(Section 4.0)**. **Section 5.2** presents the detailed description of the alternatives.

5.1 Development of Alternatives

5.1.1 Requirements and Preferences

The CERCLA process, as defined in the NCP, develops a remedy that protects human health and the environment, complies with ARARs (unless a statutory waiver is justified and granted), is cost-effective, and uses permanent solutions and alternative treatment or resource recovery technologies to the maximum extent practicable. A statutory preference for remedies that would result in permanent and significant decreases in toxicity, mobility, or volume through treatment and provide long-term protection is stated in Section 121 of CERCLA, as amended.

The NCP defines the following preferences in developing remedial action alternatives:

- Use of treatment to address the “principal threats” posed by a site, wherever practical.
- Use of engineering controls, such as containment, for waste that poses a relatively low, long-term threat and for which treatment is not practical.
- Implementation of a combination of actions, as appropriate, to achieve protection of human health and the environment. For example, in appropriate site situations, treatment of principal threats would be combined with engineering controls, such as containment, and LUCs for treatment residuals and untreated waste.
- Use of LUCs, such as drinking water supply controls and covenants, to supplement engineering controls for short- and long-term management to prevent or limit exposures to hazardous substances.
- Selection of an innovative technology when the technology offers the following: the potential for comparable or better treatment performance or implementability, fewer or lesser magnitude adverse impacts than other technologies, or lower costs than demonstrated technologies for similar levels of performance.
- Usable groundwater is expected to be returned to beneficial uses, whenever practicable, within a time frame that is reasonable given the particular circumstances of the site. When such restoration is not practicable, the prevention of further migration of the plume and of exposure to the contaminated groundwater are expected.

These statutory requirements and preferences were given due consideration in the development of alternatives for LHAAP-29.

5.1.2 Development using Remediation Strategies and Process Options

The media at LHAAP-29 presenting an unacceptable risk or hazard are groundwater, soil at isolated areas, sediment in the outfall ditch, and solid residue in the cooling water lines and manholes. Thus, the purpose of the remedial alternatives is to present the decision maker with technical and economic options for remediation of soil, sediment, residual contamination in pipe lines, and groundwater at LHAAP-29. Although all of the action alternatives have been designated to achieve the RAOs and the statutory requirements under CERCLA, each alternative must also be sufficiently unique in its strategy and approach that the range of alternatives represents a reasonable spectrum of final site conditions in the view of the decision makers.

The process options that remain after screening were grouped and combined into alternatives to meet the RAOs as indicated on **Table 5-1**.

A number of process options are common to both action alternatives (Alternatives 2 and 3):

- Long-term LUCs to restrict groundwater use are common to all action alternatives. The proposed groundwater remedy for each of the action alternatives necessitates that groundwater LUCs be maintained until cleanup levels are achieved. The LUCs include access controls and monitoring as discussed in **Section 4.4.2.2**.
- The process option for the shallow groundwater is MNA. MNA was evaluated (**Appendix C**) and is a viable option.
- The process option selected for the residual contamination in the lines and manholes is to plug the inlets and outlets. This will minimize contact from hypothetical future maintenance workers and prevent water from infiltrating and transporting contaminants.

5.2 Description of Remedial Alternatives

The following sections describe the remedial alternatives in more detail (see **Table 5-1** for a presentation of the components of each alternative). The details included in the alternative descriptions (e.g., quantities and dimensions) support the evaluation in **Section 6.0** and the cost estimate in **Appendix A**. Quantities and dimensions are provided for cost estimating purposes only and may be changed based on the design. Designs and process options other than those considered here may be substituted once the decision on remedial approach is made.

5.2.1 Alternative 1 - No Action Alternative

As required by the NCP, the “no action” alternative provides a comparative baseline against which the action alternatives can be evaluated. Under this alternative the source units (contaminated soil, sediment, and residual contamination in pipe lines) and groundwater would be left "as is," without implementing any additional containment, removal, treatment, or other mitigating actions. No other actions would be implemented to reduce existing or potential future exposure to human and ecological receptors.

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

The goals of this alternative are to prevent exposure of the hypothetical future maintenance worker to contaminated soil and groundwater and ecological receptors to surface soil/sediment at LHAAP-29. Soil and sediment that have the potential to pose risk to the human or ecological receptor or impact groundwater or surface water will be removed. To eliminate future impact to on-site surface water and groundwater, the TNT wastewater lines and the cooling water lines will be plugged and abandoned in place. The shallow zone and intermediate zone groundwater have contaminants above MCLs or GW-Ind that will be reduced over time to meet the cleanup levels.

Under this scenario, the highest concentration area in the MC plume in the intermediate groundwater zone will be treated. In situ chemical oxidation treatment is proposed. Extraction will be implemented as part of the in situ treatment to physically remove mass and to control the hydraulic gradient. After in situ treatment, natural attenuation will be monitored and evaluated to confirm that contaminant concentrations are being reduced to cleanup levels over time. LUCs would be maintained until the groundwater is returned to beneficial use.

5.2.2.1 Removal of Soil above Cleanup Levels

The recommended removal action consists of excavation of the nitrotoluene and perchlorate-contaminated soil and off-site disposal at a RCRA Subtitle D-permitted landfill. Excavation of the contaminated soil and disposal in a RCRA-permitted landfill will result in the following: 1) removal of contaminated soil that is a potential source of cross-contamination to groundwater, thereby ensuring that groundwater can ultimately be returned to its beneficial uses; 2) removal of soil that is posing risk to ecological receptors; and 3) removal of soil that is a direct risk to the hypothetical future maintenance worker, thereby protecting human health by preventing inhalation, ingestion, and dermal contact with the COCs. The estimated volume of soil to be removed is approximately 3,900 cubic yards and is based on the cleanup levels in **Table 3-4** and the receptor. The excavation locations are highlighted on **Figure 2-1**. The removal of soil contamination will be verified by collecting confirmation samples from the walls and floors of the excavation area and submitting them for laboratory analysis for the COCs of interest. Clean borrow soil will be used as needed to backfill the excavations so they can be graded for proper drainage.

With the removal of the contaminated surface soil and sediment at LHAAP-29, plugging of the former TNT wastewater and cooling water lines and abandoning the manholes associated with the cooling water lines, health and ecological risks as well as the potential migration of soil to surface water and groundwater will be eliminated and long-term operations for soil will not be required.

5.2.2.2 Plug and Abandon Lines

The transite TNT wastewater line will be flushed with water to remove visual residue. The rinsate water will be containerized. Appropriate rinsate handling procedures will be followed based on its waste classification. The inlets and outlets of the traniste TNT wastewater line will be plugged with a bentonite slurry mix or equivalent.

The cooling water lines showed no significant contamination except for 2,4-DNT in the solid residue in manholes 8 and 10. The cooling water lines will be inspected to determine if there is contaminated solid residue in the lines adjacent to manholes 8 and 10. An attempt will be made to sample and analyze the residue and water in the cooling water lines as part of the RD phase. If there is not enough residue volume to sample or the concentrations in the sample are less than the GW-Ind (water) or GWP-Ind (solid) and the residue is nonhazardous, the pipe will be plugged and abandoned. No solid residue or liquid will be left in the pipe if the explosive constituents exceed the GWP-Ind (residue), the GW-Ind (water) or the solid or liquid is determined to be hazardous (residue or water). If explosive concentrations are above the GWP-Ind (residue) or GW-Ind (water) or the material is found to be hazardous, the line will be flushed before plugging and abandoning. The rinsate will be characterized for waste handling. The manholes will then be plugged with a bentonite slurry mix or equivalent.

5.2.2.3 In Situ Chemical Oxidation for Intermediate Zone VOC Groundwater Plume

In situ chemical oxidation in groundwater is a technology that oxidizes most organic constituents in the saturated zone to carbon dioxide and mineral products. The proposed oxidant is activated persulfate. The persulfate ion ($S_2O_8^{-2}$) is a strong oxidant that reacts with organic compounds primarily by the sulfate anion radical. The persulfate reagent is very soluble in water to concentrations of 30 to 40 percent and the solutions are relatively stable at concentrations as low as 1 to 10 percent. These properties allow for optimum delivery and distribution to the subsurface matrix without being limited by solubility of the oxidant. Persulfate activation by adjusting the pH to alkaline conditions and/or applying heat is effective for chlorinated methanes, such as MC, the primary COC in the groundwater intermediate zone at LHAAP-29. A treatability study was conducted at LHAAP-29 to evaluate the effectiveness of in situ chemical oxidation using activated sodium persulfate to treat the MC and concluded that combined heat and alkaline activated persulfate oxidation appeared to be the best treatment option (**Appendix B**).

In general, the components of the in situ chemical oxidation action include:

- **Installation of injection wells.** Four intermediate zone injection wells (88 feet bgs) will be installed around existing intermediate monitoring well 29WW16, where MC was detected at the highest concentration. The four wells will be arranged in a square with well 29WW16 in the center of the square. The new wells will be spaced approximately 50 feet apart, creating a treatment zone with an aerial coverage of 2,500 square feet. The spacing may be adjusted based on actual field conditions.

- **Injection of oxidation solution.** One pore volume of heat activated (40^{o}C) combined persulfate and sodium hydroxide solution at 60 grams per liter (g/L) and 15 g/L, respectively, will be injected into four wells while simultaneously extracting groundwater from well 29WW16. Temporary piping will be used for the injection array. Based on the estimated volume of the treatment zone (50’ × 50’ × 40’) and a porosity of 25 percent, a total of 25,000 cubic feet (187,000 gallons) of activated persulfate and sodium hydroxide solution will be injected into the subsurface. An estimated 94,000 pounds of persulfate reagent and 23,500 pounds of sodium hydroxide will be injected into the subsurface. A second round of injection may be required if monitoring indicates COCs are not being effectively reduced from the initial round. For costing purposes, it is assumed a second round will be required. If contaminant concentrations do not decrease as anticipated, the method will be modified.

- **Simultaneous extraction of groundwater.** Well 29WW16 will be converted to an extraction well. Prior to conversion, a pump test will be conducted and hydrogeologic parameters will be measured to assess aquifer conditions. Groundwater flow in the vicinity of 29WW16 and the injection wells will be modeled to determine the scope of the modifications needed at 29WW16 and to assess the time required to extract one pore volume.

  A temporary piping system will be used to convey the extracted water to three 5,000-gallon on-site storage tanks. The on-site tanks will be interconnected and will be equipped with a high level shut off to the extraction pump. Once every two days, water will be pumped into a tank truck and transported to the LHAAP groundwater treatment plant for treatment and discharge. A 20-foot by 50-foot gravel pad will be prepared for the tanks, and a 6-inch layer of gravel would be placed to upgrade the road to the tanks. The estimated quantities are for costing purposes only and will be revised during the design.

- **Monitor effectiveness.** To monitor the effectiveness of the in situ chemical oxidation, six wells will be monitored biweekly for three sampling events. The six wells will include one new monitoring well, four injection wells, and 29WW16. The effect of the first chemical injection should be evident within a few weeks. It is anticipated that a second injection will be needed after approximately 2 months. Following in situ treatment, groundwater monitoring will be implemented for well 29WW16 and three additional wells to demonstrate continued reductions through MNA.

Based on the Treatability Study (included in **Appendix B**), the MC concentrations will be reduced by approximately 75% through heat-activated persulfate application. MNA will be initiated after the formation has recovered from the oxidation treatment activities.

5.2.2.4 Monitored Natural Attenuation

In both the shallow and intermediate groundwater zones, MNA will be used to complete the remediation. MNA will reduce contaminant levels to MCL/GW-Ind concentrations and return these zones to beneficial uses.

The MNA evaluation in **Appendix C** has shown that MNA has been effective in the shallow zone in reducing contaminant concentrations. Based on the findings of that evaluation, the time necessary to return the shallow aquifer is driven by 1,2-DCA, which may require approximately 70 years.

A monitoring program will be developed as part of the remedial design phase and will define the MNA expectations. The objectives of the monitoring program will include the demonstration that MNA is occurring, verification that there has been no unacceptable impact to downgradient receptors, verification that the plume is not expanding, and verification of the attainment of RAOs. The sampling program design will be based on the current plume, seasonal variations, groundwater direction, and velocity. MNA monitoring will be conducted for eight quarters. The MNA samples will be collected for VOC and MNA parameter analysis. An MNA report will be prepared to document the effectiveness of MNA in each groundwater zone. If MNA performance is adequate, performance monitoring will continue semi-annually for the next 3 years, then annually until the next 5-year review. The sampling frequency may then be changed to once every 5 years if the data suggest less frequent sampling is appropriate. For costing purposes, a 30-year monitoring program is assumed. Sampling frequency, reporting frequency, or analytical suite may be modified based on the results of the sampling program. Additional monitoring is recommended once every five years after reduction of the COCs and demonstration of MNA effectiveness to support 5-year reviews until cleanup levels are met.

The MNA evaluation in **Appendix C** has also shown that MNA in the intermediate zone will not be effective in reducing the high MC concentrations in the vicinity of 29WW16. However, in this alternative, MNA will be implemented following chemical oxidation, which will have reduced the MC concentrations to levels that are amenable to remediation by MNA. However, the introduction of the chemical oxidant may result in conditions in the intermediate groundwater zone that are not optimal for biological degradation, which is a significant mechanism of natural attenuation. Therefore, it may be necessary to inject a carbon source and specialized microorganisms into the intermediate zone to enhance biological degradation of the remaining chlorinated organics. Aquifer conditions will be evaluated following the injection to determine if this is necessary. If required, the carbon source and microorganisms would be injected via the four wells installed for the oxidant injection.

An evaluation of the site-wide extent of arsenic, mercury and nickel will be made during remedial design. During subsequent monitoring events, it is expected that groundwater will be tested for metals, including arsenic, mercury and nickel, to monitor cleanup levels, and potential mobilization of metals due to changed subsurface conditions during remediation.

5.2.2.5 Land Use Controls

Land use controls will be maintained until the proposed cleanup levels are achieved in both the shallow and intermediate zones. The LUCs will consist of a restriction on groundwater use at LHAAP-29. If at some time in the future property ownership is transferred from a federal agency to the private sector, a deed restriction for the use of groundwater will be developed. The U.S. Army will record a notice of LUCs with Harrison County and will include the notice with any transfer letter to the USFWS for the intended future use as a national wildlife refuge.

5.2.3 Alternative 3 – Excavation and Off-site Disposal for Soil; Plug Lines; and Extraction, MNA, and LUCs for Groundwater

The goals of this alternative are to prevent exposure of the hypothetical future maintenance worker to contaminated soil and groundwater and ecological receptors to surface soil/sediment at LHAAP-29. Soil and sediment that have the potential to impact groundwater will be removed. To eliminate future impact to on-site surface water and groundwater, the TNT transite wastewater lines and the cooling water lines will be plugged and abandoned in place. The shallow zone groundwater have contaminants above MCLs or GW-Ind that will be reduced over time via MNA to meet the cleanup levels. This alternative uses groundwater extraction followed by MNA to return the groundwater in the intermediate zone to the cleanup levels. The extracted groundwater would be piped to a series of on-site storage tanks, and then pumped to trucks and transported to the existing LHAAP groundwater treatment plant for treatment and discharge.

5.2.3.1 Removal of Soil above Cleanup Levels

As in Alternative 2, the recommended removal action consists of excavation of the nitrotoluene and perchlorate-contaminated soil and off-site disposal at a RCRA Subtitle D-permitted landfill. Excavation of the contaminated soil and disposal in a RCRA-permitted landfill will result in the following: 1) removal of contaminated soil that is a potential source of cross-contamination to groundwater, thereby ensuring that groundwater can ultimately be returned to its beneficial uses; 2) ecological receptors, thereby protecting the deer mouse and shrew; and 3) removal of soil that is a direct risk to the hypothetical future maintenance worker, thereby protecting human health by preventing inhalation, ingestion, and dermal contact with the COCs. The estimated volume of soil to be removed is approximately 3,900 cubic yards and is based on the cleanup levels in **Table 3-4** and the receptor. The excavation locations are highlighted on **Figure 2-1**. The removal of soil contamination will be verified by collecting confirmation samples from the walls and floors of the excavation area and submitting them for laboratory analysis for the COCs of interest. Clean borrow soil will be used as needed to backfill the excavations so they can be graded for proper drainage.

With the removal of the contaminated surface soil and sediment at LHAAP-29, plugging of the former TNT wastewater and cooling water lines and abandoning the manholes associated with the cooling water lines, health and ecological risks as well as the potential migration of soil to surface water and groundwater will be eliminated and long-term operations for soil will not be required.

5.2.3.2 Plug and Abandon

The transite TNT wastewater line will be flushed with water to remove visual residue. The rinsate water will be containerized. Appropriate rinsate handling procedures will be followed based on its waste classification. The inlets and outlets of the traniste TNT wastewater line will be plugged with a bentonite slurry mix or equivalent.

The cooling water lines showed no significant contamination except for 2,4-DNT in the solid residue in manholes 8 and 10. The cooling water lines will be inspected to determine if there is contaminated solid residue in the lines adjacent to manholes 8 and 10. An attempt will be made to sample and analyze the residue and water in the cooling water lines as part of the RD phase. If there is not enough residue volume to sample or the concentrations in the sample are less than the GW-Ind (water) or GWP-Ind (solid) and the residue is nonhazardous, the pipe will be plugged and abandoned. No solid residue or liquid will be left in the pipe if the explosive constituents exceed the GWP-Ind (residue), the GW-Ind (water) or the solid or liquid is determined to be hazardous (residue or water). If explosive concentrations are above the GWP-Ind (residue) or GW-Ind (water) or the material is found to be hazardous, the line will be flushed before plugging and abandoning. The rinsate will be characterized for waste handling. The manholes will then be plugged with a bentonite slurry mix or equivalent.

5.2.3.3 Groundwater Extraction and Treatment for Intermediate Groundwater Zone

The groundwater remediation component of this alternative involves the extraction of VOC-contaminated groundwater by means of recovery wells, temporary storage in on-site ASTs, pumping of the stored water into trucks to be transported for treatment at the existing LHAAP water treatment plant. The purpose of this “pump and treat” system is to reduce VOC concentrations in the intermediate zone groundwater to levels that can subsequently be reduced through natural attenuation (typically levels in the 1,000s of µg/L). The anticipated duration of extraction is 3 years.

This action will begin with a pre-design study. A pump test will be conducted and hydrogeologic parameters will be measured to better design the system. Groundwater flow will be modeled to set performance evaluation parameters and to assess the likely time required for remediation.

Groundwater contamination in the intermediate zone at LHAAP-29 primarily consists of a MC plume. A minimum of five additional wells (four extraction and one monitoring) are proposed to be installed in the intermediate zone within the region of greatest MC contamination in order to provide a more effective extraction process. Several groundwater monitoring wells are located throughout the site and some of these could also be converted to extract contaminated groundwater if needed.

A piping system will be constructed to transport the extracted water from five extraction wells (four new wells and 29WW16) to three 5,000-gallon storage tanks to be located on-site at LHAAP-29. The tanks will be interconnected and will be equipped with a high level shut off to the pump. Once every two days, the water will be pumped out to a tank truck and transported to the existing groundwater treatment plant for treatment and discharge. A 20-foot by 50-foot gravel pad will be prepared for the tanks plus a 6-inch layer of gravel will be placed to upgrade the road to the tanks. This will require approximately 19,000 tons of base stone at LHAAP-29. The alternative will also require the installation of approximately 2,350 feet of 2-inch high-density polyethylene piping for pumping the water to the tanks. The piping will be installed at approximately three feet bgs to prevent disturbance. These estimates are for costing purposes only and will be revised during the design.

During extraction, samples will be collected from the five extraction wells plus the new monitoring well to monitor the effectiveness of the action. During startup of the extraction system (until the system is operating properly), bimonthly sampling will be conducted. Startup is estimated to be approximately six months. After startup, monitoring will be reduced to quarterly for the remaining 2.5 years.

Water Treatment. The extracted groundwater from LHAAP-29 will be treated at the LHAAP groundwater treatment plant, which was originally built to treat groundwater containing VOCs and metals extracted from other LHAAP sites. The plant uses air stripping, carbon adsorption, and thermal oxidation. Perchlorate treatment using a fluidized bed reactor was added in April 2001 to the treatment plant. **Figure 5-1** shows a simplified flow diagram of the primary treatment components in the existing plant. The extracted water from LHAAP-29 would be discharged from the tank truck into the existing 300,000-gallon equalization tank. This tank receives water from other LHAAP sites and is stored in this tank until treatment. After the water is treated, the effluent would be discharged in accordance with plant procedures. The plant presently operates at a fraction of its maximum capacity of 1 to 1.5 million gallons of water per month. The original groundwater treatment plant components have adequate capacity to accommodate the increase in volume that will be introduced to the system when the contaminated groundwater is transported from LHAAP-29 to the plant.

Extraction System. Operation and maintenance will include groundwater extraction system maintenance, groundwater treatment plant operations, and environmental media monitoring. In three years, the extraction wells are anticipated to remove the highest concentrations of VOCs from the groundwater intermediate zone at LHAAP-29, thus reducing the contaminant mass to make conditions favorable for MNA (estimate assumes 3 years). For MNA, four wells will be selected for use as monitoring wells, and monitoring will be implemented to demonstrate that any remaining VOCs are attenuated by natural processes (see **Section 5.2.3.4**). During the groundwater extraction operations, the extraction wells will require regular maintenance to prevent fouling of well screens, and the extraction pumps will require routine maintenance and may also require replacement. Cleaning of the pipelines, refurbishing pumps and other maintenance activities will be needed on the groundwater collection and transport system during full-scale operation. O&M costs will include the addition of chemicals, power, and labor; equipment cleaning, tank cleaning, general system maintenance, and replacement; and regulatory monitoring and reporting. O&M activities will also be conducted at the LHAAP plant location as part of the routine plant O&M activities.

5.2.3.4 Monitored Natural Attenuation

In both the shallow and intermediate groundwater zones, MNA will be utilized to complete the remediation. MNA will reduce contaminant levels to MCL or GW-Ind concentrations and return these zones to beneficial uses.

The MNA evaluation in **Appendix C** has shown that MNA can be effective in the shallow zone. Based on the findings of that evaluation, the time necessary to return the shallow aquifer is driven by 1,2-DCA, which may require approximately 70 years.

The MNA evaluation in **Appendix C** has also shown that MNA in the intermediate zone will not be effective in handling the high MC concentrations in the vicinity of 29WW16. However, in this alternative, MNA will be implemented following three years of groundwater extraction, which will have reduced the MC concentrations to levels that are amenable to remediation by MNA.

A monitoring program will be developed as part of the remedial design phase and will define the MNA expectations. The objectives of the monitoring program will include the demonstration that MNA is occurring, verification that there has been no unacceptable impact to downgradient receptors, verification that the plume is not expanding, and verification of the attainment of

RAOs. The sampling program design will be based on the current plume, seasonal variations, groundwater direction, and velocity.

MNA quarterly monitoring will be conducted for eight quarters. For the estimate, 12 existing wells and 1 new well will be selected for MNA in the shallow groundwater zone. Four wells will be selected in the intermediate groundwater zone. The MNA samples will be collected for VOC and MNA parameter analysis. An MNA report will be prepared to document the effectiveness of MNA in each groundwater zone. If MNA performance is adequate, performance monitoring will continue semi-annually for the next 3 years, then annually until the next 5-year review. The sampling frequency may then be changed to once every 5 years if the data suggest less frequent sampling is appropriate. For costing purposes, a 30-year monitoring program is assumed. Sampling frequency, reporting frequency, or analytical suite may be modified based on the results of the sampling program. CERCLA 5-year reviews will be performed at LHAAP-29 as required until ARARs are achieved.

An evaluation of the site-wide extent of arsenic, mercury and nickel will be made during remedial design. During subsequent monitoring events, it is expected that groundwater will be tested for metals, including arsenic, mercury and nickel, to monitor cleanup levels, and potential mobilization of metals due to changed subsurface conditions during remediation.

5.2.3.5 Land Use Controls

Land use controls will be maintained until the proposed cleanup levels are achieved in both the shallow and intermediate zones. The LUCs will consist of a restriction on groundwater use at LHAAP-29. If at some time in the future property ownership is transferred from a federal agency to the private sector, a deed restriction for the use of groundwater will be developed. The U.S. Army will record a notice of LUCs with Harrison County and will include the notice with any transfer letter to the USFWS for the intended future use as a national refuge.

Table 5-1
Alternative Development

Contaminated Media	Process Option	Selected for Alternative Grouping		
		1 (No Action)	2	3
SOLIDS				
Soil / Sediment	Excavate media above cleanup levels, off-site disposal.	—	Yes	Yes
Residue in TNT Waste Water and Cooling Water Pipe Lines	Plug inlets and outlets including manholes.	—	Yes	Yes
GROUNDWATER				
Shallow Zone	Monitored Natural Attenuation (MNA) and LUCs until goals achieved.	—	Yes	Yes
Intermediate Zone	In situ treatment, MNA, LUCs until goals achieved.	—	Yes	—
	Ex-situ treatment, MNA, LUCs until goals achieved	—	—	Yes

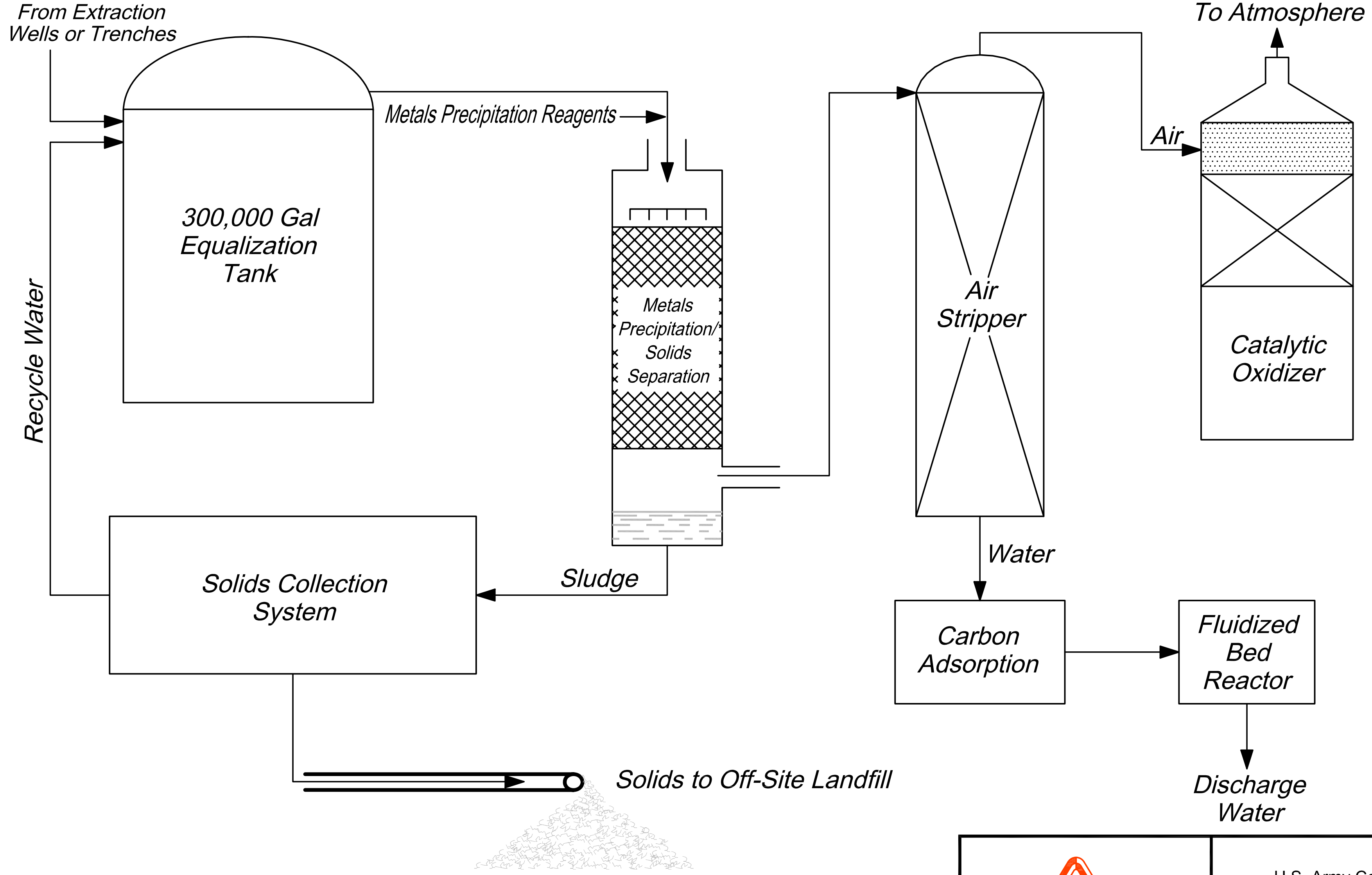
Abbreviations:

TNT	*trinitrotoluene*
LUCs	*land use controls*

PLOT DATE: 1/30/06
FORMAT REVISION 5/13/02

IMAGE	X-REF	OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		DRAWING NUMBER
---	---	STOUGHTON, MA	D. CRISPO	01/17/06	S. WATSON	03/09/09	P. SRIVASTAV	03/09/09	117591-A45

00091247



Shaw®

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

Figure 5-1

Existing Groundwater Treatment Plant Process

LHAAP-29 Feasibility Study

Longhorn Army Ammunition Plant
Karnack, Texas

6.0 Detailed Analysis of Alternatives

6.1 Introduction

This section presents and assesses relevant information that provides the basis for selecting an alternative. **Section 6.2** provides an overview of the evaluation criteria. The detailed analysis begins with an individual analysis in **Section 6.3** in which each alternative is individually evaluated according to the evaluation criteria identified in the NCP (40 CFR 300.430). Following the individual analyses, the alternatives are compared in relation to the two threshold criteria and then the alternatives are assessed regarding the five balancing criteria, highlighting the key advantages, disadvantages, and trade-offs that are considered as part of the evaluation process.

6.2 Overview of the Evaluation Criteria

CERCLA, Section 121, as amended, specifies statutory requirements for remedial actions. These requirements include protection of human health and the environment, compliance with ARARs, a preference for permanent solutions that incorporate treatment as a principal element to the maximum extent practicable, and cost-effectiveness. To assess whether alternatives meet the requirements, the USEPA has identified nine criteria in the NCP (40 CFR 300.430) that must be evaluated for each alternative considered for selection (Section 300.430[e][9][iii]). Provided here are summaries of the nine criteria and an overview of the approach taken by this FS to evaluate each alternative with regard to these criteria.

6.2.1 Criterion 1: Overall Protection of Human Health and the Environment

This evaluation criterion assesses whether the alternative achieves and maintains adequate protection of human health and the environment in accordance with the RAOs established in **Section 3.0**. Because the scope of this criterion is broad, it also reflects the discussions of the subsequent criteria, including long-term effectiveness and permanence, and short-term effectiveness. Evaluation of this criterion describes how site risks associated with each pathway are eliminated, reduced, or mitigated through treatment, engineering, or LUCs. This criterion also considers whether an alternative poses an unacceptable short-term or cross-media affect.

6.2.2 Criterion 2: Compliance with ARARs

This criterion addresses compliance with promulgated federal and state environmental requirements. The detailed analysis summarizes which requirements are applicable or relevant and appropriate to an alternative and how the alternative meets these requirements. If an alternative cannot meet a requirement, a determination can be made that a waiver under CERCLA may be appropriate, and a basis for justifying the waiver is presented. ARARs consist of two sets of requirements – those that apply and those that are relevant and appropriate. In certain cases, standards may not exist that address the proposed action or the COCs. In such cases, nonpromulgated advisories, criteria, or guidance developed by the USEPA or other federal agencies or states can be TBCs. There are three types of ARARs; chemical-specific, location-specific, and action-specific. The chemical-, location- and action-specific ARARs are presented in **Section 3.2**.

6.2.3 Criterion 3: Long-Term Effectiveness and Permanence

This criterion evaluates the extent to which an alternative achieves an overall reduction in risk to human health and the environment after the RAOs are met. The criterion considers the degree to which the alternative provides sufficient long-term controls and reliability to prevent exposures that exceed protective levels for human and environmental receptors. The principal factors addressed by this criterion include magnitude of residual risk and the adequacy and reliability of controls to address such risk. This criterion also addresses the uncertainties associated with these factors.

The evaluation of adequacy and reliability of controls assesses the effectiveness of any treatment, containment, or institutional measures that are part of the alternative. Factors considered include performance characteristics, maintenance requirements, and expected durability. Information and data from past performance and similar technology applications are incorporated appropriately into the evaluation. LUCs are considered where they have the potential to improve the effectiveness of engineered measures.

6.2.4 Criterion 4: Reduction of Toxicity, Mobility, or Volume through Treatment

This criterion reflects the statutory preference that remedial alternatives contain a principal component that substantially reduces toxicity, mobility, or volume of hazardous substances through treatment. The evaluation regarding this criterion considers the extent to which alternative technologies can effectively and permanently fix, transform, immobilize, or reduce the volume of waste materials and contaminated media.

6.2.5 Criterion 5: Short-Term Effectiveness

This criterion addresses the effects of the construction and implementation phases of the alternative until the RAOs are achieved. The evaluation regarding this criterion considers the effect on human health and the environment posed by operations conducted during the remedial action phases. Both the potential effect and associated mitigative measures are examined for maintaining protectiveness for the community, remediation workers, and environmental receptors throughout the duration of remedial activities.

Potential short-term risks to the public include inhalation of constituents that may be released during waste removal and treatment operations, and contaminant exposure and physical injury during waste transport off site. Potential short-term risks to workers include direct contact and exposure during construction, waste handling, and transportation; physical injury or death during construction and transportation activities; and nonremediation worker exposures to airborne contaminants during waste and soil removal operations. Alternative analyses also include a description of mitigating measures such as engineering and LUCs that are expected to minimize potential risks to the public and workers. This evaluation also addresses the anticipated duration of remedial activities.

6.2.6 Criterion 6: Implementability

This criterion examines the technical and administrative factors affecting implementation of an alternative and considers the availability of services and materials required during implementation. Technical factors to be assessed include the ease and reliability of construction and operations, the prospects for implementing a future action, and the adequacy of monitoring systems to detect failures. Administrative factors include permitting and coordination requirements between the lead agency and regulatory agencies. Service and material considerations include TSD capacities, equipment and operator availability, and prospective technology applicability or development requirements.

The assessment of technical feasibility examines the performance history of the technologies in direct applications or considers the expected performance for similar applications. Uncertainties associated with construction, operation, and performance monitoring are also addressed.

The evaluation of administrative feasibility includes a discussion of those actions required to coordinate with regulatory agencies to establish the framework for complying with key substantive technical requirements that must be met by an alternative. Additionally, those alternatives that include off-site transportation of waste are reviewed to assess the feasibility of off-site disposal.

The availability of services and materials is addressed by analyzing the material components of the proposed technologies to determine the locations and quantities of those materials, and by reviewing process operations to identify special services, operator skills, or training required to readily implement the process.

The NCP requires that the evaluation of the relative administrative feasibility of each alternative include "…activities needed to coordinate with other offices and agencies, and the ability and time required to obtain any necessary approvals and permits from other agencies (for off-site actions). CERCLA, Section 121(e), stipulates that no deferral, state, or local permit shall be required for the portion of any removal or remedial action conducted entirely on site." An action must satisfy the substantive requirements of the permits that will otherwise be required.

6.2.7 Criterion 7: Cost

Cost estimates are included for each remedial alternative. The estimates are based on feasibility level scoping and are intended to aid in making project evaluations and comparisons among alternatives. The estimates have an expected accuracy of +50 to –30 percent for the scope of the action described in **Section 5.0** for each alternative. The estimates are divided into capital cost and O&M cost and are developed according to an assumed schedule for the various activities based on similar project experience.

Capital costs are defined as those expenditures required to initiate and install an alternative. These are short-term costs and are exclusive of costs required to maintain the action throughout the project lifetime. Capital costs consist of direct and indirect costs. Direct costs include construction costs (material, labor, and equipment to install an action), service equipment, process and new process buildings, utilities, and waste disposal costs. Indirect costs include design engineering, inspection, project integration, project administration and management, and project contingencies.

O&M costs are long-term costs associated with ongoing remediation at a site. These costs occur after construction and installation are completed. The costs include labor, materials, utilities, and services required to monitor, operate, and maintain the facilities for a period of up to 30 years.

The estimated present worth of each remedial alternative is determined on a discount rate of 2.8 percent and a base O&M and monitoring period of up to 30 years, unless the alternative evaluated is expected to be complete in less than 30 years.

Appendix E presents detailed cost estimates and the major assumptions used to develop the cost estimates for each remedial alternative.

6.2.8 Criterion 8: State Acceptance

State acceptance of an alternative will be evaluated in the PP issued for public comment. Therefore, this criterion is not considered in this FS.

6.2.9 Criterion 9: Community Acceptance

Community acceptance of each alternative will be evaluated after a PP is issued for public comment. Therefore, this criterion is not considered in this FS.

6.3 Individual Analysis of Alternatives

6.3.1 Alternative 1 - No Action Alternative

Under the “no action” alternative, no further action will be taken at LHAAP-29 to control human exposure to contaminated groundwater or to monitor potential groundwater impacts to surface water. The contaminated waste and cooling water lines, soil, sediment and groundwater will remain in place without the implementation of any contaminant removal, treatment, or containment. The LUCs to prevent groundwater access at the site will not be established or will be discontinued. No environmental monitoring will occur. It is assumed that the public and ecological receptors could access the waste. This alternative provides a baseline for comparison purposes.

6.3.1.1 Overall Protection of Human Health and the Environment

The "no action" alternative does not achieve the RAOs for LHAAP-29. This alternative provides no control of exposure to the contaminated waste and cooling water lines, soil, sediment, and groundwater and no reduction in the risks to human and ecological receptors for current and future land use scenarios. Risks to receptors will exceed the USEPA-established threshold for acceptable incremental lifetime cancer risk of 1×10^{-4} for carcinogens or an HI of 1 for noncarcinogens. The greatest risk will come from ingestion of groundwater although risk from exposure to surface soil is possible. The contaminants causing the greatest amount of risk are VOCs in the intermediate groundwater zone and perchlorate and explosive compounds in the shallow groundwater zone. The EEQ is greater than 1 for the deer mouse and short-tailed shrew. Explosive compounds in the soil are located at isolated areas of the site and pose a human health and ecological hazard. Additionally, the residual material in the TNT waste and cooling water lines have the potential to migrate to surface water and groundwater since the lines remain open to the environment.

6.3.1.2 Compliance with ARARs

CERCLA, Section 121, cleanup standards, including compliance with ARARs, apply only to actions the USEPA determines should be taken under CERCLA, Sections 104 and 106 authority. A "no action" decision will be made when no action is deemed necessary to reduce, control, or mitigate exposure because the site does not present a threat to human health and the environment, or because any action taken will worsen the negative effects on human health and the environment. Because no remedial activities are associated with this alternative, compliance with chemical-specific ARARs will not be met. Since no remedial activities will be conducted, action-specific and location-specific ARARs will not apply.

6.3.1.3 Long-Term Effectiveness and Permanence

6.3.1.3.1 Magnitude of Residual Risk

The "no action" alternative will not provide an effective or permanent long-term solution. Soil exposure routes generated an HI of 1.3 for the hypothetical future maintenance worker and an unacceptable EEQ for ecological receptors. The residual risk and toxicity from groundwater exposure under a "no action" alternative will be unacceptable at LHAAP-29. For the hypothetical future maintenance worker, groundwater exposure routes account for over 99 percent of the overall carcinogenic and non-carcinogenic risks, generating a carcinogenic risk of

3.9×10^{-1} and an HI of 3,000. These risks were conservatively calculated for a hypothetical future maintenance worker ingesting the groundwater. Currently, the groundwater at LHAAP-29 is not used for drinking water, and is not anticipated to be used for drinking water under a national wildlife refuge future use scenario.

6.3.1.3.2 Adequacy and Reliability of Controls

The "no action" alternative will not establish or maintain any LUCs at LHAAP-29 and, therefore, will not reduce the existing site risks.

6.3.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Implementation of the "no action" alternative will not reduce toxicity, mobility, or volume of contaminants because this alternative does not employ treatment.

6.3.1.5 Short-Term Effectiveness

Under the "no action" alternative, no remedial action will be taken; therefore, the short-term effectiveness criterion is not applicable to this alternative. The "no action" alternative will not cause any added short-term risks to remediation workers, the community or the environment.

6.3.1.6 Implementability

This alternative is inherently implementable because no remedial action will be taken.

6.3.1.7 Cost

There are no costs associated with the "no action" alternative.

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

This alternative consists of the following major components:

- Soil and sediment excavation
- Plugging and abandonment of the former TNT transite wastewater and cooling water lines and cooling water line manholes
- In situ chemical oxidation to address the area of greatest contamination in the intermediate zone groundwater plume
- MNA for the remaining contamination in the intermediate groundwater zone
- MNA for COCs in the shallow groundwater zone
- Long-term LUCs to restrict use of groundwater until proposed cleanup levels are met

6.3.2.1 Overall Protection of Human Health and the Environment

6.3.2.1.1 Protection of Human Health

The actions proposed for this alternative will:

1. Prevent exposure to residual wastes in the pipe lines, manholes, soil, and sediment that exceed cleanup levels
2. Prevent potential transport of contaminated soil, contaminated sediment, and residual wastes in the pipe lines
3. Prevent leaching of contaminants from the soil or the pipe lines into the groundwater at concentrations that exceed cleanup levels
4. Directly treat high concentrations of VOCs in the intermediate groundwater zone
5. Ultimately return both the intermediate and shallow groundwater zones to cleanup levels
6. Prevent inappropriate groundwater usage via LUCs

Therefore, the residual site risk upon completion of these actions will be within the target risk range for the hypothetical future maintenance worker. This alternative is protective of human health and the environment and achieves the RAOs for LHAAP-29.

The field activities planned under this alternative will have some short-term risks requiring the significant reliance on engineering controls to minimize the risk. Exposure to risks that occur during excavation of contaminated soil and sediment and plugging of underground lines will be controlled through the implementation of a health and safety plan in compliance with 29 CFR 1910.120. The plan will establish safe work procedures and appropriate PPE.

6.3.2.1.2 Protection of the Environment

The removal of soil and sediment that exceeds cleanup levels at LHAAP-29 will reduce the risk to ecological receptors from contaminated soil. In the short-term, risks will occur when soils and sediment are removed and staged. Engineering controls will be important to control direct exposure and runoff potential during the field work.

6.3.2.2 Compliance with ARARs

6.3.2.2.1 Chemical-Specific ARARs

This alternative will comply with the chemical-specific ARARs for surface soils and sediment at LHAAP-29. Soil and sediment excavation will remove material that causes exceedances of the target cancer risk range and the non-cancer HI for the hypothetical future maintenance worker in these media. The removal of the source soils and sediment and plugging of the former TNT wastewater and cooling water lines will positively impact groundwater by eliminating the potential for the leaching of contaminants into groundwater at concentrations exceeding cleanup levels. The remediation of the elevated MC concentrations in the intermediate groundwater zone will target the bulk of the contaminant mass, provide an efficient remedy to arrest potential vertical and horizontal plume migration, and reduce risks of exposure to groundwater that exceeds chemical-specific ARARs.

6.3.2.2.2 Location-Specific ARARs

The activities that will be conducted under this alternative would comply with all location-specific ARARs. No activities would take place in sensitive environments such as wetlands, and no impacts to archeological resources or threatened and endangered species are anticipated.

6.3.2.2.3 Action-Specific ARARs

The activities that will be conducted under this alternative will comply with all action-specific ARARs. Soil remediation will occur in compliance with all transportation and disposal requirements. Runoff controls will be important during soil/sediment excavation. All runoff requirements will be met to protect Goose Prairie Creek and Central Creek.

6.3.2.3 Long-Term Effectiveness and Permanence

6.3.2.3.1 Magnitude of Residual Risks

Upon completion of source removal, the residual site risk will be within the target risk range and below an HI of 1 for the hypothetical future maintenance worker and within risk range for the ecological receptor. The implementation of LUCs under this alternative would prevent direct contact by human receptors with contaminated groundwater at LHAAP-29, thus minimizing the potential risk posed by groundwater contamination.

6.3.2.3.2 Adequacy and Reliability of Controls

The soil exposure risk at LHAAP-29 for a hypothetical future maintenance worker or ecological receptor would be removed by excavating the isolated contaminated soil and sediment areas and plugging the former TNT wastewater and cooling water lines and manholes.

Treatment of high concentrations of VOCs in the intermediate groundwater zone through in situ treatment will be effective for reducing COC concentrations to levels that can be addressed via natural attenuation. In situ treatment includes concurrent groundwater extraction. The extracted water will be treated at the existing LHAAP groundwater treatment plant. That plant has been operating successfully for several years. There are significant issues associated with the effectiveness of groundwater extraction. If hydraulic conductivity in the aquifer is too low, the volumetric flow rate of groundwater to the well will be low and will decrease the effectiveness of extraction. A small capture zone may require excessive time to capture the contamination. There are more pump maintenance issues associated with low flow conditions. If the extraction well goes dry, it causes the pump to overheat and fail to operate.

The layer of clay to silty clay between the shallow and intermediate groundwater zones will provide a barrier that will keep the passive reductive process within the shallow zone from being affected by the chemical oxidation process proposed for the intermediate zone. In addition, the properties of persulfate, the proposed chemical oxidant, allow for optimum delivery and distribution to the subsurface matrix without being limited by solubility as is the case with other oxidants.

MNA will be implemented for groundwater in both the shallow zone and the intermediate zone. In the intermediate zone, it will be initiated after the in situ treatment phase. The MNA evaluation (**Appendix C**) has demonstrated that natural attenuation can be effective in the shallow zone. Effectiveness of natural attenuation in the intermediate zone will depend on successful completion of the in situ treatment. In both zones, long-term success will be verified by monitoring the progress of natural attenuation.

Long-term LUCs for groundwater will prevent exposure to the remaining COCs in both the shallow and intermediate groundwater zones until proposed cleanup levels are met. The reliability of LUCs would depend on the maintenance of the controls. It is not anticipated that groundwater cleanup levels in the shallow zone will be met in the near future.

Consistent with the required 5-year CERCLA review, compliance with the risk-reduction goals will be monitored and performance of the controls will be assessed. The 5-year reviews may indicate the need for components of this alternative to be repaired, modified, or replaced.

6.3.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment

In two ways, this alternative satisfies the USEPA statutory preference for remedial actions that permanently reduce contaminant toxicity, mobility and volume and utilize treatment as a principle element. In the intermediate groundwater zone of LHAAP-29, in situ chemical oxidation will reduce the toxicity and volume of the major contaminants. In both the shallow and intermediate groundwater zones, MNA will reduce the toxicity and volume through natural biological and chemical processes.

6.3.2.5 Short-Term Effectiveness

6.3.2.5.1 Protection of the Community during Remedial Action

This alternative is protective of the surrounding community during remedy implementation primarily because all activities would occur on site with very little disturbance of contaminated material. Truck traffic for equipment and materials, including the shipment of contaminated soil off site for disposal and on-site delivery of borrow material (for backfilling), and chemical oxidant (for in situ treatment) will occur. If a spill of contaminated soils occurs, the spill would be easy to contain and would not impact the surrounding communities. During remediation activities at LHAAP-29, control of surface runoff will be important to avoid releases of contamination to adjacent surface water bodies.

6.3.2.5.2 Protection of Workers during Remedial Action

Some short-term risks to human health or the environment will exist during implementation of this alternative. The soil excavation activity has the potential for transportation or construction accidents. Additionally, this alternative will involve potential short-term risks to workers associated with the operation of drilling equipment and potential exposure to decontamination fluids, chemical oxidant, contaminated groundwater, and excavated soil. Other risks to workers include those generally associated with construction activities (e.g., slips, trips, and falls).

The implementation of proper engineering controls and safety equipment will minimize potential short-term risks to remediation personnel conducting the installation of the groundwater extraction system and groundwater sampling activities. Measures will be taken to prevent the contact of personnel with the extracted groundwater. Remediation workers will conform to the site health and safety program and will be equipped with the necessary PPE. A site-specific health and safety plan will be prepared prior to implementing this alternative.

6.3.2.5.3 Short-Term Environmental Effects

Minor clearing and grubbing at LHAAP-29 will be required to effectively excavate the soil and sediment and install monitoring wells or injection points for in situ chemical oxidation of groundwater. However, since these areas have been cleared in the past, it is unlikely that there are any sensitive species that will be impacted. If any sensitive areas are found, the appropriate regulation will be followed. The implementation of proper engineering controls will minimize the risk of environmental impacts.

6.3.2.5.4 Duration of Remedial Activities

In six months, in situ treatment is expected to remove the highest concentrations of VOCs in the intermediate zone, thus reducing the contaminant mass to concentrations that can be readily addressed by natural attenuation. At that point, the injection wells will begin to be used as monitoring wells, and monitoring will be implemented to demonstrate that any remaining VOCs are attenuated by natural processes. Perchlorate, VOCs, and explosive compounds detected in the shallow zone are expected to continue to attenuate by natural processes. After the initial eight quarters of MNA performance monitoring in each zone, natural attenuation monitoring will be semiannually for three years, then annually until the next CERCLA 5-year review.

Long-term monitoring, consisting of LUCs surveillance and groundwater monitoring will be implemented every five years thereafter. Until cleanup levels are met, monitoring will be needed to determine trends in groundwater contamination levels and effectiveness of the remedial action. The monitoring time may increase or decrease depending on the effectiveness of the treatment method. The amount of time needed to achieve cleanup levels in groundwater will depend on the effectiveness of the natural attenuation. The natural attenuation evaluation (**Appendix C**) estimates that it will take approximately 70 years (due to 1,2-DCA) for complete attenuation to cleanup levels for the shallow zone.

6.3.2.6 Implementability

6.3.2.6.1 Technical Feasibility

The limited amount of soil and sediment excavation is easy to implement once the area requiring excavation is defined and cleared. Plugging and abandonment of the TNT transite wastewater and cooling water lines and the cooling water line manholes can be conducted without extensive intrusive activities. Considering the small quantity of soil with reasonably low levels of contamination requiring disposal, a disposal location will be available. All equipment, services and materials are readily available to conduct the activities for this alternative, and the LHAAP groundwater treatment plant is already operational.

Minimal technical concerns exist that will hinder the implementation of the in situ chemical oxidation. The equipment and materials required for oxidant source delivery are commercially available, but specialized knowledge of in situ chemical oxidation treatment will be required for implementation. This methodology may be difficult to implement in situ because of concerns regarding delivery and sufficient exposure of the contaminants to the chemical agents. An additional typical concern is the release of excess reactants or byproducts to the environment. Low groundwater yield could decrease the effectiveness of the associated extraction.

6.3.2.6.2 Administrative Feasibility

All actions under this alternative would be implemented on the site and thus do not require permits, though substantive provisions of permits that would otherwise be required are considered to be ARARs. By legal agreement (i.e., the FFA), the U.S. Army shall submit to the USEPA and TCEQ a Responsiveness Summary and ROD. Following consideration of any comments by TCEQ, the ROD will be finalized jointly by the U.S. Army and USEPA, or if they are unable to reach agreement about the selection of the remedial action, by the USEPA administrator. By addressing the identified ARARs in the ROD and subsequent documents, it is anticipated that the alternative would adequately address all administrative barriers.

LUCs, although administratively implementable, would require the development of an implementation plan as part of the remedial design, and internal notices to relevant regulatory offices of the existence of the LUCs. Approval by the USEPA and the State of Texas is required prior to the modification or termination of LUCs, implementation actions, or modification of land-use by the U.S. Army. The U.S. Army must also seek concurrence from the USEPA and the State of Texas prior to any action that may disrupt the effectiveness of the LUCs or any action that may alter or negate the need for LUCs.

6.3.2.7 Cost

The total project present worth cost of Alternative 2 is approximately $3.0 million. The details and a comparison of the cost estimates for all of the alternatives are presented in **Appendix E**.

6.3.2.7.1 Capital Cost

The total capital cost is estimated at approximately $2.1 million. The direct capital cost includes mobilization of construction activities; excavation of soil material; plugging of underground lines; filling of manholes associated with the cooling water lines; installation and operation of the in situ chemical oxidation system (including the associated groundwater extraction); transportation and disposal of excavated soils; demobilization of construction activities and the activities associated with LUCs. Capital costs also include a work plan, regulatory and remedial design documents and a closure report.

6.3.2.7.2 O&M Cost

The total O&M cost is estimated at approximately $919,000. This cost includes monitoring for MNA in the shallow and intermediate zones, monitoring to support required CERCLA 5-year reviews, and LUC surveillance to verify groundwater is not used.

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

This alternative consists of the following major components:

- Soil and sediment excavation;
- Plugging and abandonment of the former TNT transite wastewater and cooling water lines and the cooling water line manholes;
- Extraction, treatment, and disposal of highly contaminated groundwater from in the intermediate zone
- MNA for the remaining contamination in the intermediate groundwater zone
- MNA for COCs in the shallow groundwater zone
- Long-term LUCs to restrict use of the groundwater until the proposed cleanup levels are met

6.3.3.1 Overall Protection of Human Health and the Environment

6.3.3.1.1 Protection of Human Health

The actions proposed for this alternative will:

1. Prevent exposure to residual wastes in the pipe lines, manholes, soil, and sediment that exceed cleanup levels

2. Prevent potential transport of contaminated soil, contaminated sediment, and residual wastes in the pipe lines
3. Prevent leaching of contaminants from the soil or the pipe lines into the groundwater at concentrations that exceed cleanup levels
4. Extract, treat, and dispose highly contaminated groundwater from the intermediate groundwater zone
5. Ultimately return both the intermediate and shallow groundwater zones to cleanup levels
6. Prevent inappropriate groundwater usage via LUCs

Therefore, the residual site risk upon completion of these actions would be within the target risk range for the hypothetical future maintenance worker. This alternative is protective of human health and the environment and achieves the RAOs for LHAAP-29.

The field activities planned under this alternative will have some short-term risks requiring significant reliance on engineering controls to minimize the risk. Exposure to risks that occur during excavation of contaminated soil and sediment and plugging of the underground lines will be controlled through the implementation of a health and safety plan in compliance with 29 CFR 1910.120. The plan will establish safe work procedures and appropriate PPE.

6.3.3.1.2 Protection of the Environment

The removal of soil and sediment that exceed cleanup levels at LHAAP-29 will reduce the risk to ecological receptors from contaminated soil. In the short-term, risks will occur when the soil and sediment are removed and staged. Engineering controls will be important to control direct exposure and runoff potential during the field work.

6.3.3.2 Compliance with ARARs

6.3.3.2.1 Chemical-Specific ARARs

This alternative would comply with the chemical-specific ARARs for surface soils and sediment at LHAAP-29. Soil and sediment excavation will remove material that causes exceedance of the target cancer risk range and the non-cancer HI for the hypothetical future maintenance worker in these media. The removal of the source soils and sediment and plugging of the underground TNT wastewater and cooling water lines will positively impact groundwater by eliminating the potential for leaching of contaminants into soils and ultimately to groundwater at concentrations exceeding cleanup levels. Groundwater remediation under this alternative will ultimately achieve cleanup levels in both the shallow and intermediate zone under the industrial user scenario.

6.3.3.2.2 Location-Specific ARARs

The activities that will be conducted under this alternative will comply with all location-specific ARARs. No activities would take place in sensitive environments such as wetlands, and no impacts to archeological resources or threatened and endangered species are anticipated.

6.3.3.2.3 Action-Specific ARARs

The activities that will be conducted under this alternative will comply with all action-specific ARARs. Soil remediation will occur in compliance with all transportation and disposal requirements. Runoff control will be important during soil/sediment excavation. All runoff requirements will be met to protect Goose Prairie Creek and Central Creek.

6.3.3.3 Long-Term Effectiveness and Permanence

6.3.3.3.1 Magnitude of Residual Risks

Upon completion of source removal, the residual site risk will be within the target risk range and below an HI of 1 for the hypothetical future maintenance worker and within risk range for the ecological receptor. The implementation of LUCs under this alternative would prevent direct contact by human receptors with contaminated groundwater at LHAAP-29, thus minimizing the potential risk posed by groundwater contamination.

6.3.3.3.2 Adequacy and Reliability of Controls

The soil exposure risk at LHAAP-29 for a hypothetical future maintenance worker or ecological receptor will be removed by excavating the isolated contaminated soil and sediment areas and plugging the underground TNT wastewater and cooling water lines and abandonment of the cooling water line manholes.

Groundwater extraction and treatment will be effective for reducing COC concentrations to concentrations that can be addressed via natural attenuation. The extracted water will be treated at the existing LHAAP groundwater treatment plant, which has been operating successfully for several years. There are significant issues associated with the effectiveness of groundwater extraction, especially associated with the use of extraction wells. If the hydraulic conductivity is too low in the aquifer, groundwater extraction will be slow and ineffective. Small capture zones may lead to excessive time frames to capture the contamination. There are also maintenance issues associated with low flow conditions. If extraction wells go dry, it causes the pumps to overheat and fail to operate. A pre-design study may be needed to determine the optimum configuration of wells.

MNA will be implemented for groundwater in both the shallow zone and the intermediate zone. In the intermediate zone, it will be initiated after the extraction phase. The MNA evaluation (**Appendix C**) has demonstrated that natural attenuation can be effective in the shallow zone. Effectiveness of natural attenuation in the intermediate zone will depend on successful completion of the in situ treatment. In both zones, long-term success will be ensured by monitoring that verifies that natural attenuation is actively occurring.

LUCs will prevent exposure to the groundwater COCs exceeding the cleanup levels in the intermediate zone during the time required to remediate the groundwater. The reliability of LUCs will depend on the maintenance of the controls. It is not anticipated that groundwater cleanup levels in either the shallow or intermediate zone will be met in the near future. Compliance with the risk-reduction goals will be monitored and performance of the controls will be assessed throughout the duration of this alternative. The assessment may indicate the need for components of this alternative to be repaired, modified, or replaced.

Consistent with the required 5-year CERCLA review, compliance with the risk-reduction goals would be monitored and performance of the controls will be assessed. The 5-year reviews may indicate the need for components of this alternative to be maintained, modified, or replaced.

6.3.3.4 Reduction of Toxicity, Mobility, or Volume through Treatment

This alternative satisfies the USEPA statutory preference for remedial actions that permanently reduce the toxicity, mobility, and volume of the contaminants and utilize treatment as a principal element. Implementation of groundwater extraction at LHAAP-29 would permanently reduce the toxicity, mobility, and volume of the groundwater contaminants in this area. Use of the current LHAAP plant would provide irreversible destruction of the COCs in the extracted groundwater from the intermediate zone. In both the shallow and intermediate groundwater zones, MNA will reduce the toxicity and volume through natural biological and chemical processes.

6.3.3.5 Short-Term Effectiveness

6.3.3.5.1 Protection of the Community during Remedial Action

This alternative is protective of the surrounding community during remedy implementation primarily because all activities would occur on site with very little disturbance of contaminated material. Truck traffic for equipment and materials, including the shipment of contaminated soil off site for disposal and on-site delivery of borrow material for backfilling, will occur. If a spill of contaminated soils, the spill would be easy to contain and would not impact the surrounding communities. During remediation activities at LHAAP-29, control of surface runoff will be important to avoid releases of contamination to adjacent surface water bodies.

6.3.3.5.2 Protection of Workers during Remedial Action

Some short-term risks to human health or the environment will exist during implementation of this alternative. The soil excavation activity has the potential for transportation or construction accidents. Additionally, this alternative will involve potential short-term risks to workers associated with the operation of drilling equipment and potential exposure to decontamination fluids, contaminated groundwater, and excavated soil. Other risks to workers include those associated with extended operation of the LHAAP groundwater treatment plant plus risks common to construction activities (e.g., slips, trips, and falls).

The implementation of proper engineering controls and safety equipment will minimize potential short-term risks to remediation personnel conducting the installation of the groundwater extraction system and groundwater sampling activities. Measures will be taken to prevent the contact of personnel with the extracted groundwater. Remediation workers will conform to the site health and safety program and will be equipped with the necessary PPE. A site-specific health and safety plan will be prepared prior to implementing this alternative.

6.3.3.5.3 Short-Term Environmental Effects

Minor clearing and grubbing at LHAAP-29 will be required to effectively excavate the soil and to install extraction wells and pipelines for groundwater recovery. However, since these areas have been cleared in the past, it is unlikely that there are any sensitive species that will be impacted. If any sensitive areas are found, the appropriate regulation will be followed. The implementation of proper engineering controls will minimize the risk of environmental impacts.

6.3.3.5.4 Duration of Remedial Activities

In three years, the groundwater extraction system is expected to remove the highest concentrations of VOCs from LHAAP-29 intermediate groundwater zone, thus reducing the contaminant mass. After three years, the extraction wells will be used as monitoring wells, and monitoring will be implemented to demonstrate that any remaining VOCs in the intermediate zone are attenuated by natural processes. Perchlorate, VOCs, and explosive compounds detected in the shallow zone are also expected to attenuate by natural processes. Natural attenuation in each of the shallow and intermediate zones will be monitored quarterly for two years to evaluate its effectiveness. Then monitoring would continue semiannually for three years, then annually until the next CERCLA 5-year review. Monitoring will continue once every five years until cleanup levels are achieved. The natural attenuation evaluation (**Appendix C**) estimates that it would be approximately 70 years (due to 1,2-DCA) for complete attenuation for the shallow zone.

6.3.3.6 Implementability

6.3.3.6.1 Technical Feasibility

The limited amount of soil and sediment excavation is easy to implement once the area requiring excavation is defined and cleared. Plugging of the TNT transite wastewater and cooling water lines can be conducted without extensive intrusive activities. All equipment, services and materials are readily available to conduct the activities for this alternative. Considering the small quantity of soil with reasonably low levels of contamination requiring disposal, a disposal location will be available.

Minimal technical concerns exist that will hinder the implementation of this alternative. Routine inspection and maintenance of the LUCs would be required. All equipment, services and materials are readily available to conduct the activities for this alternative, and the LHAAP groundwater treatment plant is already operational. Low groundwater yield could decrease the effectiveness of the extraction system. A detailed pre-design study would be needed to determine the optimum configuration of wells for effective extraction of the LHAAP-29 groundwater.

6.3.3.6.2 Administrative Feasibility

All actions under this alternative would be implemented on the site and thus do not require permits, though substantive provisions of permits that would otherwise be required are considered to be ARARs. By legal agreement (i.e., the FFA), the U.S. Army shall submit to the USEPA and TCEQ a Responsiveness Summary and ROD. Following consideration of any comments by TCEQ, the ROD will be finalized jointly by the U.S. Army and USEPA, or if they are unable to reach agreement about the selection of the remedial action, by the USEPA administrator. By addressing the identified ARARs in the ROD and subsequent documents, it is anticipated that the alternative would adequately address all administrative barriers.

LUCs, although administratively implementable, would require the development of an implementation plan as part of the remedial design, and internal notices to relevant regulatory offices of the existence of the LUCs. Approval by the USEPA and the State of Texas is required prior to the modification or termination of LUCs, implementation actions, or modification of land-use by the U.S. Army. The U.S. Army must also seek concurrence from the USEPA and the State of Texas prior to any action that may disrupt the effectiveness of the LUCs or any action that may alter or negate the need for LUCs.

6.3.3.7 Cost

The total project present worth cost of Alternative 3 is approximately $2.9 million. The details and a comparison of the cost estimates for all of the alternatives are presented in **Appendix E**.

6.3.4.7.1 Capital Cost

The total capital cost is estimated at approximately $1.3 million. The capital costs include mobilization, excavation of soil material, plugging the underground pipes, installing the groundwater extraction system and on-site storage system, transportation and disposal of excavated soils, demobilization of construction activities and the activities associated with LUCs.

The capital costs also include a work plans, remedial design document, pre-design study and a closure report.

6.3.4.7.2 O&M Cost

The total O&M cost is estimated at approximately $1.6 million. The O&M cost includes O&M for of the groundwater extraction and storage system for the intermediate groundwater zone, monitoring for MNA in the shallow and intermediate zones, monitoring to support the required CERCLA 5-year review process, and LUC surveillance to verify groundwater is not used until proposed cleanup levels are met.

6.4 Comparative Analysis of Alternatives

6.4.1 Introduction

This section presents a comparative analysis of the remedial alternatives for LHAAP-29 according to the CERCLA evaluation criteria described in **Section 6.2**. This analysis is the second stage of the detailed evaluation process and provides information that forms the basis for selecting a preferred remedy.

This comparative analysis considers two of the three criteria categories, the threshold criteria and primary balancing criteria. The threshold category contains two criteria that must be satisfied by the selected alternative:

- Overall protection of human health and the environment and
- Compliance with ARARs.

These criteria are important because they reflect the key statutory mandates of CERCLA. If an alternative does not satisfy both of these criteria, it is not eligible to be selected.

The primary balancing category contains five criteria under which the relative advantages and disadvantages of the alternatives are compared to determine the most appropriate remedy. The five criteria are the following:

- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume through treatment;
- Short-term effectiveness;
- Implementability; and
- Cost

The comparison of these five criteria for the alternatives forms the basis of the comparative analysis. The first and second balancing criteria address the statutory preference for treatment as a principal element of the remedy. Together with the third and fourth criteria, they form the basis for determining the general feasibility of each alternative and for determining whether costs are proportional to the overall effectiveness.

The two modifying criteria, state and community acceptance, must be satisfied if the alternative is to be accepted. The modifying criteria of state and community acceptance are typically not evaluated until the public has had an opportunity to comment on the PP. Because specific alternatives have not been presented to the state and community, these two criteria are not formally compared in the FS.

A comparative analysis under the threshold and primary balancing criteria is presented in **Sections 6.4.2** and **6.4.3**, respectively, and is consistent with the format of the individual analysis of alternatives in **Section 6.3**.

6.4.2 Threshold Criteria

6.4.2.1 Overall Protection of Human Health and the Environment

The three alternatives provide varying levels of human health protection. The “no action” alternative (Alternative 1) would not be protective of human health or the environment as no remedial activities or LUCs would be conducted. Alternative 1 does not achieve RAOs and provides the least protection of all the alternatives; it provides no reduction in risks to human health or the environment because no measures would be implemented to eliminate pathways for human and ecological exposure.

Alternatives 2 and 3 both satisfy the RAOs for LHAAP-29 and provide access and use restrictions for residual contamination. Alternatives 2 and 3 rely heavily on LUCs to prevent access to the shallow groundwater zone until cleanup levels are achieved. Both Alternatives 2 and 3 provide treatment of the primary COC for human health in the intermediate zone.

6.4.2.2 Compliance with ARARs

Alternative 1 does not comply with chemical-specific ARARs as no remediation of groundwater will be conducted. Alternatives 2 and 3 comply with all chemical-specific ARARs for soil and groundwater, as well as the location-specific and action-specific ARARs.

6.4.3 Primary Balancing Criteria

6.4.3.1 Long-Term Effectiveness and Permanence

Alternative 1 would be the least effective and permanent in the long term. Under this alternative, no contaminant removal or treatment would take place and no measures would be implemented to control exposure risks posed by contaminated surface soil and groundwater at LHAAP-29.

Alternatives 2 and 3 would significantly and permanently reduce groundwater contaminant concentrations to the applicable cleanup levels and, therefore, provide long-term effectiveness and permanence. Should in situ chemical oxidation or groundwater extraction be considered ineffective after implementation, the remedy or the cleanup levels may need to be re-evaluated.

Alternatives 2 and 3 both rely on MNA and LUCs until the proposed cleanup levels are achieved.

Alternative 2 provides a slightly higher level of effectiveness than Alternative 3 since the intermediate groundwater zone would reach concentrations amenable to natural attenuation in a shorter time frame. By requiring a shorter time frame, Alternative 2 allows the opportunity to evaluate the impact of the in situ treatment and re-inject if necessary.

6.4.3.2 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternatives 2 and 3 both provide a large degree of permanent reduction in toxicity and volume of the groundwater contaminants while Alternative 1 provides no attempt at reduction.

6.4.3.3 Short-Term Effectiveness

Because Alternative 1 does not involve remedial measures, no short-term risk to remediation workers, the local community, or the environment would exist. Alternatives 2 and 3 involve material excavation and off-site disposal, which represent a greater exposure potential to remediation workers, a greater potential for runoff releases to the environment, and the potential for off-site traffic accidents and impacts on communities between LHAAP and the disposal facility. Additionally, Alternatives 2 and 3 both involve potential short-term risks to workers associated with exposure to contaminated groundwater from monitoring and/or operation of drilling/construction equipment.

Alternative 2 has short-term risks due to remediation workers constructing and operating an in situ treatment system, including the handling of chemical oxidants. Both Alternatives 2 and 3 have short-term risks associated with increased operations at the LHAAP groundwater treatment system, which includes chemical handling (caustic acids) and operation of a high-temperature catalytic oxidizer. However, Alternative 3 is estimated to have a longer operation period (3 years) than Alternative 2 (6 months).

By planning the construction, excavation, and transportation activities in accordance with industry and OSHA codes and requirements, risks from contaminant exposure and construction operations would be controlled to acceptable levels. Sediment deposition into adjacent surface water bodies can be controlled during earthwork and construction activities. Erosion control measures would include surface grading; emplacement of silt fences; covering surfaces with straw, mulch, riprap, and/or geotextile fabrics. Following completion of all construction and excavation, disturbed areas would be regraded with clean backfill and revegetated with native grasses.

6.4.3.4 Implementability

Administratively, all of the alternatives are implemental. Under Alternative 1, no remedial action would be taken. Therefore, no difficulties or uncertainties would be associated with its implementation.

For Alternatives 2 and 3, soil excavation would require coordination between excavation, sampling, transportation, and disposal. For groundwater, Alternatives 2 and 3 are also technically implementable, but there are uncertainties associated with hydrogeologic conditions that may impact the ability of in situ chemical oxidation or groundwater extraction to lower contaminant levels sufficiently to reach concentrations amenable to MNA. Alternative 3 would be somewhat more difficult to implement than Alternative 2 from a technical standpoint due to the increased duration (six months for Alternative 2 compared to three years for Alternative 3) that would be required to convey the contaminated groundwater to the existing LHAAP groundwater treatment plant.

6.4.3.5 Cost

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

Costs developed are capital costs (including fixed-price remedial construction) and long-term O&M costs (post-remediation). Overall 30-year present worth costs are developed for each alternative assuming a discount rate of 2.8 percent. Total project present worth costs for each alternative is presented in **Appendix E**.

The progression of present worth costs from the least expensive alternative to the most expensive alternative is as follows: Alternative 1, Alternative 3, and Alternative 2. No costs are associated with Alternative 1 because no remedial activities would be conducted. Alternative 3 has the highest O&M costs associated with the estimated 3-year extraction period. Alternative 2 has the highest present worth and capital costs primarily due to the activities associated with the injection phase of the in situ chemical oxidation. Alternative 3 costs would be higher if there was no existing LHAAP groundwater treatment system.

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Appendix A

Investigation Results – 2004 and 2005

Appendix A
Investigation Results – December 2004 and February 2005

1.0 Introduction

Shaw Environmental, Inc. (Shaw) performed additional field investigation activities at LHAAP-29 in December 2004 and February 2005 to further define the extent of perchlorate and explosives in soil, sediment, and water. Also in February 2005, the USACE collected soil samples near building foundations for explosives analysis. The numbers of samples and the types of analyses are summarized in **Table A-1** and the sample locations are provided in **Figures A-1** and **A-2**.

2.0 Shaw Investigation Activities

In December 2004 and February 2005, Shaw collected ten soil, 3 sediment, 8 solid residue, and 15 water samples at various locations to assess the affect of explosives in or near former wastewater drainage lines, ditches, and a pond. The ten soil samples were collected at five separate locations (29SB81 through 29SB85) at depth intervals of 4 to 5, and 8 to 9 feet below ground surface (bgs). These locations were adjacent to wash house sumps at five of the six previously active former 2,4,6-trinitrotoluene (TNT) production lines. Twelve soil samples (two from each of the six sump locations) were initially proposed, in accordance with the Addendum 3, *Additional Investigation, LHAAP-29 and LHAAP-49, Final Work Plan, Groundwater Data Gaps Investigation Groups 2 and 4* (Addendum 3, Additional Investigation) (Shaw, 2004a). One soil boring location, however, was submerged in water and drilling at this location was not practical. Eight solid residue and twelve water samples were collected from manholes around the site. Originally, a total of 12 manholes were proposed to be sampled for solid residue and surface water; however, one manhole (MH-04) was collapsed and no samples were collected from this location. Additionally, no solid residue samples were collected from manholes MH-01, MH-03, and MH-11 due to a lack of solid residue. Due to dry conditions during the December 2004 sampling activities, water samples were collected only from manholes MH-01, MH-02, and MH-09. In February 2005, additional water samples were collected from MH-03, and MH-05 through MH-12. One sediment sample and one surface water sample were collected from the outfall ditch that received water from the cooling water drain lines. The remaining two sediment and two surface water samples were collected from the pond that exists at the location of the former pump house for the wastewater (red/yellow liquor) collection system.

Shaw also collected 12 soil samples (three in each of four soil borings) to examine the vertical and horizontal extent of perchlorate contamination in two areas in the northern portion of LHAAP-29. Two of the four borings, 29SB88 and 29SB89, were advanced through the slab at the location of the former rocket motor washout building. Three samples were collected from each boring. One sample was collected from immediately beneath the slab, one sample was collected from a depth of 4 to 5 feet beneath the previous sample, and one sample was collected immediately above the water table. Borings 29SB86 and 29SB87 were advanced in an area approximately 600 feet southwest of the former rocket motor washout building where perchlorate had been detected in the soil during earlier investigations. Samples from these borings were collected at depth intervals of 0 to 0.5 feet bgs, 6 to 8 feet bgs, and immediately above the water table.

The analytical results for the December 2004 and February 2005 investigations at LHAAP-29 are provided in **Tables A-2, A-3,** and **A-4**, for soil, sediment and solid residue, and water, respectively. Results for one explosive analyte (TNT) are also presented on **Figure A-1,** and results for perchlorate are presented on **Figure A-2**.

2.1 Sampling and Analysis

This section describes the sampling and analysis procedures applicable to water, sediment, solid residue, and soil samples collected. Samples were collected and handled in accordance with TERC Standard Operating Procedure 1111, Sample Handling (IT Corporation/OHM Remediation Services Corp., 2002). Samples were analyzed on a 7-day turnaround time. Health and safety procedures, including screening methods, are described in the Site Safety and Health Plan, Appendix A of the Final Work Plan (Shaw, 2004b).

2.1.1 Soil Sampling

Soil samples were collected at the boring locations identified in **Figures A-1** and **A-2**. Two to three soil samples were collected from each boring location. Soil borings were advanced using a direct push technology (DPT) rig. The DPT method involved the use of a high-capacity hydraulic ram mounted on an all-terrain vehicle to advance a drive sampler attached to steel push rods. At two locations (29SB88 and 29SB89), concrete slabs were penetrated using a concrete boring tool. Soil samples were collected continuously during DPT operation using a 24- to 36-inch-long sampler with a disposable liner. The depths of the borings were based on Addendum 3, Additional Investigation (Shaw, 2004a).

Boring locations were marked with a stake, where practical, and a Global Positioning System (GPS) device was used to obtain location coordinates. Site personnel covered the tailgate of a pick-up truck with plastic sheeting and used it as a sample preparation area. Field analytical and health and safety instruments were calibrated and recorded within the field logbook. New disposable gloves were donned between each sampling interval to prevent cross-contamination. The sampling equipment was decontaminated as described in Section 4.5 in the Chemical Data Acquisition Plan, Appendix C of the Final Work Plan (Shaw, 2004b). The drilling operations observed proper safety, sampling, and drilling methods. When the soil sample was received from the driller, the soil-filled sampler was opened, the sample liner was removed from the barrel, the liner was cut open, and the sample liner was placed on the plastic sheeting. The entire length of material from the barrel was described according to ASTM D2488-93, "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)" (ASTM International, 2004) and recorded on the standard Drilling Log Form. After verifying the appropriate sampling intervals, composite soil samples were placed in a container. Each sample container was labeled as described in Section 4.6.2 of the Chemical Data Acquisition Plan (Shaw, 2004b), enclosed in a sealable plastic bag, and placed in a cooler containing ice. This procedure was repeated for each interval to the total boring depth. Drilling activities and sampling procedures were recorded on a Field Sampling Report or logbook. COC documentation was completed and a photographic record of sample locations was maintained. Cuttings were disposed into the same borehole and the hole was grouted to surface. Decontamination fluids were disposed at the LHAAP-18/24 groundwater treatment plant. The samples were placed in 4-ounce wide-mouth glass containers, preserved on ice at a temperature of 4 degrees Celsius or less, and delivered to the analytical laboratory for analysis using EPA methods SW 8330 or EPA 314.0 for explosives or perchlorate, respectively.

Field duplicates (quality control samples) were collected and analyzed to assess the precision for the field sampling and laboratory analytical process. Each field duplicate was collected by filling a second sample container in rapid succession after collecting the primary soil sample. Duplicates were collected for samples 29SB85-001 and 29SB85-002.

2.1.2 Sediment and Solid Residue Sampling

Sediment was collected at the locations identified in **Figure A-1**. A sampling site was prepared by laying plastic sheeting on the adjacent ground. Field equipment and instruments were calibrated to verify they were in proper working order and calibration values were recorded in the field logbook. New disposable gloves were donned between samples to prevent cross-contamination. The sampling equipment was decontaminated as described in Section 4.5 in the Chemical Data Acquisition Plan (Shaw, 2004b). Information, deviations from procedures, and rationale for changes were recorded in the field logbook. Coordinates of each sampling location were recorded using a GPS unit.

The sediment sampling interval was 0 to 0.5 feet bgs. In manholes with concrete or masonry floors, the solid residue sample was limited to soil-like material that had collected atop the floor.

One sediment or solid residue sample was collected from each proposed location as stated in Addendum 3, Additional Investigation (Shaw, 2004a).

Sediment was placed into a clean stainless steel bowl and thoroughly mixed with a clean stainless steel spoon. At the manholes, a decontaminated trowel was attached to a 12-foot extension handle. Sediment was retrieved using this device, mixed, and placed in a 4-ounce glass container. An organic vapor meter was used to check for volatile organic compounds and record readings in the field logbook. The sample containers were filled directly from the tray or bowl with the spatula or spoon. As many stones, twigs, grass, etc., were removed from the sample as possible. If the sample was water saturated, the water was carefully decanted from the container with minimal disturbance to the sample. The sample was transferred directly from the sampler to the sample container leaving no headspace. Using wide, clear tape, the label was covered and the container was placed in a sealed plastic bag, and immediately placed in an iced cooler. Location coordinates were obtained using a GPS for the sediment sample locations. The location, sample-depth, and/or field measurements were recorded in the field logbook. COC documentation was completed and a photographic record was maintained. The samples were placed in 4-ounce glass containers, preserved on ice at a temperature of 4 degrees Celsius or less, and delivered to the analytical laboratory for analysis using EPA Method SW 8330 for explosives.

A field duplicate (quality control sample) was collected and analyzed to assess the precision for the field sampling and laboratory analytical process. The field duplicate was collected by filling a second sample container in rapid succession after collecting the primary sample. The duplicate was collected for sample 29SD640-MH09.

2.1.3 Surface Water Sampling

Surface water samples were collected at the locations shown in **Figure A-1**. A sampling site was prepared by laying plastic sheeting on the adjacent ground. Field equipment and instruments were calibrated to verify they were in proper working order and calibration values were recorded in the field logbook. Shaw personnel recorded a description of the site and sampling locations, including the coordinates of the sampling locations based on a GPS unit and/or site maps. Personal protective equipment was donned as required and specified in the Site Safety and Health Plan (Shaw, 2004b). New disposable gloves were donned prior to initializing sampling activities. The water samples were usually collected at locations where sediment samples were also collected. At those locations, the water sample was collected first. Water samples were collected in one of three ways:

- Surface water samples from the pond and the ditch were collected in open containers.

- Manhole water samples were collected in December 2004 using a clean/decontaminated 2-inch-diameter PVC sampler with a valve.
- Manhole water samples were collected in February 2005 using a peristaltic pump with clean/decontaminated tubing.

The sampling procedures were recorded on a field logbook. General water quality parameters (e.g., pH, conductivity, temperature, oxidation/reduction potential, turbidity) were measured using field instruments and recorded on the field logbook. COC documentation was completed and a photographic record was maintained. The sample was placed in a 1-liter amber bottle, preserved on ice at a temperature of 4 degrees Celsius or less, and shipped to the laboratory for analysis. Explosives were analyzed using EPA Method SW 8330.

Two field duplicates were collected and analyzed to assess the precision for the field sampling and laboratory analytical process. The field duplicates were collected by filling two separate 1-liter glass amber containers in rapid succession after collecting the primary water sample. Duplicates were collected for samples 29WL40-MH09 and 29WL40-MH09-02.

2.2 Results

The December 2004 and February 2005 results for explosives and perchlorate in the soil, sediment, and water samples from LHAAP-29 are presented in **Tables A-2, A-3,** and **A-4**. The associated data evaluation reports are included as **Attachment 1** of this document.

2.2.1 Explosives Results

Explosives were analyzed in soil, sediment, solid residue, and water samples collected throughout LHAAP-29. The soil samples were associated with the wash house sumps, while the sediment, solid residue, and water samples were associated either with the pond, the cooling water outfall ditch, or the cooling water manholes.

The explosives soil sample results in the soil near the sumps were largely non-detects, with a detection limit of 200 µg/kg. Of the 14 explosives parameters analyzed in ten primary samples and 2 field duplicates, there were six detected results. These included TNT at 4 to 5 feet bgs at 29SB83 (430 µg/kg), 2-amino-4,6-dinitrotoluene (DNT) at 4 to 5 feet bgs at 29SB85 (230J µg/kg), and both 2-amino-4,6-DNT (900 µg/kg) and 4-amino-2,6-DNT (300J µg/kg) at 8 to 9 feet bgs at 29SB85. The remaining two detections were in the field duplicate for the 8- to 9-foot-interval at 29SB85.

In the two sediment samples at the pond, the only detection was 410 µg/kg TNT at 29SD43-MH12 and 29SD45; the detection limit was 200 µg/kg. The two surface water samples had detections of TNT (0.4J and 0.39J µg/L), 2-amino-4,6-DNT (0.56J and 0.53J µg/L), and

4-amino-2,6-DNT (2 and 1.9 µg/L) at 29SW44 and 29SW45, respectively; the detection limit was 0.2 µg/L.

The highest results for both sediment and soil during the investigation were at the cooling water outfall ditch. The sediment sample (29SD46) had 26,000,000 µg/kg TNT and 8,000,000 µg/kg 2,4-DNT. The associated water sample (29SW46) had 860 µg/L TNT. Both samples had detections for other explosives, at lower concentrations.

Several explosives (1,3,5-trinitrobenzene; TNT; 2,4-DNT; 2,6-DNT; 2-amino-4,6-DNT; and 4-amino-2,6-DNT) were detected in both the water and solid residue from the cooling water manholes. Explosives were detected at low concentrations in solid residue samples from six of the eight cooling water manholes that were sampled. The highest solid residue result was 11,000 µg/kg TNT at manhole MH-02. The next highest results were for degradation products (9,000 µg/kg 2-amino-4,6-DNT and 7800 µg/kg 4-amino-2,6-DNT) at MH-10. The 12 water samples from the manholes had detected results for explosives, though the magnitude of the results varied several orders of magnitude. The highest explosives concentration from the water samples was 5,200 µg/L TNT in manhole MH-09, which also had detections of 27 µg/L, 220 µg/L, and 290 µg/L of 2,6-DNT, 2-amino-4,6-DNT, and 4-amino-2,6-DNT, respectively. MH-09 was sampled again in February 2005 and had a TNT result of 20 µg/L at that time.

2.2.2 Perchlorate Results

Perchlorate was detected in five of the 12 soil samples collected at two areas in the northeastern portion of LHAAP-29. The detections at LHAAP-29 varied from 40.3 µg/kg to 8,600 µg/kg. However, due to interferences, the detection limits of the non-detect results varied from 114 to 267 µg/kg. The highest results were not found at the two borings drilled through the slab at the former rocket motor washout facility, but at boring 29SB86. That boring location was chosen because of elevated perchlorate results in earlier investigations. As shown in **Figure A-2**, the results at 29SB86 varied from 40.3 µg/kg at the surface to 8,600 µg/kg at 6-8 feet bgs to 689 µg/kg at 20-21 feet bgs (just above the water table). The 8,600 µg/kg value exceeds perchlorate results in soil from earlier investigations at LHAAP-29.

3.0 USACE Investigation Activities

Plexus (Plexus, 2005) reported stained soil in the vicinity of wash house Building 806-D, possibly caused by explosives, such as TNT. On February 9 and 10, 2005, the USACE collected samples of soil at the foundation of Wash House 806-D and submitted them for explosives analysis (USACE, 2005). The results are presented in **Table A-5**.

The concrete foundation was cored in two places on the western end of the wash house. The western end of each wash house is the downgradient end and could be expected to have received runoff from settling tanks that were once housed in each wash house. Location 29DLineWHC01 was at a crack in the slab. The second location 29DLineWHCO2, was slightly north and downgradient of the first core. The soil beneath the cores was slightly sandy with high clay content. The third sample was collected along the edge of the foundation at the most western end of the wash house slab. The soil was visually inspected at several locations along the foundation, and sample 29DLineWHW01 was collected at the location with the most obvious staining. **Figure A-3** indicates the sample locations.

The soil samples at the cored locations had no detected results for explosives. The sample from the edge of the foundation had detected results for four explosives parameters; the highest result was 27,300 µg/kg TNT.

4.0 References

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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. (Shaw), 2004a, *Draft Addendum 3, Additional Investigation, LHAAP-29 and LHAAP-49, Final Work Plan Groundwater Data Gaps Investigation Groups 2 and 4*, Houston, Texas, September.

Shaw, 2004b, *Final Work Plan, Groundwater Data Gaps Investigation, Groups 2 and 4*, Houston, Texas, February.

USACE, 2005, Personal Communication (e-mail from C. Murray to R. Zeiler), Subject: Washhouse Soil Sampling, March 28.

Tables

Table A-1
December 2004/February 2005 Sampling and Analyses
LHAAP-29

Media	Sample Locations	Primary Samples	Field Duplicates	Analytical Suite	Results Table
Soil					
Soil Near Wash House Sumps	29SB81-29SB85	10	2	Explosives	A-2
Soil in Perchlorate Areas	29SB86-29SB89	12	0	Perchlorate	A-2
Sediment					
Pond Sediment	29SD44, 29SD45	2	0	Explosives	A-3
Outfall Ditch Sediment	29SD46	1	0	Explosives	A-3
Manhole Solid Residue	29SD33, 29SD36-29SD41, 29SD43 (Manholes 2, 5-10, and 12)	8	1	Explosives	A-3
Water					
Pond Surface Water	29SW44, 29SW45	2	0	Explosives	A-4
Outfall Ditch Surface Water	29SW46	1	0	Explosives	A-4
Manhole Water	Manholes 1-3 and 5-12	12	2	Explosives	A-4

Table A-2
Soil Sampling Results
2004 Soil Investigation
LHAAP-29

Sample Location		29SB81					29SB81					29SB82					29SB82					29SB83					29SB83				
Sample ID		29SB81-001					29SB81-002					29SB82-001					29SB82-002					29SB83-001					29SB83-002				
Sample Date		16-Dec-04					16-Dec-04					15-Dec-04					15-Dec-04					15-Dec-04					15-Dec-04				
Sample Depth		4-5 ft bgs					8-9 ft bgs					4-5 ft bgs					8-9 ft bgs					4-5 ft bgs					8-9 ft bgs				
Sample Type		REG					REG					REG					REG					REG					REG				
Parameter	Units	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF
Explosives																															
1,3,5-Trinitrobenzene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
1,3-Dinitrobenzene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
2,4,6-Trinitrotoluene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	430				1	200	U	U		1
2,4-Dinitrotoluene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
2,6-Dinitrotoluene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
2-Amino-4,6-dinitrotoluene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
4-Amino-2,6-dinitrotoluene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
HMX	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
m-Nitrotoluene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
Nitrobenzene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
o-Nitrotoluene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
p-Nitrotoluene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
RDX	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
Tetryl	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
Anions																															
Perchlorate	µg/kg																														

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Table A-2
Soil Sampling Results
2004 Soil Investigation
LHAAP-29

Sample Location		29SB84					29SB84					29SB85					29SB85					29SB85					29SB85				
Sample ID		29SB84-001					29SB84-002					29SB85-001					29SB85-001-FD					29SB85-002					29SB85-002-FD				
Sample Date		15-Dec-04					15-Dec-04					15-Dec-04					15-Dec-04					15-Dec-04					15-Dec-04				
Sample Depth		4-5 ft bgs					8-9 ft bgs					4-5 ft bgs					4-5 ft bgs					8-9 ft bgs					8-9 ft bgs				
Sample Type		REG					REG					REG					FD					REG					FD				
Parameter	Units	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF
Explosives																															
1,3,5-Trinitrobenzene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
1,3-Dinitrobenzene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
2,4,6-Trinitrotoluene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
2,4-Dinitrotoluene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
2,6-Dinitrotoluene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
2-Amino-4,6-dinitrotoluene	µg/kg	200	U	U		1	200	U	U		1	230	J	J	15	1	200	U	U		1	900				1	830				1
4-Amino-2,6-dinitrotoluene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	300	J	J	15	1	240	J	J	15	1
HMX	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
m-Nitrotoluene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
Nitrobenzene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
o-Nitrotoluene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
p-Nitrotoluene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
RDX	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
Tetryl	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
Anions																															
Perchlorate	µg/kg																														

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Table A-2
Soil Sampling Results
2004 Soil Investigation
LHAAP-29

Sample Location		29SB86					29SB86					29SB86					29SB87					29SB87					29SB87				
Sample ID		29SB86-001					29SB86-002					29SB86-003					29SB87-001					29SB87-002					29SB87-003				
Sample Date		14-Dec-04					14-Dec-04					14-Dec-04					14-Dec-04					14-Dec-04					14-Dec-04				
Sample Depth		0-0.5 ft bgs					6-8 ft bgs					20-21 ft bgs					0-0.5 ft bgs					6-8 ft bgs					19-20 ft bgs				
Sample Type		REG					REG					REG					REG					REG					REG				
Parameter	Units	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF
Explosives																															
1,3,5-Trinitrobenzene	µg/kg																														
1,3-Dinitrobenzene	µg/kg																														
2,4,6-Trinitrotoluene	µg/kg																														
2,4-Dinitrotoluene	µg/kg																														
2,6-Dinitrotoluene	µg/kg																														
2-Amino-4,6-dinitrotoluene	µg/kg																														
4-Amino-2,6-dinitrotoluene	µg/kg																														
HMX	µg/kg																														
m-Nitrotoluene	µg/kg																														
Nitrobenzene	µg/kg																														
o-Nitrotoluene	µg/kg																														
p-Nitrotoluene	µg/kg																														
RDX	µg/kg																														
Tetryl	µg/kg																														
Anions																															
Perchlorate	µg/kg	40.3				1	8600				100	689				2	117	U	U		10	57	U	U		5	122	U	U		10

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Table A-2
Soil Sampling Results
2004 Soil Investigation
LHAAP-29

Sample Location		29SB88					29SB88					29SB88					29SB89					29SB89					29SB89				
Sample ID		29SB88-001					29SB88-002					29SB88-003					29SB89-001					29SB89-002					29SB89-003				
Sample Date		14-Dec-04					14-Dec-04					14-Dec-04					15-Dec-04					15-Dec-04					15-Dec-04				
Sample Depth		0-1 ft bgs					4-5 ft bgs					15-16 ft bgs					0-0.5 ft bgs					4-5 ft bgs					12-13 ft bgs				
Sample Type		REG					REG					REG					REG					REG					REG				
Parameter	Units	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF
Explosives																															
1,3,5-Trinitrobenzene	µg/kg																														
1,3-Dinitrobenzene	µg/kg																														
2,4,6-Trinitrotoluene	µg/kg																														
2,4-Dinitrotoluene	µg/kg																														
2,6-Dinitrotoluene	µg/kg																														
2-Amino-4,6-dinitrotoluene	µg/kg																														
4-Amino-2,6-dinitrotoluene	µg/kg																														
HMX	µg/kg																														
m-Nitrotoluene	µg/kg																														
Nitrobenzene	µg/kg																														
o-Nitrotoluene	µg/kg																														
p-Nitrotoluene	µg/kg																														
RDX	µg/kg																														
Tetryl	µg/kg																														
Anions																															
Perchlorate	µg/kg	74.5				1	133	U	U		10	64.4	U	U		5	60.2	U	U		5	63.9	U	U		5	144				1

Notes:

µg/kg - micrograms per kilogram

DF - dilution factor

FD - field duplicate

ft bgs - feet below ground surface

J - The analyte was positively identified; the reported value is the estimated concentration of the constituent detected in the sample analyzed.

Qual - qualifier

RC - reason code

15 - quantitation

REG - regular

U - Not detected. The analyte was analyzed for, but not detected above the associated reporting limit.

ValQual - validation qualifier

Table A-3
Sediment and Solid Residue Sampling Results
2004 Investigation
LHAAP-29

Sample Location		29SD33-MH02					29SD36-MH05					29SD37-MH06					29SD38-MH07					29SD39-MH08					29SD40-MH09				
Sample ID		29SD33-MH02					29SD36-MH05					29SD37-MH06					29SD38-MH07					29SD39-MH08					29SD40-MH09				
Sample Date		17-Dec-04					17-Dec-04					17-Dec-04					16-Dec-04					16-Dec-04					17-Dec-04				
Sample Depth		0-0.3 ft bgs					0-0.3 ft bgs					0-0.3 ft bgs					0-0.3 ft bgs					0-0.3 ft bgs					0-0.3 ft bgs				
Sample Type		REG					REG					REG					REG					REG					REG				
Parameter	Units	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF
Explosives																															
1,3,5-Trinitrobenzene	µg/kg	440				1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
1,3-Dinitrobenzene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
2,4,6-Trinitrotoluene	µg/kg	11000				5	200	U	U		1	290	J	J	15	1	630				1	5500				1	1200				1
2,4-Dinitrotoluene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	710				1	200	U	U		1
2,6-Dinitrotoluene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	300	J	J	15	1	200	U	U		1
2-Amino-4,6-dinitrotoluene	µg/kg	3800		J	17	1	200	U	UJ	17	1	290	J	J	17, 15	1	200	U	U		1	1200				1	2400		J	17	1
4-Amino-2,6-dinitrotoluene	µg/kg	2600		J	17	1	200	U	UJ	17	1	260	J	J	17, 15	1	200	U	U		1	880				1	2500		J	17	1
HMX	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
m-Nitrotoluene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
Nitrobenzene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
o-Nitrotoluene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
p-Nitrotoluene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
RDX	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1
Tetryl	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1

Notes can be found on the last page

Table A-3
Sediment and Solid Residue Sampling Results
2004 Investigation
LHAAP-29

Sample Location		29SD40-MH09					29SD41-MH10					29SD43-MH12					29SD44					29SD45					29SD46				
Sample ID		29SD40-MH09-FD					29SD41-MH10					29SD43-MH12					29SD44					29SD45					29SD46				
Sample Date		17-Dec-04					16-Dec-04					17-Dec-04					19-Dec-04					19-Dec-04					16-Dec-04				
Sample Depth		0-0.3 ft bgs					0-0.3 ft bgs					0-0.3 ft bgs					0-0.5 ft bgs					0-0.5 ft bgs					0-0.5 ft bgs				
Sample Type		FD					REG					REG					REG					REG					REG				
Parameter	Units	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF
Explosives																															
1,3,5-Trinitrobenzene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	2000	U	U		10
1,3-Dinitrobenzene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	2000	U	U		10
2,4,6-Trinitrotoluene	µg/kg	1100				1	7000				1	410				1	200	U	U		1	410				1	26000000				5000
2,4-Dinitrotoluene	µg/kg	200	U	U		1	1100				1	200	U	U		1	200	U	U		1	200	U	U		1	8000000				5000
2,6-Dinitrotoluene	µg/kg	200	U	U		1	240	J	J	15	1	200	U	U		1	200	U	U		1	200	U	U		1	15000				10
2-Amino-4,6-dinitrotoluene	µg/kg	470		J	17	1	9000				10	200	U	UJ	17	1	200	U	U		1	200	U	U		1	48000				10
4-Amino-2,6-dinitrotoluene	µg/kg	460		J	17	1	7800				1	200	U	UJ	17	1	200	U	U		1	200	U	U		1	2000	U	U		10
HMX	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	2000	U	U		10
m-Nitrotoluene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	2000	U	U		10
Nitrobenzene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	2000	U	U		10
o-Nitrotoluene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	2000	U	U		10
p-Nitrotoluene	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	2000	U	U		10
RDX	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	2000	U	U		10
Tetryl	µg/kg	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	200	U	U		1	2000	U	U		10

Notes:

µg/kg - micrograms per kilogram

DF - dilution factor

FD - field duplicate

ft bgs - feet below ground surface

J - The analyte was positively identified; the reported value is the estimated concentration of the constituent detected in the sample analyzed.

Qual - qualifier

RC - reason code

15 - quantitation

17 - field duplicate RPD criteria is exceeded

REG - regular

U - Not detected. The analyte was analyzed for, but not detected above the associated reporting limit.

ValQual - validation qualifier

Table A-4
Water Sampling Results
2004 Investigation/2005 Investigation
LHAAP-29

Sample Location		29SW44					29SW45					29SW46					29WL32-MH01					29WL33-MH02					29WL34-MH03				
Sample ID		29SW44-041219					29SW45-041219					29SW46-041216					29WL32-MH01					29WL33-MH02					29WL34-MH03-02				
Sample Date		19-Dec-04					19-Dec-04					16-Dec-04					15-Dec-04					15-Dec-04					24-Feb-05				
Sample Depth		-					-					-					-					-					-				
Sample Type		REG					REG					REG					REG					REG					REG				
Parameter	Units	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF
Explosives																															
1,3,5-Trinitrobenzene	µg/L	0.2	U	U		1	0.2	U	U		1	0.73		J	15	1	0.2	U	U		1	0.2	U	U		1	0.263	U	UJL	07A	1
1,3-Dinitrobenzene	µg/L	0.2	U	U		1	0.2	U	U		1	0.2	U	U		1	0.2	U	U		1	0.2	U	U		1	0.263	U	UJL	07A	1
2,4,6-Trinitrotoluene	µg/L	0.4	J	J	15	1	0.39	J	J	15	1	860				100	250				50	0.93	J	J	15	1	23		JL	07A	5
2,4-Dinitrotoluene	µg/L	0.2	U	U		1	0.2	U	U		1	19				10	15				5	0.2	U	U		1	0.263	U	UJL	07A	1
2,6-Dinitrotoluene	µg/L	0.2	U	U		1	0.2	U	U		1	7.6				1	4.1				1	0.2	U	U		1	0.263	U	UJL	07A	1
2-Amino-4,6-dinitrotoluene	µg/L	0.56	J	J	15	1	0.53	J	J	15	1	20				10	16				5	3.4				1	1.19		JL	07A	1
4-Amino-2,6-dinitrotoluene	µg/L	2				1	1.9				1	48				10	33				5	6.1				1	2.13		JL	07A	1
HMX	µg/L	0.2	U	U		1	0.2	U	U		1	0.2	U	U		1	0.2	U	U		1	0.2	U	U		1	0.263	U	UJL	07A	1
m-Nitrotoluene	µg/L	0.2	U	U		1	0.2	U	U		1	0.2	U	U		1	0.2	U	U		1	0.2	U	U		1	0.263	U	UJL	07A	1
Nitrobenzene	µg/L	0.2	U	U		1	0.2	U	U		1	0.2	U	U		1	0.2	U	U		1	0.2	U	U		1	0.263	U	UJL	07A	1
o-Nitrotoluene	µg/L	0.2	U	U		1	0.2	U	U		1	0.2	U	U		1	0.2	U	U		1	0.2	U	U		1	0.263	U	UJL	07A	1
p-Nitrotoluene	µg/L	0.2	U	U		1	0.2	U	U		1	0.2	U	U		1	0.2	U	U		1	0.2	U	U		1	0.263	U	UJL	07A	1
RDX	µg/L	0.2	U	U		1	0.2	U	U		1	0.2	U	U		1	0.2	U	U		1	0.2	U	U		1	0.263	U	UJL	07A	1
Tetryl	µg/L	0.2	U	U		1	0.2	U	U		1	0.2	U	U		1	0.2	U	U		1	0.2	U	U		1	0.263	U	UJL	07A	1

Notes can be found on last page of this table

Table A-4
Water Sampling Results
2004 Investigation/2005 Investigation
LHAAP-29

Sample Location		29WL36-MH05					29WL37-MH06					29WL38-MH07					29WL39-MH08					29WL40-MH09					29WL40-MH09				
Sample ID		29WL36-MH05-02					29WL37-MH06-02					29WL38-MH07-02					29WL39-MH08-02					29WL40-MH09					29WL40-MH09-02				
Sample Date		24-Feb-05					24-Feb-05					23-Feb-05					23-Feb-05					17-Dec-04					23-Feb-05				
Sample Depth		-					-					-					-					-					-				
Sample Type		REG					REG					REG					REG					REG					REG				
Parameter	Units	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF
Explosives																															
1,3,5-Trinitrobenzene	µg/L	0.26	U	UJL	07A	1	1.34		JL	07A	1	0.26	U	U		1	0.258	U	U		1	0.2	U	U		1	0.266	U	U		1
1,3-Dinitrobenzene	µg/L	0.26	U	UJL	07A	1	0.26	U	UJL	07A	1	0.26	U	U		1	0.258	U	U		1	0.2	U	U		1	0.266	U	U		1
2,4,6-Trinitrotoluene	µg/L	84.3		JL	07A	10	430		JL	07A	100	0.955	J	J	15	1	6.36				1	5200				500	20				5
2,4-Dinitrotoluene	µg/L	0.26	U	UJL	07A	1	0.26	U	UJL	07A	1	0.26	U	U		1	0.258	U	U		1	0.8	J	J	15	1	1.13				1
2,6-Dinitrotoluene	µg/L	0.26	U	UJL	07A	1	0.26	U	UJL	07A	1	0.26	U	U		1	0.258	U	U		1	27				20	1.27				1
2-Amino-4,6-dinitrotoluene	µg/L	1.82		JL	07A	1	6.27		JL	07A	1	0.428	J	J	15	1	1.29				1	220				20	1.68				1
4-Amino-2,6-dinitrotoluene	µg/L	2.74		JL	07A	1	8.15		JL	07A	1	0.364	J	J	15	1	1.7				1	290				20	2.42				1
HMX	µg/L	0.26	U	UJL	07A	1	0.26	U	UJL	07A	1	0.26	U	U		1	0.258	U	U		1	0.2	U	U		1	0.266	U	U		1
m-Nitrotoluene	µg/L	0.26	U	UJL	07A	1	0.26	U	UJL	07A	1	0.26	U	U		1	0.258	U	U		1	0.2	U	U		1	0.266	U	U		1
Nitrobenzene	µg/L	0.26	U	UJL	07A	1	0.26	U	UJL	07A	1	0.26	U	U		1	0.258	U	U		1	0.2	U	U		1	0.266	U	U		1
o-Nitrotoluene	µg/L	0.26	U	UJL	07A	1	0.26	U	UJL	07A	1	0.26	U	U		1	0.258	U	U		1	0.2	U	U		1	0.266	U	U		1
p-Nitrotoluene	µg/L	0.26	U	UJL	07A	1	0.26	U	UJL	07A	1	0.26	U	U		1	0.258	U	U		1	0.2	U	U		1	0.266	U	U		1
RDX	µg/L	0.26	U	UJL	07A	1	0.494	J	JL	07A, 15	1	0.26	U	U		1	0.258	U	U		1	0.2	U	U		1	0.266	U	U		1
Tetryl	µg/L	0.26	U	UJL	07A	1	0.26	U	UJL	07A	1	0.26	U	U		1	0.258	U	U		1	0.2	U	U		1	0.266	U	U		1

Notes can be found on last page of this table

Table A-4
Water Sampling Results
2004 Investigation/2005 Investigation
LHAAP-29

Sample Location		29WL40-MH09					29WL40-MH09					29WL41-MH10					29WL42-MH11					29WL43-MH12				
Sample ID		29WL40-MH09-02-FD					29WL40-MH09-FD					29WL41-MH10-02					29WL42-MH11-02					29WL43-MH12-02				
Sample Date		23-Feb-05					17-Dec-04					23-Feb-05					23-Feb-05					23-Feb-05				
Sample Depth		-					-					-					-					-				
Sample Type		FD					FD					REG					REG					REG				
Parameter	Units	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF	Result	Qual	ValQual	RC	DF
Explosives																										
1,3,5-Trinitrobenzene	µg/L	0.258	U	U		1	0.2	U	U		1	0.258	U	U		1	0.258	U	U		1	0.275	U	U		1
1,3-Dinitrobenzene	µg/L	0.258	U	U		1	0.2	U	U		1	0.258	U	U		1	0.258	U	U		1	0.275	U	U		1
2,4,6-Trinitrotoluene	µg/L	24				5	5900				500	15				4	18				5	25				5
2,4-Dinitrotoluene	µg/L	1.09				1	0.83	J	J	15	1	1.05				1	0.922	J	J	15	1	0.934	J	J	15	1
2,6-Dinitrotoluene	µg/L	1.24				1	27				20	1.35				1	1.15				1	1.31				1
2-Amino-4,6-dinitrotoluene	µg/L	1.63				1	210				20	2.01				1	1.29				1	1.75				1
4-Amino-2,6-dinitrotoluene	µg/L	2.36				1	280				20	2.58				1	1.96				1	2.67				1
HMX	µg/L	0.258	U	U		1	0.2	U	U		1	0.258	U	U		1	0.258	U	U		1	0.275	U	U		1
m-Nitrotoluene	µg/L	0.258	U	U		1	0.2	U	U		1	0.258	U	U		1	0.258	U	U		1	0.275	U	U		1
Nitrobenzene	µg/L	0.258	U	U		1	0.2	U	U		1	0.258	U	U		1	0.258	U	U		1	0.275	U	U		1
o-Nitrotoluene	µg/L	0.258	U	U		1	0.2	U	U		1	0.258	U	U		1	0.258	U	U		1	0.275	U	U		1
p-Nitrotoluene	µg/L	0.258	U	U		1	0.2	U	U		1	0.258	U	U		1	0.258	U	U		1	0.275	U	U		1
RDX	µg/L	0.258	U	U		1	0.2	U	U		1	0.258	U	U		1	0.258	U	U		1	0.275	U	U		1
Tetryl	µg/L	0.258	U	U		1	0.2	U	U		1	0.258	U	U		1	0.258	U	U		1	0.275	U	U		1

Notes:

µg/L - micrograms per liter

DF - dilution factor

FD - field duplicate

J - The analyte was positively identified; the reported value is the estimated concentration of the constituent detected in the sample analyzed.

L - Result may be biased low. Details are provided in the validation report.

Qual - qualifier

RC - reason code

07A - sample

15 - quantitation

REG - regular

U - Not detected. The analyte was analyzed for, but not detected above the associated reporting limit.

ValQual - validation qualifier

Table A-5
Explosives Analytes at Wash House 806-D Foundation[a]
2005 Sampling by USACE
LHAAP-29

Analyte	2005 Sampling by USACE Explosives Results (µg/kg)		
	29DLineWHC01	29DLineWHC02	29DLineWHW01
1,3,5-Trinitrobenzene	< 375	< 375	4,610
2,4,6-Trinitrotoluene	< 375	< 375	27,300
2,4-Dinitrotoluene	< 375	< 375	< 375
2,6-Dinitrotoluene	< 375	< 375	< 375
2-Amino-4,6-dinitrotoluene	< 375	< 375	5,780
4-Amino-2,6-dinitrotoluene	< 375	< 375	2,870
HMX	< 375	< 375	< 375
m-Dinitrobenzene	< 375	< 375	< 375
m-Nitrotoluene	< 375	< 375	< 375
Nitrobenzene	< 375	< 375	< 375
o-Nitrotoluene	< 375	< 375	< 375
p-Nitrotoluene	< 375	< 375	< 375
RDX	< 375	< 375	< 375
Tetryl	< 375	< 375	< 375

Notes:

[a] Reference: USACE, 2005, Personal Communication (e-mail from C. Murray to R. Zeiler), Subject: Wash house soil sampling, March 28.

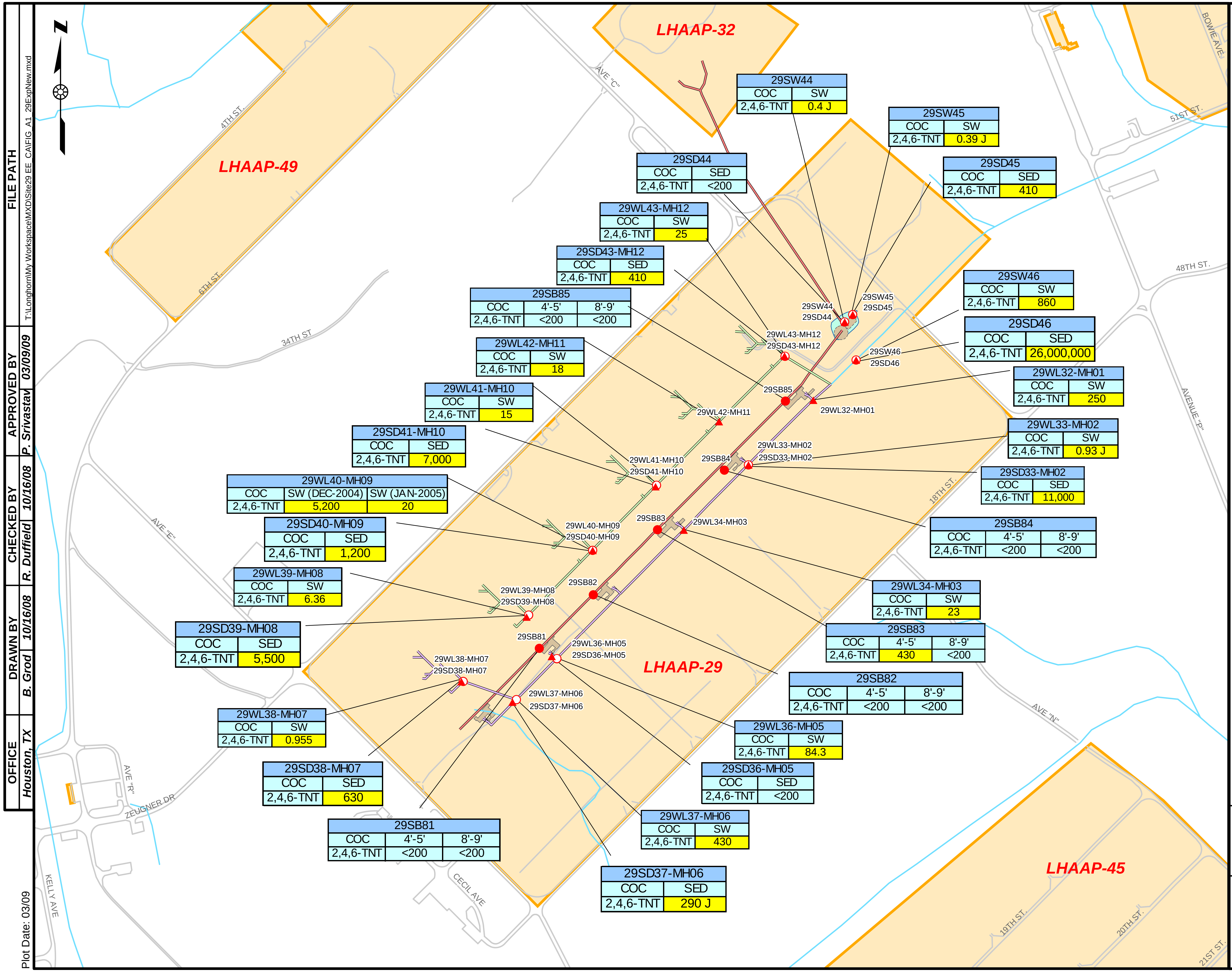
µg/kg micrograms per kilogram

Figures

FILE PATH T:\Longhorn\My Workspace\MXD\Site29 EE CAIFIG_A1_29ExpNew.mxd

APPROVED BY	CHECKED BY	DRAWN BY	OFFICE
P. Srivastav 03/09/09	*R. Duffield 10/16/08*	*B. Grod 10/16/08*	*Houston, TX*

Plot Date: 03/09



29SW44

COC	SW
2,4,6-TNT	0.4 J

29SW45

COC	SW
2,4,6-TNT	0.39 J

29SD44

COC	SED
2,4,6-TNT	<200

29SD45

COC	SED
2,4,6-TNT	410

29WL43-MH12

COC	SW
2,4,6-TNT	25

29SD43-MH12

COC	SED
2,4,6-TNT	410

29SB85

COC	4'-5'	8'-9'
2,4,6-TNT	<200	<200

29SW46

COC	SW
2,4,6-TNT	860

29SD46

COC	SED
2,4,6-TNT	26,000,000

29WL42-MH11

COC	SW
2,4,6-TNT	18

29WL32-MH01

COC	SW
2,4,6-TNT	250

29WL41-MH10

COC	SW
2,4,6-TNT	15

29SD41-MH10

COC	SED
2,4,6-TNT	7,000

29WL33-MH02

COC	SW
2,4,6-TNT	0.93 J

29SD33-MH02

COC	SED
2,4,6-TNT	11,000

29WL40-MH09

COC	SW (DEC-2004)	SW (JAN-2005)
2,4,6-TNT	5,200	20

29SD40-MH09

COC	SED
2,4,6-TNT	1,200

29SB84

COC	4'-5'	8'-9'
2,4,6-TNT	<200	<200

29WL39-MH08

COC	SW
2,4,6-TNT	6.36

29WL34-MH03

COC	SW
2,4,6-TNT	23

29SD39-MH08

COC	SED
2,4,6-TNT	5,500

29SB83

COC	4'-5'	8'-9'
2,4,6-TNT	430	<200

29SB82

COC	4'-5'	8'-9'
2,4,6-TNT	<200	<200

29WL38-MH07

COC	SW
2,4,6-TNT	0.955

29WL36-MH05

COC	SW
2,4,6-TNT	84.3

29SD38-MH07

COC	SED
2,4,6-TNT	630

29SD36-MH05

COC	SED
2,4,6-TNT	<200

29SB81

COC	4'-5'	8'-9'
2,4,6-TNT	<200	<200

29WL37-MH06

COC	SW
2,4,6-TNT	430

29SD37-MH06

COC	SED
2,4,6-TNT	290 J

Legend

Sample Location

●	Soil Boring
○	Sediment
▲	Surface Water
═	TNT Cooling Water Drain Line (South)
═	TNT Cooling Water Drain Line (North)
═	TNT Wastewater Line
─	Stream
═	Road
▨	Former Building Location
▨	Former Pump House and Storage Tank
▨	Storage Pond
▨	Site

Notes:
1. COC - Contaminant of concern
2. SW - Surface water
3. SED - Sediment
4. TNT - Trinitrotoluene
5. Depths are reported in feet below ground surface.
6. Soil and sediment sample concentrations are reported in micrograms per kilogram.
7. Water sample concentrations are reported in micrograms per liter.
8. Yellow highlight indicates detected result.

0 250 500 1,000 Feet

Shaw

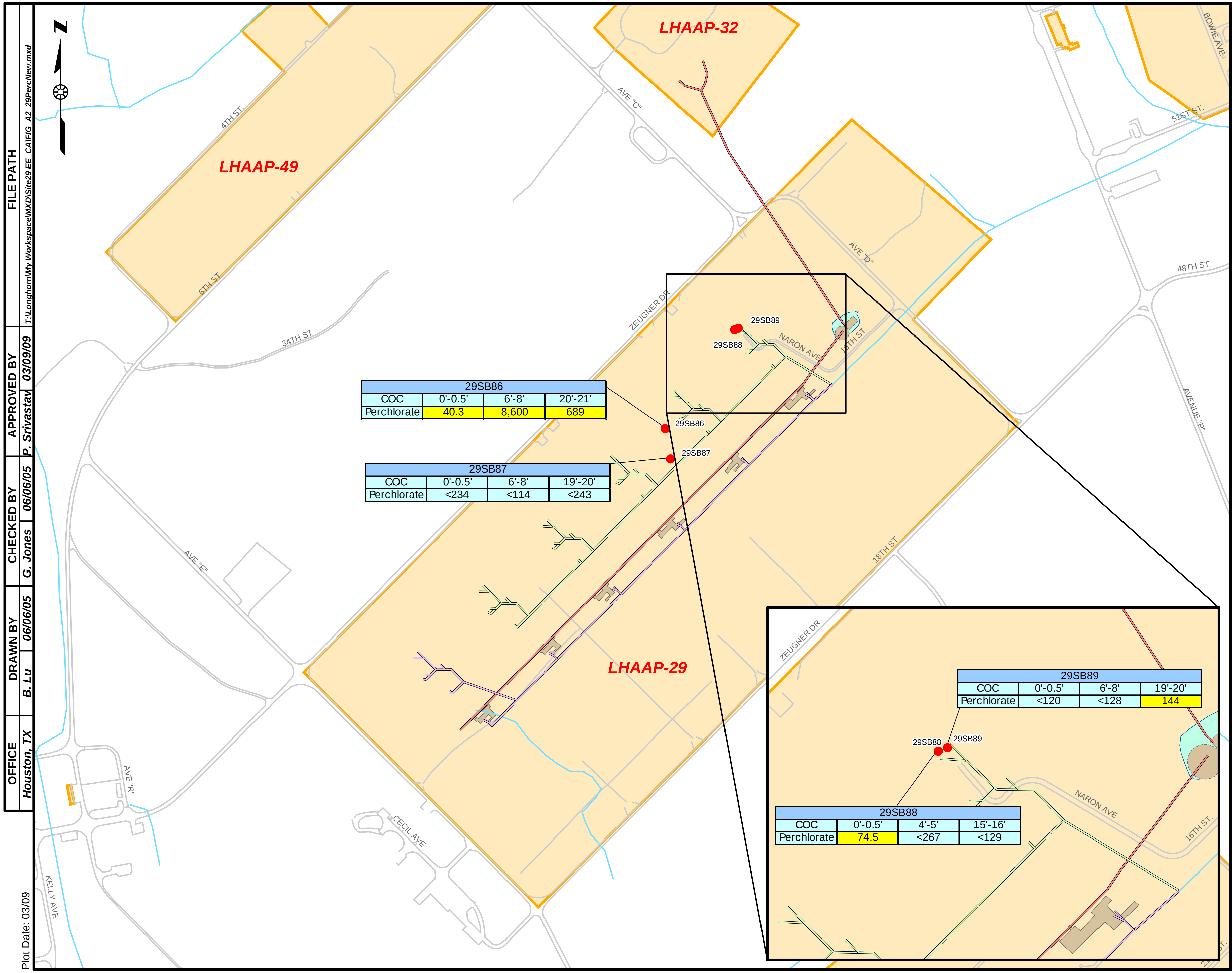
U.S. ARMY CORPS OF ENGINEERS
TULSA DISTRICT
TULSA, OKLAHOMA

FIGURE A-1

SAMPLE LOCATIONS FOR EXPLOSIVES AND RESULTS FOR TNT, DECEMBER 2004 AND FEBRUARY 2005
LHAAP-29

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

00091293



29SB86			
COC	0'-0.5'	6'-8'	20'-21'
Perchlorate	40.3	8,600	689

29SB87			
COC	0'-0.5'	6'-8'	19'-20'
Perchlorate	<234	<114	<243

29SB89			
COC	0'-0.5'	6'-8'	19'-20'
Perchlorate	<120	<128	144

29SB88			
COC	0'-0.5'	4'-5'	15'-16'
Perchlorate	74.5	<267	<129

Legend

Sample Location

- ● Soil Boring
- TNT Cooling Water Drain Line (South)
- TNT Cooling Water Drain Line (North)
- TNT Wastewater Line
- Stream
- Road
- ▨ Former Building Location
- ▨ Former Pump House and Storage Tank
- 🟩 Storage Pond
- ☐ Site

Notes:
1. COC - Contaminant of concern
2. Depths are reported in feet below ground surface.
3. Concentrations are reported in micrograms per kilogram.
4. Yellow highlight indicates detected result.

0 250 500 1,000
Feet

Shaw

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

FIGURE A-2

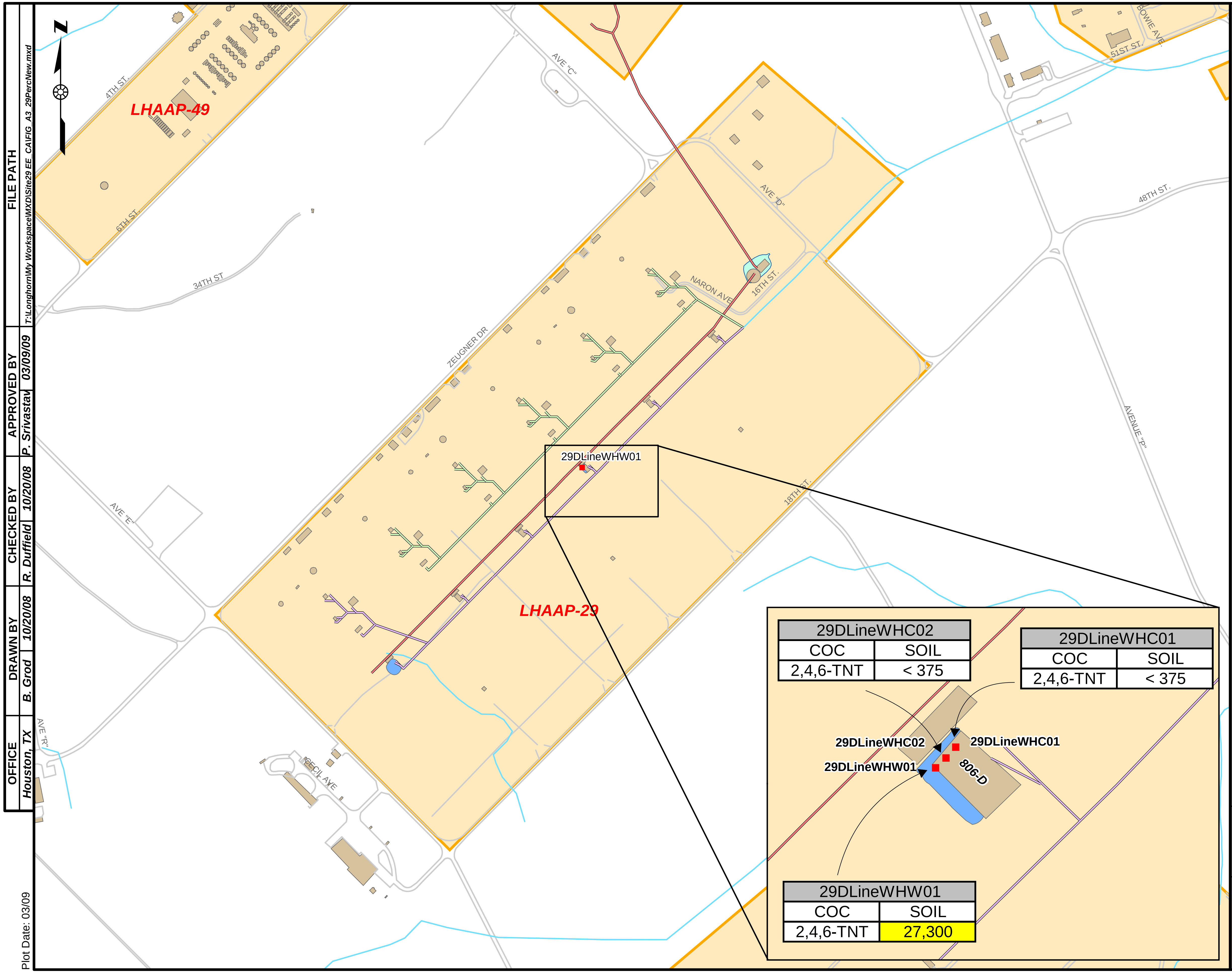
SAMPLE LOCATIONS AND RESULTS FOR
PERCHLORATE, DECEMBER 2004
LHAAP-29

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	FILE PATH
Houston, TX	B. Lu 06/06/05	G. Jones 06/06/05	P. Srivastav 03/09/09	T:\Longhorn\My Workspace\MXD\Site29 EE_CA\FIG_A2_29PercNew.mxd

Plot Date: 03/09

00091294



29DLineWHC02	
COC	SOIL
2,4,6-TNT	< 375

29DLineWHC01	
COC	SOIL
2,4,6-TNT	< 375

29DLineWHW01	
COC	SOIL
2,4,6-TNT	27,300

Legend

Sample Location

- 🟥 Surface Soil
- TNT Cooling Water Drain Line (South)
- TNT Cooling Water Drain Line (North)
- TNT Wastewater Line
- Stream
- Road
- Former Building Location
- Former Pump House and Storage Tank
- Storage Pond
- Site
- Stained Soil

Notes:
1. COC - Contaminant of concern
2. Depths assumed to be 0' - 0.5'.
3. Concentrations are reported in micrograms per kilogram.
4. Yellow highlight indicates detected result.

0 250 500 1,000
Feet

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

FIGURE A-3

SOIL SAMPLE LOCATIONS AND RESULTS FOR EXPLOSIVES, USACE 2005
LHAAP-29

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	FILE PATH
Houston, TX	B. Grod 10/20/08	R. Duffield 10/20/08	P. Srivastav 03/09/09	T:\Longhorn\My Workspace\MXD\Site29 EE_CA\FIG_A3_29PercNew.mxd

Plot Date: 03/09

Attachment 1
Laboratory Reports

Available on the Attached CD

TABLE OF CONTENTS

CLIENT: **SHAW E&I**

PROJECT: **LONGHORN ARMY AMMUNITION PLANT**

SDG: **04L128**

** - Not Requested

EMAX
LABORATORIES, INC.
1835 W. 205th Street
Torrance, CA 90501
Tel: (310) 618-8889
Fax: (310) 618-0818

Date: 01-03-2005
EMAX Batch No.: 04L128

Attn: Diane Meyer

Shaw E&I
1430 Enclave Parkway
Houston TX 77077

Subject: Laboratory Report
Project: Longhorn Army Ammunition Plant

Enclosed is the Laboratory report for samples received on 12/16/04. The data reported include :

Sample ID	Control #	Col Date	Matrix	Analysis
29SB85-001	L128-01	12/15/04	SOIL	NITROAROMATICS & NITRAMINES
29SB85-002	L128-02	12/15/04	SOIL	NITROAROMATICS & NITRAMINES
29SB85-001-QC	L128-03	12/15/04	SOIL	NITROAROMATICS & NITRAMINES
29SB85-002-QC	L128-04	12/15/04	SOIL	NITROAROMATICS & NITRAMINES
29SB82-001	L128-05	12/15/04	SOIL	NITROAROMATICS & NITRAMINES
29SB82-002	L128-06	12/15/04	SOIL	NITROAROMATICS & NITRAMINES
29SB83-001	L128-07	12/15/04	SOIL	NITROAROMATICS & NITRAMINES
29SB83-002	L128-08	12/15/04	SOIL	NITROAROMATICS & NITRAMINES
29SB84-001	L128-09	12/15/04	SOIL	NITROAROMATICS & NITRAMINES
29SB84-002	L128-10	12/15/04	SOIL	NITROAROMATICS & NITRAMINES
29WL32-MH01	L128-11	12/15/04	WATER	NITROAROMATICS & NITRAMINES
29WL32-MH02	L128-12	12/15/04	WATER	NITROAROMATICS & NITRAMINES

The results are summarized on the following pages.

Please feel free to call if you have any questions concerning these results.

Sincerely yours,

Kam Y. Pang, Ph.D.
Laboratory Director

00091298

Shaw *Environmental & Infrastructure, Inc.*
1430 Enclave Parkway
Houston, TX 77077 (281) 368-4000
Tulsa TERC DACA56-94-D-0020

CHAIN-OF-CUSTODY

No. **29-EMAX-DEC04-002**

04L128

Laboratory Name: **EMAX**
Address: **1835 205th Street Torrance, CA 90501**
Contact: Joe Kelbley
Project Name **Longhorn AAP**
Project Location **Area 29 Former TNT Production Area**
Project No. **845714**
Project Contact **Diane Meyer**
Project Telephone No. **281-368-4404**
USACE Point of contact: **Cliff Murray**
USACE Telephone No.
Project Manager/Supervisor **Praveen Srivastav**

									Analysis and Method Desired (Indicate separate containers)							Remarks
Item No.	Sample Number	Date	Time	Comp	Grab	Matrix	Sample Description, Location	Number of Containers	Nitroaromatics and Nitroamines by 8330	Perchlorate by 314.0						
1	29SB85-001	12/15/04	10:15			SOIL	**29SB85**	1	X							
2	29SB85-002		10:22			SOIL	**29SB85**	1	X							
3	29SB 85 -001-QC		10:15			SOIL	29SB85	1	X							
4	29SB 85 -002-QC		10:22			SOIL	29SB85	1	X							
~~5~~																
~~6~~																
~~7~~																
~~8~~																
~~9~~																
~~10~~																

Transfers Relinquished By (Signature)	Date/Time	Transfers Accepted By (Signature)	Date/Time
M. Allen			
		Laboratory	12-16-04 0930

Special Instructions /
FedEx Airbill No.:
Sampler's Signature

TAT: ____ Standard ____ Rush Due: ________ Seals Intact? ____Y____N Received Good Condition ✓Y____N____ Cold 3.0°C

White - Lab Copy Canary - Field Copy Pink - File Copy

~~0009~~1299

Shaw *Environmental & Infrastructure, Inc.*
1430 Enclave Parkway
Houston, TX 77077 (281) 368-4000

CHAIN-OF-CUSTODY

No. **29-EMAX-DEC04-001**

042128

Laboratory Name: **EMAX**
Address: **1835 205th Street, Torrance, CA 90501**
Contact: Joe Kelbley

Project Name: **Longhorn AAP**
Project Location: **Area 29 Former TNT Production Area**
Project No.: **845714**
Project Contact: **Diane Meyer**
Project Telephone No.: **281-368-4404**
USACE Point of contact: **Cliff Murray**
USACE Telephone No.:
Project Manager/Supervisor: **Praveen Srivastav**

Item No.	Sample Number	Date	Time	Comp	Grab	Matrix	Sample Description, Location	Number of Containers	Nitroaromatics and Nitroamines by 8330	Perchlorate by 314.0						Remarks
~~1~~	~~29SB80-001~~					~~SOIL~~	~~29SB80~~	~~1~~	~~X~~							
~~2~~	~~29SB80-002~~					~~SOIL~~	~~29SB80~~	~~1~~	~~X~~							
~~3~~	~~29SB81-001~~					~~SOIL~~	~~29SB81~~	~~1~~	~~X~~							
~~4~~	~~29SB81-002~~					~~SOIL~~	~~29SB81~~	~~1~~	~~X~~							
5	29SB82-001	12/15/04	14:36		X	SOIL	29SB82	1	X							
6	29SB82-002		14:48		X	SOIL	29SB82	1	X							
7	29SB83-001		1400		X	SOIL	29SB83	1	X							
8	29SB83-002		1405		X	SOIL	29SB83	1	X							
9	29SB84-001		1125		X	SOIL	29SB84	1	X							
10	29SB84-002		1130		X	SOIL	29SB84	1	X							

Transfers Relinquished By (Signature)	Date/Time	Transfers Accepted By (Signature)	Date/Time	
M. Miller	12/15/04 1600			Special Instructions
				FedEx Airbill No.:
		Laboratory	12-16-04 0930	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

00091300

Shaw *Environmental & Infrastructure, Inc.*

1430 Enclave Parkway
Houston, TX 77077 (281) 368-4000
Tulsa TERC DACA56-94-D-0020

CHAIN-OF-CUSTODY

No. 29-EMAX-DEC04-008

04L128

Laboratory Name: EMAX
Address: 1835 205th Street, Torrance, CA 90501
Contact:

Project Name: Longhorn AAP
Project Location: Area 29 Former TNT Production Area
Project No.: 845714
Project Contact: Diane Meyer
Project Telephone No.: 281-368-4404
USACE Point of contact: Cliff Murray
Project Manager/Supervisor: Praveen Srivastav
USACE Telephone No.:

Analysis and Method Desired (Indicate separate containers)

Item No.	Sample Number	Date	Time	Comp	Grab	Matrix	Sample Description, Location	Number of Containers	Nitroaromatics and Nitroamines by 8330	Perchlorate by 314.0	Remarks
1	29WL32-MH01	12/15/04	1330		X	sw	29WL32-MH01	2	X		
2	29WL33-MH02	12/15/04	1445		X	sw	29WL33-MH02	2	X		
~~3~~	~~29WL34-MH03~~					~~sw~~	~~29WL34-MH03~~	~~2~~	~~X~~		
~~4~~	~~29WL35-MH04~~					~~sw~~	~~29WL35-MH04~~	~~2~~	~~X~~		
~~5~~	~~29WL36-MH05~~					~~sw~~	~~29WL36-MH05~~	~~2~~	~~X~~		
~~6~~	~~29WL37-MH06~~		MSW			~~sw~~	~~29WL37-MH06~~	~~2~~	~~X~~		
~~7~~	~~29WL38-MH07~~					~~sw~~	~~29WL38-MH07~~	~~2~~	~~X~~		
~~8~~	~~29WL39-MH08~~					~~sw~~	~~29WL39-MH08~~	~~2~~	~~X~~		
9											
10											

Transfers Relinquished By (Signature)	Date/Time	Transfers Accepted By (Signature)	Date/Time
	12/15/04 1600		
		Laboratory	12-16-04 0930

Special Instructions

FedEx Airbill No.:

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

SAMPLE RECEIPT FORM 1

Type of Delivery	Delivered By/Airbill		
☐ EMAX Courier		ECN	04L128
☐ Client Delivery		Recepient	Jon Luna/Sergey
☑ Third Party UPS	J178 746 4218	Date	12-16-04
		Time	0930

COC Inspection

☑ Client Name
☑ Address
☑ Client PM/FC
☑ Tel #/Fax #
☑ Sampler Name
☐ Courier Signature/Date/Time
☐ TAT
☑ Sample ID
☑ Sampling Date/Time/Location
☑ Analysis Required
☑ Matrix
☐ Preservative (if any)
Safety Issues ☑ None ☐ High Concentrations expected ☐ Superfund Site Samples
Comments: ☐ Rad Screening Required

Packaging Inspection

Container	☑ Cooler	☐ Box	☐	☐
Condition	☐ Custody Seal	☐ Intact	☐ Damaged	☐
Packaging	☑ Bubble Pack	☐ Styrofoam	☑ Sufficient	☑ plastic bag
Temperatures	☑ Cooler 1 3.0°c	☑ Cooler 2 ____	☐ Cooler 3 ____	☐ Cooler 4 ____
	☐ Cooler 5 ____	☐ Cooler 6 ____	☐ Cooler 7 ____	☐ Cooler 8 ____
	☐ Cooler 9 ____	☐ Cooler 10 ____	☐ Cooler 11 ____	☐ Cooler 12 ____

Comments:

LSCID	Client ID	Discrepancy	Corrective Action
L128-03	29SB85-001-QC	LABEL REQSTD FOR PERCHLORATE	called client
		ANALYSIS	IDs with 80, 81, 82
			83, 84 85 → explosives
-04	29SB85-002-QC	LABEL ID READS 29SB85QC,	86, 87, 88, 89 → Perchlorate
		(DATE/TIME WERE MATCHED ON	
		COC) REQSTD FOR PERCHLORATE	run these samples
		ANALYSIS	for explosives per client
-05		NO COLLECTION DATE ON LABEL	refer to chain of custody
-06		COLLECTION TIME ON LABEL	↓
		READS 1445 (1448 ON COC)	
-09		COLLECTION TIME ON LABEL	
		READS 1124 (1125 ON COC)	

LSCID : Lab Sample Container ID

REVIEWS

Sample Labeling
Date 12-16-04

SRF
Date 12-17-04

PM amk
Date 12/17/04

UPS Next Day Air®
UPS Worldwide Express℠
Shipping Document

04L128
04L129 } 12-16-04
0951

SHIPMENT FROM

UPS ACCOUNT NO. 66V 7[illegible]

REFERENCE NUMBER

TELEPHONE

[illegible]

DELIVERY TO

TELEPHONE

[illegible]

Residential ☐

010101120 5/00 W

United Parcel Service [illegible]ville, KY

WEIGHT	WEIGHT	DIMENSIONAL WEIGHT	
	59		

The shipper authorizes UPS to act as forwarding agent for export control and customs purposes.
The shipper certifies that these commodities, technology or software were exported from the United States in accordance with the Export Administration Regulations. Diversion contrary to U.S. law is prohibited.

☐ EXPRESS (INT'L)

☐ DOCUMENTS ONLY 1

SATURDAY DELIVERY ☐

J178 746 421 8

J178 746 421 8

EXPORT

UPS Next Day Air® **1**

EXTREMELY URGENT

J178 746 421 8

J178 746 421 8

TRACKING NUMBER

DELIVERY

DATE OF SHIPMENT

[illegible]

REPORTING CONVENTIONS

DATA QUALIFIERS:

Lab Qualifier	AFCEE Qualifier	Description
J	F	Indicates that the analyte is positively identified and the result is less than RL but greater than MDL.
N		Indicates presumptive evidence of a compound.
B	B	Indicates that the analyte is found in the associated method blank as well as in the sample at above QC level.
E	J	Indicates that the result is above the maximum calibration range.
*	*	Out of QC limit.

Note: The above qualifiers are used to flag the results unless the project requires a different set of qualification criteria.

ACRONYMS AND ABBREVIATIONS:

CRDL	Contract Required Detection Limit
RL	Reporting Limit
MRL	Method Reporting Limit
PQL	Practical Quantitation Limit
MDL	Method Detection Limit
DO	Diluted out

DATES

The date and time information for leaching and preparation reflect the beginning date and time of the procedure unless the method, protocol, or project specifically requires otherwise.

LABORATORY REPORT FOR

SHAW E&I

LONG HORN ARMY AMMUNITION PLANT

EPA METHOD 8330
EXPLOSIVES

SDG#: 04L128

CASE NARRATIVE

CLIENT:	**SHAW E & I**
PROJECT:	**LONG HORN ARMY AMMUNITION PLANT**
EMAX SDG:	**04L128**

EPA METHOD 8330
EXPLOSIVES

Two (2) water and ten (10) soil samples were received on 12/16/04 for Explosives analysis by EPA Method 8330 in accordance with USEPA-SW846 3rd edition, and EMAX-8330.

1. Holding Time

Analytical holding time was met. Extraction for water samples was started and completed on 12/20/04. Extraction for soil samples was started on 12/20/04 and completed on 12/21/04

2. Calibration

Initial calibration was 5 point. %RSDs were within 20%. All continuing calibrations of the primary column were carried out at 12-hour intervals and the recoveries were within 85-115%.

3. Method Blank

Method blanks were free of contamination at the Reporting Limit.

4. Surrogate recovery

Surrogate recovery for sample L128-11I was diluted out. All other surrogate recoveries were within QC limits.

5. Lab Control Sample / Lab Control Duplicate

All recoveries were within QC limits.

6. Matrix Spike/Matrix Spike Duplicate

Sample L128-02 was spiked. Recoveries were within QC limits.

7. Sample Analysis

Sample analyses were within QC requirements. Quantitation is from the primary column. All positive results above RL were confirmed by LC-CN column and the confirmation is presumptive because it was based on retention time window.

Samples were air-dried prior to extraction; hence, no moisture correction was applied to RL, MDL and results.

LAB CHRONICLE
EXPLOSIVES

Client : SHAW E&I
Project : LONGHORN ARMY AMMUNITION PLANT

SDG NO. : 04L128
Instrument ID : T081

SOIL

Client Sample ID	Laboratory Sample ID	Dilution Factor	% Moist	Analysis DateTime	Extraction DateTime	Sample Data FN	Calibration Data FN	Prep. Batch	Notes
MBLK1S	EXL005SB	1	NA	12/21/0417:34	12/20/0417:30	XL21013A	XL21012A	EXL005S	Method Blank
LCS1S	EXL005SL	1	NA	12/21/0418:03	12/20/0417:30	XL21014A	XL21012A	EXL005S	Lab Control Sample (LCS)
29SB85-001	L128-01	1	NA	12/21/0418:32	12/20/0417:30	XL21015A	XL21012A	EXL005S	Field Sample
29SB85-002	L128-02	1	NA	12/21/0419:01	12/20/0417:30	XL21016A	XL21012A	EXL005S	Field Sample
29SB85-002MS	L128-02M	1	NA	12/21/0419:29	12/20/0417:30	XL21017A	XL21012A	EXL005S	Matrix Spike Sample (MS)
29SB85-002MSD	L128-02S	1	NA	12/21/0419:58	12/20/0417:30	XL21018A	XL21012A	EXL005S	MS Duplicate (MSD)
29SB85-001-QC	L128-03	1	NA	12/21/0420:27	12/20/0417:30	XL21019A	XL21012A	EXL005S	Field Sample
29SB85-002-QC	L128-04	1	NA	12/21/0421:54	12/20/0417:30	XL21022A	XL21021A	EXL005S	Field Sample
29SB82-001	L128-05	1	NA	12/21/0422:22	12/20/0417:30	XL21023A	XL21021A	EXL005S	Field Sample
29SB82-002	L128-06	1	NA	12/21/0422:51	12/20/0417:30	XL21024A	XL21021A	EXL005S	Field Sample
29SB83-001	L128-07	1	NA	12/21/0423:20	12/20/0417:30	XL21025A	XL21021A	EXL005S	Field Sample
29SB83-002	L128-08	1	NA	12/21/0423:49	12/20/0417:30	XL21026A	XL21021A	EXL005S	Field Sample
29SB84-001	L128-09	1	NA	12/22/0400:18	12/20/0417:30	XL21027A	XL21021A	EXL005S	Field Sample
29SB84-002	L128-10	1	NA	12/22/0400:46	12/20/0417:30	XL21028A	XL21021A	EXL005S	Field Sample

WATER

Client Sample ID	Laboratory Sample ID	Dilution Factor	% Moist	Analysis DateTime	Extraction DateTime	Sample Data FN	Calibration Data FN	Prep. Batch	Notes
MBLK1W	EXL004WB	1	NA	12/20/0418:27	12/20/0413:00	XL20004A	XL20003A	EXL004W	Method Blank
LCS1W	EXL004WL	1	NA	12/20/0418:56	12/20/0413:00	XL20005A	XL20003A	EXL004W	Lab Control Sample (LCS)
LCD1W	EXL004WC	1	NA	12/20/0419:24	12/20/0413:00	XL20006A	XL20003A	EXL004W	LCS Duplicate
29WL32-MH01	L128-11	1	NA	12/20/0419:53	12/20/0413:00	XL20007A	XL20003A	EXL004W	Field Sample
29WL32-MH01DL1	L128-11T	5	NA	12/21/0413:15	12/20/0413:00	XL21004A	XL21002A	EXL004W	Diluted Sample
29WL32-MH01DL2	L128-11I	50	NA	12/21/0412:46	12/20/0413:00	XL21003A	XL21002A	EXL004W	Diluted Sample
29WL32-MH02	L128-12	1	NA	12/20/0420:22	12/20/0413:00	XL20008A	XL20003A	EXL004W	Field Sample

FN - Filename
% Moist - Percent Moisture

SAMPLE RESULTS

EPA METHOD 8330
EXPLOSIVES

Client : SHAW E&I
Project : LONGHORN ARMY AMMUNITION PLANT
Batch No. : 04L128
Sample ID: 29SB85-001
Lab Samp ID: L128-01
Lab File ID: XL21015A
Ext Btch ID: EXL005S
Calib. Ref.: XL21012A

Date Collected: 12/15/04
Date Received: 12/16/04
Date Extracted: 12/20/04 17:30
Date Analyzed: 12/21/04 18:32
Dilution Factor: 1
Matrix : SOIL
% Moisture : NA
Instrument ID : T-081

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	400	200
RDX	ND	400	200
1,3,5-TNB	ND	400	200
1,3-DNB	ND	400	200
TETRYL	ND	400	200
NITROBENZENE	ND	400	200
2,4,6-TNT	ND	400	200
4-AM-2,6-DNT	ND	400	200
2-AM-4,6-DNT	230J	400	200
2,6-DNT	ND	400	200
2,4-DNT	ND	400	200
2-NITROTOLUENE	ND	400	200
3-NITROTOLUENE	ND	400	200
4-NITROTOLUENE	ND	400	200

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	101	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

```
==============================================================================
Client      : SHAW E&I                           Date  Collected: 12/15/04
Project     : LONGHORN ARMY AMMUNITION PLANT     Date   Received: 12/16/04
Batch No.   : 04L128                             Date  Extracted: 12/20/04 17:30
Sample    ID: 29SB85-002                         Date   Analyzed: 12/21/04 19:01
Lab Samp ID: L128-02                             Dilution Factor: 1
Lab File ID: XL21016A                            Matrix         : SOIL
Ext Btch ID: EXL005S                             % Moisture     : NA
Calib. Ref.: XL21012A                            Instrument ID  : T-081
==============================================================================
```

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	400	200
RDX	ND	400	200
1,3,5-TNB	ND	400	200
1,3-DNB	ND	400	200
TETRYL	ND	400	200
NITROBENZENE	ND	400	200
2,4,6-TNT	ND	400	200
4-AM-2,6-DNT	300J	400	200
2-AM-4,6-DNT	900	400	200
2,6-DNT	ND	400	200
2,4-DNT	ND	400	200
2-NITROTOLUENE	ND	400	200
3-NITROTOLUENE	ND	400	200
4-NITROTOLUENE	ND	400	200

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	99	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

Client : SHAW E&I
Project : LONGHORN ARMY AMMUNITION PLANT
Batch No. : 04L128
Sample ID: 29SB85-001-QC
Lab Samp ID: L128-03
Lab File ID: XL21019A
Ext Btch ID: EXL005S
Calib. Ref.: XL21012A

Date Collected: 12/15/04
Date Received: 12/16/04
Date Extracted: 12/20/04 17:30
Date Analyzed: 12/21/04 20:27
Dilution Factor: 1
Matrix : SOIL
% Moisture : NA
Instrument ID : T-081

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	400	200
RDX	ND	400	200
1,3,5-TNB	ND	400	200
1,3-DNB	ND	400	200
TETRYL	ND	400	200
NITROBENZENE	ND	400	200
2,4,6-TNT	ND	400	200
4-AM-2,6-DNT	ND	400	200
2-AM-4,6-DNT	ND	400	200
2,6-DNT	ND	400	200
2,4-DNT	ND	400	200
2-NITROTOLUENE	ND	400	200
3-NITROTOLUENE	ND	400	200
4-NITROTOLUENE	ND	400	200

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	104	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

Client	: SHAW E&I	Date Collected:	12/15/04
Project	: LONGHORN ARMY AMMUNITION PLANT	Date Received:	12/16/04
Batch No.	: 04L128	Date Extracted:	12/20/04 17:30
Sample ID:	29SB85-002-QC	Date Analyzed:	12/21/04 21:54
Lab Samp ID:	L128-04	Dilution Factor:	1
Lab File ID:	XL21022A	Matrix	: SOIL
Ext Btch ID:	EXL005S	% Moisture	: NA
Calib. Ref.:	XL21021A	Instrument ID	: T-081

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	400	200
RDX	ND	400	200
1,3,5-TNB	ND	400	200
1,3-DNB	ND	400	200
TETRYL	ND	400	200
NITROBENZENE	ND	400	200
2,4,6-TNT	ND	400	200
4-AM-2,6-DNT	240J	400	200
2-AM-4,6-DNT	830	400	200
2,6-DNT	ND	400	200
2,4-DNT	ND	400	200
2-NITROTOLUENE	ND	400	200
3-NITROTOLUENE	ND	400	200
4-NITROTOLUENE	ND	400	200

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	101	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

Client : SHAW E&I
Project : LONGHORN ARMY AMMUNITION PLANT
Batch No. : 04L128
Sample ID: 29SB82-001
Lab Samp ID: L128-05
Lab File ID: XL21023A
Ext Btch ID: EXL005S
Calib. Ref.: XL21021A

Date Collected: 12/15/04
Date Received: 12/16/04
Date Extracted: 12/20/04 17:30
Date Analyzed: 12/21/04 22:22
Dilution Factor: 1
Matrix : SOIL
% Moisture : NA
Instrument ID : T-081

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	400	200
RDX	ND	400	200
1,3,5-TNB	ND	400	200
1,3-DNB	ND	400	200
TETRYL	ND	400	200
NITROBENZENE	ND	400	200
2,4,6-TNT	ND	400	200
4-AM-2,6-DNT	ND	400	200
2-AM-4,6-DNT	ND	400	200
2,6-DNT	ND	400	200
2,4-DNT	ND	400	200
2-NITROTOLUENE	ND	400	200
3-NITROTOLUENE	ND	400	200
4-NITROTOLUENE	ND	400	200

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	100	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

Client : SHAW E&I
Project : LONGHORN ARMY AMMUNITION PLANT
Batch No. : 04L128
Sample ID: 29SB82-002
Lab Samp ID: L128-06
Lab File ID: XL21024A
Ext Btch ID: EXL005S
Calib. Ref.: XL21021A

Date Collected: 12/15/04
Date Received: 12/16/04
Date Extracted: 12/20/04 17:30
Date Analyzed: 12/21/04 22:51
Dilution Factor: 1
Matrix : SOIL
% Moisture : NA
Instrument ID : T-081

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	400	200
RDX	ND	400	200
1,3,5-TNB	ND	400	200
1,3-DNB	ND	400	200
TETRYL	ND	400	200
NITROBENZENE	ND	400	200
2,4,6-TNT	ND	400	200
4-AM-2,6-DNT	ND	400	200
2-AM-4,6-DNT	ND	400	200
2,6-DNT	ND	400	200
2,4-DNT	ND	400	200
2-NITROTOLUENE	ND	400	200
3-NITROTOLUENE	ND	400	200
4-NITROTOLUENE	ND	400	200

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	100	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

Client	: SHAW E&I	Date Collected:	12/15/04
Project	: LONGHORN ARMY AMMUNITION PLANT	Date Received:	12/16/04
Batch No.	: 04L128	Date Extracted:	12/20/04 17:30
Sample ID:	29SB83-001	Date Analyzed:	12/21/04 23:20
Lab Samp ID:	L128-07	Dilution Factor:	1
Lab File ID:	XL21025A	Matrix :	SOIL
Ext Btch ID:	EXL005S	% Moisture :	NA
Calib. Ref.:	XL21021A	Instrument ID :	T-081

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	400	200
RDX	ND	400	200
1,3,5-TNB	ND	400	200
1,3-DNB	ND	400	200
TETRYL	ND	400	200
NITROBENZENE	ND	400	200
2,4,6-TNT	430	400	200
4-AM-2,6-DNT	ND	400	200
2-AM-4,6-DNT	ND	400	200
2,6-DNT	ND	400	200
2,4-DNT	ND	400	200
2-NITROTOLUENE	ND	400	200
3-NITROTOLUENE	ND	400	200
4-NITROTOLUENE	ND	400	200

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	102	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

Client	: SHAW E&I	Date Collected:	12/15/04
Project	: LONGHORN ARMY AMMUNITION PLANT	Date Received:	12/16/04
Batch No.	: 04L128	Date Extracted:	12/20/04 17:30
Sample ID:	29SB83-002	Date Analyzed:	12/21/04 23:49
Lab Samp ID:	L128-08	Dilution Factor:	1
Lab File ID:	XL21026A	Matrix :	SOIL
Ext Btch ID:	EXL005S	% Moisture :	NA
Calib. Ref.:	XL21021A	Instrument ID :	T-081

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	400	200
RDX	ND	400	200
1,3,5-TNB	ND	400	200
1,3-DNB	ND	400	200
TETRYL	ND	400	200
NITROBENZENE	ND	400	200
2,4,6-TNT	ND	400	200
4-AM-2,6-DNT	ND	400	200
2-AM-4,6-DNT	ND	400	200
2,6-DNT	ND	400	200
2,4-DNT	ND	400	200
2-NITROTOLUENE	ND	400	200
3-NITROTOLUENE	ND	400	200
4-NITROTOLUENE	ND	400	200

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	100	63-143

Note: All positive results are confirmed by CN column

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                         EPA METHOD 8330
                           EXPLOSIVES

==============================================================================
Client      : SHAW E&I                           Date  Collected: 12/15/04
Project     : LONGHORN ARMY AMMUNITION PLANT     Date   Received: 12/16/04
Batch No.   : 04L128                             Date  Extracted: 12/20/04 17:30
Sample    ID: 29SB84-001                         Date   Analyzed: 12/22/04 00:18
Lab Samp ID: L128-09                             Dilution Factor: 1
Lab File ID: XL21027A                            Matrix         : SOIL
Ext Btch ID: EXL005S                             % Moisture     : NA
Calib. Ref.: XL21021A                            Instrument ID  : T-081
==============================================================================

                                             RESULTS        RL              MDL
PARAMETERS                                   (ug/kg)     (ug/kg)        (ug/kg)
----------                                   -------     -------        -------
HMX                                               ND         400            200
RDX                                               ND         400            200
1,3,5-TNB                                         ND         400            200
1,3-DNB                                           ND         400            200
TETRYL                                            ND         400            200
NITROBENZENE                                      ND         400            200
2,4,6-TNT                                         ND         400            200
4-AM-2,6-DNT                                      ND         400            200
2-AM-4,6-DNT                                      ND         400            200
2,6-DNT                                           ND         400            200
2,4-DNT                                           ND         400            200
2-NITROTOLUENE                                    ND         400            200
3-NITROTOLUENE                                    ND         400            200
4-NITROTOLUENE                                    ND         400            200

SURROGATE PARAMETERS                       % RECOVERY     QC LIMIT
--------------------                       ----------     --------
3,4-DINITROTOLUENE                                101       63-143

Note:  All positive results are confirmed by CN column
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EPA METHOD 8330
EXPLOSIVES

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==============================================================================
Client      : SHAW E&I                          Date  Collected: 12/15/04
Project     : LONGHORN ARMY AMMUNITION PLANT    Date   Received: 12/16/04
Batch No.   : 04L128                            Date  Extracted: 12/20/04 17:30
Sample    ID: 29SB84-002                        Date   Analyzed: 12/22/04 00:46
Lab Samp ID: L128-10                            Dilution Factor: 1
Lab File ID: XL21028A                           Matrix         : SOIL
Ext Btch ID: EXL005S                            % Moisture     : NA
Calib. Ref.: XL21021A                           Instrument ID  : T-081
==============================================================================
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PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	400	200
RDX	ND	400	200
1,3,5-TNB	ND	400	200
1,3-DNB	ND	400	200
TETRYL	ND	400	200
NITROBENZENE	ND	400	200
2,4,6-TNT	ND	400	200
4-AM-2,6-DNT	ND	400	200
2-AM-4,6-DNT	ND	400	200
2,6-DNT	ND	400	200
2,4-DNT	ND	400	200
2-NITROTOLUENE	ND	400	200
3-NITROTOLUENE	ND	400	200
4-NITROTOLUENE	ND	400	200

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	105	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

Client	: SHAW E&I	Date Collected:	12/15/04
Project	: LONGHORN ARMY AMMUNITION PLANT	Date Received:	12/16/04
Batch No.	: 04L128	Date Extracted:	12/20/04 13:00
Sample ID:	29WL32-MH01	Date Analyzed:	12/20/04 19:53
Lab Samp ID:	L128-11	Dilution Factor:	1
Lab File ID:	XL20007A	Matrix :	WATER
Ext Btch ID:	EXL004W	% Moisture :	NA
Calib. Ref.:	XL20003A	Instrument ID :	T-081

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
HMX	ND	1	.2
RDX	ND	1	.2
1,3,5-TNB	ND	1	.2
1,3-DNB	ND	1	.2
TETRYL	ND	1	.2
NITROBENZENE	ND	1	.2
2,4,6-TNT	240E	1	.2
4-AM-2,6-DNT	34E	1	.2
2-AM-4,6-DNT	17E	1	.2
2,6-DNT	4.1	1	.2
2,4-DNT	17E	1	.2
2-NITROTOLUENE	ND	1	.2
3-NITROTOLUENE	ND	1	.2
4-NITROTOLUENE	ND	1	.2

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	90	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

Client	SHAW E&I	Date Collected	12/15/04
Project	LONGHORN ARMY AMMUNITION PLANT	Date Received	12/16/04
Batch No.	04L128	Date Extracted	12/20/04 13:00
Sample ID	29WL32-MH01DL1	Date Analyzed	12/21/04 13:15
Lab Samp ID	L128-11T	Dilution Factor	5
Lab File ID	XL21004A	Matrix	WATER
Ext Btch ID	EXL004W	% Moisture	NA
Calib. Ref.	XL21002A	Instrument ID	T-081

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
HMX	ND	5	1
RDX	ND	5	1
1,3,5-TNB	ND	5	1
1,3-DNB	ND	5	1
TETRYL	ND	5	1
NITROBENZENE	ND	5	1
2,4,6-TNT	240E	5	1
4-AM-2,6-DNT	33	5	1
2-AM-4,6-DNT	16	5	1
2,6-DNT	2.7J	5	1
2,4-DNT	15	5	1
2-NITROTOLUENE	ND	5	1
3-NITROTOLUENE	ND	5	1
4-NITROTOLUENE	ND	5	1

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	84 ✓	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

Client	SHAW E&I	Date Collected	12/15/04
Project	LONGHORN ARMY AMMUNITION PLANT	Date Received	12/16/04
Batch No.	04L128	Date Extracted	12/20/04 13:00
Sample ID	29WL32-MH01DL2	Date Analyzed	12/21/04 12:46
Lab Samp ID	L128-11I	Dilution Factor	50
Lab File ID	XL21003A	Matrix	WATER
Ext Btch ID	EXL004W	% Moisture	NA
Calib. Ref.	XL21002A	Instrument ID	T-081

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
HMX	ND	50	10
RDX	ND	50	10
1,3,5-TNB	ND	50	10
1,3-DNB	ND	50	10
TETRYL	ND	50	10
NITROBENZENE	ND	50	10
2,4,6-TNT	250	50	10
4-AM-2,6-DNT	36J	50	10
2-AM-4,6-DNT	17J	50	10
2,6-DNT	ND	50	10
2,4-DNT	15J	50	10
2-NITROTOLUENE	ND	50	10
3-NITROTOLUENE	ND	50	10
4-NITROTOLUENE	ND	50	10

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	DO	63-143

Note: All positive results are confirmed by CN column

DO : Diluted out

EPA METHOD 8330
EXPLOSIVES

Client	: SHAW E&I	Date Collected:	12/15/04
Project	: LONGHORN ARMY AMMUNITION PLANT	Date Received:	12/16/04
Batch No.	: 04L128	Date Extracted:	12/20/04 13:00
Sample ID:	29WL32-MH02	Date Analyzed:	12/20/04 20:22
Lab Samp ID:	L128-12	Dilution Factor:	1
Lab File ID:	XL20008A	Matrix :	WATER
Ext Btch ID:	EXL004W	% Moisture :	NA
Calib. Ref.:	XL20003A	Instrument ID :	T-081

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
HMX	ND	1	.2
RDX	ND	1	.2
1,3,5-TNB	ND	1	.2
1,3-DNB	ND	1	.2
TETRYL	ND	1	.2
NITROBENZENE	ND	1	.2
2,4,6-TNT	.93J	1	.2
4-AM-2,6-DNT	6.1	1	.2
2-AM-4,6-DNT	3.4	1	.2
2,6-DNT	ND	1	.2
2,4-DNT	ND	1	.2
2-NITROTOLUENE	ND	1	.2
3-NITROTOLUENE	ND	1	.2
4-NITROTOLUENE	ND	1	.2

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	95	63-143

Note: All positive results are confirmed by CN column

QC SUMMARIES

EPA METHOD 8330
EXPLOSIVES

Client : SHAW E&I
Project : LONGHORN ARMY AMMUNITION PLANT
Batch No. : 04L128
Sample ID: MBLK1W
Lab Samp ID: EXL004WB
Lab File ID: XL20004A
Ext Btch ID: EXL004W
Calib. Ref.: XL20003A

Date Collected: NA
Date Received: 12/20/04
Date Extracted: 12/20/04 13:00
Date Analyzed: 12/20/04 18:27
Dilution Factor: 1
Matrix : WATER
% Moisture : NA
Instrument ID : T-081

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
HMX	ND	1	.2
RDX	ND	1	.2
1,3,5-TNB	ND	1	.2
1,3-DNB	ND	1	.2
TETRYL	ND	1	.2
NITROBENZENE	ND	1	.2
2,4,6-TNT	ND	1	.2
4-AM-2,6-DNT	ND	1	.2
2-AM-4,6-DNT	ND	1	.2
2,6-DNT	ND	1	.2
2,4-DNT	ND	1	.2
2-NITROTOLUENE	ND	1	.2
3-NITROTOLUENE	ND	1	.2
4-NITROTOLUENE	ND	1	.2

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	100	63-143

Note: All positive results are confirmed by CN column

EMAX QUALITY CONTROL DATA
LCS/LCD ANALYSIS

CLIENT: SHAW E&I
PROJECT: LONGHORN ARMY AMMUNITION PLANT
BATCH NO.: 04L128
METHOD: EPA 8330

MATRIX:	WATER			% MOISTURE:	NA
DILUTION FACTOR:	1	1	1		
SAMPLE ID:	MBLK1W				
LAB SAMP ID:	EXL004WB	EXL004WL	EXL004WC		
LAB FILE ID:	XL20004A	XL20005A	XL20006A		
DATE EXTRACTED:	12/20/0413:00	12/20/0413:00	12/20/0413:00	DATE COLLECTED:	NA
DATE ANALYZED:	12/20/0418:27	12/20/0418:56	12/20/0419:24	DATE RECEIVED:	12/20/04
PREP. BATCH:	EXL004W	EXL004W	EXL004W		
CALIB. REF:	XL20003A	XL20003A	XL20003A		

ACCESSION:

PARAMETER	BLNK RSLT (ug/L)	SPIKE AMT (ug/L)	BS RSLT (ug/L)	BS % REC	SPIKE AMT (ug/L)	BSD RSLT (ug/L)	BSD % REC	RPD (%)	QC LIMIT (%)	MAX RPD (%)
HMX	ND	4	3.84	96	4	3.99	100	4	70-130	30
RDX	ND	4	3.31	83	4	3.19	80	4	60-130	30
1,3,5-TNB	ND	4	4.03	101	4	4.06	101	1	70-130	30
1,3-DNB	ND	4	3.85	96	4	3.86	96	0	70-130	30
Tetryl	ND	4	4.08	102	4	4.1	102	0	50-140	30
Nitrobenzene	ND	4	3.62	90	4	3.64	91	1	60-130	30
2,4,6-TNT	ND	4	4.18	105	4	4.22	105	1	70-140	30
4-AM-2,6-DNT	ND	4	3.92	98	4	3.92	98	0	70-130	30
2-AM-4,6-DNT	ND	4	4.01	100	4	4.04	101	1	70-130	30
2,6-DNT	ND	4	4.03	101	4	4.07	102	1	70-130	30
2,4-DNT	ND	4	4.13	103	4	4.12	103	0	70-130	30
2-Nitrotoluene	ND	4	3.81	95	4	3.81	95	0	70-130	30
3-Nitrotoluene	ND	4	3.99	100	4	4.02	100	1	70-130	30
4-Nitrotoluene	ND	4	4.02	100	4	4.07	102	1	70-130	30

SURROGATE PARAMETER	SPIKE AMT (ug/L)	BS RSLT (ug/L)	BS % REC	SPIKE AMT (ug/L)	BSD RSLT (ug/L)	BSD % REC	QC LIMIT (%)
3,4-Dinitrotoluene	4	4.09	102	4	4.27	107	70-130

EPA METHOD 8330
EXPLOSIVES

Client : SHAW E&I
Project : LONGHORN ARMY AMMUNITION PLANT
Batch No. : 04L128
Sample ID: MBLK1S
Lab Samp ID: EXL005SB
Lab File ID: XL21013A
Ext Btch ID: EXL005S
Calib. Ref.: XL21012A

Date Collected: NA
Date Received: 12/20/04
Date Extracted: 12/20/04 17:30
Date Analyzed: 12/21/04 17:34
Dilution Factor: 1
Matrix : SOIL
% Moisture : NA
Instrument ID : T-081

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	400	200
RDX	ND	400	200
1,3,5-TNB	ND	400	200
1,3-DNB	ND	400	200
TETRYL	ND	400	200
NITROBENZENE	ND	400	200
2,4,6-TNT	ND	400	200
4-AM-2,6-DNT	ND	400	200
2-AM-4,6-DNT	ND	400	200
2,6-DNT	ND	400	200
2,4-DNT	ND	400	200
2-NITROTOLUENE	ND	400	200
3-NITROTOLUENE	ND	400	200
4-NITROTOLUENE	ND	400	200

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	103	63-143

Note: All positive results are confirmed by CN column

EMAX QUALITY CONTROL DATA
LCS ANALYSIS

CLIENT:	SHAW E&I
PROJECT:	LONGHORN ARMY AMMUNITION PLANT
BATCH NO.:	04L128
METHOD:	EPA 8330

MATRIX:	SOIL		% MOISTURE:	NA
DILUTION FACTOR:	1	1		
SAMPLE ID:	MBLK1S			
LAB SAMP ID:	EXL005SB	EXL005SL		
LAB FILE ID:	XL21013A	XL21014A		
DATE EXTRACTED:	12/20/0417:30	12/20/0417:30	DATE COLLECTED:	NA
DATE ANALYZED:	12/21/0417:34	12/21/0418:03	DATE RECEIVED:	12/20/04
PREP. BATCH:	EXL005S	EXL005S		
CALIB. REF:	XL21012A	XL21012A		

✓

ACCESSION:

PARAMETER	BLNK RSLT (ug/kg)	SPIKE AMT (ug/kg)	BS RSLT (ug/kg)	BS % REC	QC LIMIT (%)
HMX	ND	2000	2110	106	70-140
RDX	ND	2000	2100	105	70-140
1,3,5-TNB	ND	2000	2180	109	70-130
1,3-DNB	ND	2000	2180	109	70-130
Tetryl	ND	2000	2080	104	60-140
Nitrobenzene	ND	2000	2190	109	70-130
2,4,6-TNT	ND	2000	2180	109	70-140
4-AM-2,6-DNT	ND	2000	2160	108	70-130
2-AM-4,6-DNT	ND	2000	2170	109	70-130
2,6-DNT	ND	2000	2120	106	70-140
2,4-DNT	ND	2000	2140	107	70-130
2-Nitrotoluene	ND	2000	2000	100	70-130
3-Nitrotoluene	ND	2000	2090	105	70-130
4-Nitrotoluene	ND	2000	2090	105	70-130

✓

SURROGATE PARAMETER	SPIKE AMT (ug/kg)	BS RSLT (ug/kg)	BS % REC	QC LIMIT (%)
3,4-Dinitrotoluene	2000	2260	113	70-130

EMAX QUALITY CONTROL DATA
MS/MSD ANALYSIS

CLIENT: SHAW E&I
PROJECT: LONGHORN ARMY AMMUNITION PLANT
BATCH NO.: 04L128
METHOD: EPA 8330

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MATRIX: SOIL　　% MOISTURE: NA

DILUTION FACTOR:	1	1	1		
SAMPLE ID:	29SB85-002				
LAB SAMP ID:	L128-02	L128-02M	L128-02S		
LAB FILE ID:	XL21016A	XL21017A	XL21018A		
DATE EXTRACTED:	12/20/0417:30	12/20/0417:30	12/20/0417:30	DATE COLLECTED:	12/15/04
DATE ANALYZED:	12/21/0419:01	12/21/0419:29	12/21/0419:58	DATE RECEIVED:	12/16/04
PREP. BATCH:	EXL005S	EXL005S	EXL005S		
CALIB. REF:	XL21012A	XL21012A	XL21012A		

ACCESSION:

PARAMETER	SMPL RSLT (ug/kg)	SPIKE AMT (ug/kg)	MS RSLT (ug/kg)	MS % REC	SPIKE AMT (ug/kg)	MSD RSLT (ug/kg)	MSD % REC	RPD (%)	QC LIMIT (%)	MAX RPD (%)
HMX	ND	2000	2250	113	2000	2170	108	4	63-154	50
RDX	ND	2000	1770	88	2000	1760	88	0	63-154	50
1,3,5-TNB	ND	2000	2160	108	2000	2070	104	4	63-143	50
1,3-DNB	ND	2000	2130	107	2000	2130	106	0	63-143	50
Tetryl	ND	2000	2040	102	2000	1960	98	4	54-154	50
Nitrobenzene	ND	2000	2110	105	2000	1980	99	6	63-143	50
2,4,6-TNT	ND	2000	2120	106	2000	2050	102	3	63-154	50
4-AM-2,6-DNT	300J	2000	2400	105	2000	2270	99	6	63-143	50
2-AM-4,6-DNT	900	2000	3130	111	2000	3010	105	4	63-143	50
2,6-DNT	ND	2000	2130	107	2000	2060	103	3	63-154	50
2,4-DNT	ND	2000	2160	108	2000	2130	106	2	63-143	50
2-Nitrotoluene	ND	2000	2000	100	2000	1890	95	5	63-143	50
3-Nitrotoluene	ND	2000	2030	102	2000	1980	99	3	63-143	50
4-Nitrotoluene	ND	2000	2050	102	2000	2040	102	1	63-143	50

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SURROGATE PARAMETER	SPIKE AMT (ug/kg)	MS RSLT (ug/kg)	MS % REC	SPIKE AMT (ug/kg)	MSD RSLT (ug/kg)	MSD % REC	QC LIMIT (%)
3,4-Dinitrotoluene	2000	2130	106	2000	1950	98	63-143

INITIAL CALIBRATION

INITIAL CALIBRATION
METHOD 8330

Lab Name : EMAX Inc
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
LFID & Datetime: XJ19016A 10/19/04 19:08
LFID & Datetime: XJ19017A 10/19/04 19:36
LFID & Datetime: XJ19013A 10/19/04 17:41
LFID & Datetime: XJ19014A 10/19/04 18:10
LFID & Datetime: XJ19015A 10/19/04 18:39
CONC UNIT: ppb

COMPOUND	CONC X	CALIBRATION FACTORS (AREA or HEIGHT)/UNIT 1.00X	5.00X	10.00X	20.00X	40.00X	MEAN	%RSD
HMX	20.00	69.25	67.82	72.36	72.87	71.66	70.79	3.1
RDX	20.00	80.55	89.55	93.32	92.82	91.48	89.54	5.8
1,3,5-TNB	20.00	212.60	206.29	208.40	210.28	208.06	209.13	1.1
1,3-DNB	20.00	284.05	289.17	293.78	291.57	290.36	289.79	1.3
Tetryl	20.00	169.65	165.60	171.93	171.00	171.53	169.94	1.5
Nitrobenzene	20.00	196.75	195.67	202.54	203.55	201.64	200.03	1.8
2,4,6-TNT	20.00	206.40	200.92	203.90	208.44	205.06	204.94	1.4
4-AM-2,6-DNT	20.00	156.75	144.28	146.21	146.58	146.43	148.05	3.3
2-AM-4,6-DNT	20.00	229.95	205.98	210.31	215.07	216.25	215.51	4.2
2,6-DNT	20.00	137.60	131.99	135.36	140.29	135.29	136.11	2.3
2,4-DNT	20.00	276.20	270.64	273.11	277.46	281.68	275.82	1.5
2-Nitrotoluene	20.00	130.40	127.75	127.93	129.28	128.10	128.69	0.9
4-Nitrotoluene	20.00	104.40	103.10	107.11	109.25	110.43	106.86	2.9
3-Nitrotoluene	20.00	132.95	130.43	138.71	137.68	140.89	136.13	3.2
SURROGATE	X	1.00X	5.00X	10.00X	20.00X	40.00X	MEAN	%RSD
3,4-Dinitrotoluene	20.00	117.40	121.21	124.62	126.61	126.82	123.33	3.2

EX81J19.MET

RA

10/25/04

INITIAL CALIBRATION
METHOD 8330

Lab Name : EMAX Inc
Instrument ID : HPLC1 81
GC Column : VARIAN C18
Column size ID : 25CMX4.6MM
LFID & Datetime: XJ19016A 10/19/04 19:08
LFID & Datetime: XJ19017A 10/19/04 19:36
LFID & Datetime: XJ19013A 10/19/04 17:41
LFID & Datetime: XJ19014A 10/19/04 18:10
LFID & Datetime: XJ19015A 10/19/04 18:39

COMPOUND	RT OF STANDARDS (MIN) 1.0X	5.0X	10.0X	20.0X	40.0X	MEAN RT	RT WINDOW FROM	TO	RTWINDOW WIDTH
HMX	4.300	4.292	4.292	4.292	4.275	4.290	4.240	4.340	0.050
RDX	6.433	6.383	6.367	6.375	6.333	6.378	6.240	6.516	0.138
1,3,5-TNB	8.650	8.617	8.600	8.633	8.575	8.615	8.462	8.768	0.153
1,3-DNB	10.492	10.450	10.417	10.483	10.400	10.448	10.219	10.677	0.229
Tetryl	11.358	11.308	11.250	11.342	11.250	11.302	11.014	11.590	0.288
Nitrobenzene	12.117	12.092	12.042	12.108	12.033	12.078	11.677	12.479	0.401
2,4,6-TNT	13.675	13.642	13.567	13.642	13.575	13.620	13.219	14.021	0.401
4-AM-2,6-DNT	14.433	14.392	14.292	14.383	14.308	14.362	13.857	14.867	0.505
2-AM-4,6-DNT	14.967	14.983	14.867	14.950	14.883	14.930	14.382	15.478	0.548
2,6-DNT	15.817	15.825	15.742	15.800	15.758	15.788	15.325	16.251	0.463
2,4-DNT	16.383	16.425	16.317	16.367	16.350	16.368	15.891	16.845	0.477
2-Nitrotoluene	19.467	19.525	19.442	19.458	19.467	19.472	18.881	20.063	0.591
4-Nitrotoluene	21.192	21.225	21.150	21.175	21.142	21.177	20.520	21.834	0.657
3-Nitrotoluene	22.658	22.717	22.592	22.633	22.600	22.640	21.888	23.392	0.752
SURROGATE	1.0X	5.0X	10.0X	20.0X	40.0X	RT	FROM	TO	WIDTH
3,4-Dinitrotoluene	12.900	12.858	12.792	12.875	12.792	12.843	12.468	13.218	0.375

EX81J19.MET

RA
10/25/04

INITIAL CALIBRATION VERIFICATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: XJ19014A 10/19/2004 18:10
Conc Cont LFID & Datetime: XJ19018A 10/19/2004 20:05
CONC UNIT : ppb ✓

COMPOUND	RT MINUTES	RT WINDOW FROM	RT WINDOW TO	TRUE CONC	AVERAGE CF	RESULT AREA	RESULT CONC	%D	QL	%D LIMITS
HMX	4.300	4.250	4.350	400.0	70.800	31158	440.13	10		15
RDX	6.400	6.262	6.538	400.0	89.500	38533	430.32	8		15
1,3,5-TNB	8.642	8.489	8.795	400.0	209.100	91920	439.54	10		15
1,3-DNB	10.483	10.254	10.712	400.0	289.800	127403	439.64	10		15
Tetryl	11.342	11.054	11.630	400.0	169.900	71202	418.98	5		15
Nitrobenzene	12.108	11.707	12.509	400.0	200.000	86805	433.96	8		15
2,4,6-TNT	13.625	13.224	14.026	400.0	204.900	88599	432.31	8		15
4-AM-2,6-DNT	14.400	13.895	14.905	400.0	148.100	60914	411.44	3		15
2-AM-4,6-DNT	14.950	14.402	15.498	400.0	215.500	91200	423.18	6		15
2,6-DNT	15.800	15.337	16.263	400.0	136.100	56248	413.27	3		15
2,4-DNT	16.383	15.906	16.860	400.0	275.800	117421	425.72	6		15
2-Nitrotoluene	19.475	18.884	20.066	400.0	128.700	53460	415.40	4		15
4-Nitrotoluene	21.192	20.535	21.849	400.0	106.900	46579	435.89	9		15
3-Nitrotoluene	22.667	21.915	23.419	400.0	136.100	57575	422.93	6		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-Dinitrotoluene	12.875	12.500	13.250	400.0	123.300	52174	423.04	6		15

EX81J19.MET ✓

ds
10/25/04

ANALYSIS RUN LOG FOR HPLC

SOP ☑ EMAX-8330 Rev. No: 2 ☐ EMAX-8310 Rev. No: 4 ☐ EMAX-8332 Rev. No: 0 ☐ Book # A81-02-005

Starting Date: 10/19/04 Time: ~~1645~~ XP 10/19/04 11:27 Ending Date: 10/19/04 Time: 20:05

ANALYTICAL BATCH NA

Preparation Batch	Data File Name	Lab Sample ID	DF	Matrix (W)	Matrix (S)	Notes
	XJ19.001	TEST				
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10	IB81J614				
NA	11	EX81J1901 20				Not evaluated
	12	02 100				RT shifted
	13	03 200				
	14	04 400				8330 Ical
	15	05 800				(Primary col.)
	16	01 20				
	17	02 100				
	18	IEX81J1901 400				

XP 10/19/04

Instrument Number	81

INITIAL CALIBRATION REFERENCE

Date	10/19/04
Method	EX81J19
Mid Point	XJ19014A (4/5)
ICAL ID	SH1B-03-40-3 (800ppb)
ICV ID	SH1B-03-36-2 (10ppm)
DCC ID	

Solvents ID

Acetonitrile	
Methanol	43206332
Water	43189

Electronic Data Archival

Location	Date
☐ EZC_5_HPLC	
☐	

Comments: Samples disposed off 10/20/04

Analyzed By: XP.

This page is checked during the data review process.

EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

INITIAL CALIBRATION
METHOD 8330

Lab Name : EMAX Inc
Instrument ID : HPLC1 LCT001(T017)
GC Column : LUNA 5U PHENYL-HEXYL
Column size ID : 25CMX4.6MM
LFID & Datetime: PH17007A 08/17/04 16:21
LFID & Datetime: PH17003A 08/17/04 13:35
LFID & Datetime: PH17004A 08/17/04 14:16
LFID & Datetime: PH17005A 08/17/04 14:58
LFID & Datetime: PH17006A 08/17/04 15:39
CONC UNIT: ppb

COMPOUND	CONC X	CALIBRATION FACTORS (AREA or HEIGHT)/UNIT 1.00X	5.00X	10.00X	20.00X	40.00X	MEAN	%RSD
HMX	20.00	265.05	223.86	243.86	247.42	244.74	244.99	6.0
RDX	20.00	315.15	255.37	260.41	253.93	258.37	268.65	9.7
Nitrobenzene	20.00	359.70	349.71	329.86	323.97	326.71	337.99	4.7
1,3-DNB	20.00	514.05	508.34	520.54	516.70	515.48	515.02	0.9
2-Nitrotoluene	20.00	238.50	278.15	281.94	287.52	281.20	273.46	7.3
4-Nitrotoluene	20.00	287.00	275.75	289.34	288.21	284.04	284.87	1.9
4-AM-2,6-DNT	20.00	276.50	256.61	256.86	264.78	254.15	261.78	3.5
3-Nitrotoluene	20.00	353.75	380.73	345.64	344.94	337.55	352.52	4.8
2-AM-4,6-DNT	20.00	464.60	447.94	400.02	400.57	393.79	421.38	7.7
1,3,5-TNB	20.00	368.85	364.11	349.42	354.06	340.07	355.30	3.2
2,6-DNT	20.00	258.20	256.25	261.51	248.39	253.99	255.67	1.9
2,4-DNT	20.00	433.50	511.11	524.55	509.46	513.54	498.43	7.4
Tetryl	20.00	511.65	504.42	558.66	520.24	525.23	524.04	4.0
2,4,6-TNT	20.00	421.55	507.22	574.38	536.85	548.40	517.68	11.4
SURROGATE	X	1.00X	5.00X	10.00X	20.00X	40.00X	MEAN	%RSD
3,4-DNT	20.00	288.40	260.85	245.15	244.29	241.54	256.04	7.7

EX17H17C.MET

RX
8/20/04

INITIAL CALIBRATION
METHOD 8330

Lab Name : EMAX Inc
Instrument ID : HPLC1 LCT001(T017)
GC Column : LUNA 5U PHENYL-HEXYL
Column size ID : 25CMX4.6MM
LFID & Datetime: PH17007A 08/17/04 16:21
LFID & Datetime: PH17003A 08/17/04 13:35
LFID & Datetime: PH17004A 08/17/04 14:16
LFID & Datetime: PH17005A 08/17/04 14:58
LFID & Datetime: PH17006A 08/17/04 15:39

COMPOUND	RT OF STANDARDS (MIN) 1.0X	5.0X	10.0X	20.0X	40.0X	MEAN RT	RT WINDOW FROM	TO	RTWINDOW WIDTH
HMX	6.025	6.050	6.042	6.058	6.033	6.042	5.962	6.122	0.080
RDX	7.800	7.817	7.817	7.833	7.792	7.812	7.708	7.916	0.104
Nitrobenzene	10.633	10.675	10.667	10.692	10.633	10.660	10.556	10.764	0.104
1,3-DNB	15.183	15.258	15.258	15.292	15.175	15.233	14.872	15.594	0.361
2-Nitrotoluene	15.725	15.783	15.767	15.817	15.692	15.757	15.497	16.017	0.260
4-Nitrotoluene	16.225	16.342	16.342	16.375	16.258	16.308	16.018	16.598	0.290
4-AM-2,6-DNT	16.950	17.108	17.108	17.150	17.000	17.063	16.500	17.626	0.563
3-Nitrotoluene	17.700	17.800	17.775	17.825	17.700	17.760	17.393	18.127	0.367
2-AM-4,6-DNT	18.925	19.125	19.125	19.175	19.025	19.075	18.317	19.833	0.758
1,3,5-TNB	20.142	20.267	20.267	20.317	20.200	20.239	19.626	20.852	0.613
2,6-DNT	21.517	21.642	21.650	21.683	21.558	21.610	20.886	22.334	0.724
2,4-DNT	22.733	22.825	22.892	22.942	22.800	22.838	22.041	23.635	0.797
Tetryl	31.667	31.808	31.850	31.875	31.617	31.763	30.113	33.413	1.650
2,4,6-TNT	33.233	33.367	33.358	33.375	33.150	33.297	31.954	34.640	1.343

SURROGATE	1.0X	5.0X	10.0X	20.0X	40.0X	RT	FROM	TO	WIDTH
3,4-DNT	18.492	18.650	18.600	18.675	18.525	18.588	18.055	19.121	0.533

EX17H17C.MET

RK
8/20/04

6030

DAILY CALIBRATION

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: XJ19014A 10/19/2004 18:10
Conc Cont LFID & Datetime: XL20003A 12/20/2004 17:58
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	RT WINDOW TO	TRUE CONC	AVERAGE CF	RESULT AREA	RESULT CONC	%D	QL	%D LIMITS
HMX	4.292	4.242	4.342	400.0	70.800	28461	402.03	1		15
RDX	6.300	6.162	6.438	400.0	89.500	35641	398.02	-0		15
1,3,5-TNB	8.500	8.347	8.653	400.0	209.100	83199	397.84	-1		15
1,3-DNB	10.250	10.021	10.479	400.0	289.800	115929	400.05	0		15
Tetryl	11.000	10.712	11.288	400.0	169.900	68123	400.86	0		15
Nitrobenzene	11.792	11.391	12.193	400.0	200.000	80732	403.60	1		15
2,4,6-TNT	13.300	12.899	13.701	400.0	204.900	80648	393.51	-2		15
4-AM-2,6-DNT	13.875	13.370	14.380	400.0	148.100	60372	407.78	2		15
2-AM-4,6-DNT	14.408	13.860	14.956	400.0	215.500	86596	401.82	0		15
2,6-DNT	15.358	14.895	15.821	400.0	136.100	55446	407.37	2		15
2,4-DNT	15.908	15.431	16.385	400.0	275.800	111329	403.63	1		15
2-Nitrotoluene	18.875	18.284	19.466	400.0	128.700	51626	401.15	0		15
4-Nitrotoluene	20.425	19.768	21.082	400.0	106.900	45124	422.27	6		15
3-Nitrotoluene	21.842	21.090	22.594	400.0	136.100	57301	420.92	5		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-Dinitrotoluene	12.517	12.142	12.892	400.0	123.300	50724	411.28	3		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: XJ19014A 10/19/2004 18:10
Conc Cont LFID & Datetime: XL20015A 12/20/2004 23:44
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	TO	TRUE CONC	AVERAGE CF	RESULT AREA	CONC	%D	QL	%D LIMITS
HMX	4.333	4.283	4.383	400.0	70.800	29272	413.49	3		15
RDX	6.408	6.270	6.546	400.0	89.500	38105	425.54	6		15
1,3,5-TNB	8.642	8.489	8.795	400.0	209.100	85122	407.03	2		15
1,3-DNB	10.467	10.238	10.696	400.0	289.800	119721	413.14	3		15
Tetryl	11.275	10.987	11.563	400.0	169.900	69968	411.72	3		15
Nitrobenzene	12.042	11.641	12.443	400.0	200.000	82996	414.92	4		15
2,4,6-TNT	13.592	13.191	13.993	400.0	204.900	84236	411.02	3		15
4-AM-2,6-DNT	14.333	13.828	14.838	400.0	148.100	61879	417.96	4		15
2-AM-4,6-DNT	14.875	14.327	15.423	400.0	215.500	87276	404.97	1		15
2,6-DNT	15.750	15.287	16.213	400.0	136.100	57777	424.50	6		15
2,4-DNT	16.325	15.848	16.802	400.0	275.800	113421	411.21	3		15
2-Nitrotoluene	19.358	18.767	19.949	400.0	128.700	52495	407.90	2		15
4-Nitrotoluene	20.983	20.326	21.640	400.0	106.900	46819	438.13	10		15
3-Nitrotoluene	22.450	21.698	23.202	400.0	136.100	57711	423.93	6		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-Dinitrotoluene	12.850	12.475	13.225	400.0	123.300	51463	417.27	4		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: XJ19014A 10/19/2004 18:10
Conc Cont LFID & Datetime: XL21002A 12/21/2004 12:17
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	TO	TRUE CONC	AVERAGE CF	RESULT AREA	CONC	%D	QL	%D LIMITS
HMX	4.308	4.258	4.358	400.0	70.800	28235	398.84	-0		15
RDX	6.342	6.204	6.480	400.0	89.500	36063	402.74	1		15
1,3,5-TNB	8.550	8.397	8.703	400.0	209.100	82108	392.62	-2		15
1,3-DNB	10.325	10.096	10.554	400.0	289.800	115534	398.69	-0		15
Tetryl	11.108	10.820	11.396	400.0	169.900	67938	399.77	-0		15
Nitrobenzene	11.875	11.474	12.276	400.0	200.000	79947	399.67	-0		15
2,4,6-TNT	13.400	12.999	13.801	400.0	204.900	80421	392.40	-2		15
4-AM-2,6-DNT	14.033	13.528	14.538	400.0	148.100	59823	404.07	1		15
2-AM-4,6-DNT	14.558	14.010	15.106	400.0	215.500	84462	391.91	-2		15
2,6-DNT	15.492	15.029	15.955	400.0	136.100	54767	402.38	1		15
2,4-DNT	16.033	15.556	16.510	400.0	275.800	110265	399.77	-0		15
2-Nitrotoluene	19.008	18.417	19.599	400.0	128.700	51046	396.64	-1		15
4-Nitrotoluene	20.592	19.935	21.249	400.0	106.900	45322	424.12	6		15
3-Nitrotoluene	22.008	21.256	22.760	400.0	136.100	56862	417.70	4		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-Dinitrotoluene	12.633	12.258	13.008	400.0	123.300	49767	403.52	1		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: XJ19014A 10/19/2004 18:10
Conc Cont LFID & Datetime: XL21012A 12/21/2004 17:05
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	RT WINDOW TO	TRUE CONC	AVERAGE CF	RESULT AREA	RESULT CONC	%D	QL	%D LIMITS
HMX	4.300	4.250	4.350	400.0	70.800	28637	404.52	1		15
RDX	6.325	6.187	6.463	400.0	89.500	35492	396.36	-1		15
1,3,5-TNB	8.525	8.372	8.678	400.0	209.100	83787	400.65	0		15
1,3-DNB	10.283	10.054	10.512	400.0	289.800	116602	402.37	1		15
Tetryl	11.033	10.745	11.321	400.0	169.900	68756	404.58	1		15
Nitrobenzene	11.833	11.432	12.234	400.0	200.000	81307	406.47	2		15
2,4,6-TNT	13.350	12.949	13.751	400.0	204.900	80995	395.20	-1		15
4-AM-2,6-DNT	13.925	13.420	14.430	400.0	148.100	61989	418.70	5		15
2-AM-4,6-DNT	14.442	13.894	14.990	400.0	215.500	85780	398.03	-0		15
2,6-DNT	15.417	14.954	15.880	400.0	136.100	55335	406.56	2		15
2,4-DNT	15.950	15.473	16.427	400.0	275.800	111179	403.09	1		15
2-Nitrotoluene	18.933	18.342	19.524	400.0	128.700	51488	400.08	0		15
4-Nitrotoluene	20.508	19.851	21.165	400.0	106.900	44634	417.68	4		15
3-Nitrotoluene	21.917	21.165	22.669	400.0	136.100	57110	419.52	5		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-Dinitrotoluene	12.575	12.200	12.950	400.0	123.300	51157	414.79	4		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: XJ19014A 10/19/2004 18:10
Conc Cont LFID & Datetime: XL21021A 12/21/2004 21:25
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	TO	TRUE CONC	AVERAGE CF	RESULT AREA	CONC	%D	QL	%D LIMITS
HMX	4.333	4.283	4.383	400.0	70.800	29529	417.12	4		15
RDX	6.408	6.270	6.546	400.0	89.500	36651	409.30	2		15
1,3,5-TNB	8.642	8.489	8.795	400.0	209.100	83931	401.34	0		15
1,3-DNB	10.458	10.229	10.687	400.0	289.800	118138	407.67	2		15
Tetryl	11.258	10.970	11.546	400.0	169.900	68631	403.85	1		15
Nitrobenzene	12.033	11.632	12.434	400.0	200.000	81515	407.51	2		15
2,4,6-TNT	13.583	13.182	13.984	400.0	204.900	82418	402.15	1		15
4-AM-2,6-DNT	14.300	13.795	14.805	400.0	148.100	60872	411.15	3		15
2-AM-4,6-DNT	14.850	14.302	15.398	400.0	215.500	85539	396.91	-1		15
2,6-DNT	15.733	15.270	16.196	400.0	136.100	56026	411.63	3		15
2,4-DNT	16.308	15.831	16.785	400.0	275.800	111103	402.81	1		15
2-Nitrotoluene	19.342	18.751	19.933	400.0	128.700	52850	410.66	3		15
4-Nitrotoluene	20.992	20.335	21.649	400.0	106.900	43058	402.94	1		15
3-Nitrotoluene	22.442	21.690	23.194	400.0	136.100	56680	416.36	4		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-Dinitrotoluene	12.833	12.458	13.208	400.0	123.300	50526	409.68	2		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: XJ19014A 10/19/2004 18:10
Conc Cont LFID & Datetime: XL21030A 12/22/2004 01:44
CONC UNIT : ppb

	RT	RT WINDOW		TRUE	AVERAGE	RESULT				%D
COMPOUND	MINUTES	FROM	TO	CONC	CF	AREA	CONC	%D	QL	LIMITS
HMX	4.358	4.308	4.408	400.0	70.800	28761	406.27	2		15
RDX	6.475	6.337	6.613	400.0	89.500	36851	411.54	3		15
1,3,5-TNB	8.717	8.564	8.870	400.0	209.100	85213	407.47	2		15
1,3-DNB	10.583	10.354	10.812	400.0	289.800	118482	408.86	2		15
Tetryl	11.425	11.137	11.713	400.0	169.900	68419	402.60	1		15
Nitrobenzene	12.183	11.782	12.584	400.0	200.000	82651	413.19	3		15
2,4,6-TNT	13.758	13.357	14.159	400.0	204.900	84235	411.01	3		15
4-AM-2,6-DNT	14.583	14.078	15.088	400.0	148.100	60816	410.78	3		15
2-AM-4,6-DNT	15.158	14.610	15.706	400.0	215.500	86030	399.19	-0		15
2,6-DNT	15.992	15.529	16.455	400.0	136.100	57301	421.00	5		15
2,4-DNT	16.567	16.090	17.044	400.0	275.800	111937	405.83	1		15
2-Nitrotoluene	19.650	19.059	20.241	400.0	128.700	51783	402.37	1		15
4-Nitrotoluene	21.333	20.676	21.990	400.0	106.900	44795	419.19	5		15
3-Nitrotoluene	22.808	22.056	23.560	400.0	136.100	55798	409.88	2		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-Dinitrotoluene	13.025	12.650	13.400	400.0	123.300	50569	410.02	3		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 LCT001(T017)
GC Column : LUNA 5U PHENYL-HEXYL
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: PH17005A 08/17/2004 14:58
Conc Cont LFID & Datetime: PL21002A 12/21/2004 14:29
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	RT WINDOW TO	TRUE CONC	AVERAGE CF	RESULT AREA	RESULT CONC	%D	QL	%D LIMITS
HMX	6.125	6.045	6.205	400.0	245.000	97335	397.31	-1		15
RDX	7.933	7.829	8.037	400.0	268.600	100692	374.81	-6		15
Nitrobenzene	10.725	10.621	10.829	400.0	338.000	131155	388.04	-3		15
1,3-DNB	15.442	15.081	15.803	400.0	515.000	191677	372.17	-7		15
2-Nitrotoluene	15.850	15.590	16.110	400.0	273.500	107744	394.00	-2		15
4-Nitrotoluene	16.450	16.160	16.740	400.0	284.900	117212	411.46	3		15
4-AM-2,6-DNT	17.433	16.870	17.996	400.0	261.800	89732	342.78	-14		15
3-Nitrotoluene	17.883	17.516	18.250	400.0	352.500	145090	411.58	3		15
2-AM-4,6-DNT	19.600	18.842	20.358	400.0	421.400	157332	373.37	-7		15
1,3,5-TNB	20.467	19.854	21.080	400.0	355.300	135909	382.52	-4		15
2,6-DNT	21.867	21.143	22.591	400.0	255.700	96515	377.50	-6		15
2,4-DNT	23.225	22.428	24.022	400.0	498.400	200257	401.77	0		15
Tetryl	32.650	31.000	34.300	400.0	524.000	188547	359.79	-10		15
2,4,6-TNT	33.833	32.490	35.176	400.0	517.700	227459	439.38	10		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-DNT	18.908	18.375	19.441	400.0	256.000	92885	362.77	-9		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 LCT001(T017)
GC Columm : LUNA 5U PHENYL-HEXYL
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: PH17005A 08/17/2004 14:58
Conc Cont LFID & Datetime: PL21013A 12/21/2004 22:06
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	RT WINDOW TO	TRUE CONC	AVERAGE CF	RESULT AREA	RESULT CONC	%D	QL	%D LIMITS
HMX	6.200	6.120	6.280	400.0	245.000	97276	397.07	-1		15
RDX	8.042	7.938	8.146	400.0	268.600	100724	374.93	-6		15
Nitrobenzene	10.883	10.779	10.987	400.0	338.000	129845	384.17	-4		15
1,3-DNB	15.733	15.372	16.094	400.0	515.000	200479	389.26	-3		15
2-Nitrotoluene	16.150	15.890	16.410	400.0	273.500	105320	385.14	-4		15
4-Nitrotoluene	16.767	16.477	17.057	400.0	284.900	119340	418.93	5		15
4-AM-2,6-DNT	18.058	17.495	18.621	400.0	261.800	93293	356.38	-11		15
3-Nitrotoluene	18.250	17.883	18.617	400.0	352.500	142248	403.51	1		15
2-AM-4,6-DNT	20.108	19.350	20.866	400.0	421.400	160422	380.70	-5		15
1,3,5-TNB	20.933	20.320	21.546	400.0	355.300	139700	393.19	-2		15
2,6-DNT	22.450	21.726	23.174	400.0	255.700	98773	386.33	-3		15
2,4-DNT	23.783	22.986	24.580	400.0	498.400	207335	415.97	4		15
Tetryl	33.750	32.100	35.400	400.0	524.000	184486	352.04	-12		15
2,4,6-TNT	34.808	33.465	36.151	400.0	517.700	238090	459.92	15		15

SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-DNT	19.358	18.825	19.891	400.0	256.000	93389	364.74	-9		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name	: EMAX
Instrument ID	: HPLC1 LCT001(T017)
GC Columm	: LUNA 5U PHENYL-HEXYL
Column size ID	: 25CMX4.6MM
Mid Conc Init LFID & Datetime:	PH17005A 08/17/2004 14:58
Conc Cont LFID & Datetime:	PL23002A 12/23/2004 13:31
CONC UNIT	: ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	RT WINDOW TO	TRUE CONC	AVERAGE CF	RESULT AREA	RESULT CONC	%D	QL	%D LIMITS
HMX	6.150	6.070	6.230	400.0	245.000	96411	393.54	-2		15
RDX	7.975	7.871	8.079	400.0	268.600	99473	370.27	-7		15
Nitrobenzene	10.817	10.713	10.921	400.0	338.000	128532	380.28	-5		15
1,3-DNB	15.583	15.222	15.944	400.0	515.000	188524	366.05	-8		15
2-Nitrotoluene	16.017	15.757	16.277	400.0	273.500	108923	398.31	-0		15
4-Nitrotoluene	16.600	16.310	16.890	400.0	284.900	114247	401.05	0		15
4-AM-2,6-DNT	17.642	17.079	18.205	400.0	261.800	91953	351.26	-12		15
3-Nitrotoluene	18.083	17.716	18.450	400.0	352.500	133535	378.80	-5		15
2-AM-4,6-DNT	19.750	18.992	20.508	400.0	421.400	149389	354.52	-11		15
1,3,5-TNB	20.700	20.087	21.313	400.0	355.300	127994	360.24	-10		15
2,6-DNT	22.158	21.434	22.882	400.0	255.700	88146	344.77	-14		15
2,4-DNT	23.458	22.661	24.255	400.0	498.400	195937	393.11	-2		15
Tetryl	33.050	31.400	34.700	400.0	524.000	186616	356.11	-11		15
2,4,6-TNT	34.250	32.907	35.593	400.0	517.700	227296	439.07	10		15

SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-DNT	19.067	18.534	19.600	400.0	256.000	88738	346.57	-13		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 LCT001(T017)
GC Columm : LUNA 5U PHENYL-HEXYL
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: PH17005A 08/17/2004 14:58
Conc Cont LFID & Datetime: PL23010A 12/23/2004 19:14
CONC UNIT : ppb

	RT	RT WINDOW		TRUE	AVERAGE	RESULT				%D
COMPOUND	MINUTES	FROM	TO	CONC	CF	AREA	CONC	%D	QL	LIMITS
HMX	6.092	6.012	6.172	400.0	245.000	100956	412.09	3		15
RDX	7.892	7.788	7.996	400.0	268.600	106815	397.60	-1		15
Nitrobenzene	10.725	10.621	10.829	400.0	338.000	137424	406.59	2		15
1,3-DNB	15.433	15.072	15.794	400.0	515.000	190308	369.52	-8		15
2-Nitrotoluene	15.683	15.423	15.943	400.0	273.500	120478	440.57	10		15
4-Nitrotoluene	16.433	16.143	16.723	400.0	284.900	131083	460.16	15		15
4-AM-2,6-DNT	17.467	16.904	18.030	400.0	261.800	89560	342.12	-14		15
3-Nitrotoluene	17.933	17.566	18.300	400.0	352.500	156892	445.05	11		15
2-AM-4,6-DNT	19.500	18.742	20.258	400.0	421.400	186947	443.65	11		15
1,3,5-TNB	20.517	19.904	21.130	400.0	355.300	140781	396.23	-1		15
2,6-DNT	21.958	21.234	22.682	400.0	255.700	100508	393.12	-2		15
2,4-DNT	23.267	22.470	24.064	400.0	498.400	210136	421.59	5		15
Tetryl	32.625	30.975	34.275	400.0	524.000	197217	376.34	-6		15
2,4,6-TNT	33.950	32.607	35.293	400.0	517.700	237840	459.43	15		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-DNT	18.925	18.392	19.458	400.0	256.000	77807	303.88	-24	*	15

ANALYTICAL LOGS

ANALYSIS RUN LOG FOR HPLC

Book # A81-02-005

SOP ☑ EMAX-8330 Rev. No: 2 ☐ EMAX-8310 Rev. No: 4 ☐ EMAX-8332 Rev. No: 0 ☐

Starting Date: 12/20/04 Time: 17:00 Ending Date: 12/20/04 Time: 23:44

ANALYTICAL BATCH XL20003A

Preparation Batch	Data File Name	Lab Sample ID	DF	Matrix (W)	Matrix (S)	Notes
	XP 12/20/04 ~~XE~~ XL20.001	TEST				
	2	RB812664				
	3	CEX81J19664				800
EXL004W	4	EXL004WB	✓	✓		
	5	L				
	6	↓ C				
	7	04L128-11				E
	8	↓ 12				
	9	04L142-07				E
↓	10	04L145-01	↓	↓		Sat.
	11	Rinse				
EXL004W	12	04L145-02	✓	✓		Sat.
	13	Rinse				
	14	↓				
	↓ 15	CEX81J19665				800

XP 12/20/04

Instrument Number	81

INITIAL CALIBRATION REFERENCE

Date	10/19/04
Method	EX81J19
Mid Point	XJ19074A (4/5)
ICAL ID	—
ICV ID	—
DCC ID	SHIC-03-54-2

Solvents ID

Acetonitrile	—
Methanol	43206332
Water	44168

Electronic Data Archival

Location	Date
☐ EZC_5_HPLC	
☐	

Comments: samples disposed off 12/21/04

Analyzed By: XP

This page is checked during the data review process.

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ANALYSIS RUN LOG FOR HPLC

SOP ☑ EMAX-8330 **Rev. No:** 2 ☐ EMAX-8310 **Rev. No:** 4 ☐ EMAX-8332 **Rev. No:** 0 ☐ **Book # A81-02-005**

Starting Date: 12/21/04 **Time:** 11:48 **Ending Date:** 12/22/04 **Time:** 01:44

ANALYTICAL BATCH XL21002A

Preparation Batch	Data File Name	Lab Sample ID	DF	Matrix (W)	Matrix (S)	Notes
	XL21.001	IB81L666				
	2	CEX81J19666				800
EXL004W	3	04L128-11I	50	✓		
	4	↓ 11T	5			
	5	04L145-01I	500			
	6	01T	20			
	7	02I	500			
	8	↓ 02T	20			
	9	04L142-07I	100			
↓	10	↓ 07T	10	↓		
	11	IB				
	12	CEX81J19667				800
EXL005S	13	EXL005SB	1		✓	
	14	↓ L				
	15	04L128-01				
	16	02				
	17	02M				
	18	02S				
↓	19	↓ 03	↓		↓	
	20	IB				
	21	CEX81J19668				800
EXL005S	22	04L128-04	1		✓	
	23	05				
	24	06				
	25	07				
	26	08				
	27	09				
↓	28	↓ 10	↓		↓	
	29	Rinse				
	↓ 30	CEX81J19669				800

Instrument Number	**81**

INITIAL CALIBRATION REFERENCE

Date	10/19/04
Method	EX81J19
Mid Point	XJ19014A (4/8)
ICAL ID	—
ICV ID	—
DCC ID	SHIC-03-54-2

Solvents ID

Acetonitrile	—
Methanol	43206332
Water	44168

Electronic Data Archival

Location	Date
☐ EZC_5_HPLC	
☐	

Comments: Samples disposed off 12/22/04

Analyzed By: XP

This page is checked during the data review process.

EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

ANALYSIS RUN LOG FOR HPLC

SOP ☑ EMAX-8330 Rev. No: 2 conf. ☐ EMAX-8310 Rev. No: 4 ☐ EMAX-8332 Rev. No: 0 ☐ Book # A17-010

Starting Date: 12/21/04 Time: 13:47 Ending Date: 12/21/04 Time: 22:06

EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

ANALYTICAL BATCH PL21009A

Preparation Batch	Data File Name	Lab Sample ID	DF	Matrix S	Matrix W	Notes
	PL21.001	IB172694				
	2	CEX17H17C694				800.
EXL004W	3	04L128-11T	5		✓	hmp. RR
	4	11T				
	5	12	1			
	6	04L145-01T	20			
	7	01	1			
	8	02T	20			
	9	01	1			
	10	04L142-07T	10			
	11	07	1			
EXL005S	12	04L128-01	1	✓		
	13	~~CEXS~~ XP 12/21/04 CEX17H17C695				800

XP 12/21/04

Instrument Number	17

Initial Calibration	
Date	08/17/04
met.	EX17H17C
m.p	PH17005A (4/5)

Standards		
Name	ID	Conc. (µg/L)
DCC ID	SHIC-03-54-2	~~80~~ 400 XP 12/21/04

Solvent ID		
Methanol	43206332	pure
Water	44168	
Acetonitrile	—	

Electronic Data Archival	
Location	Date

Comments: samples disposed off 12/22/04

Analyzed By: XP

This page is checked during the data review process.

ANALYSIS RUN LOG FOR HPLC

SOP ☑ EMAX-8330 Rev. No: 2 ☐ EMAX-8310 Rev. No: 4 ☐ EMAX-8332 Rev. No: 0 ☐ corr.

Book # A17-010

Starting Date: 12/23/04 Time: 12:49 Ending Date: 12/24/04 Time: 02:51

ANALYTICAL BATCH PL23002A

Preparation Batch	Data File Name	Lab Sample ID	DF	Matrix S	Matrix W	Notes
	PL23001	IB17L700				
	002	CCX17H17C700				400
EXL005SB	003	04L128-03	1	✓		
↓	004	-04	↓	↓		
↓	005	-06	↓	↓		
↓	006	-07	↓	↓		
↓	007	-10	↓	↓		
↓	008	-02W	↓	↓		
↓	009	-06W	↓	↓		
	010	CCX17H17C701				
	011	TEST				
EXL006S	012	04L145-03	1	✓		RR
↓	013	-04	↓	↓		
↓	014	-05	↓	↓		
↓	015	-07	↓	↓		
↓	016	-08	↓	↓		
↓	017	-06T	5	↓		
↓	018	-06	1	↓		
	019	IB				
	020	↓				
	021	CCX17H17C702				Bad separation

DT 12/27/04

Instrument Number	17

Initial Calibration

Date	08/17/04
met.	EX17H17C
m.p	PH17003B

Standards

Name	ID	Conc. (µg/L)
DCC ID	SHIC-03-56-2	400

Solvent ID

Methanol	43306332	pure
Water	44168	↓
Acetonitrile		

Electronic Data Archival

Location	Date
EZC-5-HPLC	12/27/04

Comments: Samples disposed off 12/27/04

Analyzed By: DT

This page is checked during the data review process.

EMAX Laboratories, Inc. 1835 W. 205th St. Torrance, CA 90501

6046

EXTRACTION LOGS

EXTRACTION LOG FOR EXPLOSIVES

SOP: ☒ EMAX-8330 **Rev.No.:** 3 ☐

Matrix: SOIL **Start Date:** 12/20/04 **Time:** 17:30 **End Date:** 12/21/04 **Time:** 11:00 **Book # EEX-010**

EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

PREPARATION BATCH: EXL005-S

Sample Prep ID	Lab Sample ID	Sample Amount (g | ml)	Extract Volume (ml)	Notes
*01	EXL005-SB	2.00	20	
*02	JV 12/20/04 SL	2.01	20	
*03	04L128 -801	2.03	20	
*04	-02	2.01	20	
*05	-02M	2.02	20	
*06	-02S	2.03	20	
*07	-03	2.01	20	
*08	-04	2.00	20	
*09	-05	2.03	20	
*10	-06	2.03	20	
*11	-07	2.02	20	
*12	-08	2.02	20	
*13	-09	2.01	20	
*14	-10	2.02	20	
*15	04L142 -01	2.02	20	
*16	-02	2.00	20	
*17	-03	2.01	20	
*18	-04	2.03	20	
*19	-05	2.03	20	
*20	-06	2.02	20	
*21				
*22	12/20/04	JV		
*23				
*24				
*25				
*26				

Standards	ID	Amount Added (ml)
Surrogate	SH1B-03-36-1	0.4
LCS/MS	SH1B-03-36-2	0.4

Reagent	Lot# / ID
Acetonitrile	43080
NaCl	–
$CaCl_2$	SP1B-01-267
Silica Sand	42289249

SDG #	Extract Location
	SE04 # 1

Comments:

Prepared By: JV

Standard Added By: JV / YK

ML 12/4/04

Checked By: ~~YK~~ ML

Extract Received By: DS 12/21/04

Disposal Date:

6048

EXTRACTION LOG FOR EXPLOSIVES

SOP: ☒ EMAX-8330 **Rev.No.:** 3 ☐

Matrix: WATER **Start Date:** 12/20/04 **Time:** 13:00 **End Date:** 12/20/04 **Time:** ~~14~~ 15:30 **Book # EEX-010**

PREPARATION BATCH: EXL004-W

Sample Prep ID	Lab Sample ID	Sample Amount (g | ml)	Extract Volume (ml)	Notes
*01	EXL004-WB	200	4	
*02	↓ -WL	200	4	
*03	↓ -WC	200	4	
*04	04L128 -11	200	4	
*05	↓ -12	200	4	
*06	04L142 -07	200	4	
*07	04L145 -01	200	4	
*08	↓ -02	200	4	
*09				
*10	JV 12/20/04			
*11				
*12				
*13				
*14				
*15				
*16				
*17				
*18				
*19				
*20				
*21				
*22				
*23				
*24				
*25				
*26				

Standards	JV 12/20/04 ID	Amount Added (ml)
Surrogate	SHIB-03-36-1	0.08
LCS/MS	SHIB-03-36-2	0.08

Reagent	Lot# / ID
Acetonitrile	43080
NaCl	SWIA-02-1478
CaCl₂	SPIB-~~02~~ JV 12/20/4 01-267
Silica Sand	~~#2289249~~ JV 12/20/4

SDG #	Extract Location
	SECH #1

Comments:

Prepared By: JV
Standard Added By: JV/EG
Checked By: ML
Extract Received By: XP 12/20/04
Disposal Date:

EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

6049

TABLE OF CONTENTS

CLIENT: **SHAW E&I**

PROJECT: **LONGHORN ARMY AMMUNITION PLANT**

SDG: **04L129**

** - Not Requested

EMAX
LABORATORIES, INC.
1835 W. 205th Street
Torrance, CA 90501
Tel: (310) 618-8889
Fax: (310) 618-0818

Date: 01-07-2005
EMAX Batch No.: 04L129

Attn: Diane Meyer

Shaw E&I
1430 Enclave Parkway
Houston TX 77077

Subject: Laboratory Report
Project: Longhorn Army Ammunition Plant

Enclosed is the Laboratory report for samples received on 12/16/04. The data reported include :

Sample ID	Control #	Col Date	Matrix	Analysis
29SB86-001	L129-01	12/14/04	SOIL	PERCHLORATE BY IC
29SB86-002	L129-02	12/14/04	SOIL	PERCHLORATE BY IC
29SB86-003	L129-03	12/14/04	SOIL	PERCHLORATE BY IC
29SB87-001	L129-04	12/14/04	SOIL	PERCHLORATE BY IC
29SB87-002	L129-05	12/14/04	SOIL	PERCHLORATE BY IC
29SB87-003	L129-06	12/14/04	SOIL	PERCHLORATE BY IC
29SB88-001	L129-07	12/14/04	SOIL	PERCHLORATE BY IC
29SB88-002	L129-08	12/14/04	SOIL	PERCHLORATE BY IC
29SB88-003	L129-09	12/14/04	SOIL	PERCHLORATE BY IC
29SB89-001	L129-10	12/15/04	SOIL	PERCHLORATE BY IC
29SB89-002	L129-11	12/15/04	SOIL	PERCHLORATE BY IC
29SB89-003	L129-12	12/15/04	SOIL	PERCHLORATE BY IC

The results are summarized on the following pages.

Please feel free to call if you have any questions concerning these results.

Sincerely yours,

Kam Y. Pang, Ph.D.
Laboratory Director

00091356

Shaw *Environmental & Infrastructure, Inc.*

1430 Enclave Parkway
Houston, TX 77077 (281) 368-4000
Tulsa TERC DACA56-94-D-0020

B6

CHAIN-OF-CUSTODY

No. **29-EMAX-DEC04-003**

04L129

Laboratory Name: **EMAX**

Address: **1835 205th Street**
Torrance, CA 90501

Contact: Joe Kelbley

Project Name: **Longhorn AAP**

Project Location: **Area 29 Former TNT Production Area**

Project No.: **845714**

Project Contact: **Diane Meyer**

Project Telephone No.: **281-368-4404**

USACE Point of contact: **Cliff Murray**

USACE Telephone No.:

Project Manager/Supervisor: **Praveen Srivastav**

Analysis and Method Desired (Indicate separate containers)

Item No.	Sample Number	Date	Time	Comp	Grab	Matrix	Sample Description, Location	Number of Containers	Nitroaromatics and Nitroamines by 8330	Perchlorate by 314.0						Remarks
1	29SB86-001	12/14/04	9:10		X	SOIL	29SB86	1		X						
2	29SB86-002		9:23		X	SOIL	29SB86	1		X						
3	29SB86-003		12:30		X	SOIL	29SB86	1		X						
4	29SB87-001		13:10		X	SOIL	29SB87	1		X						
5	29SB87-002		13:25		X	SOIL	29SB87	1		X						
6	29SB87-003		13:47		X	SOIL	29SB87	1		X						
7	29SB88-001 + FD (29SB88-001QC)		14:35		X	SOIL	29SB88	2		X						
8	29SB88-002 + FD(29SB88-002QC		14:40		X	SOIL	29SB88	2		X						
9	29SB88-003 + FD(29SB88-003QC		15:05		X	SOIL	29SB88	2		X						
~~10~~																

Transfers Relinquished By (Signature)	Date/Time	Transfers Accepted By (Signature)	Date/Time	Special Instructions
M. Mill	12/15/04 1600		12/16/04 0930	
				FedEx Airbill No.:
		Laboratory		Sampler's Signature

TAT: _____ Standard _____ Rush Due: _________ Seals Intact? _____ Y _____ N Received Good Condition ✓ Y _____ N _____ Cold 3.0°C

White - Lab Copy Canary - Field Copy Pink - File Copy

00091357

Shaw Environmental & Infrastructure, Inc.
1430 Enclave Parkway
Houston, TX 77077 (281) 368-4000
Tulsa TERC DACA56-94-D-0020

CHAIN-OF-CUSTODY

No. 29-EMAX-DEC04-004

042129

Laboratory Name: EMAX
Address: 1835 205th Street, Torrance, CA 90501
Contact: Joe Kelbley

Project Name: Longhorn AAP
Project Location: Area 29 Former TNT Production Area
Project No.: 845714
Project Contact: Diane Meyer
Project Telephone No.: 281-368-4404
USACE Point of contact: Cliff Murray
USACE Telephone No.:
Project Manager/Supervisor: Praveen Srivastav

Analysis and Method Desired (Indicate separate containers)

Item No.	Sample Number	Date	Time	Comp	Grab	Matrix	Sample Description, Location	Number of Containers	Nitroaromatics and Nitroamines by 8330	Perchlorate by 314.0						Remarks
10 ~~1~~	29SB89-001	12/15/04	0850		X	SOIL	29SB89	1		X						
11 ~~2~~	29SB89-002	↓	0910		X	SOIL	29SB89	1		X						
12 ~~3~~	29SB89-003	↓	0920		X	SOIL	29SB89	1		X						
~~4~~	~~29SB___00___-QC~~					~~SOIL~~		1		X						
5																
6																
7																
8																
9																
10																

Transfers Relinquished By (Signature)	Date/Time	Transfers Accepted By (Signature)	Date/Time
	12/15/04 1000		12/16/04 0930
		Laboratory	

Special Instructions:

FedEx Airbill No.:

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

SAMPLE RECEIPT FORM 1

Type of Delivery	Delivered By/Airbill		
☐ EMAX Courier		ECN	04L129
☐ Client Delivery		Recepient	jon / SERGEY
☒ Third Party UPS	J1787464218	Date	12-16-04
		Time	0930

COC Inspection

☒ Client Name	☒ Sampler Name	☒ Sampling Date/Time/Location
☒ Address	☐ Courier Signature/Date/Time	☒ Analysis Required
☒ Client PM/FC	☐ TAT	☒ Matrix
☒ Tel #/Fax #	☒ Sample ID	☐ Preservative (if any)
Safety Issues ☒ None	☐ High Concentrations expected	☐ Superfund Site Samples

Comments: ☐ Rad Screening Required

Packaging Inspection

Container	☒ Cooler	☐ Box	☐	☐
Condition	☐ Custody Seal	☐ Intact	☐ Damaged	☐
Packaging	☒ Bubble Pack	☐ Styrofoam	☒ Sufficient	☒ plastic bag
Temperatures	☒ Cooler 1 3.0°C	☑ Cooler 2 ____	☐ Cooler 3 ____	☐ Cooler 4 ____
	☐ Cooler 5 ____	☐ Cooler 6 ____	☐ Cooler 7 ____	☐ Cooler 8 ____
	☐ Cooler 9 ____	☐ Cooler 10 ____	☐ Cooler 11 ____	☐ Cooler 12 ____

Comments:

LSCID	Client ID	Discrepancy	Corrective Action
L129-07	29SB88-001-QC	LABEL REQSTD FOR 8330	called Client
(008)		ANALYSIS	IDs with 80, 81, 82,
			83, 84, 85 → explosives
-08	29SB88-002-QC	LABEL REQSTD FOR 8330	86, 87, 88, 89, - perchlorate
(010)		ANALYSIS	
			→ run for perchlorate, per client

LSCID : Lab Sample Container ID

REVIEWS

Sample Labeling ____ Date 12/16/04

SRF ____ Date 12-17-04

PM ____ Date 12/17/04

UPS Next Day Air®
UPS Worldwide Express℠
Shipping Document

04L128
04L129 } 12-16-04
0951

WEIGHT	WEIGHT	DIMENSIONAL WEIGHT	
	5		

The shipper authorizes UPS to act as forwarding agent for export control and customs purposes.
The shipper certifies that these commodities, technology or software were exported from the United States in accordance with the Export Administration Regulations. Diversion contrary to U.S. law is prohibited.

☐ EXPRESS (INT'L)

☐ DOCUMENTS ONLY 1

SATURDAY DELIVERY ☐

SHIPMENT FROM

UPS ACCOUNT NO. 66V 725

REFERENCE NUMBER

Alan [illegible]
TELEPHONE (281) 389-[illegible]
(281) 368 [illegible]

[illegible]

[illegible]

[illegible] 77[illegible]

EXPORT

J178 746 421 8

J178 746 421 8

DELIVERY TO

TELEPHONE [illegible]

[illegible]

[illegible]

[illegible]

[illegible] 105[illegible]

Residential ☐

UPS Next Day Air® 1
EXTREMELY URGENT

J178 746 421 8

J178 746 421 8
TRACKING NUMBER

DELIVERY

DATE OF SHIPMENT
12/16/04

010191120 6/00 W

United Parcel Service, [illegible]ville, KY

REPORTING CONVENTIONS

DATA QUALIFIERS:

Lab Qualifier	AFCEE Qualifier	Description
J	F	Indicates that the analyte is positively identified and the result is less than RL but greater than MDL.
N		Indicates presumptive evidence of a compound.
B	B	Indicates that the analyte is found in the associated method blank as well as in the sample at above QC level.
E	J	Indicates that the result is above the maximum calibration range.
*	*	Out of QC limit.

Note: The above qualifiers are used to flag the results unless the project requires a different set of qualification criteria.

ACRONYMS AND ABBREVIATIONS:

CRDL	Contract Required Detection Limit
RL	Reporting Limit
MRL	Method Reporting Limit
PQL	Practical Quantitation Limit
MDL	Method Detection Limit
DO	Diluted out

DATES

The date and time information for leaching and preparation reflect the beginning date and time of the procedure unless the method, protocol, or project specifically requires otherwise.

LABORATORY REPORT FOR

SHAW E&I

LONGHORN ARMY AMMUNITION PLANT

METHOD 314.0
PERCHLORATE

SDG#: 04L129

CASE NARRATIVE

CLIENT: **SHAW E&I**

PROJECT: **LONGHORN ARMY AMMUNITION PLANT**

SDG: **04L129**

METHOD 314.0
PERCHLORATE

Twelve (12) soil samples were received on 12/16/04 for Perchlorate analysis by Method 314.0 in accordance with "Method for Determination of Perchlorate by Ion Chromatography", EPA 600/98-118.

1. **Holding Time**

   Analysis met holding time criteria.

2. **Method Blank**

   Method blank was free of contamination at half the Method Reporting Limit.

3. **Lab Control Sample**

   Lab control sample results were within QC limits.

4. **Duplicate**

   Samples L129-01 and –08 were analyzed for Duplicate. % RPD's were within QC limit.

5. **Matrix Spike**

   Sample L129-01 was spiked. % Recovery was within QC limit.

6. **Sample Analysis**

   Samples were analyzed according to the prescribed QC procedures. All criteria were met.

   Non-dilution runs of samples L129-04 to 06, and 08 to 11 could not be evaluated due to matrix interference. The samples were reported from dilution runs.

SAMPLE RESULTS

METHOD 314.0
PERCHLORATE

Client : SHAW E&I
Project : LONGHORN ARMY AMMUNITION PLANT
Batch No. : 04L129

Matrix : SOIL
Instrument ID : TI057

SAMPLE ID	EMAX SAMPLE ID	RESULTS (ug/kg)	DLF	MOIST	RL (ug/kg)	MDL (ug/kg)	Analysis DATETIME	Extraction DATETIME	LFID	CAL REF	PREP BATCH	Collection DATETIME	Received DATETIME
MBLK1S	PCL007SB	ND	1	NA	20	10	12/29/0418:46	12/28/0416:00	JL29-2	JL29-1	PCL007S	NA	12/28/04
LCS1S	PCL007SL	109	1	NA	20	10	12/29/0419:27	12/28/0416:00	JL29-4	JL29-1	PCL007S	NA	12/28/04
LCD1S	PCL007SC	108	1	NA	20	10	12/29/0419:47	12/28/0416:00	JL29-5	JL29-1	PCL007S	NA	12/28/04
29SB86-001	L129-01	40.3	1	16.6	24	12	12/29/0420:07	12/28/0416:00	JL29-6	JL29-1	PCL007S	12/14/04	12/16/04
29SB86-001DUP	L129-01D	39.4	1	16.6	24	12	12/29/0420:27	12/28/0416:00	JL29-7	JL29-1	PCL007S	12/14/04	12/16/04
29SB86-001MS	L129-01M	164	1	16.6	24	12	12/29/0420:47	12/28/0416:00	JL29-8	JL29-1	PCL007S	12/14/04	12/16/04
29SB86-002	L129-02	8600	100	15.7	2370	1190	01/04/0515:52	12/28/0416:00	JA04-6	JA04-1	PCL007S	12/14/04	12/16/04
29SB86-003	L129-03	689	2	20.2	50.1	25.1	01/04/0516:12	12/28/0416:00	JA04-7	JA04-1	PCL007S	12/14/04	12/16/04
29SB87-001	L129-04	ND	10	14.4	234	117	01/04/0520:04	12/28/0416:00	JA04-18	JA04-12	PCL007S	12/14/04	12/16/04
29SB87-002	L129-05	ND	5	12.3	114	57	01/04/0516:53	12/28/0416:00	JA04-9	JA04-1	PCL007S	12/14/04	12/16/04
29SB87-003	L129-06	ND	10	17.7	243	122	01/04/0520:24	12/28/0416:00	JA04-19	JA04-12	PCL007S	12/14/04	12/16/04
29SB88-001	L129-07	74.5	1	10.6	22.4	11.2	01/04/0519:43	12/28/0416:00	JA04-17	JA04-12	PCL007S	12/14/04	12/16/04
29SB88-002	L129-08	ND	10	25.0	267	133	01/04/0520:44	12/28/0416:00	JA04-20	JA04-12	PCL007S	12/14/04	12/16/04
29SB88-002DUP	L129-08D	ND	10	25.0	267	133	01/04/0521:04	12/28/0416:00	JA04-21	JA04-12	PCL007S	12/14/04	12/16/04
29SB88-003	L129-09	ND	5	22.4	129	64.4	01/04/0518:14	12/28/0416:00	JA04-13	JA04-12	PCL007S	12/14/04	12/16/04
29SB89-001	L129-10	ND	5	16.9	120	60.2	01/04/0518:34	12/28/0416:00	JA04-14	JA04-12	PCL007S	12/15/04	12/16/04
29SB89-002	L129-11	ND	5	21.8	128	63.9	01/04/0518:54	12/28/0416:00	JA04-15	JA04-12	PCL007S	12/15/04	12/16/04
29SB89-003	L129-12	144	1	24.5	26.5	13.2	01/04/0519:14	12/28/0416:00	JA04-16	JA04-12	PCL007S	12/15/04	12/16/04

EMAX QUALITY CONTROL DATA
MS ANALYSIS

CLIENT: SHAW E&I
PROJECT: LONGHORN ARMY AMMUNITION PLANT
BATCH NO.: 04L129
METHOD: METHOD 314.0

MATRIX:	SOIL		% MOISTURE:	16.6
DILUTION FACTOR:	1	1		
SAMPLE ID:	29SB86-001			
LAB SAMP ID:	L129-01	L129-01M		
LAB FILE ID:	JL29-6	JL29-8		
DATE EXTRACTED:	12/28/0416:00	12/28/0416:00	DATE COLLECTED:	12/14/04
DATE ANALYZED:	12/29/0420:07	12/29/0420:47	DATE RECEIVED:	12/16/04
PREP. BATCH:	PCL007S	PCL007S		
CALIB. REF:	JL29-1	JL29-1		

ACCESSION:

PARAMETER	SMPL RSLT (ug/kg)	SPIKE AMT (ug/kg)	MS RSLT (ug/kg)	MS % REC	QC LIMIT (%)
Perchlorate	40.3	120	164	103	75-125

EMAX QUALITY CONTROL DATA
LCS/LCD ANALYSIS

CLIENT: SHAW E&I
PROJECT: LONGHORN ARMY AMMUNITION PLANT
BATCH NO.: 04L129
METHOD: METHOD 314.0

MATRIX:	SOIL			% MOISTURE:	NA
DILUTION FACTOR:	1	1	1		
SAMPLE ID:	MBLK1S				
LAB SAMP ID:	PCL007SB	PCL007SL	PCL007SC		
LAB FILE ID:	JL29-2	JL29-4	JL29-5		
DATE EXTRACTED:	12/28/0416:00	12/28/0416:00	12/28/0416:00	DATE COLLECTED:	NA
DATE ANALYZED:	12/29/0418:46	12/29/0419:27	12/29/0419:47	DATE RECEIVED:	12/28/04
PREP. BATCH:	PCL007S	PCL007S	PCL007S		
CALIB. REF:	JL29-1	JL29-1	JL29-1		

ACCESSION:

PARAMETER	BLNK RSLT (ug/kg)	SPIKE AMT (ug/kg)	BS RSLT (ug/kg)	BS % REC	SPIKE AMT (ug/kg)	BSD RSLT (ug/kg)	BSD % REC	RPD (%)	QC LIMIT (%)	MAX RPD (%)
Perchlorate	ND	100	109	109	100	108	108	1	80-120	20

EMAX QUALITY CONTROL DATA
DUPLICATE SAMPLE ANALYSIS

CLIENT: SHAW E&I
PROJECT: LONGHORN ARMY AMMUNITION PLANT
BATCH NO.: 04L129
METHOD: METHOD 314.0

MATRIX:	SOIL		% MOISTURE:	16.6
DILUTION FACTOR:	1	1		
SAMPLE ID:	29SB86-001	29SB86-001DUP		
EMAX SAMP ID:	L129-01	L129-01D		
LAB FILE ID:	JL29-6	JL29-7		
DATE EXTRACTED:	12/28/0416:00	12/28/0416:00	DATE COLLECTED:	12/14/04
DATE ANALYZED:	12/29/0420:07	12/29/0420:27	DATE RECEIVED:	12/16/04
PREP. BATCH:	PCL007S	PCL007S		
CALIB. REF:	JL29-1	JL29-1		

ACCESSION:

PARAMETER	SMPL RSLT (ug/kg)	DUPL RSLT (ug/kg)	RPD RSLT %	QC LIMIT (%)
Perchlorate	40.3	39.4	2	20

EMAX QUALITY CONTROL DATA
DUPLICATE SAMPLE ANALYSIS

CLIENT: SHAW E&I
PROJECT: LONGHORN ARMY AMMUNITION PLANT
BATCH NO.: 04L129
METHOD: METHOD 314.0

MATRIX:	SOIL		% MOISTURE:	25.0
DILUTION FACTOR:	10	10		
SAMPLE ID:	29SB88-002	29SB88-002DUP		
EMAX SAMP ID:	L129-08	L129-08D		
LAB FILE ID:	JA04-20	JA04-21		
DATE EXTRACTED:	12/28/0416:00	12/28/0416:00	DATE COLLECTED:	12/14/04
DATE ANALYZED:	01/04/0520:44	01/04/0521:04	DATE RECEIVED:	12/16/04
PREP. BATCH:	PCL007S	PCL007S		
CALIB. REF:	JA04-12	JA04-12		

ACCESSION:

PARAMETER	SMPL RSLT (ug/kg)	DUPL RSLT (ug/kg)	RPD RSLT %	QC LIMIT (%)
Perchlorate	ND	ND	NA	20

IC RESULT FORM

LFID$	LSID$	DF$	PERCHLORATE
JL06-1	IB	1	ND
JL06-2	S-0.0	1	ND
JL06-3	S-2.0	1	101%
JL06-4	S-4.0	1	88.7%
JL06-5	S-10.0	1	91.3%
JL06-6	S-25.0	1	91.2%
JL06-7	S-30.0	1	92.8%
JL06-8	ICV	1	103%
JL06-9	ICB	1	ND
JL06-10	IPCS	1	98.2%
JL06-11	PCL003WB	1	ND
JL06-12	MRL	1	108%
JL06-13	PCL003WL	1	10.8
JL06-14	PCL003WC	1	10.7
JL06-15	L023-01	1	ND
JL06-16	L023-02	1	ND
JL06-17	L023-01	2	ND
JL06-18	L023-02	2	ND
JL06-19	K208-02	1	ND
JL06-20	K208-03	1	ND
JL06-21	K208-04	1	ND
JL06-22	CCV1-15	1	104%
JL06-23	K208-05	20	289
JL06-24	K208-06	1	ND
JL06-25	K184-02	1	ND
JL06-26	K184-03	5	80.2
JL06-27	K184-05	10	211
JL06-28	K184-07	20	301
JL06-29	K184-08	20	446
JL06-30	K184-10	20	281
JL06-31	K184-12	1	5.55
JL06-32	CCV2-30	1	107%
JL06-33	PCL004WB	1	ND
JL06-34	PCL004WL	1	10.9
JL06-35	PCL004WC	1	10.8
JL06-36	K167-02	10	145
JL06-37	K167-03	10	245
JL06-38	K167-06	10	278
JL06-39	K167-07	10	138
JL06-40	K167-10	10	176
JL06-41	K167-11	4	29.8
JL06-42	K142-12	2	54.5
JL06-43	CCV3-15	1	103%

```
                         IC SEQUENCE FORM
INDX LSID           LFID      DF        METNAME   SELCOMP   DateTime
1    IB             JL06-1    1         IC57L06   ALL       12/06/0420:29
2    S-0.0          JL06-2    1         IC57L06   ALL       12/06/0420:50
3    S-2.0          JL06-3    1         IC57L06   ALL       12/06/0421:10
4    S-4.0          JL06-4    1         IC57L06   ALL       12/06/0421:30
5    S-10.0         JL06-5    1         IC57L06   ALL       12/07/0410:04
6    S-25.0         JL06-6    1         IC57L06   ALL       12/07/0410:24
7    S-30.0         JL06-7    1         IC57L06   ALL       12/07/0410:45
8    ICV            JL06-8    1         IC57L06   ALL       12/07/0411:04
9    ICB            JL06-9    1         IC57L06   ALL       12/07/0414:31
10   IPCS           JL06-10   1         IC57L06   ALL       12/07/0414:52
11   PCL003WB       JL06-11   1         IC57L06   ALL       12/07/0415:12
12   MRL            JL06-12   1         IC57L06   ALL       12/07/0415:32
13   PCL003WL       JL06-13   1         IC57L06   ALL       12/07/0415:52
14   PCL003WC       JL06-14   1         IC57L06   ALL       12/07/0416:12
15   L023-01        JL06-15   1         IC57L06   ALL       12/07/0416:32
16   L023-02        JL06-16   1         IC57L06   ALL       12/07/0416:53
17   L023-01        JL06-17   2         IC57L06   ALL       12/07/0417:13
18   L023-02        JL06-18   2         IC57L06   ALL       12/07/0417:33
19   K208-02        JL06-19   1         IC57L06   ALL       12/07/0418:13
20   K208-03        JL06-20   1         IC57L06   ALL       12/07/0418:33
21   K208-04        JL06-21   1         IC57L06   ALL       12/07/0418:53
22   CCV1-15        JL06-22   1         IC57L06   ALL       12/07/0419:13
23   K208-05        JL06-23   20        IC57L06   ALL       12/07/0419:33
24   K208-06        JL06-24   1         IC57L06   ALL       12/07/0419:53
25   K184-02        JL06-25   1         IC57L06   ALL       12/07/0420:13
26   K184-03        JL06-26   5         IC57L06   ALL       12/07/0420:34
27   K184-05        JL06-27   10        IC57L06   ALL       12/07/0420:54
28   K184-07        JL06-28   20        IC57L06   ALL       12/07/0421:14
29   K184-08        JL06-29   20        IC57L06   ALL       12/07/0421:34
30   K184-10        JL06-30   20        IC57L06   ALL       12/07/0421:54
31   K184-12        JL06-31   1         IC57L06   ALL       12/07/0422:14
32   CCV2-30        JL06-32   1         IC57L06   ALL       12/07/0422:34
33   PCL004WB       JL06-33   1         IC57L06   ALL       12/07/0422:55
34   PCL004WL       JL06-34   1         IC57L06   ALL       12/07/0423:15
35   PCL004WC       JL06-35   1         IC57L06   ALL       12/07/0423:35
36   K167-02        JL06-36   10        IC57L06   ALL       12/07/0423:55
37   K167-03        JL06-37   10        IC57L06   ALL       12/08/0400:15
38   K167-06        JL06-38   10        IC57L06   ALL       12/08/0400:35
39   K167-07        JL06-39   10        IC57L06   ALL       12/08/0400:56
40   K167-10        JL06-40   10        IC57L06   ALL       12/08/0401:16
41   K167-11        JL06-41   4         IC57L06   ALL       12/08/0401:36
42   K142-12        JL06-42   2         IC57L06   ALL       12/08/0401:56
43   CCV3-15        JL06-43   1         IC57L06   ALL       12/08/0402:17
```

IC RESULT FORM

LFID$	LSID$	DF$	PERCHLORATE
JL29-1	IPCS	1	102%
JL29-2	PCL007SB	1	.411
JL29-3	MRL	1	117%
JL29-4	PCL007SL	1	10.9
JL29-5	PCL007SC	1	10.8
JL29-6	L129-01	1	3.36
JL29-7	L129-01D	1	3.29
JL29-8	L129-01M	1	13.7
JL29-9	L129-02	1	66.9
JL29-10	L129-03	1	62.4
JL29-11	L129-04	1	ND
JL29-12	L129-05	1	ND
JL29-13	CCV7-15	1	95.3%
JL29-14	B	1	ND
JL29-15	L129-06	1	ND
JL29-16	L129-07	1	ND
JL29-17	L129-08	1	ND
JL29-18	L129-09	1	ND
JL29-19	L129-10	1	9.7
JL29-20	L129-11	1	ND
JL29-21	L129-12	1	12.2
JL29-22	CCV8-30	1	42.3%*
JL29-23	L129-02	25	1800
JL29-24	L129-03	2	ND
JL29-25	L129-04	1	ND
JL29-26	L129-05	1	ND
JL29-27	L129-06	1	ND
JL29-28	CCV9-15	1	ND
JL29-29	L129-05	5	ND
JL29-30	L129-06	5	ND
JL29-31	L129-08	5	ND
JL29-32	L129-09	5	ND
JL29-33	L129-10	5	ND
JL29-34	L129-11	5	313
JL29-35	CCV10-30	1	111%*

IC SEQUENCE FORM

INDX	LSID	LFID	DF	METNAME	SELCOMP	DateTime
1	IPCS	JL29-1	1	IC57L06	ALL	12/29/0418:26
2	PCL007SB	JL29-2	1	IC57L06	ALL	12/29/0418:46
3	MRL	JL29-3	1	IC57L06	ALL	12/29/0419:07
4	PCL007SL	JL29-4	1	IC57L06	ALL	12/29/0419:27
5	PCL007SC	JL29-5	1	IC57L06	ALL	12/29/0419:47
6	L129-01	JL29-6	1	IC57L06	ALL	12/29/0420:07
7	L129-01D	JL29-7	1	IC57L06	ALL	12/29/0420:27
8	L129-01M	JL29-8	1	IC57L06	ALL	12/29/0420:47
9	L129-02	JL29-9	1	IC57L06	ALL	12/29/0421:07
10	L129-03	JL29-10	1	IC57L06	ALL	12/29/0421:28
11	L129-04	JL29-11	1	IC57L06	ALL	12/29/0421:48
12	L129-05	JL29-12	1	IC57L06	ALL	12/29/0422:08
13	CCV7-15	JL29-13	1	IC57L06	ALL	12/29/0422:28
14	B	JL29-14	1	IC57L06		12/29/0422:48
15	L129-06	JL29-15	1	IC57L06	ALL	12/29/0423:08
16	L129-07	JL29-16	1	IC57L06	ALL	12/29/0423:29
17	L129-08	JL29-17	1	IC57L06	ALL	12/29/0423:49
18	L129-09	JL29-18	1	IC57L06	ALL	12/30/0400:09
19	L129-10	JL29-19	1	IC57L06	ALL	12/31/0403:14
20	L129-11	JL29-20	1	IC57L06	ALL	12/31/0403:46
21	L129-12	JL29-21	1	IC57L06	ALL	12/31/0404:18
22	CCV8-30	JL29-22	1	IC57L06	ALL	12/31/0404:51
23	L129-02	JL29-23	25	IC57L06	ALL	12/31/0405:23
24	L129-03	JL29-24	2	IC57L06	ALL	12/31/0405:55
25	L129-04	JL29-25	1	IC57L06	ALL	12/31/0406:27
26	L129-05	JL29-26	1	IC57L06	ALL	12/31/0406:59
27	L129-06	JL29-27	1	IC57L06	ALL	12/31/0407:31
28	CCV9-15	JL29-28	1	IC57L06	ALL	12/31/0408:03
29	L129-05	JL29-29	5	IC57L06	ALL	12/31/0408:36
30	L129-06	JL29-30	5	IC57L06	ALL	12/31/0409:08
31	L129-08	JL29-31	5	IC57L06	ALL	12/31/0409:40
32	L129-09	JL29-32	5	IC57L06	ALL	12/31/0410:12
33	L129-10	JL29-33	5	IC57L06	ALL	12/31/0410:44
34	L129-11	JL29-34	5	IC57L06	ALL	12/31/0411:16
35	CCV10-30	JL29-35	1	IC57L06	ALL	12/31/0411:48

```
          IC RESULT FORM
LFID$     LSID$     DF$    PERCHLOR
JA04-1    IPCS      1          13.3
JA04-2    PCL007SQ  1            ND
JA04-3    MRL       1          2.21
JA04-4    PCL007SX  1          10.9
JA04-5    PCL007SY  1          10.9
JA04-6    L129-02   100         725
JA04-7    L129-03   2          54.9
JA04-8    L129-04   5            ND
JA04-9    L129-05   5            ND
JA04-10   L129-06   5            ND
JA04-11   L129-08   5            ND
JA04-12   CCV11-15  1          108%
JA04-13   L129-09   5            ND
JA04-14   L129-10   5            ND
JA04-15   L129-11   5            ND
JA04-16   L129-12   1          10.9
JA04-17   L129-07   1          6.66
JA04-18   L129-04   10           ND
JA04-19   L129-06   10           ND
JA04-20   L129-08   10           ND
JA04-21   L129-08D  10           ND
JA04-22   L129-08A  10          116
JA04-23   BL        1            ND
JA04-24   CCV12-30  1          114%
JA04-25   CCV12-30  1          114%
```

```
                         IC SEQUENCE FORM
INDX LSID            LFID      DF        METNAME   SELCOMP   DateTime
1    IPCS            JA04-1    1         IC57L06   ALL       01/04/0513:03
2    PCL007SQ        JA04-2    1         IC57L06   ALL       01/04/0514:31
3    MRL             JA04-3    1         IC57L06   ALL       01/04/0514:51
4    PCL007SX        JA04-4    1         IC57L06   ALL       01/04/0515:11
5    PCL007SY        JA04-5    1         IC57L06   ALL       01/04/0515:32
6    L129-02         JA04-6    100       IC57L06   ALL       01/04/0515:52
7    L129-03         JA04-7    2         IC57L06   ALL       01/04/0516:12
8    L129-04         JA04-8    5         IC57L06   ALL       01/04/0516:32
9    L129-05         JA04-9    5         IC57L06   ALL       01/04/0516:53
10   L129-06         JA04-10   5         IC57L06   ALL       01/04/0517:13
11   L129-08         JA04-11   5         IC57L06   ALL       01/04/0517:33
12   CCV11-15        JA04-12   1         IC57L06   ALL       01/04/0517:53
13   L129-09         JA04-13   5         IC57L06   ALL       01/04/0518:14
14   L129-10         JA04-14   5         IC57L06   ALL       01/04/0518:34
15   L129-11         JA04-15   5         IC57L06   ALL       01/04/0518:54
16   L129-12         JA04-16   1         IC57L06   ALL       01/04/0519:14
17   L129-07         JA04-17   1         IC57L06   ALL       01/04/0519:43
18   L129-04         JA04-18   10        IC57L06   ALL       01/04/0520:04
19   L129-06         JA04-19   10        IC57L06   ALL       01/04/0520:24
20   L129-08         JA04-20   10        IC57L06   ALL       01/04/0520:44
21   L129-08D        JA04-21   10        IC57L06   ALL       01/04/0521:04
22   L129-08A        JA04-22   10        IC57L06   ALL       01/04/0521:25
23   BL              JA04-23   1         IC57L06   ALL       01/04/0521:45
24   CCV12-30        JA04-24   1         IC57L06   ALL       01/04/0522:05
25   CCV12-30        JA04-25   1         IC57L06   ALL       01/04/0522:25
```

ANALYSIS RUN LOG FOR IC - PERCHLORATE

SOP ☑ **EMAX-314.0 Revision No. 2** ☐ **Book # A57-008**

Start Date 12/29/04 **Time** 1820 **Ending Date** 12/31/04 **Time** 1148

EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

BATCH * PCL007S **

Sample Prep ID	Data File Name	Lab Sample ID	DF	Matrix S	Matrix W	Conductivity, (us/cm)	Notes
* 1	JL29-1	IPCS	1			2660	
* 2	2	PCL007SB		S			
* 3	3	MRL					
* 4	4	PCL007SL		S			
* 5	5	SC					
* 6	6	L129-01				36.1	
* 7	7	-01D				35.8	
* 8	8	-01M				36.7	
* 9	9	-02				18.1	
* 10	10	-03				26	
* 1	11	-04				10.4	
* 2	12	-05				33.5	
* 3	13	CCV7-15					
* 4	14	BL					
* 5	15	L129-06		S		174.5	*unstable
* 6	16	-07				16.0	baseline
* 7	17	-08				90.1	reanalyze
* 8	18	-09				124.4	samples
* 19	19	-10				211.3	
* 20	20	-11				13.5	
* 1	21	-12				89	
* 2	22	CCV8-30	1				
* 3	23	L129-02	25	S			
* 4	24	-03	2				
* 5	25	-04	1				**
* 6	26	-05					
* 7	27	-06					
* 8	28	CCV9-15	1			not injected	
* 29	29	L129-05	5				
* 30	30	-06					1/4/05

Instrument Number	57

INITIAL CALIBRATION REFERENCE	
Method File	IC57L06.MET
ICAL ID	SW8B-02-652
ICV ID	-654

Standards

Name		ID	Conc. (ug/L)
ICAL	S1	Refer to ICAL p20 A57-008	
	S2		
	S3		
	S4		
	S5		
ICV			
CCV-15		SW8B-02-660	15
CCV-30		-661	30
LCS		662	10
MS		-651	1000
IPC		-663	30/10
CMC		SW3B-02-565	1413

Comments:

CMC Reading, (us/cm)	QC Criteria (us/cm)	Temp. (°C)
1409	±30	25

Electronic Data Archival

Location	Date
** Peaks detected in series	

Analyzed By: JK

This page is checked during the data review process.

8014

ANALYSIS RUN LOG FOR IC - PERCHLORATE

SOP ☑ EMAX-314.0 Revision No. 2 ☐

Book # A57-008

Start Date 1/4/05 Time 13:03 Ending Date 1/4/05 Time

BATCH * PCA007S **

Sample Prep ID	Data File Name	Lab Sample ID	DF	Matrix S	Matrix W	Conductivity, (us/cm)	Notes
* 1	JA04-1	IPCS	1			2680	
* 2	2	PCL007SQ		S			
* 3	3	MRL					
* 4	4	PCL007SX		S			
* 5	5	SY	1				
* 6	6	L129-02	100			Refer to	
* 7	7	-03	2			pp	
* 8	8	-04	5			A57-008	
* 9	9	-05				24	
* 10	10	-06					
* 1	11	-08	5				
* 2	12	CCV11-15	1				
* 3	13	L129-09	5	S			
* 4	14	-10					
* 5	15	-11	5				
* 6	16	-12	1				
* 7	17	-07					
* 8	18	-04	10				
* 19	19	-06					
* 20	20	-08					
* 1	21	-08D					
* 2	22	-08A	10				
* 3	23	BL	1				
* 4	24	CCV12-30					
* 5	25	CCV12-30R					
* 6	26						
* 7	27						
* 8	28						
* 29	29						
* 30	30						

1/5/05

Instrument Number	57

INITIAL CALIBRATION REFERENCE

Method File	IC57L06.MET
ICAL ID	SW8B-02-652
ICV ID	-654

Standards

Name		ID	Conc. (ug/L)
ICAL	S1	Refer to A57-008 p 20	
	S2		
	S3		
	S4		
	S5		
ICV			
CCV-15		SW8B-02-660	15
CCV-30		-661	30
LCS		-662	10
MS/A		-651	10
IPC		SW8B-02-663	300ppm/10ppb
CMC		SW3B-02-565	1413 µmhos

Comments:

CMC Reading, (us/cm)	QC Criteria (us/cm)	Temp. (°C)
1411	±30	25

Electronic Data Archival

Location	Date

Analyzed By: MB/JR

This page is checked during the data review process.

ANALYSIS RUN LOG FOR IC - PERCHLORATE

SOP ☑ EMAX-314.0 Revision No. 2 ☐

Book # A57-008

Start Date 12/29/04 Time 1820 Ending Date 12/31/04 Time 11 48

BATCH * PCL007S **

Sample Prep ID	Data File Name	Lab Sample ID	DF	Matrix S	Matrix W	Conductivity, (us/cm)	Notes
* 31	1L29-31	2128-08	5				
* 2	32	-09					
* 3	33	-10					
* 4	34	-11					
* 5	35	CCV10-30					
* 6							
* 7							
* 8							Q 1/4/05
* 9							
* 0							
* 1							
* 2							
* 3							
* 4							
* 5							
* 6							
* 7							
* 8							
* 9							
* 0							
* 1							
* 2							
* 3							
* 4							
* 5							
* 6							
* 7							
* 8							
* 9							
* 0							

Instrument Number	57

INITIAL CALIBRATION REFERENCE	
Method File	SAME AS p 24
ICAL ID	
ICV ID	

Standards

Name		ID	Conc. (ug/L)
ICAL	S1	SAME AS p24	
	S2		
	S3		
	S4		
	S5		
ICV			
CCV-15			
CCV-30			
LCS			
MS			
IPC			
CMC			

Comments:

CMC Reading, (us/cm)	QC Criteria (us/cm)	Temp. (°C)
	±30	

Electronic Data Archival	
Location	Date

Analyzed By: K/NB

This page is checked during the data review process.

EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

ANALYSIS RUN LOG FOR IC - PERCHLORATE

SOP ☑ EMAX-314.0 Revision No. 2 ☐

Book # A57-008

Start Date 10/6/04 Time 12:24 Ending Date Time

EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

BATCH # N/A **

Sample Prep ID	Data File Name	Lab Sample ID	DF	Matrix S	Matrix W	Conductivity, (us/cm)	Notes
* 1	JJ06-1	IB	1		X		
* 2	2	S-0.0					
* 3	3	S-2.0					
* 4	4	S-4.0					
* 5	5	S-10.0					
* 6	6	S-25.0					
* 7	7	S-30.0					
* 8	8	ICV					
* 9	9	ICB					
* 0							
* 1							
* 2							
* 3							
* 4							
* 5							
* 6							
* 7							
* 8							10/6/04
* 9							
* 0							
* 1							
* 2							
* 3							
* 4							
* 5							
* 6							
* 7							
* 8							
* 9							
* 0							

Instrument Number	57

INITIAL CALIBRATION REFERENCE

Method File	IC57J06.MET
ICAL ID	SWBB-02-639
ICV ID	640

Standards

Name		ID	Conc. (ug/L)
ICAL	S1	SWBB-02-639	2
	S2		4
	S3		10
	S4		25
	S5		30
ICV		SWBB-02-640	25
CCV-15			
CCV-30			
LCS			10/6/04
MS			
IPC			
CMC			

Comments:

CMC Reading, (us/cm)	QC Criteria (us/cm)	Temp. (°C)
	±30	

Electronic Data Archival	
Location	Date

Analyzed By:

This page is checked during the data review process.

8017

EXTRACTION LOGS

SAMPLE PREPARATION LOG FOR ORGANIC ACID/PERCHLORATE

EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

SOP ☑ EMAX-314.0 ☐ EMAX-300.0M Book # EOP-001

Matrix soil Start Date 12/28/04 Time 1600 End Date 12/28/04 Time 2000

PREPARATION BATCH # PCL007S

Sample Prep ID	Lab Sample ID	Sample Amount (g)	Dilution Volume (ml)	Extract Volume (ml)	Notes
*01	PCL007 SB	10	100	100	
*02	SL	10			
*03	SC	10			
*04	04L129-01	10.01			Clear extract
*05	-01D	10.02			
*06	-01M	10.01			
*07	-02	10.00			Bn/Td
*08	-03	10.00			
*09	-04	10.00			
*10	-05	10.03			
*11	-06	10.02			
*12	-07	10.01			Clear
*13	-08	10.01			Bn/Td
*14	-09	10.02			Clear
*15	-10	10.00			Bn/Td
*16	-11	10.00			
*17	-12	10.00			Clear
*18					1/4/05
*19					
*20					
*21					
*22					
*23					
*24					
*25					

Standards	ID	Amount Added (ml)
Acetate	NA	
Butyrate		
Lactate		
Perchlorate	SW8B-02-051	1.0
Propionate	NA	
Pyruvate		

Reagent	Lot # / ID
H_2SO_4	NA
Nanopure	Nanopure
KCl	SW3B02-565, 1413 μmhos/cm

Legend:

Color	Texture	Clarity	Artifacts
Bu = Blue Bl = Black	Cs = Coarse	Cr = Clear	Rk = Rocks
Bn = Brown Gn = Green	Md = Medium	Cy = Cloudy	Sl = Shale
Og = Orange Rd = Red	Fn = Fine	Td = turbid	Vg= Vegetation
Yw = Yellow			

Comments:

Prepared By: JK / Nb

Standard Added By: JK / Nb

Checked By:

RETENTION TIME WINDOW

RETENTION TIME WINDOW
PERCHLORATE

Lab name: **EMAX**

Method: **EMAX-314.1**

Instrument ID: DX500IC57

IC column: AS16

Column size: 4X250NM

Sample ID	CCV10-30	CCV11-15	MRL	AVERAGE RETENTION TIME	SD	RETENTION TIME WINDOW 3*SD
Analysis Date	1/7/04	1/8/04	1/9/04			
Analysis Time	18:14	18:15	13:01			
COMPOUND	JA06-24	JA08-13	JA09-3			
PERCHLORATE	12.363	12.355	12.278	12.332	0.047	0.141

TABLE OF CONTENTS

CLIENT: **SHAW E&I**

PROJECT: **LONGHORN ARMY AMMUNITION PLANT**

SDG: **04L142**

** - Not Requested

EMAX
LABORATORIES, INC.
1835 W. 205th Street
Torrance, CA 90501
Tel: (310) 618-8889
Fax: (310) 618-0818

Date: 12-27-2004
EMAX Batch No.: 04L142

Attn: Diane Meyer

Shaw E&I
1430 Enclave Parkway
Houston TX 77077

Subject: Laboratory Report
Project: Longhorn Army Ammunition Plant

Enclosed is the Laboratory report for samples received on 12/17/04. The data reported include :

Sample ID	Control #	Col Date	Matrix	Analysis
29SB81-001	L142-01	12/16/04	SOIL	NITROAROMATICS & NITRAMINES
29SB81-002	L142-02	12/16/04	SOIL	NITROAROMATICS & NITRAMINES
29SD38-MH07	L142-03	12/16/04	SOIL	NITROAROMATICS & NITRAMINES
29SD39-MH08	L142-04	12/16/04	SOIL	NITROAROMATICS & NITRAMINES
29SD41-MH10	L142-05	12/16/04	SOIL	NITROAROMATICS & NITRAMINES
29SD46	L142-06	12/16/04	SOIL	NITROAROMATICS & NITRAMINES
29SW46	L142-07	12/16/04	WATER	NITROAROMATICS & NITRAMINES

The results are summarized on the following pages.

Please feel free to call if you have any questions concerning these results.

Sincerely yours,

Kam Y. Pang, Ph.D.
Laboratory Director

Shaw *Environmental & Infrastructure, Inc.*

1430 Enclave Parkway
Houston, TX 77077 (281) 368-4000

00091385

B6

CHAIN-OF-CUSTODY

No. 29-EMAX-DEC

042142

Laboratory Name: EMAX
Address: 1835 205th Street, Torrance, CA 90501
Contact: Joe Kelbley

Project Name: Longhorn AAP
Project Location: Area 29 Former TNT Production Area
Project No.: 845714
Project Contact: Diane Meyer
Project Telephone No.: 281-368-4404
USACE Point of contact: Cliff Murray
USACE Telephone No.:
Project Manager/Supervisor: Praveen Srivastav

Item No.	Sample Number	Date	Time	Comp	Grab	Matrix	Sample Description, Location	Number of Containers	Nitroaromatics and Nitroamines by 8330	Perchlorate by 314.0						Remarks
1	~~29SB80-001~~					~~SOIL~~	~~29SB80~~	~~1~~	~~X~~							
~~2~~	~~29SB80-002~~					~~SOIL~~	~~29SB80~~	~~1~~	~~X~~							
1 ~~3~~	29SB81-001	12/16/04	0900		X	SOIL	29SB81	1	X							
2 ~~4~~	29SB81-002	12/16/04	0905		X	SOIL	29SB81	1	X							
~~5~~	~~29SB82-001~~					~~SOIL~~	~~29SB82~~	~~1~~	~~X~~							
~~6~~	~~29SB82-002~~					~~SOIL~~	~~29SB82~~	~~1~~	~~X~~							
~~7~~	~~29SB83-001~~					~~SOIL~~	~~29SB83~~	~~1~~	~~X~~							
~~8~~	~~29SB83-002~~					~~SOIL~~	~~29SB83~~	~~1~~	~~X~~							
~~9~~	~~29SB84-001~~					~~SOIL~~	~~29SB84~~	~~1~~	~~X~~							
~~10~~	~~29SB84-002~~					~~SOIL~~	~~29SB84~~	~~1~~	~~X~~							

Transfers Relinquished By (Signature)	Date/Time	Transfers Accepted By (Signature)	Date/Time	
	1400 12/16/04		12/~~16~~17/04 0930	Special Instructions
				FedEx Airbill No.: 66V 725
		Laboratory		Sampler's Signature

TAT: 7 day Standard _____ Rush Due: 7 days
Seals Intact? ✓ Y _____ N
Received Good Condition ✓ Y _____ N _____ Cold 3.4°C

White - Lab Copy Canary - Field Copy Pink - File Copy

1001

00091386

Shaw *Environmental & Infrastructure, Inc.*

1430 Enclave Parkway
Houston, TX 77077 (281) 368-4000
Tulsa TERC DACA56-94-D-0020

CHAIN-OF-CUSTODY

No. **29-EMAX-DEC04-005**

042142

Laboratory Name: **EMAX**
Address: **1835 205th Street**
Torrance, CA 90501
Contact:

Project Name **Longhorn AAP**		Project Location **Area 29 Former TNT Production Area**	
Project No. **845714**	Project Contact **Diane Meyer**	Project Telephone No. **281-368-4404**	
USACE Point of contact: **Cliff Murray**		Project Manager/Supervisor **Praveen Srivastav**	
USACE Telephone No.			

Analysis and Method Desired (Indicate separate containers)

Item No.	Sample Number	Date	Time	Comp	Grab	Matrix	Sample Description, Location	Number of Containers	Nitroaromatics and Nitroamines by 8330	Perchlorate by 314.0							Remarks
~~1~~	~~29SD32-MH01~~					~~SED~~	~~29SD32-MH01~~	~~1~~	~~X~~								
~~2~~	~~29SD33-MH02~~					~~SED~~	~~29SD33-MH02~~	~~1~~	~~X~~								
~~3~~	~~29SD34-MH03~~					~~SED~~	~~29SD34-MH03~~	~~1~~	~~X~~								
~~4~~	~~29SD35-MH04~~					~~SED~~	~~29SD35-MH04~~	~~1~~	~~X~~								
~~5~~	~~29SD36-MH05~~					~~SED~~	~~29SD36-MH05~~	~~1~~	~~X~~								
~~6~~	~~29SD37-MH06~~					~~SED~~	~~29SD37-MH06~~	~~1~~	~~X~~								
3 ~~7~~	29SD38-MH07	12/16/04	12:45			SED	29SD38-MH07	1	X								
4 ~~8~~	29SD39-MH08	12/16/04	1307			SED	29SD39-MH08	1	X								
~~9~~																	
~~10~~																	

Transfers Relinquished By (Signature)	Date/Time	Transfers Accepted By (Signature)	Date/Time
M. Allen	12/16/04 1600 MA		
		Laboratory	12/17/04 0930

Special Instructions

FedEx Airbill No.: 664 725

Sampler's Signature M. Allen

TAT: 7 day Standard ____ Rush Due: 7 days Seals Intact? ____ [✓ Y] ____ N Received Good Condition ✓ Y ____ N ____ Cold 3.4°C

White - Lab Copy Canary - Field Copy Pink - File Copy

1002

Shaw *Environmental & Infrastructure, Inc.*

1430 Enclave Parkway
Houston, TX 77077 (281) 368-4000
Tulsa TERC DACA56-94-D-0020

CHAIN-OF-CUSTODY

No. **29-EMAX-DEC04-006**

04L142

Laboratory Name:	**EMAX**	Address:	**1835 205th Street** **Torrance, CA 90501**	Contact:	Joe Kelbley

Project Name **Longhorn AAP**		Project Location **Area 29 Former TNT Production Area**	
Project No. **845714**	Project Contact **Diane Meyer**	Project Telephone No. **281-368-4404**	
USACE Point of contact: **Cliff Murray**		Project Manager/Supervisor **Praveen Srivastav**	
USACE Telephone No.			

Analysis and Method Desired (Indicate separate containers)

	Item No.	Sample Number	Date	Time	Comp	Grab	Matrix	Sample Description, Location	Number of Containers	Nitroaromatics and Nitroamines by 8330	Perchlorate by 314.0						Remarks
	~~1~~	~~29SD40-MH09~~					~~SED~~	~~**29SD40-MH09**~~	~~1~~	~~X~~							
5	~~2~~	29SD41-MH10	12/16/04	1315		X	SED	**29SD41-MH10**	1	X							
	~~3~~	~~29SD42-MH11~~					~~SED~~	~~**29SD42-MH11**~~	~~1~~	~~X~~							
	~~4~~	~~29SD43-MH12~~					~~SED~~	~~**29SD43-MH12**~~	~~1~~	~~X~~							
	~~5~~	~~29SD44~~					~~SED~~	~~**29SD44**~~	~~1~~	~~X~~							
	~~6~~	~~29SD45~~					SED	~~**29SD45**~~	~~1~~	~~X~~							
6	~~7~~	29SD46	12/16/04	1515		X	SED	**29SD46**	1	X							
	~~8~~	~~29SD____-MH____-QC~~	~~12/16/04~~			~~X~~	SED	~~**29SD____-MH____-QC**~~	~~1~~	~~X~~							
	~~9~~	~~29SD____-QC~~					~~SED~~	~~**29SD____-QC**~~	~~1~~	~~X~~							
	10																

Transfers Relinquished By (Signature)	Date/Time	Transfers Accepted By (Signature)	Date/Time	
M. All	12/16/04 1600			Special Instructions
				FedEx Airbill No.: 6604725
		Laboratory	12/~~16~~ 17/04 0930 sc	Sampler's Signature M. All

TAT: 7 day Standard ____ Rush Due: 7 day Seals Intact? [✓ ✓Y] ____N Received Good Condition ✓Y ____N ____ Cold 3.4°C

White - Lab Copy Canary - Field Copy Pink - File Copy

00091388

Shaw *Environmental & Infrastructure, Inc.*

1430 Enclave Parkway
Houston, TX 77077 (281) 368-4000
Tulsa TERC DACA56-94-D-0020

CHAIN-OF-CUSTODY

No. **29-EMAX-DEC04-007**

042142

Laboratory Name:	**EMAX**	Address:	**1835 205th Street Torrance, CA 90501**	Contact:	Joe Kelbley

Project Name **Longhorn AAP**	Project Location **Area 29 Former TNT Production Area**	
Project No. **845714**	Project Contact **Diane Meyer**	Project Telephone No. **281-368-4404**
USACE Point of contact: **Cliff Murray**	Project Manager/Supervisor **Praveen Srivastav**	
USACE Telephone No.		

Analysis and Method Desired (Indicate separate containers)

Item No.	Sample Number	Date	Time	Comp	Grab	Matrix	Sample Description, Location	Number of Containers	Nitroaromatics and Nitroamines by 8330	Perchlorate by 314.0						Remarks
~~1~~	~~29SW44~~					~~sw~~	~~29SW44~~	~~2~~	~~X~~							
~~2~~	~~29SW45~~					~~sw~~	~~29SW45~~	~~2~~	~~X~~							
7 ~~3~~	29SW46	12/16/04	15:10			sw	29SW46	2	X							
~~4~~	~~29SW______-QC~~					~~sw~~	~~29SW______-QC~~	~~2~~	~~X~~							
5																
6																
7																
8																
9																
10																

Transfers Relinquished By (Signature)	Date/Time	Transfers Accepted By (Signature)	Date/Time	Special Instructions
	12/16/04 16:00			
				FedEx Airbill No.: ~~66V5~~ MHD 66V725
		Laboratory	12/16/04 170930	Sampler's Signature

TAT: 7 day Standard ____ Rush Due: 7 days Seals Intact? ____ Y ____ [✓ N] Received Good Condition ✓ Y ____ N ____ Cold 3.4°c

White - Lab Copy Canary - Field Copy Pink - File Copy

SAMPLE RECEIPT FORM 1

Type of Delivery		Delivered By/Airbill		
☐ EMAX Courier			ECN	041142
☐ Client Delivery			Recepient	jonluna
☑ Third Party	UPS	J1787464227	Date	12-17-04
			Time	0930

COC Inspection

☑ Client Name
☑ Address
☑ Client PM/FC
☑ Tel #/Fax #

☑ Sampler Name
☐ Courier Signature/Date/Time
☑ TAT
☑ Sample ID

☑ Sampling Date/Time/Location
☑ Analysis Required
☑ Matrix
☐ Preservative (if any)

Safety Issues ☑ None ☐ High Concentrations expected ☐ Superfund Site Samples
Comments: ☐ Rad Screening Required

Packaging Inspection

Container	☑ Cooler	☐ Box	☐	☐
Condition	☑ Custody Seal	☑ Intact	☐ Damaged	☐
Packaging	☑ Bubble Pack	☐ Styrofoam	☑ Sufficient	☑ plastic bag
Temperatures	☑ Cooler 1 3.4°C	☑ Cooler 2 ____	☐ Cooler 3 ____	☐ Cooler 4 ____
	☐ Cooler 5 ____	☐ Cooler 6 ____	☐ Cooler 7 ____	☐ Cooler 8 ____
	☐ Cooler 9 ____	☐ Cooler 10 ____	☐ Cooler 11 ____	☐ Cooler 12 ____

Comments:

LSCID	Client ID	Discrepancy	Corrective Action

LSCID : Lab Sample Container ID

REVIEWS

Sample Labeling ____ Date 12.17.04.

SRF ____ Date 12-17-04

PM ____ Date 12/17/04

UPS Next Day Air®
UPS Worldwide Express℠
Shipping Document

WEIGHT	WEIGHT	DIMENSIONAL WEIGHT	
	[illegible]		

The shipper authorizes UPS to act as forwarding agent for export control and customs purposes. The shipper certifies that these commodities, technology or software were exported from the United States in accordance with the Export Administration Regulations. Diversion contrary to U.S. law is prohibited.

☐ EXPRESS (INT'L)

☐ DOCUMENTS ONLY

SATURDAY DELIVERY ☐

J178 746 422 7

J178 746 422 7

EXPORT

NT FROM

E NUMBER

TELEPHONE

04L142
12-17-04
0930

TO

TELEPHONE

UPS Next Day Air®
EXTREMELY URGENT

J178 746 422 7

DELIVERY

Residential ☐

J178 746 422 7
TRACKING NUMBER

DATE OF SHIPMENT

/ /

United Parcel Service, Louisville, KY

1006

REPORTING CONVENTIONS

DATA QUALIFIERS:

Lab Qualifier	AFCEE Qualifier	Description
J	F	Indicates that the analyte is positively identified and the result is less than RL but greater than MDL.
N		Indicates presumptive evidence of a compound.
B	B	Indicates that the analyte is found in the associated method blank as well as in the sample at above QC level.
E	J	Indicates that the result is above the maximum calibration range.
*	*	Out of QC limit.

Note: The above qualifiers are used to flag the results unless the project requires a different set of qualification criteria.

ACRONYMS AND ABBREVIATIONS:

CRDL	Contract Required Detection Limit
RL	Reporting Limit
MRL	Method Reporting Limit
PQL	Practical Quantitation Limit
MDL	Method Detection Limit
DO	Diluted out

DATES

The date and time information for leaching and preparation reflect the beginning date and time of the procedure unless the method, protocol, or project specifically requires otherwise.

LABORATORY REPORT FOR

SHAW E&I

LONGHORN ARMY AMMUNITION PLANT

EPA METHOD 8330
EXPLOSIVES

SDG#: 04L142

CASE NARRATIVE

CLIENT: **SHAW E&I**

PROJECT: **LONG HORN ARMY AMMUNITION PLANT**

EMAX SDG: **04L142**

EPA METHOD 8330
EXPLOSIVES

One (1) water and six (6) soil samples were received on 12/17/04 for Explosives analysis by EPA Method 8330 in accordance with USEPA-SW846 3rd edition, and EMAX-8330.

1. **Holding Time**

   Analytical holding time was met. Extraction for water samples was started and completed on 12/20/04. Extraction for soil samples was started on 12/20/04 and completed on 12/21/04

2. **Calibration**

   Initial calibration was 5 point. %RSDs were within 20%. All continuing calibrations of the primary column were carried out at 12-hour intervals and the recoveries were within 85-115%.

3. **Method Blank**

   Method blanks were free of contamination at the Reporting Limit.

4. **Surrogate recovery**

   Surrogate recoveries in samples L142-05T, 06T, 06J, 07T and 07I were diluted out. All surrogate recoveries in other samples were within QC limits.

5. **Lab Control Sample / Lab Control Duplicate**

   All recoveries were within QC limits.

6. **Matrix Spike/Matrix Spike Duplicate**

   No sample was spiked.

7. **Sample Analysis**

   Sample analyses were within QC requirements. Quantitation is from the primary column. All positive results above RL were confirmed by LC-CN column and the confirmation is presumptive because it was based on retention time window.

   Samples were air-dried prior to extraction; hence, no moisture correction was applied to RL, MDL and results.

   Sample L142-06 could only be analyzed as a dilution due to dark discoloration of sample extract.

LAB CHRONICLE
EXPLOSIVES

Client : SHAW E&I
Project : LONGHORN ARMY AMMUNITION PLANT

SDG NO. : 04L142
Instrument ID : T081

SOIL

Client Sample ID	Laboratory Sample ID	Dilution Factor	% Moist	Analysis DateTime	Extraction DateTime	Sample Data FN	Calibration Data FN	Prep. Batch	Notes
MBLK1S	EXL005SB	1	NA	12/21/0417:34	12/20/0417:30	XL21013A	XL21012A	EXL005S	Method Blank
LCS1S	EXL005SL	1	NA	12/21/0418:03	12/20/0417:30	XL21014A	XL21012A	EXL005S	Lab Control Sample (LCS)
29SB81-001	L142-01	1	NA	12/22/0402:13	12/20/0417:30	XL21031A	XL21030A	EXL005S	Field Sample
29SB81-002	L142-02	1	NA	12/22/0402:42	12/20/0417:30	XL21032A	XL21030A	EXL005S	Field Sample
29SD38-MH07	L142-03	1	NA	12/22/0407:59	12/20/0417:30	XL21043A	XL21042A	EXL005S	Field Sample
29SD39-MH08	L142-04	1	NA	12/22/0408:57	12/20/0417:30	XL21045A	XL21042A	EXL005S	Field Sample
29SD41-MH10	L142-05	1	NA	12/22/0409:26	12/20/0417:30	XL21046A	XL21042A	EXL005S	Field Sample
29SD41-MH10DL	L142-05T	10	NA	12/22/0405:35	12/20/0417:30	XL21038A	XL21030A	EXL005S	Diluted Sample
29SD46	L142-06T	10	NA	12/22/0406:32	12/20/0417:30	XL21040A	XL21030A	EXL005S	Diluted Sample
29SD46DL	L142-06J	5000	NA	12/22/0410:23	12/20/0417:30	XL21048A	XL21042A	EXL005S	Diluted Sample
					✓			✓	

WATER

Client Sample ID	Laboratory Sample ID	Dilution Factor	% Moist	Analysis DateTime	Extraction DateTime	Sample Data FN	Calibration Data FN	Prep. Batch	Notes
MBLK1W	EXL004WB	1	NA	12/20/0418:27	12/20/0413:00	XL20004A	XL20003A	EXL004W	Method Blank
LCS1W	EXL004WL	1	NA	12/20/0418:56	12/20/0413:00	XL20005A	XL20003A	EXL004W	Lab Control Sample (LCS)
LCD1W	EXL004WC	1	NA	12/20/0419:24	12/20/0413:00	XL20006A	XL20003A	EXL004W	LCS Duplicate
29SW46	L142-07	1	NA	12/20/0420:51	12/20/0413:00	XL20009A	XL20003A	EXL004W	Field Sample
29SW46DL1	L142-07T	10	NA	12/21/0416:08	12/20/0413:00	XL21010A	XL21002A	EXL004W	Diluted Sample
29SW46DL2	L142-07I	100	NA	12/21/0415:39	12/20/0413:00	XL21009A	XL21002A	EXL004W	Diluted Sample
					✓			✓	

FN - Filename
% Moist - Percent Moisture

SAMPLE RESULTS

EPA METHOD 8330
EXPLOSIVES

Client	: SHAW E&I	Date Collected:	12/16/04
Project	: LONGHORN ARMY AMMUNITION PLANT	Date Received:	12/17/04
Batch No.	: 04L142	Date Extracted:	12/20/04 17:30
Sample ID:	29SB81-001	Date Analyzed:	12/22/04 02:13
Lab Samp ID:	L142-01	Dilution Factor:	1
Lab File ID:	XL21031A	Matrix	: SOIL
Ext Btch ID:	EXL005S	% Moisture	: NA
Calib. Ref.:	XL21030A	Instrument ID	: T-081

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	400	200
RDX	ND	400	200
1,3,5-TNB	ND	400	200
1,3-DNB	ND	400	200
TETRYL	ND	400	200
NITROBENZENE	ND	400	200
2,4,6-TNT	ND	400	200
4-AM-2,6-DNT	ND	400	200
2-AM-4,6-DNT	ND	400	200
2,6-DNT	ND	400	200
2,4-DNT	ND	400	200
2-NITROTOLUENE	ND	400	200
3-NITROTOLUENE	ND	400	200
4-NITROTOLUENE	ND	400	200

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	101	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

Client	: SHAW E&I	Date Collected:	12/16/04
Project	: LONGHORN ARMY AMMUNITION PLANT	Date Received:	12/17/04
Batch No.	: 04L142	Date Extracted:	12/20/04 17:30
Sample ID:	29SB81-002	Date Analyzed:	12/22/04 02:42
Lab Samp ID:	L142-02	Dilution Factor:	1
Lab File ID:	XL21032A	Matrix	: SOIL ✓
Ext Btch ID:	EXL005S	% Moisture	: NA
Calib. Ref.:	XL21030A	Instrument ID	: T-081

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	400	200
RDX	ND	400	200
1,3,5-TNB	ND	400	200
1,3-DNB	ND	400	200
TETRYL	ND	400	200
NITROBENZENE	ND	400	200
2,4,6-TNT	ND	400	200
4-AM-2,6-DNT	ND	400	200
2-AM-4,6-DNT	ND	400	200
2,6-DNT	ND	400	200
2,4-DNT	ND	400	200
2-NITROTOLUENE	ND	400	200
3-NITROTOLUENE	ND	400	200
4-NITROTOLUENE	ND	400	200

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	102	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

Client	: SHAW E&I	Date Collected:	12/16/04
Project	: LONGHORN ARMY AMMUNITION PLANT	Date Received:	12/17/04
Batch No.	: 04L142	Date Extracted:	12/20/04 17:30
Sample ID:	29SD38-MH07	Date Analyzed:	12/22/04 07:59
Lab Samp ID:	L142-03	Dilution Factor:	1
Lab File ID:	XL21043A	Matrix :	SOIL
Ext Btch ID:	EXL005S	% Moisture :	NA
Calib. Ref.:	XL21042A	Instrument ID :	T-081

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	400	200
RDX	ND	400	200
1,3,5-TNB	ND	400	200
1,3-DNB	ND	400	200
TETRYL	ND	400	200
NITROBENZENE	ND	400	200
2,4,6-TNT	630	400	200
4-AM-2,6-DNT	ND	400	200
2-AM-4,6-DNT	ND	400	200
2,6-DNT	ND	400	200
2,4-DNT	ND	400	200
2-NITROTOLUENE	ND	400	200
3-NITROTOLUENE	ND	400	200
4-NITROTOLUENE	ND	400	200

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	102	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

Client	: SHAW E&I	Date Collected:	12/16/04
Project	: LONGHORN ARMY AMMUNITION PLANT	Date Received:	12/17/04
Batch No.	: 04L142	Date Extracted:	12/20/04 17:30
Sample ID:	29SD39-MH08	Date Analyzed:	12/22/04 08:57
Lab Samp ID:	L142-04	Dilution Factor:	1
Lab File ID:	XL21045A	Matrix	: SOIL
Ext Btch ID:	EXL005S	% Moisture	: NA
Calib. Ref.:	XL21042A	Instrument ID	: T-081

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	400	200
RDX	ND	400	200
1,3,5-TNB	ND	400	200
1,3-DNB	ND	400	200
TETRYL	ND	400	200
NITROBENZENE	ND	400	200
2,4,6-TNT	5500	400	200
4-AM-2,6-DNT	880	400	200
2-AM-4,6-DNT	1200	400	200
2,6-DNT	300J	400	200
2,4-DNT	710	400	200
2-NITROTOLUENE	ND	400	200
3-NITROTOLUENE	ND	400	200
4-NITROTOLUENE	ND	400	200

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	104	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

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==============================================================================
Client      : SHAW E&I                        Date  Collected: 12/16/04
Project     : LONGHORN ARMY AMMUNITION PLANT  Date   Received: 12/17/04
Batch No.   : 04L142                          Date  Extracted: 12/20/04 17:30
Sample   ID: 29SD41-MH10                      Date   Analyzed: 12/22/04 09:26
Lab Samp ID: L142-05                          Dilution Factor: 1
Lab File ID: XL21046A                         Matrix         : SOIL
Ext Btch ID: EXL005S                          % Moisture     : NA
Calib. Ref.: XL21042A                         Instrument ID  : T-081
==============================================================================
```

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	400	200
RDX	ND	400	200
1,3,5-TNB	ND	400	200
1,3-DNB	ND	400	200
TETRYL	ND	400	200
NITROBENZENE	ND	400	200
2,4,6-TNT	7000	400	200
4-AM-2,6-DNT	7800	400	200
2-AM-4,6-DNT	9200E	400	200
2,6-DNT	240J	400	200
2,4-DNT	1100	400	200
2-NITROTOLUENE	ND	400	200
3-NITROTOLUENE	ND	400	200
4-NITROTOLUENE	ND	400	200

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	101	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

Client	: SHAW E&I	Date Collected:	12/16/04
Project	: LONGHORN ARMY AMMUNITION PLANT	Date Received:	12/17/04
Batch No.	: 04L142	Date Extracted:	12/20/04 17:30
Sample ID:	29SD41-MH10DL	Date Analyzed:	12/22/04 05:35
Lab Samp ID:	L142-05T	Dilution Factor:	10
Lab File ID:	XL21038A	Matrix	: SOIL
Ext Btch ID:	EXL005S	% Moisture	: NA
Calib. Ref.:	XL21030A	Instrument ID	: T-081

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	4000	2000
RDX	ND	4000	2000
1,3,5-TNB	ND	4000	2000
1,3-DNB	ND	4000	2000
TETRYL	ND	4000	2000
NITROBENZENE	ND	4000	2000
2,4,6-TNT	7300	4000	2000
4-AM-2,6-DNT	7800	4000	2000
2-AM-4,6-DNT	9000	4000	2000
2,6-DNT	ND	4000	2000
2,4-DNT	ND	4000	2000
2-NITROTOLUENE	ND	4000	2000
3-NITROTOLUENE	ND	4000	2000
4-NITROTOLUENE	ND	4000	2000

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	DO	63-143

Note: All positive results are confirmed by CN column
DO: Diluted Out

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                         EPA METHOD 8330
                           EXPLOSIVES

==============================================================================
Client      : SHAW E&I                          Date  Collected: 12/16/04
Project     : LONGHORN ARMY AMMUNITION PLANT    Date   Received: 12/17/04
Batch No.   : 04L142                            Date  Extracted: 12/20/04 17:30
Sample   ID: 29SD46                             Date   Analyzed: 12/22/04 06:32
Lab Samp ID: L142-06T                           Dilution Factor: 10
Lab File ID: XL21040A                           Matrix         : SOIL
Ext Btch ID: EXL005S                            % Moisture     : NA
Calib. Ref.: XL21030A                           Instrument ID  : T-081
==============================================================================

                                         RESULTS         RL             MDL
PARAMETERS                               (ug/kg)     (ug/kg)         (ug/kg)
----------                               -------     -------         -------
HMX                                           ND        4000            2000
RDX                                           ND        4000            2000
1,3,5-TNB                                     ND        4000            2000
1,3-DNB                                       ND        4000            2000
TETRYL                                        ND        4000            2000
NITROBENZENE                                  ND        4000            2000
2,4,6-TNT                              11000000E        4000            2000
4-AM-2,6-DNT                                  ND        4000            2000
2-AM-4,6-DNT                               48000        4000            2000
2,6-DNT                                    15000        4000            2000
2,4-DNT                                 3500000E        4000            2000
2-NITROTOLUENE                                ND        4000            2000
3-NITROTOLUENE                                ND        4000            2000
4-NITROTOLUENE                                ND        4000            2000

SURROGATE PARAMETERS                  % RECOVERY    QC LIMIT
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3,4-DINITROTOLUENE                            DO      63-143

Note:  All positive results are confirmed by CN column
DO: Diluted Out
```

EPA METHOD 8330
EXPLOSIVES

Client	: SHAW E&I	Date Collected:	12/16/04
Project	: LONGHORN ARMY AMMUNITION PLANT	Date Received:	12/17/04
Batch No.	: 04L142	Date Extracted:	12/20/04 17:30
Sample ID:	29SD46DL	Date Analyzed:	12/22/04 10:23
Lab Samp ID:	L142-06J	Dilution Factor:	5000
Lab File ID:	XL21048A	Matrix	: SOIL
Ext Btch ID:	EXL005S	% Moisture	: NA
Calib. Ref.:	XL21042A	Instrument ID	: T-081

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	2000000	1000000
RDX	ND	2000000	1000000
1,3,5-TNB	ND	2000000	1000000
1,3-DNB	ND	2000000	1000000
TETRYL	ND	2000000	1000000
NITROBENZENE	ND	2000000	1000000
2,4,6-TNT	26000000	2000000	1000000
4-AM-2,6-DNT	ND	2000000	1000000
2-AM-4,6-DNT	ND	2000000	1000000
2,6-DNT	ND	2000000	1000000
2,4-DNT	8000000	2000000	1000000
2-NITROTOLUENE	ND	2000000	1000000
3-NITROTOLUENE	ND	2000000	1000000
4-NITROTOLUENE	ND	2000000	1000000

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	DO	63-143

Note: All positive results are confirmed by CN column
DO: Diluted Out

EPA METHOD 8330
EXPLOSIVES

Client : SHAW E&I
Project : LONGHORN ARMY AMMUNITION PLANT
Batch No. : 04L142
Sample ID: 29SW46
Lab Samp ID: L142-07
Lab File ID: XL20009A
Ext Btch ID: EXL004W
Calib. Ref.: XL20003A

Date Collected: 12/16/04
Date Received: 12/17/04
Date Extracted: 12/20/04 13:00
Date Analyzed: 12/20/04 20:51
Dilution Factor: 1
Matrix : WATER
% Moisture : NA
Instrument ID : T-081

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
HMX	ND	1	.2
RDX	ND	1	.2
1,3,5-TNB	.73	1	.2
1,3-DNB	ND	1	.2
TETRYL	ND	1	.2
NITROBENZENE	ND	1	.2
2,4,6-TNT	820E	1	.2
4-AM-2,6-DNT	49E	1	.2
2-AM-4,6-DNT	21E	1	.2
2,6-DNT	7.6	1	.2
2,4-DNT	20E	1	.2
2-NITROTOLUENE	ND	1	.2
3-NITROTOLUENE	ND	1	.2
4-NITROTOLUENE	ND	1	.2

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	108	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

Client	SHAW E&I	Date Collected:	12/16/04
Project	LONGHORN ARMY AMMUNITION PLANT	Date Received:	12/17/04
Batch No.	04L142	Date Extracted:	12/20/04 13:00
Sample ID:	29SW46DL1	Date Analyzed:	12/21/04 16:08
Lab Samp ID:	L142-07T	Dilution Factor:	10
Lab File ID:	XL21010A	Matrix	WATER
Ext Btch ID:	EXL004W	% Moisture	NA
Calib. Ref.:	XL21002A	Instrument ID	T-081

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
HMX	ND	10	2
RDX	ND	10	2
1,3,5-TNB	ND	10	2
1,3-DNB	ND	10	2
TETRYL	ND	10	2
NITROBENZENE	ND	10	2
2,4,6-TNT	780E	10	2
4-AM-2,6-DNT	48	10	2
2-AM-4,6-DNT	20	10	2
2,6-DNT	7.1J	10	2
2,4-DNT	19	10	2
2-NITROTOLUENE	ND	10	2
3-NITROTOLUENE	ND	10	2
4-NITROTOLUENE	ND	10	2

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	DO	63-143

Note: All positive results are confirmed by CN column
DO: Diluted Out

EPA METHOD 8330
EXPLOSIVES

Client : SHAW E&I
Project : LONGHORN ARMY AMMUNITION PLANT
Batch No. : 04L142
Sample ID: 29SW46DL2
Lab Samp ID: L142-07I
Lab File ID: XL21009A
Ext Btch ID: EXL004W
Calib. Ref.: XL21002A

Date Collected: 12/16/04
Date Received: 12/17/04
Date Extracted: 12/20/04 13:00
Date Analyzed: 12/21/04 15:39
Dilution Factor: 100
Matrix : WATER
% Moisture : NA
Instrument ID : T-081

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
HMX	ND	100	20
RDX	ND	100	20
1,3,5-TNB	ND	100	20
1,3-DNB	ND	100	20
TETRYL	ND	100	20
NITROBENZENE	ND	100	20
2,4,6-TNT	860	100	20
4-AM-2,6-DNT	47J	100	20
2-AM-4,6-DNT	ND	100	20
2,6-DNT	ND	100	20
2,4-DNT	ND	100	20
2-NITROTOLUENE	ND	100	20
3-NITROTOLUENE	ND	100	20
4-NITROTOLUENE	ND	100	20

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	DO	63-143

Note: All positive results are confirmed by CN column
DO: Diluted Out

QC SUMMARIES

EPA METHOD 8330
EXPLOSIVES

Client : SHAW E&I
Project : LONGHORN ARMY AMMUNITION PLANT
Batch No. : 04L142
Sample ID: MBLK1W
Lab Samp ID: EXL004WB
Lab File ID: XL20004A
Ext Btch ID: EXL004W
Calib. Ref.: XL20003A

Date Collected: NA
Date Received: 12/20/04
Date Extracted: 12/20/04 13:00
Date Analyzed: 12/20/04 18:27
Dilution Factor: 1
Matrix : WATER
% Moisture : NA
Instrument ID : T-081

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
HMX	ND	1	.2
RDX	ND	1	.2
1,3,5-TNB	ND	1	.2
1,3-DNB	ND	1	.2
TETRYL	ND	1	.2
NITROBENZENE	ND	1	.2
2,4,6-TNT	ND	1	.2
4-AM-2,6-DNT	ND	1	.2
2-AM-4,6-DNT	ND	1	.2
2,6-DNT	ND	1	.2
2,4-DNT	ND	1	.2
2-NITROTOLUENE	ND	1	.2
3-NITROTOLUENE	ND	1	.2
4-NITROTOLUENE	ND	1	.2

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	100	63-143

Note: All positive results are confirmed by CN column

EMAX QUALITY CONTROL DATA
LCS/LCD ANALYSIS

CLIENT: SHAW E&I
PROJECT: LONGHORN ARMY AMMUNITION PLANT
BATCH NO.: 04L142
METHOD: EPA 8330

MATRIX:	WATER			% MOISTURE:	NA
DILUTION FACTOR:	1	1	1		
SAMPLE ID:	MBLK1W				
LAB SAMP ID:	EXL004WB	EXL004WL	EXL004WC		
LAB FILE ID:	XL20004A	XL20005A	XL20006A		
DATE EXTRACTED:	12/20/0413:00	12/20/0413:00	12/20/0413:00	DATE COLLECTED:	NA
DATE ANALYZED:	12/20/0418:27	12/20/0418:56	12/20/0419:24	DATE RECEIVED:	12/20/04
PREP. BATCH:	EXL004W	EXL004W	EXL004W		
CALIB. REF:	XL20003A	XL20003A	XL20003A		

ACCESSION:

PARAMETER	BLNK RSLT (ug/L)	SPIKE AMT (ug/L)	BS RSLT (ug/L)	BS % REC	SPIKE AMT (ug/L)	BSD RSLT (ug/L)	BSD % REC	RPD (%)	QC LIMIT (%)	MAX RPD (%)
HMX	ND	4	3.84	96	4	3.99	100	4	70-130	30
RDX	ND	4	3.31	83	4	3.19	80	4	60-130	30
1,3,5-TNB	ND	4	4.03	101	4	4.06	101	1	70-130	30
1,3-DNB	ND	4	3.85	96	4	3.86	96	0	70-130	30
Tetryl	ND	4	4.08	102	4	4.1	102	0	50-140	30
Nitrobenzene	ND	4	3.62	90	4	3.64	91	1	60-130	30
2,4,6-TNT	ND	4	4.18	105	4	4.22	105	1	70-140	30
4-AM-2,6-DNT	ND	4	3.92	98	4	3.92	98	0	70-130	30
2-AM-4,6-DNT	ND	4	4.01	100	4	4.04	101	1	70-130	30
2,6-DNT	ND	4	4.03	101	4	4.07	102	1	70-130	30
2,4-DNT	ND	4	4.13	103	4	4.12	103	0	70-130	30
2-Nitrotoluene	ND	4	3.81	95	4	3.81	95	0	70-130	30
3-Nitrotoluene	ND	4	3.99	100	4	4.02	100	1	70-130	30
4-Nitrotoluene	ND	4	4.02	100	4	4.07	102	1	70-130	30

SURROGATE PARAMETER	SPIKE AMT (ug/L)	BS RSLT (ug/L)	BS % REC	SPIKE AMT (ug/L)	BSD RSLT (ug/L)	BSD % REC	QC LIMIT (%)
3,4-Dinitrotoluene	4	4.09	102	4	4.27	107	70-130

EPA METHOD 8330
EXPLOSIVES

Client	: SHAW E&I	Date Collected	: NA
Project	: LONGHORN ARMY AMMUNITION PLANT	Date Received	: 12/20/04
Batch No.	: 04L142	Date Extracted	: 12/20/04 17:30
Sample ID	: MBLK1S	Date Analyzed	: 12/21/04 17:34
Lab Samp ID	: EXL005SB	Dilution Factor	: 1
Lab File ID	: XL21013A	Matrix	: SOIL
Ext Btch ID	: EXL005S	% Moisture	: NA
Calib. Ref.	: XL21012A	Instrument ID	: T-081

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	400	200
RDX	ND	400	200
1,3,5-TNB	ND	400	200
1,3-DNB	ND	400	200
TETRYL	ND	400	200
NITROBENZENE	ND	400	200
2,4,6-TNT	ND	400	200
4-AM-2,6-DNT	ND	400	200
2-AM-4,6-DNT	ND	400	200
2,6-DNT	ND	400	200
2,4-DNT	ND	400	200
2-NITROTOLUENE	ND	400	200
3-NITROTOLUENE	ND	400	200
4-NITROTOLUENE	ND	400	200

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	103	63-143

Note: All positive results are confirmed by CN column

EMAX QUALITY CONTROL DATA
LCS ANALYSIS

CLIENT: SHAW E&I
PROJECT: LONGHORN ARMY AMMUNITION PLANT
BATCH NO.: 04L142
METHOD: EPA 8330

MATRIX:	SOIL		% MOISTURE:	NA
DILUTION FACTOR:	1	1		
SAMPLE ID:	MBLK1S			
LAB SAMP ID:	EXL005SB	EXL005SL		
LAB FILE ID:	XL21013A	XL21014A		
DATE EXTRACTED:	12/20/0417:30	12/20/0417:30	DATE COLLECTED:	NA
DATE ANALYZED:	12/21/0417:34	12/21/0418:03	DATE RECEIVED:	12/20/04
PREP. BATCH:	EXL005S	EXL005S		
CALIB. REF:	XL21012A	XL21012A		

ACCESSION:

PARAMETER	BLNK RSLT (ug/kg)	SPIKE AMT (ug/kg)	BS RSLT (ug/kg)	BS % REC	QC LIMIT (%)
HMX	ND	2000	2110	106	70-140
RDX	ND	2000	2100	105	70-140
1,3,5-TNB	ND	2000	2180	109	70-130
1,3-DNB	ND	2000	2180	109	70-130
Tetryl	ND	2000	2080	104	60-140
Nitrobenzene	ND	2000	2190	109	70-130
2,4,6-TNT	ND	2000	2180	109	70-140
4-AM-2,6-DNT	ND	2000	2160	108	70-130
2-AM-4,6-DNT	ND	2000	2170	109	70-130
2,6-DNT	ND	2000	2120	106	70-140
2,4-DNT	ND	2000	2140	107	70-130
2-Nitrotoluene	ND	2000	2000	100	70-130
3-Nitrotoluene	ND	2000	2090	105	70-130
4-Nitrotoluene	ND	2000	2090	105	70-130

SURROGATE PARAMETER	SPIKE AMT (ug/kg)	BS RSLT (ug/kg)	BS % REC	QC LIMIT (%)
3,4-Dinitrotoluene	2000	2260	113	70-130

INITIAL CALIBRATION

INITIAL CALIBRATION
METHOD 8330

Lab Name : EMAX Inc
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
LFID & Datetime: XJ19016A 10/19/04 19:08
LFID & Datetime: XJ19017A 10/19/04 19:36
LFID & Datetime: XJ19013A 10/19/04 17:41
LFID & Datetime: XJ19014A 10/19/04 18:10
LFID & Datetime: XJ19015A 10/19/04 18:39
CONC UNIT: ppb

COMPOUND	CONC X	CALIBRATION FACTORS (AREA or HEIGHT)/UNIT 1.00X	5.00X	10.00X	20.00X	40.00X	MEAN	%RSD
HMX	20.00	69.25	67.82	72.36	72.87	71.66	70.79	3.1
RDX	20.00	80.55	89.55	93.32	92.82	91.48	89.54	5.8
1,3,5-TNB	20.00	212.60	206.29	208.40	210.28	208.06	209.13	1.1
1,3-DNB	20.00	284.05	289.17	293.78	291.57	290.36	289.79	1.3
Tetryl	20.00	169.65	165.60	171.93	171.00	171.53	169.94	1.5
Nitrobenzene	20.00	196.75	195.67	202.54	203.55	201.64	200.03	1.8
2,4,6-TNT	20.00	206.40	200.92	203.90	208.44	205.06	204.94	1.4
4-AM-2,6-DNT	20.00	156.75	144.28	146.21	146.58	146.43	148.05	3.3
2-AM-4,6-DNT	20.00	229.95	205.98	210.31	215.07	216.25	215.51	4.2
2,6-DNT	20.00	137.60	131.99	135.36	140.29	135.29	136.11	2.3
2,4-DNT	20.00	276.20	270.64	273.11	277.46	281.68	275.82	1.5
2-Nitrotoluene	20.00	130.40	127.75	127.93	129.28	128.10	128.69	0.9
4-Nitrotoluene	20.00	104.40	103.10	107.11	109.25	110.43	106.86	2.9
3-Nitrotoluene	20.00	132.95	130.43	138.71	137.68	140.89	136.13	3.2
SURROGATE	X	1.00X	5.00X	10.00X	20.00X	40.00X	MEAN	%RSD
3,4-Dinitrotoluene	20.00	117.40	121.21	124.62	126.61	126.82	123.33	3.2

EX81J19.MET

CA 6021
10/25/04

INITIAL CALIBRATION
METHOD 8330

Lab Name : EMAX Inc
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
LFID & Datetime: XJ19016A 10/19/04 19:08
LFID & Datetime: XJ19017A 10/19/04 19:36
LFID & Datetime: XJ19013A 10/19/04 17:41
LFID & Datetime: XJ19014A 10/19/04 18:10
LFID & Datetime: XJ19015A 10/19/04 18:39

COMPOUND	RT OF STANDARDS (MIN) 1.0X	5.0X	10.0X	20.0X	40.0X	MEAN RT	RT WINDOW FROM	TO	RTWINDOW WIDTH
HMX	4.300	4.292	4.292	4.292	4.275	4.290	4.240	4.340	0.050
RDX	6.433	6.383	6.367	6.375	6.333	6.378	6.240	6.516	0.138
1,3,5-TNB	8.650	8.617	8.600	8.633	8.575	8.615	8.462	8.768	0.153
1,3-DNB	10.492	10.450	10.417	10.483	10.400	10.448	10.219	10.677	0.229
Tetryl	11.358	11.308	11.250	11.342	11.250	11.302	11.014	11.590	0.288
Nitrobenzene	12.117	12.092	12.042	12.108	12.033	12.078	11.677	12.479	0.401
2,4,6-TNT	13.675	13.642	13.567	13.642	13.575	13.620	13.219	14.021	0.401
4-AM-2,6-DNT	14.433	14.392	14.292	14.383	14.308	14.362	13.857	14.867	0.505
2-AM-4,6-DNT	14.967	14.983	14.867	14.950	14.883	14.930	14.382	15.478	0.548
2,6-DNT	15.817	15.825	15.742	15.800	15.758	15.788	15.325	16.251	0.463
2,4-DNT	16.383	16.425	16.317	16.367	16.350	16.368	15.891	16.845	0.477
2-Nitrotoluene	19.467	19.525	19.442	19.458	19.467	19.472	18.881	20.063	0.591
4-Nitrotoluene	21.192	21.225	21.150	21.175	21.142	21.177	20.520	21.834	0.657
3-Nitrotoluene	22.658	22.717	22.592	22.633	22.600	22.640	21.888	23.392	0.752
SURROGATE	1.0X	5.0X	10.0X	20.0X	40.0X	RT	FROM	TO	WIDTH
3,4-Dinitrotoluene	12.900	12.858	12.792	12.875	12.792	12.843	12.468	13.218	0.375

EX81J19.MET

RA
10/25/04

SECOND SOURCE

INITIAL CALIBRATION VERIFICATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: XJ19014A 10/19/2004 18:10
Conc Cont LFID & Datetime: XJ19018A 10/19/2004 20:05
CONC UNIT : ppb ✓

COMPOUND	RT MINUTES	RT WINDOW FROM	RT WINDOW TO	TRUE CONC	AVERAGE CF	RESULT AREA	RESULT CONC	%D	QL	%D LIMITS
HMX	4.300	4.250	4.350	400.0	70.800	31158	440.13	10		15
RDX	6.400	6.262	6.538	400.0	89.500	38533	430.32	8		15
1,3,5-TNB	8.642	8.489	8.795	400.0	209.100	91920	439.54	10		15
1,3-DNB	10.483	10.254	10.712	400.0	289.800	127403	439.64	10		15
Tetryl	11.342	11.054	11.630	400.0	169.900	71202	418.98	5		15
Nitrobenzene	12.108	11.707	12.509	400.0	200.000	86805	433.96	8		15
2,4,6-TNT	13.625	13.224	14.026	400.0	204.900	88599	432.31	8		15
4-AM-2,6-DNT	14.400	13.895	14.905	400.0	148.100	60914	411.44	3		15
2-AM-4,6-DNT	14.950	14.402	15.498	400.0	215.500	91200	423.18	6		15
2,6-DNT	15.800	15.337	16.263	400.0	136.100	56248	413.27	3		15
2,4-DNT	16.383	15.906	16.860	400.0	275.800	117421	425.72	6		15
2-Nitrotoluene	19.475	18.884	20.066	400.0	128.700	53460	415.40	4		15
4-Nitrotoluene	21.192	20.535	21.849	400.0	106.900	46579	435.89	9		15
3-Nitrotoluene	22.667	21.915	23.419	400.0	136.100	57575	422.93	6		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-Dinitrotoluene	12.875	12.500	13.250	400.0	123.300	52174	423.04	6		15

EX81J19.MET ✓

6024

dt
10/25/04

INITIAL CALIBRATION
METHOD 8330

Lab Name : EMAX Inc
Instrument ID : HPLC1 LCT001(T017)
GC Columm : LUNA 5U PHENYL-HEXYL
Column size ID : 25CMX4.6MM
LFID & Datetime: PH17007A 08/17/04 16:21
LFID & Datetime: PH17003A 08/17/04 13:35
LFID & Datetime: PH17004A 08/17/04 14:16
LFID & Datetime: PH17005A 08/17/04 14:58
LFID & Datetime: PH17006A 08/17/04 15:39
CONC UNIT: ppb

COMPOUND	CONC X	CALIBRATION FACTORS (AREA or HEIGHT)/UNIT 1.00X	5.00X	10.00X	20.00X	40.00X	MEAN	%RSD
HMX	20.00	265.05	223.86	243.86	247.42	244.74	244.99	6.0
RDX	20.00	315.15	255.37	260.41	253.93	258.37	268.65	9.7
Nitrobenzene	20.00	359.70	349.71	329.86	323.97	326.71	337.99	4.7
1,3-DNB	20.00	514.05	508.34	520.54	516.70	515.48	515.02	0.9
2-Nitrotoluene	20.00	238.50	278.15	281.94	287.52	281.20	273.46	7.3
4-Nitrotoluene	20.00	287.00	275.75	289.34	288.21	284.04	284.87	1.9
4-AM-2,6-DNT	20.00	276.50	256.61	256.86	264.78	254.15	261.78	3.5
3-Nitrotoluene	20.00	353.75	380.73	345.64	344.94	337.55	352.52	4.8
2-AM-4,6-DNT	20.00	464.60	447.94	400.02	400.57	393.79	421.38	7.7
1,3,5-TNB	20.00	368.85	364.11	349.42	354.06	340.07	355.30	3.2
2,6-DNT	20.00	258.20	256.25	261.51	248.39	253.99	255.67	1.9
2,4-DNT	20.00	433.50	511.11	524.55	509.46	513.54	498.43	7.4
Tetryl	20.00	511.65	504.42	558.66	520.24	525.23	524.04	4.0
2,4,6-TNT	20.00	421.55	507.22	574.38	536.85	548.40	517.68	11.4
SURROGATE	X	1.00X	5.00X	10.00X	20.00X	40.00X	MEAN	%RSD
3,4-DNT	20.00	288.40	260.85	245.15	244.29	241.54	256.04	7.7

EX17H17C.MET

FORM VI EX -2 1/96

RX
8/20/04

INITIAL CALIBRATION
METHOD 8330

Lab Name : EMAX Inc
Instrument ID : HPLC1 LCT001(T017)
GC Column : LUNA 5U PHENYL-HEXYL
Column size ID : 25CMX4.6MM
LFID & Datetime: PH17007A 08/17/04 16:21
LFID & Datetime: PH17003A 08/17/04 13:35
LFID & Datetime: PH17004A 08/17/04 14:16
LFID & Datetime: PH17005A 08/17/04 14:58
LFID & Datetime: PH17006A 08/17/04 15:39

	RT OF STANDARDS (MIN)					MEAN	RT WINDOW		RTWINDOW
COMPOUND	1.0X	5.0X	10.0X	20.0X	40.0X	RT	FROM	TO	WIDTH
HMX	6.025	6.050	6.042	6.058	6.033	6.042	5.962	6.122	0.080
RDX	7.800	7.817	7.817	7.833	7.792	7.812	7.708	7.916	0.104
Nitrobenzene	10.633	10.675	10.667	10.692	10.633	10.660	10.556	10.764	0.104
1,3-DNB	15.183	15.258	15.258	15.292	15.175	15.233	14.872	15.594	0.361
2-Nitrotoluene	15.725	15.783	15.767	15.817	15.692	15.757	15.497	16.017	0.260
4-Nitrotoluene	16.225	16.342	16.342	16.375	16.258	16.308	16.018	16.598	0.290
4-AM-2,6-DNT	16.950	17.108	17.108	17.150	17.000	17.063	16.500	17.626	0.563
3-Nitrotoluene	17.700	17.800	17.775	17.825	17.700	17.760	17.393	18.127	0.367
2-AM-4,6-DNT	18.925	19.125	19.125	19.175	19.025	19.075	18.317	19.833	0.758
1,3,5-TNB	20.142	20.267	20.267	20.317	20.200	20.239	19.626	20.852	0.613
2,6-DNT	21.517	21.642	21.650	21.683	21.558	21.610	20.886	22.334	0.724
2,4-DNT	22.733	22.825	22.892	22.942	22.800	22.838	22.041	23.635	0.797
Tetryl	31.667	31.808	31.850	31.875	31.617	31.763	30.113	33.413	1.650
2,4,6-TNT	33.233	33.367	33.358	33.375	33.150	33.297	31.954	34.640	1.343
SURROGATE	1.0X	5.0X	10.0X	20.0X	40.0X	RT	FROM	TO	WIDTH
3,4-DNT	18.492	18.650	18.600	18.675	18.525	18.588	18.055	19.121	0.533

EX17H17C.MET

RK 8/20/04

DAILY CALIBRATION

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: XJ19014A 10/19/2004 18:10
Conc Cont LFID & Datetime: XL20003A 12/20/2004 17:58
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	RT WINDOW TO	TRUE CONC	AVERAGE CF	RESULT AREA	RESULT CONC	%D	QL	%D LIMITS
HMX	4.292	4.242	4.342	400.0	70.800	28461	402.03	1		15
RDX	6.300	6.162	6.438	400.0	89.500	35641	398.02	-0		15
1,3,5-TNB	8.500	8.347	8.653	400.0	209.100	83199	397.84	-1		15
1,3-DNB	10.250	10.021	10.479	400.0	289.800	115929	400.05	0		15
Tetryl	11.000	10.712	11.288	400.0	169.900	68123	400.86	0		15
Nitrobenzene	11.792	11.391	12.193	400.0	200.000	80732	403.60	1		15
2,4,6-TNT	13.300	12.899	13.701	400.0	204.900	80648	393.51	-2		15
4-AM-2,6-DNT	13.875	13.370	14.380	400.0	148.100	60372	407.78	2		15
2-AM-4,6-DNT	14.408	13.860	14.956	400.0	215.500	86596	401.82	0		15
2,6-DNT	15.358	14.895	15.821	400.0	136.100	55446	407.37	2		15
2,4-DNT	15.908	15.431	16.385	400.0	275.800	111329	403.63	1		15
2-Nitrotoluene	18.875	18.284	19.466	400.0	128.700	51626	401.15	0		15
4-Nitrotoluene	20.425	19.768	21.082	400.0	106.900	45124	422.27	6		15
3-Nitrotoluene	21.842	21.090	22.594	400.0	136.100	57301	420.92	5		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-Dinitrotoluene	12.517	12.142	12.892	400.0	123.300	50724	411.28	3		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: XJ19014A 10/19/2004 18:10
Conc Cont LFID & Datetime: XL20015A 12/20/2004 23:44
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	RT WINDOW TO	TRUE CONC	AVERAGE CF	RESULT AREA	RESULT CONC	%D	QL	%D LIMITS
HMX	4.333	4.283	4.383	400.0	70.800	29272	413.49	3		15
RDX	6.408	6.270	6.546	400.0	89.500	38105	425.54	6		15
1,3,5-TNB	8.642	8.489	8.795	400.0	209.100	85122	407.03	2		15
1,3-DNB	10.467	10.238	10.696	400.0	289.800	119721	413.14	3		15
Tetryl	11.275	10.987	11.563	400.0	169.900	69968	411.72	3		15
Nitrobenzene	12.042	11.641	12.443	400.0	200.000	82996	414.92	4		15
2,4,6-TNT	13.592	13.191	13.993	400.0	204.900	84236	411.02	3		15
4-AM-2,6-DNT	14.333	13.828	14.838	400.0	148.100	61879	417.96	4		15
2-AM-4,6-DNT	14.875	14.327	15.423	400.0	215.500	87276	404.97	1		15
2,6-DNT	15.750	15.287	16.213	400.0	136.100	57777	424.50	6		15
2,4-DNT	16.325	15.848	16.802	400.0	275.800	113421	411.21	3		15
2-Nitrotoluene	19.358	18.767	19.949	400.0	128.700	52495	407.90	2		15
4-Nitrotoluene	20.983	20.326	21.640	400.0	106.900	46819	438.13	10		15
3-Nitrotoluene	22.450	21.698	23.202	400.0	136.100	57711	423.93	6		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-Dinitrotoluene	12.850	12.475	13.225	400.0	123.300	51463	417.27	4		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: XJ19014A 10/19/2004 18:10
Conc Cont LFID & Datetime: XL21002A 12/21/2004 12:17
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	TO	TRUE CONC	AVERAGE CF	RESULT AREA	CONC	%D	QL	%D LIMITS
HMX	4.308	4.258	4.358	400.0	70.800	28235	398.84	-0		15
RDX	6.342	6.204	6.480	400.0	89.500	36063	402.74	1		15
1,3,5-TNB	8.550	8.397	8.703	400.0	209.100	82108	392.62	-2		15
1,3-DNB	10.325	10.096	10.554	400.0	289.800	115534	398.69	-0		15
Tetryl	11.108	10.820	11.396	400.0	169.900	67938	399.77	-0		15
Nitrobenzene	11.875	11.474	12.276	400.0	200.000	79947	399.67	-0		15
2,4,6-TNT	13.400	12.999	13.801	400.0	204.900	80421	392.40	-2		15
4-AM-2,6-DNT	14.033	13.528	14.538	400.0	148.100	59823	404.07	1		15
2-AM-4,6-DNT	14.558	14.010	15.106	400.0	215.500	84462	391.91	-2		15
2,6-DNT	15.492	15.029	15.955	400.0	136.100	54767	402.38	1		15
2,4-DNT	16.033	15.556	16.510	400.0	275.800	110265	399.77	-0		15
2-Nitrotoluene	19.008	18.417	19.599	400.0	128.700	51046	396.64	-1		15
4-Nitrotoluene	20.592	19.935	21.249	400.0	106.900	45322	424.12	6		15
3-Nitrotoluene	22.008	21.256	22.760	400.0	136.100	56862	417.70	4		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-Dinitrotoluene	12.633	12.258	13.008	400.0	123.300	49767	403.52	1		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: XJ19014A 10/19/2004 18:10
Conc Cont LFID & Datetime: XL21012A 12/21/2004 17:05
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	RT WINDOW TO	TRUE CONC	AVERAGE CF	RESULT AREA	RESULT CONC	%D	QL	%D LIMITS
HMX	4.300	4.250	4.350	400.0	70.800	28637	404.52	1		15
RDX	6.325	6.187	6.463	400.0	89.500	35492	396.36	-1		15
1,3,5-TNB	8.525	8.372	8.678	400.0	209.100	83787	400.65	0		15
1,3-DNB	10.283	10.054	10.512	400.0	289.800	116602	402.37	1		15
Tetryl	11.033	10.745	11.321	400.0	169.900	68756	404.58	1		15
Nitrobenzene	11.833	11.432	12.234	400.0	200.000	81307	406.47	2		15
2,4,6-TNT	13.350	12.949	13.751	400.0	204.900	80995	395.20	-1		15
4-AM-2,6-DNT	13.925	13.420	14.430	400.0	148.100	61989	418.70	5		15
2-AM-4,6-DNT	14.442	13.894	14.990	400.0	215.500	85780	398.03	-0		15
2,6-DNT	15.417	14.954	15.880	400.0	136.100	55335	406.56	2		15
2,4-DNT	15.950	15.473	16.427	400.0	275.800	111179	403.09	1		15
2-Nitrotoluene	18.933	18.342	19.524	400.0	128.700	51488	400.08	0		15
4-Nitrotoluene	20.508	19.851	21.165	400.0	106.900	44634	417.68	4		15
3-Nitrotoluene	21.917	21.165	22.669	400.0	136.100	57110	419.52	5		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-Dinitrotoluene	12.575	12.200	12.950	400.0	123.300	51157	414.79	4		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: XJ19014A 10/19/2004 18:10
Conc Cont LFID & Datetime: XL21021A 12/21/2004 21:25
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	RT WINDOW TO	TRUE CONC	AVERAGE CF	RESULT AREA	RESULT CONC	%D	QL	%D LIMITS
HMX	4.333	4.283	4.383	400.0	70.800	29529	417.12	4		15
RDX	6.408	6.270	6.546	400.0	89.500	36651	409.30	2		15
1,3,5-TNB	8.642	8.489	8.795	400.0	209.100	83931	401.34	0		15
1,3-DNB	10.458	10.229	10.687	400.0	289.800	118138	407.67	2		15
Tetryl	11.258	10.970	11.546	400.0	169.900	68631	403.85	1		15
Nitrobenzene	12.033	11.632	12.434	400.0	200.000	81515	407.51	2		15
2,4,6-TNT	13.583	13.182	13.984	400.0	204.900	82418	402.15	1		15
4-AM-2,6-DNT	14.300	13.795	14.805	400.0	148.100	60872	411.15	3		15
2-AM-4,6-DNT	14.850	14.302	15.398	400.0	215.500	85539	396.91	-1		15
2,6-DNT	15.733	15.270	16.196	400.0	136.100	56026	411.63	3		15
2,4-DNT	16.308	15.831	16.785	400.0	275.800	111103	402.81	1		15
2-Nitrotoluene	19.342	18.751	19.933	400.0	128.700	52850	410.66	3		15
4-Nitrotoluene	20.992	20.335	21.649	400.0	106.900	43058	402.94	1		15
3-Nitrotoluene	22.442	21.690	23.194	400.0	136.100	56680	416.36	4		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-Dinitrotoluene	12.833	12.458	13.208	400.0	123.300	50526	409.68	2		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: XJ19014A 10/19/2004 18:10
Conc Cont LFID & Datetime: XL21030A 12/22/2004 01:44
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	RT WINDOW TO	TRUE CONC	AVERAGE CF	RESULT AREA	RESULT CONC	%D	QL	%D LIMITS
HMX	4.358	4.308	4.408	400.0	70.800	28761	406.27	2		15
RDX	6.475	6.337	6.613	400.0	89.500	36851	411.54	3		15
1,3,5-TNB	8.717	8.564	8.870	400.0	209.100	85213	407.47	2		15
1,3-DNB	10.583	10.354	10.812	400.0	289.800	118482	408.86	2		15
Tetryl	11.425	11.137	11.713	400.0	169.900	68419	402.60	1		15
Nitrobenzene	12.183	11.782	12.584	400.0	200.000	82651	413.19	3		15
2,4,6-TNT	13.758	13.357	14.159	400.0	204.900	84235	411.01	3		15
4-AM-2,6-DNT	14.583	14.078	15.088	400.0	148.100	60816	410.78	3		15
2-AM-4,6-DNT	15.158	14.610	15.706	400.0	215.500	86030	399.19	-0		15
2,6-DNT	15.992	15.529	16.455	400.0	136.100	57301	421.00	5		15
2,4-DNT	16.567	16.090	17.044	400.0	275.800	111937	405.83	1		15
2-Nitrotoluene	19.650	19.059	20.241	400.0	128.700	51783	402.37	1		15
4-Nitrotoluene	21.333	20.676	21.990	400.0	106.900	44795	419.19	5		15
3-Nitrotoluene	22.808	22.056	23.560	400.0	136.100	55798	409.88	2		15

SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-Dinitrotoluene	13.025	12.650	13.400	400.0	123.300	50569	410.02	3		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: XJ19014A 10/19/2004 18:10
Conc Cont LFID & Datetime: XL21042A 12/22/2004 07:30
CONC UNIT : ppb

	RT	RT WINDOW		TRUE	AVERAGE	RESULT				%D
COMPOUND	MINUTES	FROM	TO	CONC	CF	AREA	CONC	%D	QL	LIMITS
HMX	4.367	4.317	4.417	400.0	70.800	28930	408.65	2		15
RDX	6.500	6.362	6.638	400.0	89.500	36558	408.26	2		15
1,3,5-TNB	8.758	8.605	8.911	400.0	209.100	85438	408.55	2		15
1,3-DNB	10.633	10.404	10.862	400.0	289.800	118329	408.33	2		15
Tetryl	11.492	11.204	11.780	400.0	169.900	68305	401.93	0		15
Nitrobenzene	12.242	11.841	12.643	400.0	200.000	81988	409.88	2		15
2,4,6-TNT	13.825	13.424	14.226	400.0	204.900	83467	407.27	2		15
4-AM-2,6-DNT	14.692	14.187	15.197	400.0	148.100	60261	407.03	2		15
2-AM-4,6-DNT	15.267	14.719	15.815	400.0	215.500	85239	395.52	-1		15
2,6-DNT	16.083	15.620	16.546	400.0	136.100	56754	416.98	4		15
2,4-DNT	16.675	16.198	17.152	400.0	275.800	110980	402.36	1		15
2-Nitrotoluene	19.758	19.167	20.349	400.0	128.700	52534	408.21	2		15
4-Nitrotoluene	21.458	20.801	22.115	400.0	106.900	44762	418.88	5		15
3-Nitrotoluene	22.925	22.173	23.677	400.0	136.100	55440	407.25	2		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-Dinitrotoluene	13.108	12.733	13.483	400.0	123.300	50300	407.84	2		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: XJ19014A 10/19/2004 18:10
Conc Cont LFID & Datetime: XL21049A 12/22/2004 10:52
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	RT WINDOW TO	TRUE CONC	AVERAGE CF	RESULT AREA	RESULT CONC	%D	QL	%D LIMITS
HMX	4.342	4.292	4.392	400.0	70.800	28491	402.45	1		15
RDX	6.433	6.295	6.571	400.0	89.500	35789	399.68	-0		15
1,3,5-TNB	8.675	8.522	8.828	400.0	209.100	82418	394.10	-1		15
1,3-DNB	10.517	10.288	10.746	400.0	289.800	115799	399.60	-0		15
Tetryl	11.333	11.045	11.621	400.0	169.900	66936	393.88	-2		15
Nitrobenzene	12.108	11.707	12.509	400.0	200.000	81062	405.25	1		15
2,4,6-TNT	13.667	13.266	14.068	400.0	204.900	82012	400.17	0		15
4-AM-2,6-DNT	14.433	13.928	14.938	400.0	148.100	60592	409.26	2		15
2-AM-4,6-DNT	14.983	14.435	15.531	400.0	215.500	85034	394.57	-1		15
2,6-DNT	15.867	15.404	16.330	400.0	136.100	56030	411.66	3		15
2,4-DNT	16.433	15.956	16.910	400.0	275.800	110610	401.02	0		15
2-Nitrotoluene	19.500	18.909	20.091	400.0	128.700	51773	402.29	1		15
4-Nitrotoluene	21.158	20.501	21.815	400.0	106.900	43310	405.30	1		15
3-Nitrotoluene	22.617	21.865	23.369	400.0	136.100	54824	402.73	1		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-Dinitrotoluene	12.933	12.558	13.308	400.0	123.300	50308	407.91	2		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 LCT001(T017)
GC Column : LUNA 5U PHENYL-HEXYL
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: PH17005A 08/17/2004 14:58
Conc Cont LFID & Datetime: PL21002A 12/21/2004 14:29
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	RT WINDOW TO	TRUE CONC	AVERAGE CF	RESULT AREA	RESULT CONC	%D	QL	%D LIMITS
HMX	6.125	6.045	6.205	400.0	245.000	97335	397.31	-1		15
RDX	7.933	7.829	8.037	400.0	268.600	100692	374.81	-6		15
Nitrobenzene	10.725	10.621	10.829	400.0	338.000	131155	388.04	-3		15
1,3-DNB	15.442	15.081	15.803	400.0	515.000	191677	372.17	-7		15
2-Nitrotoluene	15.850	15.590	16.110	400.0	273.500	107744	394.00	-2		15
4-Nitrotoluene	16.450	16.160	16.740	400.0	284.900	117212	411.46	3		15
4-AM-2,6-DNT	17.433	16.870	17.996	400.0	261.800	89732	342.78	-14		15
3-Nitrotoluene	17.883	17.516	18.250	400.0	352.500	145090	411.58	3		15
2-AM-4,6-DNT	19.600	18.842	20.358	400.0	421.400	157332	373.37	-7		15
1,3,5-TNB	20.467	19.854	21.080	400.0	355.300	135909	382.52	-4		15
2,6-DNT	21.867	21.143	22.591	400.0	255.700	96515	377.50	-6		15
2,4-DNT	23.225	22.428	24.022	400.0	498.400	200257	401.77	0		15
Tetryl	32.650	31.000	34.300	400.0	524.000	188547	359.79	-10		15
2,4,6-TNT	33.833	32.490	35.176	400.0	517.700	227459	439.38	10		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-DNT	18.908	18.375	19.441	400.0	256.000	92885	362.77	-9		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 LCT001(T017)
GC Column : LUNA 5U PHENYL-HEXYL
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: PH17005A 08/17/2004 14:58
Conc Cont LFID & Datetime: PL21013A 12/21/2004 22:06
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	RT WINDOW TO	TRUE CONC	AVERAGE CF	RESULT AREA	RESULT CONC	%D	QL	%D LIMITS
HMX	6.200	6.120	6.280	400.0	245.000	97276	397.07	-1		15
RDX	8.042	7.938	8.146	400.0	268.600	100724	374.93	-6		15
Nitrobenzene	10.883	10.779	10.987	400.0	338.000	129845	384.17	-4		15
1,3-DNB	15.733	15.372	16.094	400.0	515.000	200479	389.26	-3		15
2-Nitrotoluene	16.150	15.890	16.410	400.0	273.500	105320	385.14	-4		15
4-Nitrotoluene	16.767	16.477	17.057	400.0	284.900	119340	418.93	5		15
4-AM-2,6-DNT	18.058	17.495	18.621	400.0	261.800	93293	356.38	-11		15
3-Nitrotoluene	18.250	17.883	18.617	400.0	352.500	142248	403.51	1		15
2-AM-4,6-DNT	20.108	19.350	20.866	400.0	421.400	160422	380.70	-5		15
1,3,5-TNB	20.933	20.320	21.546	400.0	355.300	139700	393.19	-2		15
2,6-DNT	22.450	21.726	23.174	400.0	255.700	98773	386.33	-3		15
2,4-DNT	23.783	22.986	24.580	400.0	498.400	207335	415.97	4		15
Tetryl	33.750	32.100	35.400	400.0	524.000	184486	352.04	-12		15
2,4,6-TNT	34.808	33.465	36.151	400.0	517.700	238090	459.92	15		15

SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-DNT	19.358	18.825	19.891	400.0	256.000	93389	364.74	-9		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 LCT001(T017)
GC Column : LUNA 5U PHENYL-HEXYL
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: PH17005A 08/17/2004 14:58
Conc Cont LFID & Datetime: PL22002A 12/22/2004 15:43
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	RT WINDOW TO	TRUE CONC	AVERAGE CF	RESULT AREA	RESULT CONC	%D	QL	%D LIMITS
HMX	6.175	6.095	6.255	400.0	245.000	95772	390.93	-2		15
RDX	8.017	7.913	8.121	400.0	268.600	99646	370.92	-7		15
Nitrobenzene	10.892	10.788	10.996	400.0	338.000	128837	381.18	-5		15
1,3-DNB	15.633	15.272	15.994	400.0	515.000	190465	369.82	-8		15
2-Nitrotoluene	16.175	15.915	16.435	400.0	273.500	111705	408.48	2		15
4-Nitrotoluene	16.767	16.477	17.057	400.0	284.900	115471	405.35	1		15
4-AM-2,6-DNT	17.750	17.187	18.313	400.0	261.800	90500	345.71	-14		15
3-Nitrotoluene	18.275	17.908	18.642	400.0	352.500	135227	383.60	-4		15
2-AM-4,6-DNT	19.900	19.142	20.658	400.0	421.400	151825	360.30	-10		15
1,3,5-TNB	20.792	20.179	21.405	400.0	355.300	132191	372.05	-7		15
2,6-DNT	22.325	21.601	23.049	400.0	255.700	86134	336.90	-16	*	15
2,4-DNT	23.658	22.861	24.455	400.0	498.400	190779	382.76	-4		15
Tetryl	33.350	31.700	35.000	400.0	524.000	174767	333.50	-17	*	15
2,4,6-TNT	34.542	33.199	35.885	400.0	517.700	213536	412.49	3		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-DNT	19.300	18.767	19.833	400.0	256.000	88006	343.71	-14		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 LCT001(T017)
GC Columm : LUNA 5U PHENYL-HEXYL
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: PH17005A 08/17/2004 14:58
Conc Cont LFID & Datetime: PL22006A 12/22/2004 18:29
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	TO	TRUE CONC	AVERAGE CF	RESULT AREA	CONC	%D	QL	%D LIMITS
HMX	6.225	6.145	6.305	400.0	245.000	97161	396.60	-1		15
RDX	8.092	7.988	8.196	400.0	268.600	100361	373.58	-7		15
Nitrobenzene	11.017	10.913	11.121	400.0	338.000	128104	379.02	-5		15
1,3-DNB	15.883	15.522	16.244	400.0	515.000	189798	368.52	-8		15
2-Nitrotoluene	16.475	16.215	16.735	400.0	273.500	114963	420.40	5		15
4-Nitrotoluene	17.075	16.785	17.365	400.0	284.900	119765	420.42	5		15
4-AM-2,6-DNT	18.100	17.537	18.663	400.0	261.800	92040	351.59	-12		15
3-Nitrotoluene	18.608	18.241	18.975	400.0	352.500	147422	418.19	5		15
2-AM-4,6-DNT	20.267	19.509	21.025	400.0	421.400	161108	382.33	-4		15
1,3,5-TNB	21.125	20.512	21.738	400.0	355.300	151046	425.12	6		15
2,6-DNT	22.783	22.059	23.507	400.0	255.700	103374	404.33	1		15
2,4-DNT	24.117	23.320	24.914	400.0	498.400	216051	433.46	8		15
Tetryl	34.217	32.567	35.867	400.0	524.000	182304	347.88	-13		15
2,4,6-TNT	35.317	33.974	36.660	400.0	517.700	230791	445.82	11		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-DNT	19.675	19.142	20.208	400.0	256.000	94001	367.13	-8		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 LCT001(T017)
GC Column : LUNA 5U PHENYL-HEXYL
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: PH17005A 08/17/2004 14:58
Conc Cont LFID & Datetime: PL22011A 12/22/2004 21:57
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	RT WINDOW TO	TRUE CONC	AVERAGE CF	RESULT AREA	RESULT CONC	%D	QL	%D LIMITS
HMX	6.383	6.303	6.463	400.0	245.000	95304	389.02	-3		15
RDX	8.333	8.229	8.437	400.0	268.600	100187	372.93	-7		15
Nitrobenzene	11.367	11.263	11.471	400.0	338.000	127211	376.37	-6		15
1,3-DNB	16.417	16.056	16.778	400.0	515.000	197822	384.10	-4		15
2-Nitrotoluene	17.108	16.848	17.368	400.0	273.500	116858	427.33	7		15
4-Nitrotoluene	17.733	17.443	18.023	400.0	284.900	124307	436.37	9		15
4-AM-2,6-DNT	19.108	18.545	19.671	400.0	261.800	93341	356.56	-11		15
3-Nitrotoluene	19.333	18.966	19.700	400.0	352.500	147476	418.34	5		15
2-AM-4,6-DNT	21.242	20.484	22.000	400.0	421.400	157406	373.55	-7		15
1,3,5-TNB	21.908	21.295	22.521	400.0	355.300	139111	391.53	-2		15
2,6-DNT	23.833	23.109	24.557	400.0	255.700	85445	334.20	-16	*	15
2,4-DNT	25.183	24.386	25.980	400.0	498.400	176112	353.33	-12		15
Tetryl	36.167	34.517	37.817	400.0	524.000	173263	330.63	-17	*	15
2,4,6-TNT	37.000	35.657	38.343	400.0	517.700	176240	340.44	-15		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-DNT	20.567	20.034	21.100	400.0	256.000	94695	369.84	-8		15

ANALYTICAL LOGS

ANALYSIS RUN LOG FOR HPLC

conf.
SOP ☑ EMAX-8330 Rev. No: 2 ☐ EMAX-8310 Rev. No: 4 ☐ EMAX-8332 Rev. No: 0 ☐ Book # A17-010

Starting Date: 8/17/04 Time: 12:11 Ending Date: 8/17/04 Time: 23:58

ANALYTICAL BATCH PH17008A

Preparation Batch	Data File Name	Lab Sample ID	DF	Matrix S	Matrix W	Notes
	PH17.001	IB17H658				
	2	EX17H17C-01 20				Not evaluated
	3	02 100				
	4	03 200				8330C Ical
	5	04 400				Phenyl-hexyl column
	6	05 800				
	7	↓ 01 20				
	8	IEX17H17C-01 400				
EXH001S	9	04G156-18T	5			
	10	18DT	5			
	11	18	1			
↓	12	↓ 18D	1			
EXH002W	13	04G092-24T	10			
	14	24DT	↓			
	15	24	1			
↓	16	↓ 24D	↓			
	17	IB				
	↓ 18	CEX17H17C658				

XP 8/17/04

Instrument Number	17

Initial Calibration

Date	08/17/04
met.	EX17H17C
m.p	PH17005A

Standards

Name	ID	Conc. (µg/L)
DCC ID	SHIC-03-47-2	400
Ical Stock	~~833~~ XP 8/17/04 SHIB-03-36-3	1600
ICV	SHIC-03-53-1	400

Solvent ID

Methanol	43206332
Water	43189
Acetonitrile	—

Electronic Data Archival

Location	Date

Comments: Samples disposed off 8/18/04

Analyzed By: XP

This page is checked during the data review process.

EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

ANALYSIS RUN LOG FOR HPLC

SOP ☑ EMAX-8330 Rev. No: 2 ☐ EMAX-8310 Rev. No: 4 ☐ EMAX-8332 Rev. No: 0 ☐ **Book # A81-02-005**

Starting Date: 10/19/04 **Time:** XP 10/19/04 ~~1645~~ 11:27 **Ending Date:** 10/19/04 **Time:** 20:05

EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

ANALYTICAL BATCH NA

Preparation Batch	Data File Name	Lab Sample ID	DF	Matrix (W)	Matrix (S)	Notes
	XJ19.001	TEST				
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10	IB81J614				
NA	11	EX81J1901 20				Not evaluated
	12	02 100				RT shifted
	13	03 200				
	14	04 400				8330 Ical
	15	05 800				(Primary col.)
	16	01 20				
	17	02 100				
	18	IEX81J1901 400				

XP 10/19/04

Instrument Number	81

INITIAL CALIBRATION REFERENCE

Date	10/19/04
Method	EX81J19
Mid Point	XJ19014A (4/5)
ICAL ID	SH18-03-40-3 (800ppb)
ICV ID	SH18-03-36-2 (10ppm)
DCC ID	

Solvents ID

Acetonitrile	
Methanol	43206332
Water	43189

Electronic Data Archival

Location	Date
☐ EZC_5_HPLC	
☐	

Comments: Samples disposed off 10/20/04

Analyzed By: XP.

This page is checked during the data review process.

ANALYSIS RUN LOG FOR HPLC

Book # A81-02-005

SOP ☑ EMAX-8330 Rev. No: 2 ☐ EMAX-8310 Rev. No: 4 ☐ EMAX-8332 Rev. No: 0 ☐

Starting Date: 12/20/04 Time: 17:00 Ending Date: 12/20/04 Time: 23:44

EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

ANALYTICAL BATCH XL20003A

Preparation Batch	Data File Name	Lab Sample ID	DF	Matrix (W)	Matrix (S)	Notes
	XP 12/20/04 ~~XE~~ XL20.001	TEST				
	2	FB812664				
	3	CEX81J19664				800
EXL004W	4	EXL004WB	✓	✓		
	5	L				
	6	C				
	7	04L128-11				E
	8	12				
	9	04L142-07				E
	10	04L145-01				Sat.
	11	Rinse				
EXL004W	12	04L145-02	✓	✓		Sat.
	13	Rinse				
	14					
	15	CEX81J19665				800

XP 12/20/04

Instrument Number	81

INITIAL CALIBRATION REFERENCE

Date	10/19/04
Method	EX81J19
Mid Point	XJ19074A (4/5)
ICAL ID	—
ICV ID	—
DCC ID	SH1C-03-54-2

Solvents ID

Acetonitrile	—
Methanol	43206332
Water	44168

Electronic Data Archival

Location	Date
☐ EZC_5_HPLC	
☐	

Comments: samples disposed off 12/21/04

Analyzed By: XP

This page is checked during the data review process.

ANALYSIS RUN LOG FOR HPLC

SOP ☑ EMAX-8330 Rev. No: 2 ☐ EMAX-8310 Rev. No: 4 ☐ EMAX-8332 Rev. No: 0 ☐ Book # A81-02-005

Starting Date: 12/21/04 Time: 11:48 Ending Date: 12/22/04 Time: 01:44

ANALYTICAL BATCH XL21002A

Preparation Batch	Data File Name	Lab Sample ID	DF	Matrix (W)	Matrix (S)	Notes
	XL21.001	IB81L666				
	2	CEX81J19666				800
EXL004W	3	04L128-11I	50	✓		
	4	↓ 11T	5			
	5	04L145-01I	500			
	6	01T	20			
	7	02I	500			
	8	↓ 02T	20			
	9	04L142-07I	100			
↓	10	↓ 07T	10	↓		
	11	IB				
	12	CEX81J19667				800
EXL005S	13	EXL005SB	1		✓	
	14	↓ L				
	15	04L128-01				
	16	02				
	17	02M				
	18	02S				
↓	19	↓ 03	↓		↓	
	20	IB				
	21	CEX81J19668				800
EXL005S	22	04L128-04	1		✓	
	23	05				
	24	06				
	25	07				
	26	08				
	27	09				
↓	28	↓ 10	↓		↓	
	29	Rinse				
	↓ 30	CEX81J19669				800

Instrument Number	81

INITIAL CALIBRATION REFERENCE

Date	10/19/04
Method	EX81J19
Mid Point	XJ19014A (4/5)
ICAL ID	—
ICV ID	—
DCC ID	SHIC-03-54-2

Solvents ID

Acetonitrile	—
Methanol	43206332
Water	44168

Electronic Data Archival

Location	Date
☐ EZC_5_HPLC	
☐	

Comments: Samples disposed off 12/22/04

Analyzed By: XP

This page is checked during the data review process.

EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

6045

ANALYSIS RUN LOG FOR HPLC

Book # A81-02-005

SOP ☑ EMAX-8330 Rev. No: 2 ☐ EMAX-8310 Rev. No: 4 ☐ EMAX-8332 Rev. No: 0 ☐

Starting Date: 12/22/04 Time: 02:13 Ending Date: 12/22/04 Time: 10:52

ANALYTICAL BATCH XL21022A

Preparation Batch	Data File Name	Lab Sample ID XP 12/21/04	DF	Matrix (W)	Matrix (S)	Notes
EXL0055	XL21.031	~~04L4~~ 04L142-01	1		✓	
	32	02	↓		↓	
	33	03I	100		✓	
	34	03T	10			
	35	04I	100			
	36	04T	10			
	37	05I	100			
	38	05T	10			
	39	06I	100			
↓	40	↓ 06T	10		↓	
	41	IB				
	42	CEX81J19670				800
EXL0055	43	04L142-03				
	44	Rinse				
EXL0055	45	04L142-04	1		✓	
	46	05	1			
	47	06I	1000			
↓	48	↓ 06J	5000		↓	
	↓ 49	CEX81J19671				800

XP 12/21/04

Instrument Number	81

INITIAL CALIBRATION REFERENCE

Date	10/19/04
Method	EX81J19
Mid Point	XJ19014A (4/5)
ICAL ID	–
ICV ID	–
DCC ID	SHIC-03-54-2

Solvents ID

Acetonitrile	–
Methanol	43206332
Water	44168

Electronic Data Archival

Location	Date
☐ EZC_5_HPLC	
☐	

Comments: Samples disposed off 12/22/04

Analyzed By: XP

This page is checked during the data review process.

EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

ANALYSIS RUN LOG FOR HPLC

SOP ☑ **EMAX-8330 Rev. No: 2** ☐ **EMAX-8310 Rev. No: 4** ☐ **EMAX-8332 Rev. No: 0** ☐ conf. **Book # A17-010**

Starting Date: 12/21/04 **Time:** 13:47 **Ending Date:** 12/21/04 **Time:** 22:06

ANALYTICAL BATCH PL21009A

Preparation Batch	Data File Name	Lab Sample ID	DF	Matrix S	Matrix W	Notes
	PL21.001	IB172694				
	2	CEX17H17C694				800.
EXL004W	3	04L128-11T	5		✓	hump. RR
↓	4	↓ 11T	↓		↓	
	5	↓ 12	1			
	6	04L145-01T	20			
	7	01	1			
	8	02T	20			
	9	↓ 01	1			
	10	04L142-07T	10			
	11	↓ 07	1			
EXL055	12	04L128-01	1	✓		
	↓ 13	~~CEX5~~ XP 12/21/04 CEX17H17C695				800

XP 12/21/04

Instrument Number	**17**

Initial Calibration

Date	08/17/04
met.	EX17H17C
m.p	PH17005A (4/5)

Standards

Name	ID	Conc. (µg/L)
DCC ID	8HC-03-54-2	~~80~~ 400 XP 12/21/04

Solvent ID

Methanol	43206332	pure
Water	44168	↓
Acetonitrile	—	

Electronic Data Archival

Location	Date

Comments: samples disposed off 12/22/04

Analyzed By: XP

This page is checked during the data review process.

EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

ANALYSIS RUN LOG FOR HPLC

SOP ☑ **EMAX-8330** conf **Rev. No: 2** ☐ **EMAX-8310 Rev. No: 4** ☐ **EMAX-8332 Rev. No: 0** ☐ **Book # A17-010**

Starting Date: 12/22/04 **Time:** 15:01 **Ending Date:** 12/22/04 **Time:** 21:57

ANALYTICAL BATCH PL22002A

Preparation Batch	Data File Name	Lab Sample ID	DF	Matrix S	Matrix W	Notes
	PL22.001	IB17L696				
	.002	CEX17H17C696				400
EXL005S	.003	04L142-03	1	✓		
	.004	.04				
	.005	-05				
	.006	CEX17H17C697				400
EXL005S	.007	04L142-06J	1000	✓		
	.008	04L142-06T	10			
	.009	04L142-05W	1			
EXL005S	.010	04L128-02				
	.011	CEX17H17C698				400

RA 12/23/04.

Instrument Number	**17**

Initial Calibration

Date	08/17/04
met.	EX17H17C
m.p	PH17003A

Standards

Name	ID	Conc. (µg/L)
DCC ID	SH1C-03-56-2	400

Solvent ID

Methanol	43306332	june
Water	44168	
Acetonitrile		

Electronic Data Archival

Location	Date

Comments: Sampler dispenser off 12/23/04

Analyzed By: VP / RA

This page is checked during the data review process.

EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

6048

EXTRACTION LOGS

EXTRACTION LOG FOR EXPLOSIVES

SOP: ☒ EMAX-8330 **Rev.No.:** 3 ☐ ✓

Matrix: WATER **Start Date:** 12/20/04 **Time:** 13:00 **End Date:** 12/20/04 **Time:** ~~14~~ 15:30 **Book # EEX-010**

EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

PREPARATION BATCH: EXL004-W

Sample Prep ID	Lab Sample ID	Sample Amount (g | ml)	Extract Volume (ml)	Notes
*01	EXL004 - WB	200	4	
*02	↓ - WL	200	4	
*03	↓ - WC	200	4	
*04	04L128 - 11	200	4	
*05	↓ - 12	200	4	
*06	04L142 -07	200	4	
*07	04L145 - 01	200	4	
*08	↓ - 02	200	4	
*09				
*10	JV 12/20/04			
*11				
*12				
*13				
*14				
*15				
*16				
*17				
*18				
*19				
*20				
*21				
*22				
*23				
*24				
*25				
*26				

Standards	JV 12/20/4 ID	Amount Added (ml)
Surrogate	SH1B-03-36-1	0.08
LCS/MS	SH1B-03-36-2	0.08

Reagent	Lot# / ID
Acetonitrile	L30 80
NaCl	SW1A-02-1478
CaCl$_2$	SP1B-~~02~~ JV 12/20/4 01-267
Silica Sand	~~#2289249~~ JV 12/20/4

SDG #	Extract Location
	SEOH #1

Comments:

Prepared By: JV

Standard Added By: JV/EG

Checked By: ML

Extract Received By: XP 12/20/04

Disposal Date:

6050

EXTRACTION LOG FOR EXPLOSIVES

SOP: ☒ EMAX-8330 **Rev.No.:** 3 ☐

Matrix: SOIL **Start Date:** 12/20/04 **Time:** 17:30 **End Date:** 12/21/04 **Time:** 11:00 **Book # EEX-010**

PREPARATION BATCH: EXL005-S

Sample Prep ID	Lab Sample ID	Sample Amount (g | ml)	Extract Volume (ml)	Notes
*01	EXL005-SB	2.00	20	
*02	JV 12/20/04 SL	2.01	20	
*03	04L128 -~~S~~01	2.03	20	
*04	-02	2.01	20	
*05	-02M	2.02	20	
*06	-02S	2.03	20	
*07	-03	2.01	20	
*08	-04	2.00	20	
*09	-05	2.03	20	
*10	-06	2.03	20	
*11	-07	2.02	20	
*12	-08	2.02	20	
*13	-09	2.01	20	
*14	-10	2.02	20	
*15	04L142 -01	2.02	20	
*16	-02	2.00	20	
*17	-03	2.01	20	
*18	-04	2.03	20	
*19	-05	2.03	20	
*20	-06	2.02	20	
*21				
*22	12/20/04 JV			
*23				
*24				
*25				
*26				

Standards	ID	Amount Added (ml)
Surrogate	SH1B-03-36-1	0.4
LCS/MS	SH1B-03-36-2	0.4

Reagent	Lot# / ID
Acetonitrile	43080
NaCl	–
$CaCl_2$	SP1B-01-267
Silica Sand	42289249

SDG #	Extract Location
	SE04 # 1

Comments:

Prepared By: JV

Standard Added By: JV/YK

ML 12/4/04

Checked By: ~~YK~~ ML

Extract Received By: DA 12/21/04

Disposal Date:

EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

TABLE OF CONTENTS

CLIENT: **SHAW E&I**

PROJECT: **LONGHORN ARMY AMMUNITION PLANT**

SDG: **04L145**

** - Not Requested

EMAX
LABORATORIES, INC.
1835 W. 205th Street
Torrance, CA 90501
Tel: (310) 618-8889
Fax: (310) 618-0818

Date: 12-29-2004
EMAX Batch No.: 04L145

Attn: Diane Meyer

Shaw E&I
1430 Enclave Parkway
Houston TX 77077

Subject: Laboratory Report
Project: Longhorn Army Ammunition Plant

Enclosed is the Laboratory report for samples received on 12/20/04. The data reported include :

Sample ID	Control #	Col Date	Matrix	Analysis
29WL40-MH09	L145-01	12/17/04	WATER	NITROAROMATICS & NITRAMINES
29WL40-MH09-QC	L145-02	12/17/04	WATER	NITROAROMATICS & NITRAMINES
29SD40-MH09	L145-03	12/17/04	SOIL	NITROAROMATICS & NITRAMINES
29SD43-MH12	L145-04	12/17/04	SOIL	NITROAROMATICS & NITRAMINES
29SD40-MH09-QC	L145-05	12/17/04	SOIL	NITROAROMATICS & NITRAMINES
29SD33-MH02	L145-06	12/17/04	SOIL	NITROAROMATICS & NITRAMINES
29SD36-MH05	L145-07	12/17/04	SOIL	NITROAROMATICS & NITRAMINES
29SD37-MH06	L145-08	12/17/04	SOIL	NITROAROMATICS & NITRAMINES

The results are summarized on the following pages.

Please feel free to call if you have any questions concerning these results.

Sincerely yours,

Kam Y. Pang, Ph.D.
Laboratory Director

00091446

Shaw *Environmental & Infrastructure, Inc.*

1430 Enclave Parkway
Houston, TX 77077 (281) 368-4000
Tulsa TERC DACA56-94-D-0020

CHAIN-OF-CUSTODY

No. **29-EMAX-DEC04-009**

I 8

04L145

Laboratory Name: EMAX	Address: 1835 205th Street Torrance, CA 90501	Contact: Joe Kelbley	
Project Name Longhorn AAP	Project Location Area 29 Former TNT Production Area		
Project No. 845714	Project Contact Diane Meyer	Project Telephone No. 281-368-4404	
USACE Point of contact: Cliff Murray	Project Manager/Supervisor Praveen Srivastav		
USACE Telephone No.			

Analysis and Method Desired (Indicate separate containers)

12.20.04. 5. 5.

Item No.	Sample Number	Date	Time	Comp	Grab	Matrix	Sample Description, Location	Number of Containers	Nitroaromatics and Nitroamines by 8330	Perchlorate by 314.0	Remarks
1	29WL40-MH09	12/17/04	1315		X	sw	29WL40-MH09	2	X		
~~2~~	~~29WL41-MH10~~						~~29WL41-MH10~~	~~2~~	~~X~~		
~~3~~	~~29WL42-MH11~~						~~29WL42-MH11~~	~~2~~	~~X~~		
~~4~~	~~29WL43-MH12~~						~~29WL43-MH12~~	~~2~~	~~X~~		
~~5~~	~~29WL47~~						~~29WL47~~	~~2~~	~~X~~		
2. 6	29WL 40 -MH 09 -QC	12/17/04	1315		X	SW	29WL 40 -MH 09 -QC	2	X		
7											
8											
9											
10											

Transfers Relinquished By (Signature)	Date/Time	Transfers Accepted By (Signature)	Date/Time
	12/17/04 1600		12.20.04. 10:30
		Laboratory	

Special Instructions

~~FedEx~~ UPS Airbill No.: 66V 725

Sampler's Signature

TAT 7day Standard ____ Rush Due: ________ Seals Intact? ✓ Y ____ N Received Good Condition ✓ Y ____ N ____ Cold

White - Lab Copy Canary - Field Copy Pink - File Copy

T=4.1°C

Shaw *Environmental & Infrastructure, Inc.*

1430 Enclave Parkway
Houston, TX 77077 (281) 368-4000
Tulsa TERC DACA56-94-D-0020

00091447

No. **29-EMAX-DEC04-006**

CHAIN-OF-CUSTODY

12.20.04. 5.5.

Laboratory Name: **EMAX** Address: **1835 205th Street**
Torrance, CA 90501 Contact: Joe Kelbley

Project Name **Longhorn AAP**	Project Location **Area 29 Former TNT Production Area**		
Project No. **845714**	Project Contact **Diane Meyer**	Project Telephone No. **281-368-4404**	
USACE Point of contact: **Cliff Murray**		Project Manager/Supervisor **Praveen Srivastav**	
USACE Telephone No.			

Analysis and Method Desired (Indicate separate containers)

Item No.	Sample Number	Date	Time	Comp	Grab	Matrix	Sample Description, Location	Number of Containers	Nitroaromatics and Nitroamines by 8330	Perchlorate by 314.0	Remarks
3. 1	29SD40-MH09	12/17/04	12:40		X	**SED**	**29SD40-MH09**	1	X		
~~2~~	~~29SD41-MH10~~					~~**SED**~~	~~**29SD41-MH10**~~	~~1~~	~~X~~		
~~3~~	~~29SD42-MH11~~					~~**SED**~~	~~**29SD42-MH11**~~	~~1~~	~~X~~		
4	29SD43-MH12	12/17/04	1147		X	**SED**	**29SD43-MH12**	1	X		
~~5~~	~~29SD44~~					~~**SED**~~	~~**29SD44**~~	~~1~~	~~X~~		
~~6~~	~~29SD45~~					~~**SED**~~	~~**29SD45**~~	~~1~~	~~X~~		
~~7~~	~~29SD46~~					~~**SED**~~	~~**29SD46**~~	~~1~~	~~X~~		
5. 8	29SD 40 -MH 09 -QC	12/17/04	1240		X	**SED**	**29SD 40 -MH 09 -QC**	1	X		
~~9~~	~~29SD____-QC~~					~~**SED**~~	~~**29SD____-QC**~~	~~1~~	~~X~~		
10											

Transfers Relinquished By (Signature)	Date/Time	Transfers Accepted By (Signature)	Date/Time
M. Fl	12/17/04 1600		
			12.20.04. 10:30
		Laboratory	

Special Instructions

FedEx Airbill No.: 66V 725

Sampler's Signature M. Fl

TAT: ____ Standard ____ Rush Due: ________ Seals Intact? ✓ Y ____ N Received Good Condition ✓ Y ____ N ____ Cold

White - Lab Copy Canary - Field Copy Pink - File Copy

1002

Shaw *Environmental & Infrastructure, Inc.*

1430 Enclave Parkway
Houston, TX 77077 (281) 368-4000
Tulsa TERC DACA56-94-D-0020

CHAIN-OF-CUSTODY

No. **29-EMAX-DEC04-005**

Laboratory Name: **EMAX**

Address: **1835 205th Street**
Torrance, CA 90501

Contact: Joe kelbley

Project Name **Longhorn AAP**

Project Location **Area 29 Former TNT Production Area**

Project No. **845714**

Project Contact **Diane Meyer**

Project Telephone No. **281-368-4404**

USACE Point of contact: **Cliff Murray**

USACE Telephone No.

Project Manager/Supervisor **Praveen Srivastav**

12.20.04. 5.5

Item No.	Sample Number	Date	Time	Comp	Grab	Matrix	Sample Description, Location	Number of Containers	Nitroaromatics and Nitroamines by 8330	Perchlorate by 314.0						Remarks
~~1~~	~~29SD32-MH01~~					~~SED~~	~~29SD32-MH01~~	~~1~~	~~X~~							
6. ~~2~~	29SD33-MH02	12/17/04	0855		X	SED	29SD33-MH02	1	X							
~~3~~	~~29SD34-MH03~~					~~SED~~	~~29SD34-MH03~~	~~1~~	~~X~~							
~~4~~	~~29SD35-MH04~~					~~SED~~	~~29SD35-MH04~~	~~1~~	~~X~~							
7. ~~5~~	29SD36-MH05	12/17/04	0915		X	SED	29SD36-MH05	1	X							
8. ~~6~~	29SD37-MH06	12/17/04	0931		X	SED	29SD37-MH06	1	X							
~~7~~	~~29SD38-MH07~~					~~SED~~	~~29SD38-MH07~~	~~1~~	~~X~~							
~~8~~	~~29SD39-MH08~~					~~SED~~	~~29SD39-MH08~~	~~1~~	~~X~~							
9																
10																

Transfers Relinquished By (Signature)	Date/Time	Transfers Accepted By (Signature)	Date/Time
	12/17/04 1600		
			12.20.04. 10:30
		Laboratory	

Special Instructions

~~Fed~~Ex Airbill No.: 66V 725

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

00091449

SAMPLE RECEIPT FORM 1

Type of Delivery	Delivered By/Airbill		
☐ EMAX Courier		ECN	042145
☐ Client Delivery		Recepient	SITNIKOV
☑ Third Party UPS	J178-746-4236	Date	12-20-04
		Time	1030

COC Inspection

☑ Client Name
☑ Address
☑ Client PM/FC
☑ Tel #/Fax #

☑ Sampler Name
☐ Courier Signature/Date/Time
☑ TAT
☑ Sample ID

☑ Sampling Date/Time/Location
☑ Analysis Required
☑ Matrix
☐ Preservative (if any)

Safety Issues ☑ None ☐ High Concentrations expected ☐ Superfund Site Samples

Comments: ☐ Rad Screening Required

Packaging Inspection

Container	* ☑ Cooler	☑ Box	☐	☐
Condition	☑ Custody Seal	☑ Intact	☐ Damaged	☐
Packaging	☑ Bubble Pack	☐ Styrofoam	☑ Sufficient	☑ plastic bag
Temperatures	☑ Cooler 1 4.1°C	☑ Cooler 2 ____	☐ Cooler 3 ____	☐ Cooler 4 ____
	☐ Cooler 5 ____	☐ Cooler 6 ____	☐ Cooler 7 ____	☐ Cooler 8 ____
	☐ Cooler 9 ____	☐ Cooler 10 ____	☐ Cooler 11 ____	☐ Cooler 12 ____

Comments:

* COOLER WAS SHIPPED ON 12/17/04

LSCID	Client ID	Discrepancy	Corrective Action

LSCID : Lab Sample Container ID

REVIEWS

Sample Labeling ~~M/AN~~
Date 12-20-04

SRF qw
Date 12-20-04

PM JMK
Date 12/20/04

UPS Next Day Air
UPS Worldwide Express℠
Shipping Document

WEIGHT	WEIGHT	DIMENSIONAL WEIGHT	

The shipper authorizes UPS to act as forwarding agent for export control and customs purposes. The shipper certifies that these commodities, technology or software were exported from the United States in accordance with the Export Administration Regulations. Diversion contrary to U.S. law is prohibited.

☐ EXPRESS (INT'L)

☐ DOCUMENTS ONLY

1

SATURDAY DELIVERY ☐

J178 746 423 6

J178 746 423 6

EXPORT

SHIPMENT FROM

UPS ACCOUNT NO.

REFERENCE NUMBER

TELEPHONE

04L145
12 20 04
10.30

UPS Next Day Air® 1

EXTREMELY URGENT

J178 746 423 6

DELIVERY

DELIVERY TO

TELEPHONE

Residential ☐

J178 746 423 6
TRACKING NUMBER

DATE OF SHIPMENT

010191120 6/00 W

United Parcel Service, Louisville, KY

CUSTODY SEAL

DATE 12-17-04

SIGNATURE

QEC
Quality Environmental Containers
800-255-3950 • 304-255-3900

REPORTING CONVENTIONS

DATA QUALIFIERS:

Lab Qualifier	AFCEE Qualifier	Description
J	F	Indicates that the analyte is positively identified and the result is less than RL but greater than MDL.
N		Indicates presumptive evidence of a compound.
B	B	Indicates that the analyte is found in the associated method blank as well as in the sample at above QC level.
E	J	Indicates that the result is above the maximum calibration range.
*	*	Out of QC limit.

Note: The above qualifiers are used to flag the results unless the project requires a different set of qualification criteria.

ACRONYMS AND ABBREVIATIONS:

CRDL	Contract Required Detection Limit
RL	Reporting Limit
MRL	Method Reporting Limit
PQL	Practical Quantitation Limit
MDL	Method Detection Limit
DO	Diluted out

DATES

The date and time information for leaching and preparation reflect the beginning date and time of the procedure unless the method, protocol, or project specifically requires otherwise.

LABORATORY REPORT FOR

SHAW E&I

LONGHORN ARMY AMMUNITION PLANT

EPA METHOD 8330
EXPLOSIVES

SDG#: 04L145

CASE NARRATIVE

CLIENT:	**SHAW E&I**
PROJECT:	**LONGHORN ARMY AMMUNITION PLANT**
SDG:	**04L145**

EPA METHOD 8330
EXPLOSIVES

Two (2) water and six (6) soil samples were received on 12/20/04 for Explosives analysis by EPA Method 8330 in accordance with USEPA-SW846 3rd edition, and EMAX-8330.

1. Holding Time

Analytical holding time was met. Extraction for water samples was started and completed on 12/20/04. Extraction for soil samples was started on 12/22/04 and completed on 12/23/04

2. Calibration

Initial calibration was five points. %RSDs were within 20%. All continuing calibrations of the primary column were carried out at 12-hour intervals and the recoveries were within 85-115%.

3. Method Blank

Method blanks were free of contamination at the reporting limit.

4. Surrogate recovery

Surrogate recoveries in samples L145-01T, -01I, -02T and -02I were diluted out. All surrogate recoveries in other samples were within QC limits.

5. Lab Control Sample / Lab Control Duplicate

All recoveries were within QC limits.

6. Matrix Spike/Matrix Spike Duplicate

Sample L145-04 was spiked. Recoveries were within QC limits.

7. Sample Analysis

Samples were analyzed according to the prescribed QC procedures. Quantitation is from the primary column. All positive results above RL were confirmed by LC-CN column and the confirmation is presumptive because it was based on retention time window.

Samples were air-dried prior to extraction; hence, no moisture correction was applied to RL, MDL and results.

LAB CHRONICLE
EXPLOSIVES

Client : SHAW E&I
Project : LONGHORN ARMY AMMUNITION PLANT

SDG NO. : 04L145
Instrument ID : T081

WATER

Client Sample ID	Laboratory Sample ID	Dilution Factor	% Moist	Analysis DateTime	Extraction DateTime	Sample Data FN	Calibration Data FN	Prep. Batch	Notes
MBLK1W	EXL004WB	1	NA	12/20/0418:27	12/20/0413:00	XL20004A	XL20003A	EXL004W	Method Blank
LCS1W	EXL004WL	1	NA	12/20/0418:56	12/20/0413:00	XL20005A	XL20003A	EXL004W	Lab Control Sample (LCS)
LCD1W	EXL004WC	1	NA	12/20/0419:24	12/20/0413:00	XL20006A	XL20003A	EXL004W	LCS Duplicate
29WL40-MH09	L145-01	1	NA	12/20/0421:20	12/20/0413:00	XL20010A	XL20003A	EXL004W	Field Sample
29WL40-MH09DL	L145-01T	20	NA	12/21/0414:12	12/20/0413:00	XL21006A	XL21002A	EXL004W	Diluted Sample
29WL40-MH09DL1	L145-01I	500	NA	12/21/0413:43	12/20/0413:00	XL21005A	XL21002A	EXL004W	Diluted Sample
29WL40-MH09-QC	L145-02	1	NA	12/20/0422:17	12/20/0413:00	XL20012A	XL20003A	EXL004W	Field Sample
29WL40-MH09-QCDL	L145-02T	20	NA	12/21/0415:10	12/20/0413:00	XL21008A	XL21002A	EXL004W	Diluted Sample
29WL40-MH09-QCDL1	L145-02I	500	NA	12/21/0414:41	12/20/0413:00	XL21007A	XL21002A	EXL004W	Diluted Sample

SOIL

Client Sample ID	Laboratory Sample ID	Dilution Factor	% Moist	Analysis DateTime	Extraction DateTime	Sample Data FN	Calibration Data FN	Prep. Batch	Notes
MBLK1S	EXL006SB	1	NA	12/23/0411:51	12/22/0417:00	XL23004A	XL23002A	EXL006S	Method Blank
LCS1S	EXL006SL	1	NA	12/23/0412:20	12/22/0417:00	XL23005A	XL23002A	EXL006S	Lab Control Sample (LCS)
29SD40-MH09	L145-03	1	NA	12/23/0412:49	12/22/0417:00	XL23006A	XL23002A	EXL006S	Field Sample
29SD43-MH12	L145-04	1	NA	12/23/0413:18	12/22/0417:00	XL23007A	XL23002A	EXL006S	Field Sample
29SD43-MH12MS	L145-04M	1	NA	12/23/0413:46	12/22/0417:00	XL23008A	XL23002A	EXL006S	Matrix Spike Sample (MS)
29SD43-MH12MSD	L145-04S	1	NA	12/23/0414:15	12/22/0417:00	XL23009A	XL23002A	EXL006S	MS Duplicate (MSD)
29SD40-MH09-QC	L145-05	1	NA	12/23/0414:44	12/22/0417:00	XL23010A	XL23002A	EXL006S	Field Sample
29SD33-MH02	L145-06	1	NA	12/23/0415:13	12/22/0417:00	XL23011A	XL23002A	EXL006S	Field Sample
29SD33-MH02DL	L145-06T	5	NA	12/24/0402:44	12/22/0417:00	XL23035A	XL23027A	EXL006S	Diluted Sample
29SD36-MH05	L145-07W	1	NA	12/24/0402:16	12/22/0417:00	XL23034A	XL23027A	EXL006S	Field Sample
29SD37-MH06	L145-08	1	NA	12/23/0416:10	12/22/0417:00	XL23013A	XL23002A	EXL006S	Field Sample

FN - Filename
% Moist - Percent Moisture

SAMPLE RESULTS

EPA METHOD 8330
EXPLOSIVES

Client : SHAW E&I	Date Collected: 12/17/04
Project : LONGHORN ARMY AMMUNITION PLANT	Date Received: 12/20/04
Batch No. : 04L145	Date Extracted: 12/20/04 13:00
Sample ID: 29WL40-MH09	Date Analyzed: 12/20/04 21:20
Lab Samp ID: L145-01	Dilution Factor: 1
Lab File ID: XL20010A	Matrix : WATER
Ext Btch ID: EXL004W	% Moisture : NA
Calib. Ref.: XL20003A	Instrument ID : T-081

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
HMX	ND	1	.2
RDX	ND	1	.2
1,3,5-TNB	ND	1	.2
1,3-DNB	ND	1	.2
TETRYL	ND	1	.2
NITROBENZENE	ND	1	.2
2,4,6-TNT	2900E	1	.2
4-AM-2,6-DNT	290E	1	.2
2-AM-4,6-DNT	210E	1	.2
2,6-DNT	27E	1	.2
2,4-DNT	.8J	1	.2
2-NITROTOLUENE	ND	1	.2
3-NITROTOLUENE	ND	1	.2
4-NITROTOLUENE	ND	1	.2

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	77	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

Client : SHAW E&I
Project : LONGHORN ARMY AMMUNITION PLANT
Batch No. : 04L145
Sample ID: 29WL40-MH09DL
Lab Samp ID: L145-01T
Lab File ID: XL21006A
Ext Btch ID: EXL004W
Calib. Ref.: XL21002A

Date Collected: 12/17/04
Date Received: 12/20/04
Date Extracted: 12/20/04 13:00
Date Analyzed: 12/21/04 14:12
Dilution Factor: 20
Matrix : WATER
% Moisture : NA
Instrument ID : T-081

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
HMX	ND	20	4
RDX	ND	20	4
1,3,5-TNB	ND	20	4
1,3-DNB	ND	20	4
TETRYL	ND	20	4
NITROBENZENE	ND	20	4
2,4,6-TNT	5000E	20	4
4-AM-2,6-DNT	290	20	4
2-AM-4,6-DNT	220	20	4
2,6-DNT	27	20	4
2,4-DNT	ND	20	4
2-NITROTOLUENE	ND	20	4
3-NITROTOLUENE	ND	20	4
4-NITROTOLUENE	ND	20	4

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	DO	63-143

Note: All positive results are confirmed by CN column

DO : Diluted out

EPA METHOD 8330
EXPLOSIVES

Client : SHAW E&I	Date Collected: 12/17/04
Project : LONGHORN ARMY AMMUNITION PLANT	Date Received: 12/20/04
Batch No. : 04L145	Date Extracted: 12/20/04 13:00
Sample ID: 29WL40-MH09DL1	Date Analyzed: 12/21/04 13:43
Lab Samp ID: L145-01I	Dilution Factor: 500
Lab File ID: XL21005A	Matrix : WATER
Ext Btch ID: EXL004W	% Moisture : NA
Calib. Ref.: XL21002A	Instrument ID : T-081

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
HMX	ND	500	100
RDX	ND	500	100
1,3,5-TNB	ND	500	100
1,3-DNB	ND	500	100
TETRYL	ND	500	100
NITROBENZENE	ND	500	100
2,4,6-TNT	5200	500	100
4-AM-2,6-DNT	290J	500	100
2-AM-4,6-DNT	190J	500	100
2,6-DNT	ND	500	100
2,4-DNT	ND	500	100
2-NITROTOLUENE	ND	500	100
3-NITROTOLUENE	ND	500	100
4-NITROTOLUENE	ND	500	100

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	DO	63-143

Note: All positive results are confirmed by CN column

DO : Diluted out

EPA METHOD 8330
EXPLOSIVES

===

Client : SHAW E&I
Project : LONGHORN ARMY AMMUNITION PLANT
Batch No. : 04L145
Sample ID: 29WL40-MH09-QC
Lab Samp ID: L145-02
Lab File ID: XL20012A
Ext Btch ID: EXL004W
Calib. Ref.: XL20003A

Date Collected: 12/17/04
Date Received: 12/20/04
Date Extracted: 12/20/04 13:00
Date Analyzed: 12/20/04 22:17
Dilution Factor: 1
Matrix : WATER
% Moisture : NA
Instrument ID : T-081

===

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
HMX	ND	1	.2
RDX	ND	1	.2
1,3,5-TNB	ND	1	.2
1,3-DNB	ND	1	.2
TETRYL	ND	1	.2
NITROBENZENE	ND	1	.2
2,4,6-TNT	2900E	1	.2
4-AM-2,6-DNT	180E	1	.2
2-AM-4,6-DNT	120E	1	.2
2,6-DNT	18E	1	.2
2,4-DNT	.83J	1	.2
2-NITROTOLUENE	ND	1	.2
3-NITROTOLUENE	ND	1	.2
4-NITROTOLUENE	ND	1	.2

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	77	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

Client	: SHAW E&I	Date Collected:	12/17/04
Project	: LONGHORN ARMY AMMUNITION PLANT	Date Received:	12/20/04
Batch No.	: 04L145	Date Extracted:	12/20/04 13:00
Sample ID:	29WL40-MH09-QCDL	Date Analyzed:	12/21/04 15:10
Lab Samp ID:	L145-02T	Dilution Factor:	20
Lab File ID:	XL21008A	Matrix :	WATER
Ext Btch ID:	EXL004W	% Moisture :	NA
Calib. Ref.:	XL21002A	Instrument ID :	T-081

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
HMX	ND	20	4
RDX	ND	20	4
1,3,5-TNB	ND	20	4
1,3-DNB	ND	20	4
TETRYL	ND	20	4
NITROBENZENE	ND	20	4
2,4,6-TNT	5000E	20	4
4-AM-2,6-DNT	280	20	4
2-AM-4,6-DNT	210	20	4
2,6-DNT	27	20	4
2,4-DNT	ND	20	4
2-NITROTOLUENE	ND	20	4
3-NITROTOLUENE	ND	20	4
4-NITROTOLUENE	ND	20	4

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	DO	63-143

Note: All positive results are confirmed by CN column

DO : Diluted out

EPA METHOD 8330
EXPLOSIVES

Client : SHAW E&I
Project : LONGHORN ARMY AMMUNITION PLANT
Batch No. : 04L145
Sample ID: 29WL40-MH09-QCDL1
Lab Samp ID: L145-02I
Lab File ID: XL21007A
Ext Btch ID: EXL004W
Calib. Ref.: XL21002A

Date Collected: 12/17/04
Date Received: 12/20/04
Date Extracted: 12/20/04 13:00
Date Analyzed: 12/21/04 14:41
Dilution Factor: 500
Matrix : WATER
% Moisture : NA
Instrument ID : T-081

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
HMX	ND	500	100
RDX	ND	500	100
1,3,5-TNB	ND	500	100
1,3-DNB	ND	500	100
TETRYL	ND	500	100
NITROBENZENE	ND	500	100
2,4,6-TNT	5900	500	100
4-AM-2,6-DNT	290J	500	100
2-AM-4,6-DNT	210J	500	100
2,6-DNT	ND	500	100
2,4-DNT	ND	500	100
2-NITROTOLUENE	ND	500	100
3-NITROTOLUENE	ND	500	100
4-NITROTOLUENE	ND	500	100

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	DO	63-143

Note: All positive results are confirmed by CN column

DO : Diluted out

EPA METHOD 8330
EXPLOSIVES

Client	: SHAW E&I	Date Collected:	12/17/04
Project	: LONGHORN ARMY AMMUNITION PLANT	Date Received:	12/20/04
Batch No.	: 04L145	Date Extracted:	12/22/04 17:00
Sample ID:	29SD40-MH09	Date Analyzed:	12/23/04 12:49
Lab Samp ID:	L145-03	Dilution Factor:	1
Lab File ID:	XL23006A	Matrix :	SOIL
Ext Btch ID:	EXL006S	% Moisture :	NA
Calib. Ref.:	XL23002A	Instrument ID :	T-081

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	400	200
RDX	ND	400	200
1,3,5-TNB	ND	400	200
1,3-DNB	ND	400	200
TETRYL	ND	400	200
NITROBENZENE	ND	400	200
2,4,6-TNT	1200	400	200
4-AM-2,6-DNT	2500	400	200
2-AM-4,6-DNT	2400	400	200
2,6-DNT	ND	400	200
2,4-DNT	ND	400	200
2-NITROTOLUENE	ND	400	200
3-NITROTOLUENE	ND	400	200
4-NITROTOLUENE	ND	400	200

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	104	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

Client	: SHAW E&I	Date Collected:	12/17/04
Project	: LONGHORN ARMY AMMUNITION PLANT	Date Received:	12/20/04
Batch No.	: 04L145	Date Extracted:	12/22/04 17:00
Sample ID:	29SD43-MH12	Date Analyzed:	12/23/04 13:18
Lab Samp ID:	L145-04	Dilution Factor:	1
Lab File ID:	XL23007A	Matrix	: SOIL /
Ext Btch ID:	EXL006S	% Moisture	: NA
Calib. Ref.:	XL23002A	Instrument ID	: T-081

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	400	200
RDX	ND	400	200
1,3,5-TNB	ND	400	200
1,3-DNB	ND	400	200
TETRYL	ND	400	200
NITROBENZENE	ND	400	200
2,4,6-TNT	410 ✓	400	200
4-AM-2,6-DNT	ND	400	200
2-AM-4,6-DNT	ND	400	200
2,6-DNT	ND	400	200
2,4-DNT	ND	400	200
2-NITROTOLUENE	ND	400	200
3-NITROTOLUENE	ND	400	200
4-NITROTOLUENE	ND	400	200

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	102	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

Client : SHAW E&I
Project : LONGHORN ARMY AMMUNITION PLANT
Batch No. : 04L145
Sample ID: 29SD40-MH09-QC
Lab Samp ID: L145-05
Lab File ID: XL23010A
Ext Btch ID: EXL006S
Calib. Ref.: XL23002A

Date Collected: 12/17/04
Date Received: 12/20/04
Date Extracted: 12/22/04 17:00
Date Analyzed: 12/23/04 14:44
Dilution Factor: 1
Matrix : SOIL
% Moisture : NA
Instrument ID : T-081

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	400	200
RDX	ND	400	200
1,3,5-TNB	ND	400	200
1,3-DNB	ND	400	200
TETRYL	ND	400	200
NITROBENZENE	ND	400	200
2,4,6-TNT	1100	400	200
4-AM-2,6-DNT	460	400	200
2-AM-4,6-DNT	470	400	200
2,6-DNT	ND	400	200
2,4-DNT	ND	400	200
2-NITROTOLUENE	ND	400	200
3-NITROTOLUENE	ND	400	200
4-NITROTOLUENE	ND	400	200

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	103	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

Client	: SHAW E&I	Date Collected:	12/17/04
Project	: LONGHORN ARMY AMMUNITION PLANT	Date Received:	12/20/04
Batch No.	: 04L145	Date Extracted:	12/22/04 17:00
Sample ID:	29SD33-MH02	Date Analyzed:	12/23/04 15:13
Lab Samp ID:	L145-06	Dilution Factor:	1
Lab File ID:	XL23011A	Matrix	: SOIL
Ext Btch ID:	EXL006S	% Moisture	: NA
Calib. Ref.:	XL23002A	Instrument ID	: T-081

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	400	200
RDX	ND	400	200
1,3,5-TNB	440	400	200
1,3-DNB	ND	400	200
TETRYL	ND	400	200
NITROBENZENE	ND	400	200
2,4,6-TNT	11000E	400	200
4-AM-2,6-DNT	2600	400	200
2-AM-4,6-DNT	3800	400	200
2,6-DNT	ND	400	200
2,4-DNT	ND	400	200
2-NITROTOLUENE	ND	400	200
3-NITROTOLUENE	ND	400	200
4-NITROTOLUENE	ND	400	200

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	97	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

```
===============================================================================
Client       : SHAW E&I                       Date  Collected: 12/17/04
Project      : LONGHORN ARMY AMMUNITION PLANT Date   Received: 12/20/04
Batch No.    : 04L145                         Date  Extracted: 12/22/04 17:00
Sample    ID: 29SD33-MH02DL                   Date   Analyzed: 12/24/04 02:44
Lab Samp ID: L145-06T                         Dilution Factor: 5
Lab File ID: XL23035A                         Matrix         : SOIL
Ext Btch ID: EXL006S                          % Moisture     : NA
Calib. Ref.: XL23027A                         Instrument ID  : T-081
===============================================================================
```

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	2000	1000
RDX	ND	2000	1000
1,3,5-TNB	ND	2000	1000
1,3-DNB	ND	2000	1000
TETRYL	ND	2000	1000
NITROBENZENE	ND	2000	1000
2,4,6-TNT	11000	2000	1000
4-AM-2,6-DNT	2500	2000	1000
2-AM-4,6-DNT	4100	2000	1000
2,6-DNT	ND	2000	1000
2,4-DNT	ND	2000	1000
2-NITROTOLUENE	ND	2000	1000
3-NITROTOLUENE	ND	2000	1000
4-NITROTOLUENE	ND	2000	1000

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	96	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

```
==============================================================================
Client      : SHAW E&I                          Date  Collected: 12/17/04
Project     : LONGHORN ARMY AMMUNITION PLANT    Date   Received: 12/20/04
Batch No.   : 04L145                            Date  Extracted: 12/22/04 17:00
Sample   ID: 29SD36-MH05                        Date   Analyzed: 12/24/04 02:16
Lab Samp ID: L145-07W                           Dilution Factor: 1
Lab File ID: XL23034A                           Matrix         : SOIL
Ext Btch ID: EXL006S                            % Moisture     : NA
Calib. Ref.: XL23027A                           Instrument ID  : T-081
==============================================================================
```

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	400	200
RDX	ND	400	200
1,3,5-TNB	ND	400	200
1,3-DNB	ND	400	200
TETRYL	ND	400	200
NITROBENZENE	ND	400	200
2,4,6-TNT	ND	400	200
4-AM-2,6-DNT	ND	400	200
2-AM-4,6-DNT	ND	400	200
2,6-DNT	ND	400	200
2,4-DNT	ND	400	200
2-NITROTOLUENE	ND	400	200
3-NITROTOLUENE	ND	400	200
4-NITROTOLUENE	ND	400	200

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	103	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

Client	: SHAW E&I	Date Collected:	12/17/04
Project	: LONGHORN ARMY AMMUNITION PLANT	Date Received:	12/20/04
Batch No.	: 04L145	Date Extracted:	12/22/04 17:00
Sample ID:	29SD37-MH06	Date Analyzed:	12/23/04 16:10
Lab Samp ID:	L145-08	Dilution Factor:	1
Lab File ID:	XL23013A	Matrix	: SOIL
Ext Btch ID:	EXL006S	% Moisture	: NA
Calib. Ref.:	XL23002A	Instrument ID	: T-081

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	400	200
RDX	ND	400	200
1,3,5-TNB	ND	400	200
1,3-DNB	ND	400	200
TETRYL	ND	400	200
NITROBENZENE	ND	400	200
2,4,6-TNT	290J	400	200
4-AM-2,6-DNT	260J	400	200
2-AM-4,6-DNT	290J	400	200
2,6-DNT	ND	400	200
2,4-DNT	ND	400	200
2-NITROTOLUENE	ND	400	200
3-NITROTOLUENE	ND	400	200
4-NITROTOLUENE	ND	400	200

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	102	63-143

Note: All positive results are confirmed by CN column

QC SUMMARIES

EPA METHOD 8330
EXPLOSIVES

Client : SHAW E&I
Project : LONGHORN ARMY AMMUNITION PLANT
Batch No. : 04L145
Sample ID: MBLK1W
Lab Samp ID: EXL004WB
Lab File ID: XL20004A
Ext Btch ID: EXL004W
Calib. Ref.: XL20003A

Date Collected: NA
Date Received: 12/20/04
Date Extracted: 12/20/04 13:00
Date Analyzed: 12/20/04 18:27
Dilution Factor: 1
Matrix : WATER
% Moisture : NA
Instrument ID : T-081

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
HMX	ND	1	.2
RDX	ND	1	.2
1,3,5-TNB	ND	1	.2
1,3-DNB	ND	1	.2
TETRYL	ND	1	.2
NITROBENZENE	ND	1	.2
2,4,6-TNT	ND	1	.2
4-AM-2,6-DNT	ND	1	.2
2-AM-4,6-DNT	ND	1	.2
2,6-DNT	ND	1	.2
2,4-DNT	ND	1	.2
2-NITROTOLUENE	ND	1	.2
3-NITROTOLUENE	ND	1	.2
4-NITROTOLUENE	ND	1	.2

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	100	63-143

Note: All positive results are confirmed by CN column

EMAX QUALITY CONTROL DATA
LCS/LCD ANALYSIS

CLIENT: SHAW E&I
PROJECT: LONGHORN ARMY AMMUNITION PLANT
BATCH NO.: 04L145
METHOD: EPA 8330

MATRIX:	WATER			% MOISTURE:	NA
DILUTION FACTOR:	1	1	1		
SAMPLE ID:	MBLK1W				
LAB SAMP ID:	EXL004WB	EXL004WL	EXL004WC		
LAB FILE ID:	XL20004A	XL20005A	XL20006A		
DATE EXTRACTED:	12/20/0413:00	12/20/0413:00	12/20/0413:00	DATE COLLECTED:	NA
DATE ANALYZED:	12/20/0418:27	12/20/0418:56	12/20/0419:24	DATE RECEIVED:	12/20/04
PREP. BATCH:	EXL004W	EXL004W	EXL004W		
CALIB. REF:	XL20003A	XL20003A	XL20003A		

ACCESSION:

PARAMETER	BLNK RSLT (ug/L)	SPIKE AMT (ug/L)	BS RSLT (ug/L)	BS % REC	SPIKE AMT (ug/L)	BSD RSLT (ug/L)	BSD % REC	RPD (%)	QC LIMIT (%)	MAX RPD (%)
HMX	ND	4	3.84	96	4	3.99	100	4	70-130	30
RDX	ND	4	3.31	83	4	3.19	80	4	60-130	30
1,3,5-TNB	ND	4	4.03	101	4	4.06	101	1	70-130	30
1,3-DNB	ND	4	3.85	96	4	3.86	96	0	70-130	30
Tetryl	ND	4	4.08	102	4	4.1	102	0	50-140	30
Nitrobenzene	ND	4	3.62	90	4	3.64	91	1	60-130	30
2,4,6-TNT	ND	4	4.18	105	4	4.22	105	1	70-140	30
4-AM-2,6-DNT	ND	4	3.92	98	4	3.92	98	0	70-130	30
2-AM-4,6-DNT	ND	4	4.01	100	4	4.04	101	1	70-130	30
2,6-DNT	ND	4	4.03	101	4	4.07	102	1	70-130	30
2,4-DNT	ND	4	4.13	103	4	4.12	103	0	70-130	30
2-Nitrotoluene	ND	4	3.81	95	4	3.81	95	0	70-130	30
3-Nitrotoluene	ND	4	3.99	100	4	4.02	100	1	70-130	30
4-Nitrotoluene	ND	4	4.02	100	4	4.07	102	1	70-130	30

SURROGATE PARAMETER	SPIKE AMT (ug/L)	BS RSLT (ug/L)	BS % REC	SPIKE AMT (ug/L)	BSD RSLT (ug/L)	BSD % REC	QC LIMIT (%)
3,4-Dinitrotoluene	4	4.09	102	4	4.27	107	70-130

EPA METHOD 8330
EXPLOSIVES

Client : SHAW E&I
Project : LONGHORN ARMY AMMUNITION PLANT
Batch No. : 04L145
Sample ID: MBLK1S
Lab Samp ID: EXL006SB
Lab File ID: XL23004A
Ext Btch ID: EXL006S
Calib. Ref.: XL23002A

Date Collected: NA
Date Received: 12/22/04
Date Extracted: 12/22/04 17:00
Date Analyzed: 12/23/04 11:51
Dilution Factor: 1
Matrix : SOIL
% Moisture : NA
Instrument ID : T-081

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	400	200
RDX	ND	400	200
1,3,5-TNB	ND	400	200
1,3-DNB	ND	400	200
TETRYL	ND	400	200
NITROBENZENE	ND	400	200
2,4,6-TNT	ND	400	200
4-AM-2,6-DNT	ND	400	200
2-AM-4,6-DNT	ND	400	200
2,6-DNT	ND	400	200
2,4-DNT	ND	400	200
2-NITROTOLUENE	ND	400	200
3-NITROTOLUENE	ND	400	200
4-NITROTOLUENE	ND	400	200

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	106	63-143

Note: All positive results are confirmed by CN column

EMAX QUALITY CONTROL DATA
LCS ANALYSIS

CLIENT:	SHAW E&I			
PROJECT:	LONGHORN ARMY AMMUNITION PLANT			
BATCH NO.:	04L145			
METHOD:	EPA 8330			
MATRIX:	SOIL		% MOISTURE:	NA
DILUTION FACTOR:	1	1		
SAMPLE ID:	MBLK1S			
LAB SAMP ID:	EXL006SB	EXL006SL		
LAB FILE ID:	XL23004A	XL23005A		
DATE EXTRACTED:	12/22/0417:00	12/22/0417:00	DATE COLLECTED:	NA
DATE ANALYZED:	12/23/0411:51	12/23/0412:20	DATE RECEIVED:	12/22/04
PREP. BATCH:	EXL006S	EXL006S		
CALIB. REF:	XL23002A	XL23002A		

ACCESSION:

PARAMETER	BLNK RSLT (ug/kg)	SPIKE AMT (ug/kg)	BS RSLT (ug/kg)	BS % REC	QC LIMIT (%)
HMX	ND	2000	2050	102	70-140
RDX	ND	2000	2000	100	70-140
1,3,5-TNB	ND	2000	2160	108	70-130
1,3-DNB	ND	2000	2210	111	70-130
Tetryl	ND	2000	1970	98	60-140
Nitrobenzene	ND	2000	2190	110	70-130
2,4,6-TNT	ND	2000	2140	107	70-140
4-AM-2,6-DNT	ND	2000	2090	104	70-130
2-AM-4,6-DNT	ND	2000	2120	106	70-130
2,6-DNT	ND	2000	2140	107	70-140
2,4-DNT	ND	2000	2150	108	70-130
2-Nitrotoluene	ND	2000	2030	102	70-130
3-Nitrotoluene	ND	2000	2060	103	70-130
4-Nitrotoluene	ND	2000	2210	111	70-130

SURROGATE PARAMETER	SPIKE AMT (ug/kg)	BS RSLT (ug/kg)	BS % REC	QC LIMIT (%)
3,4-Dinitrotoluene	2000	2140	107	70-130

EMAX QUALITY CONTROL DATA
MS/MSD ANALYSIS

CLIENT: SHAW E&I
PROJECT: LONGHORN ARMY AMMUNITION PLANT
BATCH NO.: 04L145
METHOD: EPA 8330

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MATRIX:	SOIL			% MOISTURE:	NA
DILUTION FACTOR:	1	1	1		
SAMPLE ID:	29SD43-MH12				
LAB SAMP ID:	L145-04	L145-04M	L145-04S		
LAB FILE ID:	XL23007A	XL23008A	XL23009A		
DATE EXTRACTED:	12/22/0417:00	12/22/0417:00	12/22/0417:00	DATE COLLECTED:	12/17/04
DATE ANALYZED:	12/23/0413:18	12/23/0413:46	12/23/0414:15	DATE RECEIVED:	12/20/04
PREP. BATCH:	EXL006S	EXL006S	EXL006S		
CALIB. REF:	XL23002A	XL23002A	XL23002A		

ACCESSION:

PARAMETER	SMPL RSLT (ug/kg)	SPIKE AMT (ug/kg)	MS RSLT (ug/kg)	MS % REC	SPIKE AMT (ug/kg)	MSD RSLT (ug/kg)	MSD % REC	RPD (%)	QC LIMIT (%)	MAX RPD (%)
HMX	ND	2000	2110	106	2000	2140	107	1	63-154	50
RDX	ND	2000	1910	95	2000	1930	97	1	63-154	50
1,3,5-TNB	ND	2000	2090	105	2000	2120	106	1	63-143	50
1,3-DNB	ND	2000	2170	108	2000	2170	109	0	63-143	50
Tetryl	ND	2000	2000	100	2000	1990	99	0	54-154	50
Nitrobenzene	ND	2000	2140	107	2000	2140	107	0	63-143	50
2,4,6-TNT	405	2000	2220	91	2000	2250	92	1	63-154	50
4-AM-2,6-DNT	ND	2000	2090	105	2000	2040	102	3	63-143	50
2-AM-4,6-DNT	ND	2000	2140	107	2000	2080	104	2	63-143	50
2,6-DNT	ND	2000	2080	104	2000	2020	101	3	63-154	50
2,4-DNT	ND	2000	2140	107	2000	2100	105	2	63-143	50
2-Nitrotoluene	ND	2000	1950	98	2000	1970	98	1	63-143	50
3-Nitrotoluene	ND	2000	2090	104	2000	2010	100	4	63-143	50
4-Nitrotoluene	ND	2000	2140	107	2000	2110	106	1	63-143	50

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SURROGATE PARAMETER	SPIKE AMT (ug/kg)	MS RSLT (ug/kg)	MS % REC	SPIKE AMT (ug/kg)	MSD RSLT (ug/kg)	MSD % REC	QC LIMIT (%)
3,4-Dinitrotoluene	2000	2080	104	2000	2040	102	63-143

INITIAL CALIBRATION

INITIAL CALIBRATION
METHOD 8330

Lab Name : EMAX Inc
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
LFID & Datetime: XJ19016A 10/19/04 19:08
LFID & Datetime: XJ19017A 10/19/04 19:36
LFID & Datetime: XJ19013A 10/19/04 17:41
LFID & Datetime: XJ19014A 10/19/04 18:10
LFID & Datetime: XJ19015A 10/19/04 18:39
CONC UNIT: ppb

COMPOUND	CONC X	CALIBRATION FACTORS (AREA or HEIGHT)/UNIT 1.00X	5.00X	10.00X	20.00X	40.00X	MEAN	%RSD
HMX	20.00	69.25	67.82	72.36	72.87	71.66	70.79	3.1
RDX	20.00	80.55	89.55	93.32	92.82	91.48	89.54	5.8
1,3,5-TNB	20.00	212.60	206.29	208.40	210.28	208.06	209.13	1.1
1,3-DNB	20.00	284.05	289.17	293.78	291.57	290.36	289.79	1.3
Tetryl	20.00	169.65	165.60	171.93	171.00	171.53	169.94	1.5
Nitrobenzene	20.00	196.75	195.67	202.54	203.55	201.64	200.03	1.8
2,4,6-TNT	20.00	206.40	200.92	203.90	208.44	205.06	204.94	1.4
4-AM-2,6-DNT	20.00	156.75	144.28	146.21	146.58	146.43	148.05	3.3
2-AM-4,6-DNT	20.00	229.95	205.98	210.31	215.07	216.25	215.51	4.2
2,6-DNT	20.00	137.60	131.99	135.36	140.29	135.29	136.11	2.3
2,4-DNT	20.00	276.20	270.64	273.11	277.46	281.68	275.82	1.5
2-Nitrotoluene	20.00	130.40	127.75	127.93	129.28	128.10	128.69	0.9
4-Nitrotoluene	20.00	104.40	103.10	107.11	109.25	110.43	106.86	2.9
3-Nitrotoluene	20.00	132.95	130.43	138.71	137.68	140.89	136.13	3.2
SURROGATE	X	1.00X	5.00X	10.00X	20.00X	40.00X	MEAN	%RSD
3,4-Dinitrotoluene	20.00	117.40	121.21	124.62	126.61	126.82	123.33	3.2

EX81J19.MET

6024
10/25/04

INITIAL CALIBRATION
METHOD 8330

Lab Name : EMAX Inc
Instrument ID : HPLC1 81
GC Column : VARIAN C18
Column size ID : 25CMX4.6MM
LFID & Datetime: XJ19016A 10/19/04 19:08
LFID & Datetime: XJ19017A 10/19/04 19:36
LFID & Datetime: XJ19013A 10/19/04 17:41
LFID & Datetime: XJ19014A 10/19/04 18:10
LFID & Datetime: XJ19015A 10/19/04 18:39

	RT OF STANDARDS (MIN)					MEAN	RT WINDOW		RTWINDOW
COMPOUND	1.0X	5.0X	10.0X	20.0X	40.0X	RT	FROM	TO	WIDTH
HMX	4.300	4.292	4.292	4.292	4.275	4.290	4.240	4.340	0.050
RDX	6.433	6.383	6.367	6.375	6.333	6.378	6.240	6.516	0.138
1,3,5-TNB	8.650	8.617	8.600	8.633	8.575	8.615	8.462	8.768	0.153
1,3-DNB	10.492	10.450	10.417	10.483	10.400	10.448	10.219	10.677	0.229
Tetryl	11.358	11.308	11.250	11.342	11.250	11.302	11.014	11.590	0.288
Nitrobenzene	12.117	12.092	12.042	12.108	12.033	12.078	11.677	12.479	0.401
2,4,6-TNT	13.675	13.642	13.567	13.642	13.575	13.620	13.219	14.021	0.401
4-AM-2,6-DNT	14.433	14.392	14.292	14.383	14.308	14.362	13.857	14.867	0.505
2-AM-4,6-DNT	14.967	14.983	14.867	14.950	14.883	14.930	14.382	15.478	0.548
2,6-DNT	15.817	15.825	15.742	15.800	15.758	15.788	15.325	16.251	0.463
2,4-DNT	16.383	16.425	16.317	16.367	16.350	16.368	15.891	16.845	0.477
2-Nitrotoluene	19.467	19.525	19.442	19.458	19.467	19.472	18.881	20.063	0.591
4-Nitrotoluene	21.192	21.225	21.150	21.175	21.142	21.177	20.520	21.834	0.657
3-Nitrotoluene	22.658	22.717	22.592	22.633	22.600	22.640	21.888	23.392	0.752
SURROGATE	1.0X	5.0X	10.0X	20.0X	40.0X	RT	FROM	TO	WIDTH
3,4-Dinitrotoluene	12.900	12.858	12.792	12.875	12.792	12.843	12.468	13.218	0.375

EX81J19.MET

RA
10/25/04

SECOND SOURCE

INITIAL CALIBRATION VERIFICATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: XJ19014A 10/19/2004 18:10
Conc Cont LFID & Datetime: XJ19018A 10/19/2004 20:05
CONC UNIT : ppb ✓

COMPOUND	RT MINUTES	RT WINDOW FROM	RT WINDOW TO	TRUE CONC	AVERAGE CF	RESULT AREA	RESULT CONC	%D	QL	%D LIMITS
HMX	4.300	4.250	4.350	400.0	70.800	31158	440.13	10		15
RDX	6.400	6.262	6.538	400.0	89.500	38533	430.32	8		15
1,3,5-TNB	8.642	8.489	8.795	400.0	209.100	91920	439.54	10		15
1,3-DNB	10.483	10.254	10.712	400.0	289.800	127403	439.64	10		15
Tetryl	11.342	11.054	11.630	400.0	169.900	71202	418.98	5		15
Nitrobenzene	12.108	11.707	12.509	400.0	200.000	86805	433.96	8		15
2,4,6-TNT	13.625	13.224	14.026	400.0	204.900	88599	432.31	8		15
4-AM-2,6-DNT	14.400	13.895	14.905	400.0	148.100	60914	411.44	3		15
2-AM-4,6-DNT	14.950	14.402	15.498	400.0	215.500	91200	423.18	6		15
2,6-DNT	15.800	15.337	16.263	400.0	136.100	56248	413.27	3		15
2,4-DNT	16.383	15.906	16.860	400.0	275.800	117421	425.72	6		15
2-Nitrotoluene	19.475	18.884	20.066	400.0	128.700	53460	415.40	4		15
4-Nitrotoluene	21.192	20.535	21.849	400.0	106.900	46579	435.89	9		15
3-Nitrotoluene	22.667	21.915	23.419	400.0	136.100	57575	422.93	6		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-Dinitrotoluene	12.875	12.500	13.250	400.0	123.300	52174	423.04	6		15

EX81J19.MET ✓

dA
10/25/04

INITIAL CALIBRATION
METHOD 8330

Lab Name : EMAX Inc
Instrument ID : HPLC1 LCT001(T017)
GC Columm : LUNA 5U PHENYL-HEXYL
Column size ID : 25CMX4.6MM
LFID & Datetime: PH17007A 08/17/04 16:21
LFID & Datetime: PH17003A 08/17/04 13:35
LFID & Datetime: PH17004A 08/17/04 14:16
LFID & Datetime: PH17005A 08/17/04 14:58
LFID & Datetime: PH17006A 08/17/04 15:39
CONC UNIT: ppb

COMPOUND	CONC X	CALIBRATION FACTORS (AREA or HEIGHT)/UNIT 1.00X	5.00X	10.00X	20.00X	40.00X	MEAN	%RSD
HMX	20.00	265.05	223.86	243.86	247.42	244.74	244.99	6.0
RDX	20.00	315.15	255.37	260.41	253.93	258.37	268.65	9.7
Nitrobenzene	20.00	359.70	349.71	329.86	323.97	326.71	337.99	4.7
1,3-DNB	20.00	514.05	508.34	520.54	516.70	515.48	515.02	0.9
2-Nitrotoluene	20.00	238.50	278.15	281.94	287.52	281.20	273.46	7.3
4-Nitrotoluene	20.00	287.00	275.75	289.34	288.21	284.04	284.87	1.9
4-AM-2,6-DNT	20.00	276.50	256.61	256.86	264.78	254.15	261.78	3.5
3-Nitrotoluene	20.00	353.75	380.73	345.64	344.94	337.55	352.52	4.8
2-AM-4,6-DNT	20.00	464.60	447.94	400.02	400.57	393.79	421.38	7.7
1,3,5-TNB	20.00	368.85	364.11	349.42	354.06	340.07	355.30	3.2
2,6-DNT	20.00	258.20	256.25	261.51	248.39	253.99	255.67	1.9
2,4-DNT	20.00	433.50	511.11	524.55	509.46	513.54	498.43	7.4
Tetryl	20.00	511.65	504.42	558.66	520.24	525.23	524.04	4.0
2,4,6-TNT	20.00	421.55	507.22	574.38	536.85	548.40	517.68	11.4
SURROGATE	X	1.00X	5.00X	10.00X	20.00X	40.00X	MEAN	%RSD
3,4-DNT	20.00	288.40	260.85	245.15	244.29	241.54	256.04	7.7

EX17H17C.MET

RX
8/20/04

INITIAL CALIBRATION
METHOD 8330

Lab Name : EMAX Inc
Instrument ID : HPLC1 LCT001(T017)
GC Columm : LUNA 5U PHENYL-HEXYL
Column size ID : 25CMX4.6MM
LFID & Datetime: PH17007A 08/17/04 16:21
LFID & Datetime: PH17003A 08/17/04 13:35
LFID & Datetime: PH17004A 08/17/04 14:16
LFID & Datetime: PH17005A 08/17/04 14:58
LFID & Datetime: PH17006A 08/17/04 15:39

	RT OF STANDARDS (MIN)					MEAN	RT WINDOW		RTWINDOW
COMPOUND	1.0X	5.0X	10.0X	20.0X	40.0X	RT	FROM	TO	WIDTH
HMX	6.025	6.050	6.042	6.058	6.033	6.042	5.962	6.122	0.080
RDX	7.800	7.817	7.817	7.833	7.792	7.812	7.708	7.916	0.104
Nitrobenzene	10.633	10.675	10.667	10.692	10.633	10.660	10.556	10.764	0.104
1,3-DNB	15.183	15.258	15.258	15.292	15.175	15.233	14.872	15.594	0.361
2-Nitrotoluene	15.725	15.783	15.767	15.817	15.692	15.757	15.497	16.017	0.260
4-Nitrotoluene	16.225	16.342	16.342	16.375	16.258	16.308	16.018	16.598	0.290
4-AM-2,6-DNT	16.950	17.108	17.108	17.150	17.000	17.063	16.500	17.626	0.563
3-Nitrotoluene	17.700	17.800	17.775	17.825	17.700	17.760	17.393	18.127	0.367
2-AM-4,6-DNT	18.925	19.125	19.125	19.175	19.025	19.075	18.317	19.833	0.758
1,3,5-TNB	20.142	20.267	20.267	20.317	20.200	20.239	19.626	20.852	0.613
2,6-DNT	21.517	21.642	21.650	21.683	21.558	21.610	20.886	22.334	0.724
2,4-DNT	22.733	22.825	22.892	22.942	22.800	22.838	22.041	23.635	0.797
Tetryl	31.667	31.808	31.850	31.875	31.617	31.763	30.113	33.413	1.650
2,4,6-TNT	33.233	33.367	33.358	33.375	33.150	33.297	31.954	34.640	1.343
SURROGATE	1.0X	5.0X	10.0X	20.0X	40.0X	RT	FROM	TO	WIDTH
3,4-DNT	18.492	18.650	18.600	18.675	18.525	18.588	18.055	19.121	0.533

EX17H17C.MET

8/24/04

INITIAL CALIBRATION VERIFICATION
METHOD 8330

Lab Name	:	EMAX
Instrument ID	:	HPLC1 LCT001(T017)
GC Columm	:	LUNA 5U PHENYL-HEXYL
Column size ID	:	25CMX4.6MM
Mid Conc Init LFID & Datetime	:	PH17005A 08/17/2004 14:58
Conc Cont LFID & Datetime	:	PH17008A 08/17/2004 17:02
CONC UNIT	:	ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	RT WINDOW TO	TRUE CONC	AVERAGE CF	RESULT AREA	RESULT CONC	%D	QL	%D LIMITS
HMX	6.033	5.953	6.113	400.0	245.000	96246	392.86	-2		15
RDX	7.800	7.696	7.904	400.0	268.600	97411	362.60	-9		15
Nitrobenzene	10.667	10.563	10.771	400.0	338.000	123928	366.66	-8		15
1,3-DNB	15.258	14.897	15.619	400.0	515.000	198879	386.16	-3		15
2-Nitrotoluene	15.783	15.523	16.043	400.0	273.500	100966	369.21	-8		15
4-Nitrotoluene	16.342	16.052	16.632	400.0	284.900	104969	368.48	-8		15
4-AM-2,6-DNT	17.108	16.545	17.671	400.0	261.800	92990	355.22	-11		15
3-Nitrotoluene	17.808	17.441	18.175	400.0	352.500	124474	353.09	-12		15
2-AM-4,6-DNT	19.167	18.409	19.925	400.0	421.400	152612	362.17	-9		15
1,3,5-TNB	20.333	19.720	20.946	400.0	355.300	129357	364.08	-9		15
2,6-DNT	21.725	21.001	22.449	400.0	255.700	90313	353.24	-12		15
2,4-DNT	22.992	22.195	23.789	400.0	498.400	197715	396.67	-1		15
Tetryl	32.158	30.508	33.808	400.0	524.000	188490	359.68	-10		15
2,4,6-TNT	33.675	32.332	35.018	400.0	517.700	212198	409.90	2		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-DNT	18.650	18.117	19.183	400.0	256.000	90360	352.91	-12		15

EX17H17C.MET

DAILY CALIBRATION

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: XJ19014A 10/19/2004 18:10
Conc Cont LFID & Datetime: XL20003A 12/20/2004 17:58
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	RT WINDOW TO	TRUE CONC	AVERAGE CF	RESULT AREA	RESULT CONC	%D	QL	%D LIMITS
HMX	4.292	4.242	4.342	400.0	70.800	28461	402.03	1		15
RDX	6.300	6.162	6.438	400.0	89.500	35641	398.02	-0		15
1,3,5-TNB	8.500	8.347	8.653	400.0	209.100	83199	397.84	-1		15
1,3-DNB	10.250	10.021	10.479	400.0	289.800	115929	400.05	0		15
Tetryl	11.000	10.712	11.288	400.0	169.900	68123	400.86	0		15
Nitrobenzene	11.792	11.391	12.193	400.0	200.000	80732	403.60	1		15
2,4,6-TNT	13.300	12.899	13.701	400.0	204.900	80648	393.51	-2		15
4-AM-2,6-DNT	13.875	13.370	14.380	400.0	148.100	60372	407.78	2		15
2-AM-4,6-DNT	14.408	13.860	14.956	400.0	215.500	86596	401.82	0		15
2,6-DNT	15.358	14.895	15.821	400.0	136.100	55446	407.37	2		15
2,4-DNT	15.908	15.431	16.385	400.0	275.800	111329	403.63	1		15
2-Nitrotoluene	18.875	18.284	19.466	400.0	128.700	51626	401.15	0		15
4-Nitrotoluene	20.425	19.768	21.082	400.0	106.900	45124	422.27	6		15
3-Nitrotoluene	21.842	21.090	22.594	400.0	136.100	57301	420.92	5		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-Dinitrotoluene	12.517	12.142	12.892	400.0	123.300	50724	411.28	3		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: XJ19014A 10/19/2004 18:10
Conc Cont LFID & Datetime: XL20015A 12/20/2004 23:44
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	TO	TRUE CONC	AVERAGE CF	RESULT AREA	CONC	%D	QL	%D LIMITS
HMX	4.333	4.283	4.383	400.0	70.800	29272	413.49	3		15
RDX	6.408	6.270	6.546	400.0	89.500	38105	425.54	6		15
1,3,5-TNB	8.642	8.489	8.795	400.0	209.100	85122	407.03	2		15
1,3-DNB	10.467	10.238	10.696	400.0	289.800	119721	413.14	3		15
Tetryl	11.275	10.987	11.563	400.0	169.900	69968	411.72	3		15
Nitrobenzene	12.042	11.641	12.443	400.0	200.000	82996	414.92	4		15
2,4,6-TNT	13.592	13.191	13.993	400.0	204.900	84236	411.02	3		15
4-AM-2,6-DNT	14.333	13.828	14.838	400.0	148.100	61879	417.96	4		15
2-AM-4,6-DNT	14.875	14.327	15.423	400.0	215.500	87276	404.97	1		15
2,6-DNT	15.750	15.287	16.213	400.0	136.100	57777	424.50	6		15
2,4-DNT	16.325	15.848	16.802	400.0	275.800	113421	411.21	3		15
2-Nitrotoluene	19.358	18.767	19.949	400.0	128.700	52495	407.90	2		15
4-Nitrotoluene	20.983	20.326	21.640	400.0	106.900	46819	438.13	10		15
3-Nitrotoluene	22.450	21.698	23.202	400.0	136.100	57711	423.93	6		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-Dinitrotoluene	12.850	12.475	13.225	400.0	123.300	51463	417.27	4		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: XJ19014A 10/19/2004 18:10
Conc Cont LFID & Datetime: XL21002A 12/21/2004 12:17
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	RT WINDOW TO	TRUE CONC	AVERAGE CF	RESULT AREA	RESULT CONC	%D	QL	%D LIMITS
HMX	4.308	4.258	4.358	400.0	70.800	28235	398.84	-0		15
RDX	6.342	6.204	6.480	400.0	89.500	36063	402.74	1		15
1,3,5-TNB	8.550	8.397	8.703	400.0	209.100	82108	392.62	-2		15
1,3-DNB	10.325	10.096	10.554	400.0	289.800	115534	398.69	-0		15
Tetryl	11.108	10.820	11.396	400.0	169.900	67938	399.77	-0		15
Nitrobenzene	11.875	11.474	12.276	400.0	200.000	79947	399.67	-0		15
2,4,6-TNT	13.400	12.999	13.801	400.0	204.900	80421	392.40	-2		15
4-AM-2,6-DNT	14.033	13.528	14.538	400.0	148.100	59823	404.07	1		15
2-AM-4,6-DNT	14.558	14.010	15.106	400.0	215.500	84462	391.91	-2		15
2,6-DNT	15.492	15.029	15.955	400.0	136.100	54767	402.38	1		15
2,4-DNT	16.033	15.556	16.510	400.0	275.800	110265	399.77	-0		15
2-Nitrotoluene	19.008	18.417	19.599	400.0	128.700	51046	396.64	-1		15
4-Nitrotoluene	20.592	19.935	21.249	400.0	106.900	45322	424.12	6		15
3-Nitrotoluene	22.008	21.256	22.760	400.0	136.100	56862	417.70	4		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-Dinitrotoluene	12.633	12.258	13.008	400.0	123.300	49767	403.52	1		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: XJ19014A 10/19/2004 18:10
Conc Cont LFID & Datetime: XL21012A 12/21/2004 17:05
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	RT WINDOW TO	TRUE CONC	AVERAGE CF	RESULT AREA	RESULT CONC	%D	QL	%D LIMITS
HMX	4.300	4.250	4.350	400.0	70.800	28637	404.52	1		15
RDX	6.325	6.187	6.463	400.0	89.500	35492	396.36	-1		15
1,3,5-TNB	8.525	8.372	8.678	400.0	209.100	83787	400.65	0		15
1,3-DNB	10.283	10.054	10.512	400.0	289.800	116602	402.37	1		15
Tetryl	11.033	10.745	11.321	400.0	169.900	68756	404.58	1		15
Nitrobenzene	11.833	11.432	12.234	400.0	200.000	81307	406.47	2		15
2,4,6-TNT	13.350	12.949	13.751	400.0	204.900	80995	395.20	-1		15
4-AM-2,6-DNT	13.925	13.420	14.430	400.0	148.100	61989	418.70	5		15
2-AM-4,6-DNT	14.442	13.894	14.990	400.0	215.500	85780	398.03	-0		15
2,6-DNT	15.417	14.954	15.880	400.0	136.100	55335	406.56	2		15
2,4-DNT	15.950	15.473	16.427	400.0	275.800	111179	403.09	1		15
2-Nitrotoluene	18.933	18.342	19.524	400.0	128.700	51488	400.08	0		15
4-Nitrotoluene	20.508	19.851	21.165	400.0	106.900	44634	417.68	4		15
3-Nitrotoluene	21.917	21.165	22.669	400.0	136.100	57110	419.52	5		15

SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-Dinitrotoluene	12.575	12.200	12.950	400.0	123.300	51157	414.79	4		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: XJ19014A 10/19/2004 18:10
Conc Cont LFID & Datetime: XL23002A 12/23/2004 10:53
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	RT WINDOW TO	TRUE CONC	AVERAGE CF	RESULT AREA	RESULT CONC	%D	QL	%D LIMITS
HMX	4.358	4.308	4.408	400.0	70.800	29688	419.36	5		15
RDX	6.492	6.354	6.630	400.0	89.500	34599	386.39	-3		15
1,3,5-TNB	8.742	8.589	8.895	400.0	209.100	80373	384.33	-4		15
1,3-DNB	10.608	10.379	10.837	400.0	289.800	113625	392.10	-2		15
Tetryl	11.467	11.179	11.755	400.0	169.900	65675	386.45	-3		15
Nitrobenzene	12.208	11.807	12.609	400.0	200.000	79731	398.59	-0		15
2,4,6-TNT	13.792	13.391	14.193	400.0	204.900	79959	390.15	-2		15
4-AM-2,6-DNT	14.608	14.103	15.113	400.0	148.100	57911	391.15	-2		15
2-AM-4,6-DNT	15.192	14.644	15.740	400.0	215.500	83017	385.21	-4		15
2,6-DNT	16.025	15.562	16.488	400.0	136.100	55091	404.76	1		15
2,4-DNT	16.600	16.123	17.077	400.0	275.800	107692	390.44	-2		15
2-Nitrotoluene	19.675	19.084	20.266	400.0	128.700	51328	398.84	-0		15
4-Nitrotoluene	21.367	20.710	22.024	400.0	106.900	42767	400.21	0		15
3-Nitrotoluene	22.825	22.073	23.577	400.0	136.100	54537	400.62	0		15

SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-Dinitrotoluene	13.067	12.692	13.442	400.0	123.300	48651	394.47	-1		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: XJ19014A 10/19/2004 18:10
Conc Cont LFID & Datetime: XL23016A 12/23/2004 17:37
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	RT WINDOW TO	TRUE CONC	AVERAGE CF	RESULT AREA	RESULT CONC	%D	QL	%D LIMITS
HMX	4.333	4.283	4.383	400.0	70.800	27981	395.25	-1		15
RDX	6.383	6.245	6.521	400.0	89.500	35117	392.17	-2		15
1,3,5-TNB	8.625	8.472	8.778	400.0	209.100	81650	390.43	-2		15
1,3-DNB	10.425	10.196	10.654	400.0	289.800	114830	396.26	-1		15
Tetryl	11.217	10.929	11.505	400.0	169.900	67084	394.75	-1		15
Nitrobenzene	12.017	11.616	12.418	400.0	200.000	80687	403.37	1		15
2,4,6-TNT	13.558	13.157	13.959	400.0	204.900	80222	391.43	-2		15
4-AM-2,6-DNT	14.192	13.687	14.697	400.0	148.100	59942	404.87	1		15
2-AM-4,6-DNT	14.725	14.177	15.273	400.0	215.500	85062	394.70	-1		15
2,6-DNT	15.700	15.237	16.163	400.0	136.100	55098	404.82	1		15
2,4-DNT	16.250	15.773	16.727	400.0	275.800	110274	399.81	-0		15
2-Nitrotoluene	19.308	18.717	19.899	400.0	128.700	51910	403.36	1		15
4-Nitrotoluene	20.942	20.285	21.599	400.0	106.900	44073	412.43	3		15
3-Nitrotoluene	22.375	21.623	23.127	400.0	136.100	55859	410.33	3		15

SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-Dinitrotoluene	12.800	12.425	13.175	400.0	123.300	50125	406.42	2		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: XJ19014A 10/19/2004 18:10
Conc Cont LFID & Datetime: XL23027A 12/23/2004 22:54
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	TO	TRUE CONC	AVERAGE CF	RESULT AREA	CONC	%D	QL	%D LIMITS
HMX	4.375	4.325	4.425	400.0	70.800	29637	418.64	5		15
RDX	6.517	6.379	6.655	400.0	89.500	36080	402.93	1		15
1,3,5-TNB	8.792	8.639	8.945	400.0	209.100	82495	394.47	-1		15
1,3-DNB	10.675	10.446	10.904	400.0	289.800	116959	403.60	1		15
Tetryl	11.542	11.254	11.830	400.0	169.900	67565	397.58	-1		15
Nitrobenzene	12.308	11.907	12.709	400.0	200.000	82491	412.39	3		15
2,4,6-TNT	13.900	13.499	14.301	400.0	204.900	82087	400.53	0		15
4-AM-2,6-DNT	14.725	14.220	15.230	400.0	148.100	59400	401.21	0		15
2-AM-4,6-DNT	15.292	14.744	15.840	400.0	215.500	85244	395.54	-1		15
2,6-DNT	16.150	15.687	16.613	400.0	136.100	55442	407.34	2		15
2,4-DNT	16.742	16.265	17.219	400.0	275.800	109634	397.48	-1		15
2-Nitrotoluene	19.883	19.292	20.474	400.0	128.700	52269	406.15	2		15
4-Nitrotoluene	21.592	20.935	22.249	400.0	106.900	43985	411.61	3		15
3-Nitrotoluene	23.092	22.340	23.844	400.0	136.100	55630	408.64	2		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-Dinitrotoluene	13.192	12.817	13.567	400.0	123.300	49990	405.33	1		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 81
GC Columm : VARIAN C18
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: XJ19014A 10/19/2004 18:10
Conc Cont LFID & Datetime: XL23038A 12/24/2004 04:11
CONC UNIT : ppb

COMPOUND	RT MINUTES	RT WINDOW FROM	RT WINDOW TO	TRUE CONC	AVERAGE CF	RESULT AREA	RESULT CONC	%D	QL	%D LIMITS
HMX	4.400	4.350	4.450	400.0	70.800	29602	418.15	5		15
RDX	6.592	6.454	6.730	400.0	89.500	37230	415.77	4		15
1,3,5-TNB	8.892	8.739	9.045	400.0	209.100	84659	404.82	1		15
1,3-DNB	10.825	10.596	11.054	400.0	289.800	120239	414.92	4		15
Tetryl	11.742	11.454	12.030	400.0	169.900	68531	403.26	1		15
Nitrobenzene	12.483	12.082	12.884	400.0	200.000	84709	423.48	6		15
2,4,6-TNT	14.117	13.716	14.518	400.0	204.900	83632	408.07	2		15
4-AM-2,6-DNT	15.067	14.562	15.572	400.0	148.100	59693	403.19	1		15
2-AM-4,6-DNT	15.650	15.102	16.198	400.0	215.500	85801	398.13	-0		15
2,6-DNT	16.458	15.995	16.921	400.0	136.100	57170	420.04	5		15
2,4-DNT	17.058	16.581	17.535	400.0	275.800	111497	404.24	1		15
2-Nitrotoluene	20.267	19.676	20.858	400.0	128.700	53591	416.42	4		15
4-Nitrotoluene	22.025	21.368	22.682	400.0	106.900	45028	421.37	5		15
3-Nitrotoluene	23.533	22.781	24.285	400.0	136.100	56965	418.45	5		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-Dinitrotoluene	13.425	13.050	13.800	400.0	123.300	49777	403.60	1		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 LCT001(T017)
GC Columm : LUNA 5U PHENYL-HEXYL
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: PH17005A 08/17/2004 14:58
Conc Cont LFID & Datetime: PL21002A 12/21/2004 14:29
CONC UNIT : ppb

	RT	RT WINDOW		TRUE	AVERAGE	RESULT				%D
COMPOUND	MINUTES	FROM	TO	CONC	CF	AREA	CONC	%D	QL	LIMITS
HMX	6.125	6.045	6.205	400.0	245.000	97335	397.31	-1		15
RDX	7.933	7.829	8.037	400.0	268.600	100692	374.81	-6		15
Nitrobenzene	10.725	10.621	10.829	400.0	338.000	131155	388.04	-3		15
1,3-DNB	15.442	15.081	15.803	400.0	515.000	191677	372.17	-7		15
2-Nitrotoluene	15.850	15.590	16.110	400.0	273.500	107744	394.00	-2		15
4-Nitrotoluene	16.450	16.160	16.740	400.0	284.900	117212	411.46	3		15
4-AM-2,6-DNT	17.433	16.870	17.996	400.0	261.800	89732	342.78	-14		15
3-Nitrotoluene	17.883	17.516	18.250	400.0	352.500	145090	411.58	3		15
2-AM-4,6-DNT	19.600	18.842	20.358	400.0	421.400	157332	373.37	-7		15
1,3,5-TNB	20.467	19.854	21.080	400.0	355.300	135909	382.52	-4		15
2,6-DNT	21.867	21.143	22.591	400.0	255.700	96515	377.50	-6		15
2,4-DNT	23.225	22.428	24.022	400.0	498.400	200257	401.77	0		15
Tetryl	32.650	31.000	34.300	400.0	524.000	188547	359.79	-10		15
2,4,6-TNT	33.833	32.490	35.176	400.0	517.700	227459	439.38	10		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-DNT	18.908	18.375	19.441	400.0	256.000	92885	362.77	-9		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 LCT001(T017)
GC Columm : LUNA 5U PHENYL-HEXYL
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: PH17005A 08/17/2004 14:58
Conc Cont LFID & Datetime: PL21013A 12/21/2004 22:06
CONC UNIT : ppb

	RT	RT WINDOW		TRUE	AVERAGE	RESULT				%D
COMPOUND	MINUTES	FROM	TO	CONC	CF	AREA	CONC	%D	QL	LIMITS
HMX	6.200	6.120	6.280	400.0	245.000	97276	397.07	-1		15
RDX	8.042	7.938	8.146	400.0	268.600	100724	374.93	-6		15
Nitrobenzene	10.883	10.779	10.987	400.0	338.000	129845	384.17	-4		15
1,3-DNB	15.733	15.372	16.094	400.0	515.000	200479	389.26	-3		15
2-Nitrotoluene	16.150	15.890	16.410	400.0	273.500	105320	385.14	-4		15
4-Nitrotoluene	16.767	16.477	17.057	400.0	284.900	119340	418.93	5		15
4-AM-2,6-DNT	18.058	17.495	18.621	400.0	261.800	93293	356.38	-11		15
3-Nitrotoluene	18.250	17.883	18.617	400.0	352.500	142248	403.51	1		15
2-AM-4,6-DNT	20.108	19.350	20.866	400.0	421.400	160422	380.70	-5		15
1,3,5-TNB	20.933	20.320	21.546	400.0	355.300	139700	393.19	-2		15
2,6-DNT	22.450	21.726	23.174	400.0	255.700	98773	386.33	-3		15
2,4-DNT	23.783	22.986	24.580	400.0	498.400	207335	415.97	4		15
Tetryl	33.750	32.100	35.400	400.0	524.000	184486	352.04	-12		15
2,4,6-TNT	34.808	33.465	36.151	400.0	517.700	238090	459.92	15		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-DNT	19.358	18.825	19.891	400.0	256.000	93389	364.74	-9		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 LCT001(T017)
GC Columm : LUNA 5U PHENYL-HEXYL
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: PH17005A 08/17/2004 14:58
Conc Cont LFID & Datetime: PL27005A 12/27/2004 14:47 ✓
CONC UNIT : ppb

	RT	RT WINDOW		TRUE	AVERAGE	RESULT				%D
COMPOUND	MINUTES	FROM	TO	CONC	CF	AREA	CONC	%D	QL	LIMITS
HMX	6.275	6.195	6.355	400.0	245.000	91068	371.73	-7		15
RDX	8.058	7.954	8.162	400.0	268.600	100246	373.15	-7		15
Nitrobenzene	10.783	10.679	10.887	400.0	338.000	128489	380.15	-5		15
1,3-DNB	15.500	15.139	15.861	400.0	515.000	199881	388.10	-3		15
2-Nitrotoluene	15.900	15.640	16.160	400.0	273.500	108011	394.98	-1		15
4-Nitrotoluene	16.492	16.202	16.782	400.0	284.900	112972	396.58	-1		15
4-AM-2,6-DNT	17.575	17.012	18.138	400.0	261.800	94475	360.89	-10		15
3-Nitrotoluene	17.942	17.575	18.309	400.0	352.500	136658	387.66	-3		15
2-AM-4,6-DNT	19.775	19.017	20.533	400.0	421.400	152274	361.37	-10		15
1,3,5-TNB	20.475	19.862	21.088	400.0	355.300	132940	374.16	-6		15
2,6-DNT	21.917	21.193	22.641	400.0	255.700	97703	382.15	-4		15
2,4-DNT	23.292	22.495	24.089	400.0	498.400	198391	398.03	-0		15
Tetryl	32.775	31.125	34.425	400.0	524.000	201490	384.49	-4		15
2,4,6-TNT	33.817	32.474	35.160	400.0	517.700	216732	418.66	5		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-DNT	18.950	18.417	19.483	400.0	256.000	95187	371.76	-7		15

CONTINUE CALIBRATION
METHOD 8330

Lab Name : EMAX
Instrument ID : HPLC1 LCT001(T017)
GC Columm : LUNA 5U PHENYL-HEXYL
Column size ID : 25CMX4.6MM
Mid Conc Init LFID & Datetime: PH17005A 08/17/2004 14:58
Conc Cont LFID & Datetime: PL27011A 12/27/2004 18:56 ✓
CONC UNIT : ppb

	RT	RT WINDOW		TRUE	AVERAGE	RESULT				%D
COMPOUND	MINUTES	FROM	TO	CONC	CF	AREA	CONC	%D	QL	LIMITS
HMX	6.275	6.195	6.355	400.0	245.000	94700	386.55	-3		15
RDX	8.058	7.954	8.162	400.0	268.600	96936	360.83	-10		15
Nitrobenzene	10.792	10.688	10.896	400.0	338.000	128609	380.51	-5		15
1,3-DNB	15.492	15.131	15.853	400.0	515.000	201715	391.66	-2		15
2-Nitrotoluene	15.917	15.657	16.177	400.0	273.500	110711	404.85	1		15
4-Nitrotoluene	16.492	16.202	16.782	400.0	284.900	113923	399.92	-0		15
4-AM-2,6-DNT	17.567	17.004	18.130	400.0	261.800	91957	351.28	-12		15
3-Nitrotoluene	17.942	17.575	18.309	400.0	352.500	143786	407.88	2		15
2-AM-4,6-DNT	19.767	19.009	20.525	400.0	421.400	151933	360.56	-10		15
1,3,5-TNB	20.483	19.870	21.096	400.0	355.300	128895	362.78	-9		15
2,6-DNT	21.933	21.209	22.657	400.0	255.700	94871	371.07	-7		15
2,4-DNT	23.292	22.495	24.089	400.0	498.400	200622	402.50	1		15
Tetryl	32.800	31.150	34.450	400.0	524.000	201341	384.21	-4		15
2,4,6-TNT	33.842	32.499	35.185	400.0	517.700	215930	417.11	4		15
SURROGATE	MINUTES	FROM	TO	TRUECON	CF	AREA	CONC	%D	QL	LIMITS
3,4-DNT	18.950	18.417	19.483	400.0	256.000	97050	379.04	-5		15

ANALYTICAL LOGS

ANALYSIS RUN LOG FOR HPLC

SOP ☑ **EMAX-8330 Rev. No: 2** ☐ **EMAX-8310 Rev. No: 4** ☐ **EMAX-8332 Rev. No: 0** ☐ **Book # A81-02-005**

Starting Date: 10/19/04 **Time:** ~~1645~~ XP 10/19/04 11:27 **Ending Date:** 10/19/04 **Time:** 20:05

EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

ANALYTICAL BATCH NA

Preparation Batch	Data File Name	Lab Sample ID	DF	Matrix (W)	Matrix (S)	Notes
	XJ19.001	TEST				
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10	IB81J614				
NA	11	EX81J1901 20				Not evaluated RT shifted
	12	02 100				
	13	03 200				8330 Ical (Primary col.)
	14	04 400				
	15	05 800				
	16	01 20				
	17	02 100				
	18	IEX81J1901 400				

XP 10/19/04

Instrument Number	**81**

INITIAL CALIBRATION REFERENCE

Date	10/19/04
Method	EX81J19
Mid Point	XJ19014A (4/5)
ICAL ID	SH18-03-40-3 (800ppb)
ICV ID	SH18-03-36-2 (10ppm)
DCC ID	

Solvents ID

Acetonitrile	
Methanol	43206332
Water	43189

Electronic Data Archival

Location	Date
☐ EZC_5_HPLC	
☐	

Comments: Samples disposed off 10/20/04

Analyzed By: XP.

This page is checked during the data review process.

ANALYSIS RUN LOG FOR HPLC

SOP ☑ **EMAX-8330 Rev. No: 2** conf. ☐ **EMAX-8310 Rev. No: 4** ☐ **EMAX-8332 Rev. No: 0** ☐ **Book # A17-010**

Starting Date: 8/17/04 **Time:** 12:11 **Ending Date:** 8/17/04 **Time:** 23:58

ANALYTICAL BATCH PH17G08A

Preparation Batch	Data File Name	Lab Sample ID	DF	Matrix S	Matrix W	Notes
	PH17.001	IB17H658				
	2	EX17H17C- 01 20				Not evaluated
	3	02 100				8330C Ical Phenyl-hexyl column
	4	03 200				
	5	04 400				
	6	05 800				
	7	↓ 01 20				
	8	IEX17H17C-01 400				
EXH001S	9	04G156-18T	5			
	10	18DT	5			
	11	18	1			
↓	12	↓ 18D	1			
EXH002W	13	04G092-24T	10			
	14	24DT	↓			
	15	24	1			
↓	16	↓ 24D	↓			
	17	IB				
	↓ 18	CEX17H17C658				

XP 8/17/04

Instrument Number	**17**

Initial Calibration

Date	08/17/04
met.	EX17H17C
m.p	PH17005A

Standards

Name	ID	Conc. (µg/L)
DCC ID	SHIC-03-47-2	400
Ical Stock	XP 8/17/04 ~~833~~ SHIB-03-36-3	1600
ICV	SHIC-03-53-1	400

Solvent ID

Methanol	43206332	
Water	43189	
Acetonitrile	—	

Electronic Data Archival

Location	Date

Comments: Samples disposed off 8/18/04

Analyzed By: XP

This page is checked during the data review process.

EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

ANALYSIS RUN LOG FOR HPLC

Book # A81-02-005

SOP ☑ EMAX-8330 Rev. No: 2 ☐ EMAX-8310 Rev. No: 4 ☐ EMAX-8332 Rev. No: 0 ☐

Starting Date: 12/20/04 Time: 17:00 Ending Date: 12/20/04 Time: 23:44

ANALYTICAL BATCH XL20003A

Preparation Batch	Data File Name	Lab Sample ID	DF	Matrix (W)	Matrix (S)	Notes
	XP 12/20/04 ~~XE~~ XL20.001	TEST				
	2	FB812664				
	3	CEX81J19664				800
EXL004W	4	EXL004WB	✓	✓		
	5	↓ L				
	6	↓ C				
	7	04L128-11				E
	8	↓ 12				
	9	04L142-07				E
↓	10	04L145-01	↓	↓		Sat.
	11	Rinse				
EXL004W	12	04L145-02	✓	✓		Sat.
	13	Rinse				
	14	↓				
	↓ 15	CEX81J19665				800

XP 12/20/04

Instrument Number	81

INITIAL CALIBRATION REFERENCE

Date	10/19/04
Method	EX81J19
Mid Point	XJ19074A (4/5)
ICAL ID	—
ICV ID	—
DCC ID	SHIC-03-54-2

Solvents ID

Acetonitrile	—
Methanol	43206332
Water	44168

Electronic Data Archival

Location	Date
☐ EZC_5_HPLC	
☐	

Comments: samples disposed off 12/21/04

Analyzed By: XP

This page is checked during the data review process.

EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

ANALYSIS RUN LOG FOR HPLC

SOP ☑ EMAX-8330 **Rev. No:** 2 ☐ EMAX-8310 **Rev. No:** 4 ☐ EMAX-8332 **Rev. No:** 0 ☐ **Book # A81-02-005**

Starting Date: 12/21/04 **Time:** 11:48 **Ending Date:** 12/22/04 **Time:** 01:44

ANALYTICAL BATCH XL21002A

Preparation Batch	Data File Name	Lab Sample ID	DF	Matrix (W)	Matrix (S)	Notes
	XL21.001	IB81L666				
	2	CEX81J19666				800
EXL004W	3	04L128-11I	50	✓		
	4	↓ 11T	5			
	5	04L145-01I	500			
	6	01T	20			
	7	02I	500			
	8	↓ 02T	20			
	9	04L142-07I	100			
↓	10	↓ 07T	10	↓		
	11	IB				
	12	CEX81J19667				800
EXL005S	13	EXL005SB	1		✓	
	14	↓ L				
	15	04L128-01				
	16	02				
	17	02M				
	18	02S				
↓	19	↓ 03	↓		↓	
	20	IB				
	21	CEX81J19668				800
EXL005S	22	04L128-04	1		✓	
	23	05				
	24	06				
	25	07				
	26	08				
	27	09				
↓	28	↓ 10	↓		↓	
	29	Rinse				
	↓ 30	CEX81J19669				800

Instrument Number	81

INITIAL CALIBRATION REFERENCE

Date	10/19/04
Method	EX81J19
Mid Point	XJ19014A (4/8)
ICAL ID	—
ICV ID	—
DCC ID	SHIC-03-54-2

Solvents ID

Acetonitrile	—
Methanol	43206332
Water	44168

Electronic Data Archival

Location	Date
☐ EZC_5_HPLC	
☐	

Comments: Samples disposed off 12/22/04

Analyzed By: XP

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EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

6048

ANALYSIS RUN LOG FOR HPLC

SOP ☑ **EMAX-8330 Rev. No: 2** ☐ **EMAX-8310 Rev. No: 4** ☐ **EMAX-8332 Rev. No: 0** ☐ **Book # A81-02-005**

Starting Date: 12/23/04 **Time:** 10:25 **Ending Date:** 12/24/04 **Time:** 00:20

ANALYTICAL BATCH XL2300LA

Preparation Batch	Data File Name	Lab Sample ID	DF	Matrix (W)	Matrix (S)	Notes
	XL23.001	IB81L672				
	.002	CEX81J19672				400ppb
	.003	8330 Surr-Cltk *				SHIB-03-44-2 Surr QC
EXL006S	.004	EX~~E~~L006SB	1		✓	
↓	.005	12/23/04 SL	↓		↓	
	.006	04L145-03				
	.007	-04 [illegible] 12/23/04				
	008	-04M				
	009	-04S				
	010	-05				
	011	-06				
	012	-07				RR, possible carryover.
	013	-08				
	014	IB81L673				
	015	↓				
	016	CEX81J19673				400
EXL006L	017	04L154-03I	1000		✓	
↓	018	-04I	1000		↓	
	019	-03T	10			
	020	-04T	10			
	021	04L154-03	1			
	022	BLNK				
EXL006S	023	04L154-04	1			
	024	BLNK				
	025	IB				
	026	IB81L674				
	027	CEX81J19674				400
EXL007W	028	EXL007WB	1	V		
↓	029	L	↓	↓		
	030	C				

Instrument Number	**81**

INITIAL CALIBRATION REFERENCE

Date	10/19/04
Method	EX81J19
Mid Point	XJ19014A (4/5)
ICAL ID	–
ICV ID	–
DCC ID	SHIC-03-34-2

Solvents ID

Acetonitrile	–
Methanol	43206332
Water	44168

Electronic Data Archival

Location	Date
☑ EZC_5_HPLC	12/27/04
☐	

Comments: * SHIB-03-44-2

Samples disposed off 12/27/04

Analyzed By:

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EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

ANALYSIS RUN LOG FOR HPLC

SOP ☑ **EMAX-8330 Rev. No: 2** ☐ **EMAX-8310 Rev. No: 4** ☐ **EMAX-8332 Rev. No: 0** ☐ **Book # A81-02-005**

Starting Date: 12/24/04 **Time:** 00:49 **Ending Date:** 12/24 **Time:** 04:11

ANALYTICAL BATCH XL23 001W

Preparation Batch	Data File Name	Lab Sample ID	DF	Matrix (W)	Matrix (S)	Notes
EXL007W	XL23.031	04L154-01	1	✓		
↓	.032	↓ -02	↓	↓		
	.033	IB				
EXL006S	.034	04L145-07W	1		✓	
↓	.035	04L145-06F	5		↓	
	.036	IB				
	.037	EB81L675				
	.038	CEX81J19675				400

12/27/04

Instrument Number	81

INITIAL CALIBRATION REFERENCE

Date	10/19/04
Method	EX81J19
Mid Point	XJ19014A
ICAL ID	–
ICV ID	–
DCC ID	SHIC-03-54-2

Solvents ID

Acetonitrile	–
Methanol	43206332
Water	44168

Electronic Data Archival

Location	Date
☑ EZC_5_HPLC	12/27/04
☐	

Comments: Samples disposed off 12/27/04

Analyzed By:

EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

ANALYSIS RUN LOG FOR HPLC

SOP ☑ EMAX-8330 Rev. No: 2 conf. ☐ EMAX-8310 Rev. No: 4 ☐ EMAX-8332 Rev. No: 0 ☐ **Book # A17-010**

Starting Date: 12/21/04 **Time:** 13:47 **Ending Date:** 12/21/04 **Time:** 22:06

EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

ANALYTICAL BATCH PL21009A

Preparation Batch	Data File Name	Lab Sample ID	DF	Matrix S	Matrix W	Notes
	PL21.001	IB17L694				
	2	CEX17H17C694				800.
EXL004W	3	04L128-11T	5		✓	Imp. RR
	4	↓ 11T	↓			
	5	↓ 12	1			
	6	04L145-01T	20			
	7	01	1			
	8	02T	20			
	9	↓ 01	1			
	10	04L142-07T	10			
↓	11	↓ 07	1		↓	
EXL055S	12	04L128-01	1	✓		
	↓ 13	~~CEXS~~ XP 12/21/04 CEX17H17C695				800

XP 12/21/04

Instrument Number	17

Initial Calibration

Date	08/17/04
met.	EX17H17C
m.p	PH17005A (4/5)

Standards

Name	ID	Conc. (μg/L)
DCC ID	8HC-03-54-2	~~80~~ XP 12/21/04 400

Solvent ID

Methanol	43206332	pure
Water	44168	↓
Acetonitrile	—	

Electronic Data Archival

Location	Date

Comments: samples disposed off 12/22/04

Analyzed By: XP

This page is checked during the data review process.

ANALYSIS RUN LOG FOR HPLC

SOP ☑ EMAX-8330 Rev. No: 2 ☐ EMAX-8310 Rev. No: 4 ☐ EMAX-8332 Rev. No: 0 ☐ conf

Book # A17-01

Starting Date: 12/27/04 Time: 11:34 Ending Date: 12/27/04 Time: 23:05

EMAX LABORATORIES, INC. 1835 W. 205th St. Torrance, CA 90501

ANALYTICAL BATCH PL27005X

Preparation Batch	Data File Name	Lab Sample ID	DF	Matrix S	Matrix W	Notes
	PL27.001	TEST				
	.002	↓				
	.003	IB17L703				
	.004	TEST				
	.005	CEX17H17C703				400ppb
EXL0068	.006	04L145-08	1	✓		
	.007	-04				
	.008	-03				
	.009	-05				
	.010	-06				
	.011	CEX17H17C704				400ppb
EXL007W	.012	04L114-01	1		✓	
↓	.013	-02				
EXL0063	.014	-03				
↓	.015	-04				
	.016	IB				
	.017	CEX17H17C705				400ppb

DS 12/28/04

Instrument Number	17

Initial Calibration

Date	08/17/04
met.	EX17H17C
m.p	PH17003A

Standards

Name	ID	Conc. (µg/L)
DCC ID	SH1C-0336-2	400

Solvent ID

Methanol	43306332	glue
Water	44168	↓
Acetonitrile		

Electronic Data Archival

Location	Date

Comments:

Samples disposed off 12/28/04 DS

Analyzed By: DS

EXTRACTION LOGS

EXTRACTION LOG FOR EXPLOSIVES

SOP: ☒ EMAX-8330 **Rev.No.:** 3 ☐

Matrix: WATER **Start Date:** 12/20/04 **Time:** 13:00 **End Date:** 12/20/04 **Time:** ~~14~~ 15:30 JV 12/20/04 **Book # EEX-010**

PREPARATION BATCH: EXL004-W

Sample Prep ID	Lab Sample ID	Sample Amount (g | ml)	Extract Volume (ml)	Notes
*01	EXL004-WB	200	4	
*02	↓ -WL	200	4	
*03	↓ -WC	200	4	
*04	04L128 -11	200	4	
*05	↓ -12	200	4	
*06	04L142 -07	200	4	
*07	04L145 -01	200	4	
*08	↓ -02	200	4	
*09				
*10	JV 12/20/04			
*11				
*12				
*13				
*14				
*15				
*16				
*17				
*18				
*19				
*20				
*21				
*22				
*23				
*24				
*25				
*26				

Standards	ID	Amount Added (ml)
Surrogate	SHIB-03-36-1	0.08
LCS/MS	SHIB-03-36-2	0.08

Reagent	Lot# / ID
Acetonitrile	A3080
NaCl	SWIA-02-1478
CaCl$_2$	SPIB-~~02-12~~ 01-267 JV 12/20/4
Silica Sand	~~#2269249~~ JV 12/20/4

SDG #	Extract Location
	SECH #1

Comments:

Prepared By: JV

Standard Added By: JV/EG

Checked By: ML

Extract Received By: XP 12/20/04

Disposal Date:

EXTRACTION LOG FOR EXPLOSIVES

SOP: ☒ EMAX-8330 Rev.No.: 3 ☐

Matrix: SOIL Start Date: 12/22/04 Time: 17:00 End Date: 12/23/04 Time: 11:00 Book # EEX-010

Sample Prep ID	Lab Sample ID	Sample Amount (g | ml)	Extract Volume (ml)	Notes
*01	EXL006 -SB	2.02	20	
*02	↓ -SL	2.03	20	
*03	04L145 -03	2.00	20	
*04	-04	2.01	20	
*05	-04M	2.03	20	
*06	-04S	2.03	20	
*07	-05	2.04	20	
*08	-06	2.01	20	
*09	-07	2.03	20	
*10	-08	2.03	20	
*11	04L154 -03	2.02	20	
*12	↓ -04	2.01	20	
*13				
*14	JV 12/22/04			
*15				
*16				
*17				
*18				
*19				
*20				
*21				
*22				
*23				
*24				
*25				
*26				

Standards	ID	Amount Added (ml)
Surrogate	SH1B-03-36-1	0.4
LCS/MS	SH1B-03-36-2	0.4

Reagent	Lot# / ID
Acetonitrile	43080
NaCl	-
$CaCl_2$	SP1B-01-267
Silica Sand	42289249

SDG #	Extract Location
	SE04 # 1

Comments:

Prepared By: JV

Standard Added By: JV/SS

Checked By: ML

Extract Received By: DS 12/23/04

Disposal Date:

PREPARATION BATCH: EXL006-S

LABORATORY REPORT FOR

SHAW E&I

LONG HORN ARMY AMMUNITION PLANT

EPA METHOD 8330
EXPLOSIVES

SDG#: 04L154

CASE NARRATIVE

CLIENT: **SHAW E & I**

PROJECT: **LONG HORN ARMY AMMUNITION PLANT**

EMAX SDG: **04L154**

EPA METHOD 8330
EXPLOSIVES

Two (2) water and two (2) soil samples were received on 12/21/04 for Explosives analysis by EPA Method 8330 in accordance with USEPA-SW846 3rd edition, and EMAX-8330.

1. Holding Time

Analytical holding time was met. Extraction for water samples was started and completed on 12/23/04. Extraction for soil samples was started on 12/22/04 and completed on 12/23/04.

2. Calibration

Initial calibration was 5 point. %RSDs were within 20%. All continuing calibrations of the primary column were carried out at 12-hour intervals and the recoveries were within 85-115%.

3. Method Blank

Method blanks were free of contamination at the Reporting Limit.

4. Surrogate recovery

All surrogate recoveries were within QC limits.

5. Lab Control Sample / Lab Control Duplicate

All recoveries were within QC limits.

6. Matrix Spike/Matrix Spike Duplicate

No sample was spiked.

7. Sample Analysis

Sample analyses were within QC requirements. Quantitation is from the primary column. All positive results above RL were confirmed by LC-CN column and the confirmation is presumptive because it was based on retention time window.

Samples were air-dried prior to extraction; hence, no moisture correction was applied to RL, MDL and results.

LAB CHRONICLE
EXPLOSIVES

Client : SHAW E&I
Project : LONGHORN ARMY AMMUNITION PLANT

SDG NO. : 04L154
Instrument ID : T081

SOIL

Client Sample ID	Laboratory Sample ID	Dilution Factor	% Moist	Analysis DateTime	Extraction DateTime	Sample Data FN	Calibration Data FN	Prep. Batch	Notes
MBLK1S	EXL006SB	1	NA	12/23/0411:51	12/22/0417:00	XL23004A	XL23002A	EXL006S	Method Blank
LCS1S	EXL006SL	1	NA	12/23/0412:20	12/22/0417:00	XL23005A	XL23002A	EXL006S	Lab Control Sample (LCS)
29SD44	L154-03	1	NA	12/23/0420:01	12/22/0417:00	XL23021A	XL23016A	EXL006S	Field Sample
29SD45	L154-04	1	NA	12/23/0420:59	12/22/0417:00	XL23023A	XL23016A	EXL006S	Field Sample

WATER

Client Sample ID	Laboratory Sample ID	Dilution Factor	% Moist	Analysis DateTime	Extraction DateTime	Sample Data FN	Calibration Data FN	Prep. Batch	Notes
MBLK1W	EXL007WB	1	NA	12/23/0423:23	12/23/0411:00	XL23028A	XL23027A	EXL007W	Method Blank
LCS1W	EXL007WL	1	NA	12/23/0423:52	12/23/0411:00	XL23029A	XL23027A	EXL007W	Lab Control Sample (LCS)
LCD1W	EXL007WC	1	NA	12/24/0400:20	12/23/0411:00	XL23030A	XL23027A	EXL007W	LCS Duplicate
29SW44	L154-01	1	NA	12/24/0400:49	12/23/0411:00	XL23031A	XL23027A	EXL007W	Field Sample
29SW45	L154-02	1	NA	12/24/0401:18	12/23/0411:00	XL23032A	XL23027A	EXL007W	Field Sample

FN - Filename
% Moist - Percent Moisture

EPA METHOD 8330
EXPLOSIVES

Client	: SHAW E&I	Date Collected:	12/19/04
Project	: LONGHORN ARMY AMMUNITION PLANT	Date Received:	12/21/04
Batch No.	: 04L154	Date Extracted:	12/23/04 11:00
Sample ID:	29SW44	Date Analyzed:	12/24/04 00:49
Lab Samp ID:	L154-01	Dilution Factor:	1
Lab File ID:	XL23031A	Matrix	: WATER
Ext Btch ID:	EXL007W	% Moisture	: NA
Calib. Ref.:	XL23027A	Instrument ID	: T-081

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
HMX	ND	1	.2
RDX	ND	1	.2
1,3,5-TNB	ND	1	.2
1,3-DNB	ND	1	.2
TETRYL	ND	1	.2
NITROBENZENE	ND	1	.2
2,4,6-TNT	.4J	1	.2
4-AM-2,6-DNT	2	1	.2
2-AM-4,6-DNT	.56J	1	.2
2,6-DNT	ND	1	.2
2,4-DNT	ND	1	.2
2-NITROTOLUENE	ND	1	.2
3-NITROTOLUENE	ND	1	.2
4-NITROTOLUENE	ND	1	.2

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	99	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

Client : SHAW E&I	Date Collected: 12/19/04
Project : LONGHORN ARMY AMMUNITION PLANT	Date Received: 12/21/04
Batch No. : 04L154	Date Extracted: 12/23/04 11:00
Sample ID: 29SW45	Date Analyzed: 12/24/04 01:18
Lab Samp ID: L154-02	Dilution Factor: 1
Lab File ID: XL23032A	Matrix : WATER
Ext Btch ID: EXL007W	% Moisture : NA
Calib. Ref.: XL23027A	Instrument ID : T-081

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
HMX	ND	1	.2
RDX	ND	1	.2
1,3,5-TNB	ND	1	.2
1,3-DNB	ND	1	.2
TETRYL	ND	1	.2
NITROBENZENE	ND	1	.2
2,4,6-TNT	.39J	1	.2
4-AM-2,6-DNT	1.9	1	.2
2-AM-4,6-DNT	.53J	1	.2
2,6-DNT	ND	1	.2
2,4-DNT	ND	1	.2
2-NITROTOLUENE	ND	1	.2
3-NITROTOLUENE	ND	1	.2
4-NITROTOLUENE	ND	1	.2

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	90	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

Client	: SHAW E&I	Date Collected:	12/20/04
Project	: LONGHORN ARMY AMMUNITION PLANT	Date Received:	12/21/04
Batch No.	: 04L154	Date Extracted:	12/22/04 17:00
Sample ID:	29SD44	Date Analyzed:	12/23/04 20:01
Lab Samp ID:	L154-03	Dilution Factor:	1
Lab File ID:	XL23021A	Matrix :	SOIL
Ext Btch ID:	EXL006S	% Moisture :	NA
Calib. Ref.:	XL23016A	Instrument ID :	T-081

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	400	200
RDX	ND	400	200
1,3,5-TNB	ND	400	200
1,3-DNB	ND	400	200
TETRYL	ND	400	200
NITROBENZENE	ND	400	200
2,4,6-TNT	ND	400	200
4-AM-2,6-DNT	ND	400	200
2-AM-4,6-DNT	ND	400	200
2,6-DNT	ND	400	200
2,4-DNT	ND	400	200
2-NITROTOLUENE	ND	400	200
3-NITROTOLUENE	ND	400	200
4-NITROTOLUENE	ND	400	200

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	110	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

Client : SHAW E&I
Project : LONGHORN ARMY AMMUNITION PLANT
Batch No. : 04L154
Sample ID: 29SD45
Lab Samp ID: L154-04
Lab File ID: XL23023A
Ext Btch ID: EXL006S
Calib. Ref.: XL23016A

Date Collected: 12/20/04
Date Received: 12/21/04
Date Extracted: 12/22/04 17:00
Date Analyzed: 12/23/04 20:59
Dilution Factor: 1
Matrix : SOIL
% Moisture : NA
Instrument ID : T-081

PARAMETERS	RESULTS (ug/kg)	RL (ug/kg)	MDL (ug/kg)
HMX	ND	400	200
RDX	ND	400	200
1,3,5-TNB	ND	400	200
1,3-DNB	ND	400	200
TETRYL	ND	400	200
NITROBENZENE	ND	400	200
2,4,6-TNT	410	400	200
4-AM-2,6-DNT	ND	400	200
2-AM-4,6-DNT	ND	400	200
2,6-DNT	ND	400	200
2,4-DNT	ND	400	200
2-NITROTOLUENE	ND	400	200
3-NITROTOLUENE	ND	400	200
4-NITROTOLUENE	ND	400	200

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	116	63-143

Note: All positive results are confirmed by CN column

EPA METHOD 8330
EXPLOSIVES

Client : SHAW E&I
Project : LONGHORN ARMY AMMUNITION PLANT
Batch No. : 04L154
Sample ID: MBLK1W
Lab Samp ID: EXL007WB
Lab File ID: XL23028A
Ext Btch ID: EXL007W
Calib. Ref.: XL23027A

Date Collected: NA
Date Received: 12/23/04
Date Extracted: 12/23/04 11:00
Date Analyzed: 12/23/04 23:23
Dilution Factor: 1
Matrix : WATER
% Moisture : NA
Instrument ID : T-081

PARAMETERS	RESULTS (ug/L)	RL (ug/L)	MDL (ug/L)
HMX	ND	1	.2
RDX	ND	1	.2
1,3,5-TNB	ND	1	.2
1,3-DNB	ND	1	.2
TETRYL	ND	1	.2
NITROBENZENE	ND	1	.2
2,4,6-TNT	ND	1	.2
4-AM-2,6-DNT	ND	1	.2
2-AM-4,6-DNT	ND	1	.2
2,6-DNT	ND	1	.2
2,4-DNT	ND	1	.2
2-NITROTOLUENE	ND	1	.2
3-NITROTOLUENE	ND	1	.2
4-NITROTOLUENE	ND	1	.2

SURROGATE PARAMETERS	% RECOVERY	QC LIMIT
3,4-DINITROTOLUENE	91	63-143

Note: All positive results are confirmed by CN column

EMAX QUALITY CONTROL DATA
LCS/LCD ANALYSIS

CLIENT: SHAW E&I
PROJECT: LONGHORN ARMY AMMUNITION PLANT
BATCH NO.: 04L154
METHOD: EPA 8330

MATRIX:	WATER			% MOISTURE:	NA
DILUTION FACTOR:	1	1	1		
SAMPLE ID:	MBLK1W				
LAB SAMP ID:	EXL007WB	EXL007WL	EXL007WC		
LAB FILE ID:	XL23028A	XL23029A	XL23030A		
DATE EXTRACTED:	12/23/0411:00	12/23/0411:00	12/23/0411:00	DATE COLLECTED:	NA
DATE ANALYZED:	12/23/0423:23	12/23/0423:52	12/24/0400:20	DATE RECEIVED:	12/23/04
PREP. BATCH:	EXL007W	EXL007W	EXL007W		
CALIB. REF:	XL23027A	XL23027A	XL23027A		

ACCESSION:

PARAMETER	BLNK RSLT (ug/L)	SPIKE AMT (ug/L)	BS RSLT (ug/L)	BS % REC	SPIKE AMT (ug/L)	BSD RSLT (ug/L)	BSD % REC	RPD (%)	QC LIMIT (%)	MAX RPD (%)
HMX	ND	4	3.94	98	4	4.07	102	3	70-130	30
RDX	ND	4	3.13	78	4	3.23	81	3	60-130	30
1,3,5-TNB	ND	4	3.65	91	4	3.81	95	4	70-130	30
1,3-DNB	ND	4	3.45	86	4	3.63	91	5	70-130	30
Tetryl	ND	4	3.55	89	4	3.81	95	7	50-140	30
Nitrobenzene	ND	4	3.28	82	4	3.47	87	6	60-130	30
2,4,6-TNT	ND	4	3.96	99	4	4.14	104	5	70-140	30
4-AM-2,6-DNT	ND	4	3.47	87	4	3.68	92	6	70-130	30
2-AM-4,6-DNT	ND	4	3.59	90	4	3.82	95	6	70-130	30
2,6-DNT	ND	4	3.61	90	4	3.9	97	8	70-130	30
2,4-DNT	ND	4	3.67	92	4	3.91	98	6	70-130	30
2-Nitrotoluene	ND	4	3.43	86	4	3.55	89	3	70-130	30
3-Nitrotoluene	ND	4	3.48	87	4	3.68	92	6	70-130	30
4-Nitrotoluene	ND	4	3.6	90	4	3.77	94	5	70-130	30

SURROGATE PARAMETER	SPIKE AMT (ug/L)	BS RSLT (ug/L)	BS % REC	SPIKE AMT (ug/L)	BSD RSLT (ug/L)	BSD % REC	QC LIMIT (%)
3,4-Dinitrotoluene	4	3.72	93	4	4.05	101	70-130

```
                         EPA METHOD 8330
                           EXPLOSIVES

==============================================================================
Client     : SHAW E&I                          Date  Collected: NA
Project    : LONGHORN ARMY AMMUNITION PLANT    Date   Received: 12/22/04
Batch No.  : 04L154                            Date  Extracted: 12/22/04 17:00
Sample   ID: MBLK1S                            Date   Analyzed: 12/23/04 11:51
Lab Samp ID: EXL006SB                          Dilution Factor: 1
Lab File ID: XL23004A                          Matrix         : SOIL
Ext Btch ID: EXL006S                           % Moisture     : NA
Calib. Ref.: XL23002A                          Instrument ID  : T-081
==============================================================================

                                            RESULTS        RL            MDL
PARAMETERS                                  (ug/kg)     (ug/kg)        (ug/kg)
----------                                  -------     -------        -------
HMX                                           ND          400            200
RDX                                           ND          400            200
1,3,5-TNB                                     ND          400            200
1,3-DNB                                       ND          400            200
TETRYL                                        ND          400            200
NITROBENZENE                                  ND          400            200
2,4,6-TNT                                     ND          400            200
4-AM-2,6-DNT                                  ND          400            200
2-AM-4,6-DNT                                  ND          400            200
2,6-DNT                                       ND          400            200
2,4-DNT                                       ND          400            200
2-NITROTOLUENE                                ND          400            200
3-NITROTOLUENE                                ND          400            200
4-NITROTOLUENE                                ND          400            200

SURROGATE PARAMETERS                      % RECOVERY    QC LIMIT
--------------------                      ----------    --------
3,4-DINITROTOLUENE                            106        63-143

Note:  All positive results are confirmed by CN column
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EMAX QUALITY CONTROL DATA
LCS ANALYSIS

CLIENT: SHAW E&I
PROJECT: LONGHORN ARMY AMMUNITION PLANT
BATCH NO.: 04L154
METHOD: EPA 8330

MATRIX:	SOIL		% MOISTURE:	NA
DILUTION FACTOR:	1	1		
SAMPLE ID:	MBLK1S			
LAB SAMP ID:	EXL006SB	EXL006SL		
LAB FILE ID:	XL23004A	XL23005A		
DATE EXTRACTED:	12/22/0417:00	12/22/0417:00	DATE COLLECTED:	NA
DATE ANALYZED:	12/23/0411:51	12/23/0412:20	DATE RECEIVED:	12/22/04
PREP. BATCH:	EXL006S	EXL006S		
CALIB. REF:	XL23002A	XL23002A		

ACCESSION:

PARAMETER	BLNK RSLT (ug/kg)	SPIKE AMT (ug/kg)	BS RSLT (ug/kg)	BS % REC	QC LIMIT (%)
HMX	ND	2000	2050	102	70-140
RDX	ND	2000	2000	100	70-140
1,3,5-TNB	ND	2000	2160	108	70-130
1,3-DNB	ND	2000	2210	111	70-130
Tetryl	ND	2000	1970	98	60-140
Nitrobenzene	ND	2000	2190	110	70-130
2,4,6-TNT	ND	2000	2140	107	70-140
4-AM-2,6-DNT	ND	2000	2090	104	70-130
2-AM-4,6-DNT	ND	2000	2120	106	70-130
2,6-DNT	ND	2000	2140	107	70-140
2,4-DNT	ND	2000	2150	108	70-130
2-Nitrotoluene	ND	2000	2030	102	70-130
3-Nitrotoluene	ND	2000	2060	103	70-130
4-Nitrotoluene	ND	2000	2210	111	70-130

SURROGATE PARAMETER	SPIKE AMT (ug/kg)	BS RSLT (ug/kg)	BS % REC	QC LIMIT (%)
3,4-Dinitrotoluene	2000	2140	107	70-130

KEMRON
ENVIRONMENTAL SERVICES

156 Starlite Drive, Marietta, OH 45750 ● TEL 740-373-4071 ● FAX 740-373-4835 ● http://www.kemron.com

Laboratory Report Number: L0502503 - Revised

Please find enclosed the analytical results for the samples you submitted to KEMRON Environmental Services.

Review and compilation of your report was completed by KEMRON's Sales and Service Team. If you have questions, comments or require further assistance regarding this report, please contact our team member noted in the Reviewed box below at 800-373-4071. Team member e-mail addresses also appear here for your convenience.

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This report was reviewed on March 17, 2005:

Stephanie Mossburg

I certify that all test results meet all of the requirments of the NELAP standards and other applicable contract terms and conditions. All results for soil samples are reported on a 'dry-weight' basis unless specified otherwise. Analytical results for water and wastes are reported on an 'as received' basis unless specified otherwise. A statement of uncertainty for each analysis is available upon request. This laboratory report shall not be reproduced, except in full, without the written approval of KEMRON Environmental Services.

This report was certified on March 17, 2005:

David E. Vandenberg

FL DOH NELAP ID: E87551

This report contains a total of 49 pages.

Protecting Our Environmental Future

LABORATORY REPORT

L0502503

03/14/05 08:44

Submitted By

KEMRON Environmental Services
156 Starlite Drive
Marietta , OH 45750
(740) 373 - 4071

For

Account Name: Shaw E & I, Inc.
ABB Lummus Biulding
3010 Briarpark
Houston, TX 77042
Attention: Diane Meyer

Account Number: 307-ALLIANCE-798
Work ID: CHAAP-29 MANHOLES

P.O. Number: 69840

Sample Summary

Client ID	Lab ID	Date Collected	Date Received
29WL34-MH03-02	L0502503-01	24-FEB-05	25-FEB-05
29WL36-MH05-02	L0502503-02	24-FEB-05	25-FEB-05
29WL37-MH06-02	L0502503-03	24-FEB-05	25-FEB-05
29WL38-MH07-02	L0502503-04	23-FEB-05	25-FEB-05
29WL39-MH08-02	L0502503-05	23-FEB-05	25-FEB-05
29WL40-MH09-02	L0502503-06	23-FEB-05	25-FEB-05
29WL40-MH09-52	L0502503-07	23-FEB-05	25-FEB-05
29WL41-MH10-02	L0502503-08	23-FEB-05	25-FEB-05
29WL42-MH11-02	L0502503-09	23-FEB-05	25-FEB-05
29WL43-MH12-02	L0502503-10	23-FEB-05	25-FEB-05

KEMRON ENVIRONMENTAL SERVICES
REPORT NARRATIVE

KEMRON Login No.: L0502503

CHAIN OF CUSTODY: The chain of custody number was 01-KEMM-FEB05.

SHIPMENT CONDITIONS: The chain of custody forms were received sealed in a cooler. The cooler temperatures were 2, 3, and 4 degrees C.

SAMPLE MANAGEMENT: All samples received were intact.

I certify that this data package is in compliance with the terms and conditions agreed to by the client and KEMRON Environmental Services, both technically and for completeness, except for the conditions noted above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designated person, as verified by the following signature.

Approved: 01-MAR-05
Stephanie Mossburg

KEMRON ENVIRONMENTAL SERVICES
HPLC-EXPLOSIVE RESIDUES

KEMRON Login No.: L0502503

METHOD

Analysis: SW-846 8330

HOLDING TIMES

Sample Preparation: All holding times were met.

Sample Analysis: All holding times were met.

PREPARATION

Sample preparation proceeded normally.

CALIBRATION

Initial Calibration: For all compounds linear equations were applied. All acceptance criteria were met.

Alternate Source Standards: All acceptance criteria were met.

Continuing Calibration: All acceptance criteria were met.

BATCH QA/QC

Method Blank: All acceptance criteria were met.

Laboratory Control Sample: All acceptance criteria were met.

Matrix Spikes: The MS/MSD results were not associated with this sample delivery group.

SAMPLES

Surrogates: Sample fractions 01 through 03 yielded a percent recovery for the surrogate that was below the advisory limit. For fractions 02 and 03 the surrogate co-eluted with the high 2,4,6-trinitrotoluene peak. For fraction 01 the surrogate was poorly resolved from the 2,4,6-trinitrotoluene peak.

Samples: Sample fractions 01 through 03 and 06 through 10 were re-analyzed at a dilution in order to maintain the analysis within the range of calibration. All acceptance criteria were met.

Manual Integration Reason Codes

KEMRON laboratory management has identified four general cases with valid reasons supporting the use of manual integration techniques.

Reason #1: Data System Fails to Select Correct Peak
In some cases the chromatography system selects and integrates the ”wrong peak”. In this case the analyst must correct the selection and force the system to integrate the proper peak. Other times the system may miss the peak completely.

’**Reason #2: Data System Splits the Peak Incorrectly or Integrates a False Peak as a Rider Peak.**
This phenomena is common at low concentrations where the signal:noise ratio is low. A single compound (peak) is incorrectly split into multiple peaks or integrated as a main peak with one or more rider peaks resulting in low area counts for the target compound.

Reason #3: Improperly Integrated Isomers and/or coeluting compounds.
This system often fails to distinguish coeluting compounds and or isomers. The integration areas and concentrations are wrong, and they must be corrected by manual integration. Prime examples are benzo(k)fluoranthene and benzo(b)fluoranthene which are often unresolved and integrated improperly when both are present at low concentrations in standards or samples.

Reason #4: System Establishes Incorrect Baseline
There are numerous situations in chromatography where the system establishes the baseline incorrectly. Some baseline errors will be obvious to the analyst and should be corrected via manual procedures.

Reason #5: Miscellaneous
Other situations involving integration errors may require in-depth review and technical judgment. These cases should be brought to the attention of the laboratory management. If the form of manual integration is not clearly covered by these four cases, then review and approval by the Laboratory Director or the QA/QC Supervisor will be required.

I certify that this data package is in compliance with the terms and conditions agreed to by the client and KEMRON Environmental Services, both technically and for completeness, except for the conditions noted above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designated person, as verified by the following signature.

Analyst: RDC

Approved: 11-MAR-05

Sample Number:L0502503-01
Client ID:29WL34-MH03-02
Matrix:Water
Workgroup Number:WG184109
Collect Date:24-FEB-05
Sample Tag:01

Prep Method:3535
Analytical Method:8330
Analyst:ECL
Dilution:1
Units:ug/L

Instrument:HPLC4
Prep Date:03/02/2005 08:00
Cal Date:03/02/2005 16:53
Run Date:03/02/2005 19:59
File ID:4L007772.F

Analyte	CAS. Number	Result	Qual	RL	MDL
1,3,5-Trinitrobenzene	99-35-4		U	1.05	0.263
1,3-Dinitrobenzene	99-65-0		U	1.05	0.263
2,4,6-Trinitrotoluene	118-96-7	23.5	I	1.05	0.263
2,4-Dinitrotoluene	121-14-2		U	1.05	0.263
2,6-Dinitrotoluene	606-20-2		U	1.05	0.263
2-Amino-4,6-dinitrotoluene	35572-78-2	1.19		1.05	0.263
2-Nitrotoluene	88-72-2		U	1.05	0.263
3-Nitrotoluene	99-08-1		U	1.05	0.263
4-Nitrotoluene	99-99-0		U	1.05	0.263
4-Amino-2,6-dinitrotoluene	19406-51-0	2.13		1.05	0.263
HMX	2691-41-0		U	1.05	0.263
Nitrobenzene	98-95-3		U	1.05	0.263
RDX	121-82-4		U	1.05	0.263
Tetryl	479-45-8		U	1.05	0.263

Surrogate	% Recovery	Lower	Upper	Qual
3,4-Dinitrotoluene	42.9	50	150	SMI

I Semiquantitative result (out of instrument calibration range)
SMI Sample matrix interference on surrogate
U Not detected at or above the method detection limit

Sample Number:L0502503-01
Client ID:29WL34-MH03-02
Matrix:Water
Workgroup Number:WG184109
Collect Date:24-FEB-05
Sample Tag:DL01

Prep Method:3535
Analytical Method:8330
Analyst:ECL
Dilution:5
Units:ug/L

Instrument:HPLC4
Prep Date:03/02/2005 08:00
Cal Date:03/02/2005 16:53
Run Date:03/03/2005 18:31
File ID:4L007786.F

Analyte	CAS. Number	Result	Qual	RL	MDL
1,3,5-Trinitrobenzene	99-35-4		U	5.26	1.32
1,3-Dinitrobenzene	99-65-0		U	5.26	1.32
2,4,6-Trinitrotoluene	118-96-7	23.0		5.26	1.32
2,4-Dinitrotoluene	121-14-2		U	5.26	1.32
2,6-Dinitrotoluene	606-20-2		U	5.26	1.32
2-Amino-4,6-dinitrotoluene	35572-78-2		U	5.26	1.32
2-Nitrotoluene	88-72-2		U	5.26	1.32
3-Nitrotoluene	99-08-1		U	5.26	1.32
4-Nitrotoluene	99-99-0		U	5.26	1.32
4-Amino-2,6-dinitrotoluene	19406-51-0	2.20	J	5.26	1.32
HMX	2691-41-0		U	5.26	1.32
Nitrobenzene	98-95-3		U	5.26	1.32
RDX	121-82-4		U	5.26	1.32
Tetryl	479-45-8		U	5.26	1.32

Surrogate	% Recovery	Lower	Upper	Qual
3,4-Dinitrotoluene	42.7	50	150	SMI

J The analyte was positively identified, but the quantitation was below the RL
SMI Sample matrix interference on surrogate
U Not detected at or above the method detection limit

Sample Number: **L0502503-02**	Prep Method: **3535**	Instrument: **HPLC4**
Client ID: **29WL36-MH05-02**	Analytical Method: **8330**	Prep Date: **03/02/2005 08:00**
Matrix: **Water**	Analyst: **ECL**	Cal Date: **03/02/2005 16:53**
Workgroup Number: **WG184109**	Dilution: **1**	Run Date: **03/02/2005 20:36**
Collect Date: **24-FEB-05**	Units: **ug/L**	File ID: **4L007773.F**
Sample Tag: **01**		

Analyte	CAS. Number	Result	Qual	RL	MDL
1,3,5-Trinitrobenzene	99-35-4		U	1.04	0.260
1,3-Dinitrobenzene	99-65-0		U	1.04	0.260
2,4,6-Trinitrotoluene	118-96-7	88.3	I	1.04	0.260
2,4-Dinitrotoluene	121-14-2		U	1.04	0.260
2,6-Dinitrotoluene	606-20-2		U	1.04	0.260
2-Amino-4,6-dinitrotoluene	35572-78-2	1.82		1.04	0.260
2-Nitrotoluene	88-72-2		U	1.04	0.260
3-Nitrotoluene	99-08-1		U	1.04	0.260
4-Nitrotoluene	99-99-0		U	1.04	0.260
4-Amino-2,6-dinitrotoluene	19406-51-0	2.74		1.04	0.260
HMX	2691-41-0		U	1.04	0.260
Nitrobenzene	98-95-3		U	1.04	0.260
RDX	121-82-4		U	1.04	0.260
Tetryl	479-45-8		U	1.04	0.260

Surrogate	% Recovery	Lower	Upper	Qual
3,4-Dinitrotoluene		50	150	SMI

I Semiquantitative result (out of instrument calibration range)
SMI Sample matrix interference on surrogate
U Not detected at or above the method detection limit

Sample Number: **L0502503-02**	Prep Method: **3535**	Instrument: **HPLC4**
Client ID: **29WL36-MH05-02**	Analytical Method: **8330**	Prep Date: **03/02/2005 08:00**
Matrix: **Water**	Analyst: **ECL**	Cal Date: **03/02/2005 16:53**
Workgroup Number: **WG184109**	Dilution: **10**	Run Date: **03/03/2005 19:09**
Collect Date: **24-FEB-05**	Units: **ug/L**	File ID: **4L007787.F**
Sample Tag: **DL01**		

Analyte	CAS. Number	Result	Qual	RL	MDL
1,3,5-Trinitrobenzene	99-35-4		U	10.4	2.60
1,3-Dinitrobenzene	99-65-0		U	10.4	2.60
2,4,6-Trinitrotoluene	118-96-7	84.3		10.4	2.60
2,4-Dinitrotoluene	121-14-2		U	10.4	2.60
2,6-Dinitrotoluene	606-20-2		U	10.4	2.60
2-Amino-4,6-dinitrotoluene	35572-78-2		U	10.4	2.60
2-Nitrotoluene	88-72-2		U	10.4	2.60
3-Nitrotoluene	99-08-1		U	10.4	2.60
4-Nitrotoluene	99-99-0		U	10.4	2.60
4-Amino-2,6-dinitrotoluene	19406-51-0	2.88	J	10.4	2.60
HMX	2691-41-0		U	10.4	2.60
Nitrobenzene	98-95-3		U	10.4	2.60
RDX	121-82-4		U	10.4	2.60
Tetryl	479-45-8		U	10.4	2.60

Surrogate	% Recovery	Lower	Upper	Qual
3,4-Dinitrotoluene		50	150	DL

DL Surrogate or spike compound was diluted out
J The analyte was positively identified, but the quantitation was below the RL
U Not detected at or above the method detection limit

Sample Number:**L0502503-03**
Client ID:**29WL37-MH06-02**
Matrix:**Water**
Workgroup Number:**WG184109**
Collect Date:**24-FEB-05**
Sample Tag:**01**

Prep Method:**3535**
Analytical Method:**8330**
Analyst:**ECL**
Dilution:**1**
Units:**ug/L**

Instrument:**HPLC4**
Prep Date:**03/02/2005 08:00**
Cal Date:**03/02/2005 16:53**
Run Date:**03/02/2005 21:14**
File ID:**4L007774.F**

Analyte	CAS. Number	Result	Qual	RL	MDL
1,3,5-Trinitrobenzene	99-35-4	1.34		1.04	0.260
1,3-Dinitrobenzene	99-65-0		U	1.04	0.260
2,4,6-Trinitrotoluene	118-96-7	452	I	1.04	0.260
2,4-Dinitrotoluene	121-14-2		U	1.04	0.260
2,6-Dinitrotoluene	606-20-2		U	1.04	0.260
2-Amino-4,6-dinitrotoluene	35572-78-2	6.27		1.04	0.260
2-Nitrotoluene	88-72-2		U	1.04	0.260
3-Nitrotoluene	99-08-1		U	1.04	0.260
4-Nitrotoluene	99-99-0		U	1.04	0.260
4-Amino-2,6-dinitrotoluene	19406-51-0	8.15		1.04	0.260
HMX	2691-41-0		U	1.04	0.260
Nitrobenzene	98-95-3		U	1.04	0.260
RDX	121-82-4	0.494	J	1.04	0.260
Tetryl	479-45-8		U	1.04	0.260

Surrogate	% Recovery	Lower	Upper	Qual
3,4-Dinitrotoluene		50	150	SMI

I Semiquantitative result (out of instrument calibration range)
J The analyte was positively identified, but the quantitation was below the RL
SMI Sample matrix interference on surrogate
U Not detected at or above the method detection limit

Sample Number:**L0502503-03**
Client ID:**29WL37-MH06-02**
Matrix:**Water**
Workgroup Number:**WG184109**
Collect Date:**24-FEB-05**
Sample Tag:**DL01**

Prep Method:**3535**
Analytical Method:**8330**
Analyst:**ECL**
Dilution:**100**
Units:**ug/L**

Instrument:**HPLC4**
Prep Date:**03/02/2005 08:00**
Cal Date:**03/02/2005 16:53**
Run Date:**03/03/2005 19:46**
File ID:**4L007788.F**

Analyte	CAS. Number	Result	Qual	RL	MDL
1,3,5-Trinitrobenzene	99-35-4		U	104	26.0
1,3-Dinitrobenzene	99-65-0		U	104	26.0
2,4,6-Trinitrotoluene	118-96-7	430		104	26.0
2,4-Dinitrotoluene	121-14-2		U	104	26.0
2,6-Dinitrotoluene	606-20-2		U	104	26.0
2-Amino-4,6-dinitrotoluene	35572-78-2		U	104	26.0
2-Nitrotoluene	88-72-2		U	104	26.0
3-Nitrotoluene	99-08-1		U	104	26.0
4-Nitrotoluene	99-99-0		U	104	26.0
4-Amino-2,6-dinitrotoluene	19406-51-0		U	104	26.0
HMX	2691-41-0		U	104	26.0
Nitrobenzene	98-95-3		U	104	26.0
RDX	121-82-4		U	104	26.0
Tetryl	479-45-8		U	104	26.0

Surrogate	% Recovery	Lower	Upper	Qual
3,4-Dinitrotoluene		50	150	DL

DL Surrogate or spike compound was diluted out
U Not detected at or above the method detection limit

Sample Number: **L0502503-04**
Client ID: **29WL38-MH07-02**
Matrix: **Water**
Workgroup Number: **WG184109**
Collect Date: **23-FEB-05**
Sample Tag: **01**

Prep Method: **3535**
Analytical Method: **8330**
Analyst: **ECL**
Dilution: **1**
Units: **ug/L**

Instrument: **HPLC4**
Prep Date: **03/02/2005 08:00**
Cal Date: **03/02/2005 16:53**
Run Date: **03/02/2005 22:28**
File ID: **4L007776.F**

Analyte	CAS. Number	Result	Qual	RL	MDL
1,3,5-Trinitrobenzene	99-35-4		U	1.04	0.260
1,3-Dinitrobenzene	99-65-0		U	1.04	0.260
2,4,6-Trinitrotoluene	118-96-7	0.955	J	1.04	0.260
2,4-Dinitrotoluene	121-14-2		U	1.04	0.260
2,6-Dinitrotoluene	606-20-2		U	1.04	0.260
2-Amino-4,6-dinitrotoluene	35572-78-2	0.428	J	1.04	0.260
2-Nitrotoluene	88-72-2		U	1.04	0.260
3-Nitrotoluene	99-08-1		U	1.04	0.260
4-Nitrotoluene	99-99-0		U	1.04	0.260
4-Amino-2,6-dinitrotoluene	19406-51-0	0.364	J	1.04	0.260
HMX	2691-41-0		U	1.04	0.260
Nitrobenzene	98-95-3		U	1.04	0.260
RDX	121-82-4		U	1.04	0.260
Tetryl	479-45-8		U	1.04	0.260

Surrogate	% Recovery	Lower	Upper	Qual
3,4-Dinitrotoluene	74.5	50	150	

J The analyte was positively identified, but the quantitation was below the RL
U Not detected at or above the method detection limit

Sample Number: **L0502503-05**
Client ID: **29WL39-MH08-02**
Matrix: **Water**
Workgroup Number: **WG184109**
Collect Date: **23-FEB-05**
Sample Tag: **01**

Prep Method: **3535**
Analytical Method: **8330**
Analyst: **ECL**
Dilution: **1**
Units: **ug/L**

Instrument: **HPLC4**
Prep Date: **03/02/2005 08:00**
Cal Date: **03/02/2005 16:53**
Run Date: **03/02/2005 23:05**
File ID: **4L007777.F**

Analyte	CAS. Number	Result	Qual	RL	MDL
1,3,5-Trinitrobenzene	99-35-4		U	1.03	0.258
1,3-Dinitrobenzene	99-65-0		U	1.03	0.258
2,4,6-Trinitrotoluene	118-96-7	6.36		1.03	0.258
2,4-Dinitrotoluene	121-14-2		U	1.03	0.258
2,6-Dinitrotoluene	606-20-2		U	1.03	0.258
2-Amino-4,6-dinitrotoluene	35572-78-2	1.29		1.03	0.258
2-Nitrotoluene	88-72-2		U	1.03	0.258
3-Nitrotoluene	99-08-1		U	1.03	0.258
4-Nitrotoluene	99-99-0		U	1.03	0.258
4-Amino-2,6-dinitrotoluene	19406-51-0	1.70		1.03	0.258
HMX	2691-41-0		U	1.03	0.258
Nitrobenzene	98-95-3		U	1.03	0.258
RDX	121-82-4		U	1.03	0.258
Tetryl	479-45-8		U	1.03	0.258

Surrogate	% Recovery	Lower	Upper	Qual
3,4-Dinitrotoluene	61.7	50	150	

U Not detected at or above the method detection limit

Sample Number:	L0502503-06	Prep Method:	3535	Instrument:	HPLC4
Client ID:	29WL40-MH09-02	Analytical Method:	8330	Prep Date:	03/02/2005 08:00
Matrix:	Water	Analyst:	ECL	Cal Date:	03/02/2005 16:53
Workgroup Number:	WG184109	Dilution:	1	Run Date:	03/02/2005 23:43
Collect Date:	23-FEB-05	Units:	ug/L	File ID:	4L007778.F
Sample Tag:	01				

Analyte	CAS. Number	Result	Qual	RL	MDL
1,3,5-Trinitrobenzene	99-35-4		U	1.06	0.266
1,3-Dinitrobenzene	99-65-0		U	1.06	0.266
2,4,6-Trinitrotoluene	118-96-7	20.4	I	1.06	0.266
2,4-Dinitrotoluene	121-14-2	1.13		1.06	0.266
2,6-Dinitrotoluene	606-20-2	1.27		1.06	0.266
2-Amino-4,6-dinitrotoluene	35572-78-2	1.68		1.06	0.266
2-Nitrotoluene	88-72-2		U	1.06	0.266
3-Nitrotoluene	99-08-1		U	1.06	0.266
4-Nitrotoluene	99-99-0		U	1.06	0.266
4-Amino-2,6-dinitrotoluene	19406-51-0	2.42		1.06	0.266
HMX	2691-41-0		U	1.06	0.266
Nitrobenzene	98-95-3		U	1.06	0.266
RDX	121-82-4		U	1.06	0.266
Tetryl	479-45-8		U	1.06	0.266

Surrogate	% Recovery	Lower	Upper	Qual
3,4-Dinitrotoluene	67.4	50	150	

I Semiquantitative result (out of instrument calibration range)
U Not detected at or above the method detection limit

Sample Number:	L0502503-06	Prep Method:	3535	Instrument:	HPLC4
Client ID:	29WL40-MH09-02	Analytical Method:	8330	Prep Date:	03/02/2005 08:00
Matrix:	Water	Analyst:	ECL	Cal Date:	03/02/2005 16:53
Workgroup Number:	WG184109	Dilution:	5	Run Date:	03/03/2005 20:23
Collect Date:	23-FEB-05	Units:	ug/L	File ID:	4L007789.F
Sample Tag:	DL01				

Analyte	CAS. Number	Result	Qual	RL	MDL
1,3,5-Trinitrobenzene	99-35-4		U	5.32	1.33
1,3-Dinitrobenzene	99-65-0		U	5.32	1.33
2,4,6-Trinitrotoluene	118-96-7	20.0		5.32	1.33
2,4-Dinitrotoluene	121-14-2		U	5.32	1.33
2,6-Dinitrotoluene	606-20-2		U	5.32	1.33
2-Amino-4,6-dinitrotoluene	35572-78-2	1.63	J	5.32	1.33
2-Nitrotoluene	88-72-2		U	5.32	1.33
3-Nitrotoluene	99-08-1		U	5.32	1.33
4-Nitrotoluene	99-99-0		U	5.32	1.33
4-Amino-2,6-dinitrotoluene	19406-51-0	2.35	J	5.32	1.33
HMX	2691-41-0		U	5.32	1.33
Nitrobenzene	98-95-3		U	5.32	1.33
RDX	121-82-4		U	5.32	1.33
Tetryl	479-45-8		U	5.32	1.33

Surrogate	% Recovery	Lower	Upper	Qual
3,4-Dinitrotoluene	56.1	50	150	

J The analyte was positively identified, but the quantitation was below the RL
U Not detected at or above the method detection limit

Sample Number:	L0502503-07	Prep Method:	3535	Instrument:	HPLC4
Client ID:	29WL40-MH09-52	Analytical Method:	8330	Prep Date:	03/02/2005 08:00
Matrix:	Water	Analyst:	ECL	Cal Date:	03/02/2005 16:53
Workgroup Number:	WG184109	Dilution:	1	Run Date:	03/03/2005 00:20
Collect Date:	23-FEB-05	Units:	ug/L	File ID:	4L007779.F
Sample Tag:	01				

Analyte	CAS. Number	Result	Qual	RL	MDL
1,3,5-Trinitrobenzene	99-35-4		U	1.03	0.258
1,3-Dinitrobenzene	99-65-0		U	1.03	0.258
2,4,6-Trinitrotoluene	118-96-7	24.8	I	1.03	0.258
2,4-Dinitrotoluene	121-14-2	1.09		1.03	0.258
2,6-Dinitrotoluene	606-20-2	1.24		1.03	0.258
2-Amino-4,6-dinitrotoluene	35572-78-2	1.63		1.03	0.258
2-Nitrotoluene	88-72-2		U	1.03	0.258
3-Nitrotoluene	99-08-1		U	1.03	0.258
4-Nitrotoluene	99-99-0		U	1.03	0.258
4-Amino-2,6-dinitrotoluene	19406-51-0	2.36		1.03	0.258
HMX	2691-41-0		U	1.03	0.258
Nitrobenzene	98-95-3		U	1.03	0.258
RDX	121-82-4		U	1.03	0.258
Tetryl	479-45-8		U	1.03	0.258

Surrogate	% Recovery	Lower	Upper	Qual
3,4-Dinitrotoluene	74.8	50	150	

I Semiquantitative result (out of instrument calibration range)
U Not detected at or above the method detection limit

Sample Number:	L0502503-07	Prep Method:	3535	Instrument:	HPLC4
Client ID:	29WL40-MH09-52	Analytical Method:	8330	Prep Date:	03/02/2005 08:00
Matrix:	Water	Analyst:	ECL	Cal Date:	03/02/2005 16:53
Workgroup Number:	WG184109	Dilution:	5	Run Date:	03/03/2005 21:00
Collect Date:	23-FEB-05	Units:	ug/L	File ID:	4L007790.F
Sample Tag:	DL01				

Analyte	CAS. Number	Result	Qual	RL	MDL
1,3,5-Trinitrobenzene	99-35-4		U	5.15	1.29
1,3-Dinitrobenzene	99-65-0		U	5.15	1.29
2,4,6-Trinitrotoluene	118-96-7	24.0		5.15	1.29
2,4-Dinitrotoluene	121-14-2		U	5.15	1.29
2,6-Dinitrotoluene	606-20-2		U	5.15	1.29
2-Amino-4,6-dinitrotoluene	35572-78-2	1.61	J	5.15	1.29
2-Nitrotoluene	88-72-2		U	5.15	1.29
3-Nitrotoluene	99-08-1		U	5.15	1.29
4-Nitrotoluene	99-99-0		U	5.15	1.29
4-Amino-2,6-dinitrotoluene	19406-51-0	2.41	J	5.15	1.29
HMX	2691-41-0		U	5.15	1.29
Nitrobenzene	98-95-3		U	5.15	1.29
RDX	121-82-4		U	5.15	1.29
Tetryl	479-45-8		U	5.15	1.29

Surrogate	% Recovery	Lower	Upper	Qual
3,4-Dinitrotoluene	68.3	50	150	

J The analyte was positively identified, but the quantitation was below the RL
U Not detected at or above the method detection limit

Report Number:**L0502503**

Report Date :**March 14, 2005**

Sample Number:	L0502503-08	Prep Method:	3535	Instrument:	HPLC4
Client ID:	29WL41-MH10-02	Analytical Method:	8330	Prep Date:	03/02/2005 08:00
Matrix:	Water	Analyst:	ECL	Cal Date:	03/02/2005 16:53
Workgroup Number:	WG184109	Dilution:	1	Run Date:	03/03/2005 00:57
Collect Date:	23-FEB-05	Units:	ug/L	File ID:	4L007780.F
Sample Tag:	01				

Analyte	CAS. Number	Result	Qual	RL	MDL
1,3,5-Trinitrobenzene	99-35-4		U	1.03	0.258
1,3-Dinitrobenzene	99-65-0		U	1.03	0.258
2,4,6-Trinitrotoluene	118-96-7	15.4	I	1.03	0.258
2,4-Dinitrotoluene	121-14-2	1.05		1.03	0.258
2,6-Dinitrotoluene	606-20-2	1.35		1.03	0.258
2-Amino-4,6-dinitrotoluene	35572-78-2	2.01		1.03	0.258
2-Nitrotoluene	88-72-2		U	1.03	0.258
3-Nitrotoluene	99-08-1		U	1.03	0.258
4-Nitrotoluene	99-99-0		U	1.03	0.258
4-Amino-2,6-dinitrotoluene	19406-51-0	2.58		1.03	0.258
HMX	2691-41-0		U	1.03	0.258
Nitrobenzene	98-95-3		U	1.03	0.258
RDX	121-82-4		U	1.03	0.258
Tetryl	479-45-8		U	1.03	0.258

Surrogate	% Recovery	Lower	Upper	Qual
3,4-Dinitrotoluene	87.7	50	150	

I Semiquantitative result (out of instrument calibration range)
U Not detected at or above the method detection limit

Sample Number:	L0502503-08	Prep Method:	3535	Instrument:	HPLC4
Client ID:	29WL41-MH10-02	Analytical Method:	8330	Prep Date:	03/02/2005 08:00
Matrix:	Water	Analyst:	ECL	Cal Date:	03/02/2005 16:53
Workgroup Number:	WG184109	Dilution:	4	Run Date:	03/03/2005 21:38
Collect Date:	23-FEB-05	Units:	ug/L	File ID:	4L007791.F
Sample Tag:	DL01				

Analyte	CAS. Number	Result	Qual	RL	MDL
1,3,5-Trinitrobenzene	99-35-4		U	4.12	1.03
1,3-Dinitrobenzene	99-65-0		U	4.12	1.03
2,4,6-Trinitrotoluene	118-96-7	15.0		4.12	1.03
2,4-Dinitrotoluene	121-14-2	1.07	J	4.12	1.03
2,6-Dinitrotoluene	606-20-2	1.30	J	4.12	1.03
2-Amino-4,6-dinitrotoluene	35572-78-2	1.98	J	4.12	1.03
2-Nitrotoluene	88-72-2		U	4.12	1.03
3-Nitrotoluene	99-08-1		U	4.12	1.03
4-Nitrotoluene	99-99-0		U	4.12	1.03
4-Amino-2,6-dinitrotoluene	19406-51-0	2.54	J	4.12	1.03
HMX	2691-41-0		U	4.12	1.03
Nitrobenzene	98-95-3		U	4.12	1.03
RDX	121-82-4		U	4.12	1.03
Tetryl	479-45-8		U	4.12	1.03

Surrogate	% Recovery	Lower	Upper	Qual
3,4-Dinitrotoluene	83.7	50	150	

J The analyte was positively identified, but the quantitation was below the RL
U Not detected at or above the method detection limit

Sample Number:	L0502503-09	Prep Method:	3535	Instrument:	HPLC4
Client ID:	29WL42-MH11-02	Analytical Method:	8330	Prep Date:	03/02/2005 08:00
Matrix:	Water	Analyst:	ECL	Cal Date:	03/02/2005 16:53
Workgroup Number:	WG184109	Dilution:	1	Run Date:	03/03/2005 01:34
Collect Date:	23-FEB-05	Units:	ug/L	File ID:	4L007781.F
Sample Tag:	01				

Analyte	CAS. Number	Result	Qual	RL	MDL
1,3,5-Trinitrobenzene	99-35-4		U	1.03	0.258
1,3-Dinitrobenzene	99-65-0		U	1.03	0.258
2,4,6-Trinitrotoluene	118-96-7	18.5	I	1.03	0.258
2,4-Dinitrotoluene	121-14-2	0.922	J	1.03	0.258
2,6-Dinitrotoluene	606-20-2	1.15		1.03	0.258
2-Amino-4,6-dinitrotoluene	35572-78-2	1.29		1.03	0.258
2-Nitrotoluene	88-72-2		U	1.03	0.258
3-Nitrotoluene	99-08-1		U	1.03	0.258
4-Nitrotoluene	99-99-0		U	1.03	0.258
4-Amino-2,6-dinitrotoluene	19406-51-0	1.96		1.03	0.258
HMX	2691-41-0		U	1.03	0.258
Nitrobenzene	98-95-3		U	1.03	0.258
RDX	121-82-4		U	1.03	0.258
Tetryl	479-45-8		U	1.03	0.258

Surrogate	% Recovery	Lower	Upper	Qual
3,4-Dinitrotoluene	66.5	50	150	

I Semiquantitative result (out of instrument calibration range)
J The analyte was positively identified, but the quantitation was below the RL
U Not detected at or above the method detection limit

Sample Number:	L0502503-09	Prep Method:	3535	Instrument:	HPLC4
Client ID:	29WL42-MH11-02	Analytical Method:	8330	Prep Date:	03/02/2005 08:00
Matrix:	Water	Analyst:	ECL	Cal Date:	03/02/2005 16:53
Workgroup Number:	WG184109	Dilution:	5	Run Date:	03/03/2005 22:15
Collect Date:	23-FEB-05	Units:	ug/L	File ID:	4L007792.F
Sample Tag:	DL01				

Analyte	CAS. Number	Result	Qual	RL	MDL
1,3,5-Trinitrobenzene	99-35-4		U	5.15	1.29
1,3-Dinitrobenzene	99-65-0		U	5.15	1.29
2,4,6-Trinitrotoluene	118-96-7	18.0		5.15	1.29
2,4-Dinitrotoluene	121-14-2		U	5.15	1.29
2,6-Dinitrotoluene	606-20-2		U	5.15	1.29
2-Amino-4,6-dinitrotoluene	35572-78-2	1.32	J	5.15	1.29
2-Nitrotoluene	88-72-2		U	5.15	1.29
3-Nitrotoluene	99-08-1		U	5.15	1.29
4-Nitrotoluene	99-99-0		U	5.15	1.29
4-Amino-2,6-dinitrotoluene	19406-51-0	1.92	J	5.15	1.29
HMX	2691-41-0		U	5.15	1.29
Nitrobenzene	98-95-3		U	5.15	1.29
RDX	121-82-4		U	5.15	1.29
Tetryl	479-45-8		U	5.15	1.29

Surrogate	% Recovery	Lower	Upper	Qual
3,4-Dinitrotoluene	66.5	50	150	

J The analyte was positively identified, but the quantitation was below the RL
U Not detected at or above the method detection limit

Sample Number: L0502503-10
Client ID: 29WL43-MH12-02
Matrix: Water
Workgroup Number: WG184109
Collect Date: 23-FEB-05
Sample Tag: 01

Prep Method: 3535
Analytical Method: 8330
Analyst: ECL
Dilution: 1
Units: ug/L

Instrument: HPLC4
Prep Date: 03/02/2005 08:00
Cal Date: 03/02/2005 16:53
Run Date: 03/03/2005 02:12
File ID: 4L007782.F

Analyte	CAS. Number	Result	Qual	RL	MDL
1,3,5-Trinitrobenzene	99-35-4		U	1.10	0.275
1,3-Dinitrobenzene	99-65-0		U	1.10	0.275
2,4,6-Trinitrotoluene	118-96-7	25.5	I	1.10	0.275
2,4-Dinitrotoluene	121-14-2	0.934	J	1.10	0.275
2,6-Dinitrotoluene	606-20-2	1.31		1.10	0.275
2-Amino-4,6-dinitrotoluene	35572-78-2	1.75		1.10	0.275
2-Nitrotoluene	88-72-2		U	1.10	0.275
3-Nitrotoluene	99-08-1		U	1.10	0.275
4-Nitrotoluene	99-99-0		U	1.10	0.275
4-Amino-2,6-dinitrotoluene	19406-51-0	2.67		1.10	0.275
HMX	2691-41-0		U	1.10	0.275
Nitrobenzene	98-95-3		U	1.10	0.275
RDX	121-82-4		U	1.10	0.275
Tetryl	479-45-8		U	1.10	0.275

Surrogate	% Recovery	Lower	Upper	Qual
3,4-Dinitrotoluene	68.4	50	150	

I Semiquantitative result (out of instrument calibration range)
J The analyte was positively identified, but the quantitation was below the RL
U Not detected at or above the method detection limit

Sample Number: L0502503-10
Client ID: 29WL43-MH12-02
Matrix: Water
Workgroup Number: WG184109
Collect Date: 23-FEB-05
Sample Tag: DL01

Prep Method: 3535
Analytical Method: 8330
Analyst: ECL
Dilution: 5
Units: ug/L

Instrument: HPLC4
Prep Date: 03/02/2005 08:00
Cal Date: 03/02/2005 16:53
Run Date: 03/03/2005 22:52
File ID: 4L007793.F

Analyte	CAS. Number	Result	Qual	RL	MDL
1,3,5-Trinitrobenzene	99-35-4		U	5.49	1.37
1,3-Dinitrobenzene	99-65-0		U	5.49	1.37
2,4,6-Trinitrotoluene	118-96-7	25.0		5.49	1.37
2,4-Dinitrotoluene	121-14-2		U	5.49	1.37
2,6-Dinitrotoluene	606-20-2		U	5.49	1.37
2-Amino-4,6-dinitrotoluene	35572-78-2	1.69	J	5.49	1.37
2-Nitrotoluene	88-72-2		U	5.49	1.37
3-Nitrotoluene	99-08-1		U	5.49	1.37
4-Nitrotoluene	99-99-0		U	5.49	1.37
4-Amino-2,6-dinitrotoluene	19406-51-0	2.56	J	5.49	1.37
HMX	2691-41-0		U	5.49	1.37
Nitrobenzene	98-95-3		U	5.49	1.37
RDX	121-82-4		U	5.49	1.37
Tetryl	479-45-8		U	5.49	1.37

Surrogate	% Recovery	Lower	Upper	Qual
3,4-Dinitrotoluene	60.7	50	150	

J The analyte was positively identified, but the quantitation was below the RL
U Not detected at or above the method detection limit

WORKGROUP SUMMARY BY METHOD

WORKGROUP SUMMARY BY METHOD

Analysis: Explosives
Extraction Method: 3535
Workgroup: WG184026

Lab ID	Client ID	Tclp Date	Prep Date	Analysis Date	Tag	Inst Id	Analyst
L0502503-01	29WL34-MH03-02		03/02/05 08:00			SPE	CSH
L0502503-02	29WL36-MH05-02		03/02/05 08:00			SPE	CSH
L0502503-03	29WL37-MH06-02		03/02/05 08:00			SPE	CSH
L0502503-04	29WL38-MH07-02		03/02/05 08:00			SPE	CSH
L0502503-05	29WL39-MH08-02		03/02/05 08:00			SPE	CSH
L0502503-06	29WL40-MH09-02		03/02/05 08:00			SPE	CSH
L0502503-07	29WL40-MH09-52		03/02/05 08:00			SPE	CSH
L0502503-08	29WL41-MH10-02		03/02/05 08:00			SPE	CSH
L0502503-09	29WL42-MH11-02		03/02/05 08:00			SPE	CSH
L0502503-10	29WL43-MH12-02		03/02/05 08:00			SPE	CSH

Analysis: Explosives
Analytical Method: 8330
Workgroup: WG184109

Lab ID	Client ID	Tclp Date	Prep Date	Analysis Date	Tag	Inst Id	Analyst
L0502503-01	29WL34-MH03-02		03/02/05 08:00	03/02/05 19:59	01	HPLC4	ECL
L0502503-01	29WL34-MH03-02		03/02/05 08:00	03/03/05 18:31	DL01	HPLC4	ECL
L0502503-02	29WL36-MH05-02		03/02/05 08:00	03/02/05 20:36	01	HPLC4	ECL
L0502503-02	29WL36-MH05-02		03/02/05 08:00	03/03/05 19:09	DL01	HPLC4	ECL
L0502503-03	29WL37-MH06-02		03/02/05 08:00	03/02/05 21:14	01	HPLC4	ECL
L0502503-03	29WL37-MH06-02		03/02/05 08:00	03/03/05 19:46	DL01	HPLC4	ECL
L0502503-04	29WL38-MH07-02		03/02/05 08:00	03/02/05 22:28	01	HPLC4	ECL
L0502503-05	29WL39-MH08-02		03/02/05 08:00	03/02/05 23:05	01	HPLC4	ECL
L0502503-06	29WL40-MH09-02		03/02/05 08:00	03/02/05 23:43	01	HPLC4	ECL
L0502503-06	29WL40-MH09-02		03/02/05 08:00	03/03/05 20:23	DL01	HPLC4	ECL
L0502503-07	29WL40-MH09-52		03/02/05 08:00	03/03/05 00:20	01	HPLC4	ECL
L0502503-07	29WL40-MH09-52		03/02/05 08:00	03/03/05 21:00	DL01	HPLC4	ECL
L0502503-08	29WL41-MH10-02		03/02/05 08:00	03/03/05 00:57	01	HPLC4	ECL
L0502503-08	29WL41-MH10-02		03/02/05 08:00	03/03/05 21:38	DL01	HPLC4	ECL
L0502503-09	29WL42-MH11-02		03/02/05 08:00	03/03/05 01:34	01	HPLC4	ECL
L0502503-09	29WL42-MH11-02		03/02/05 08:00	03/03/05 22:15	DL01	HPLC4	ECL
L0502503-10	29WL43-MH12-02		03/02/05 08:00	03/03/05 02:12	01	HPLC4	ECL
L0502503-10	29WL43-MH12-02		03/02/05 08:00	03/03/05 22:52	DL01	HPLC4	ECL

Kemron Environmental Services
Analyst Listing March 14, 2005

AJF - AMANDA J. FICKIESEN
ALB - ANNIE L. BOCK
ALT - ANN L. THAYER
BRG - BRENDA R. GREGORY
CAF - CHERYL A. FLOWERS
CAK - CHERYL A. KOELSCH
CEB - CHAD E. BARNES
CLC - CHRYS L. CRAWFORD
CLK - CARL L. KING
CLS - CARA L. STRICKLER
CLW - CHARISSA L. WINTERS
CM - CHARLIE MARTIN
CMS - CRYSTAL M. STEPHENS
CPD - CHAD P. DAVIS
CRC - CARLA R. COCHRAN
CSH - CHRIS S. HILL
DAS - DALLAS A. SULLIVAN
DD - DIANE M. DENNIS
DDE - DEBRA D. ELLIOTT
DEL - DON E. LIGHTFRITZ
DEV - DAVID E. VANDENBERG
DGB - DOUGLAS G. BUTCHER
DIH - DEANNA I. HESSON
DLB - DAVID L. BUMGARNER
DLP - DOROTHY L. PAYNE
DLR - DIANNA L. RAUCH
DP - DEANNA L. PIERSON
DR - DEANNA ROBERTS
DRB - DOUG R. BARNETT
DSM - DAVID S. MOSSOR
DST - DENNIS S. TEPE
ECL - ERIC C. LAWSON
EED - EMILY E. DECKER
HAV - HEMA VILASAGAR
JAL - JOHN A. LENT
JJG - JOHN J. GREUEY
JKT - JANE K. THOMPSON
JLS - JANICE L. SCHIMMEL
JWR - JOHN W. RICHARDS
JWS - JACK W. SHEAVES
JYH - JI Y. HU
KEB - KATHRYN E. BARNES
KHR - KIM H. RHODES
KRA - KATHY R. ALBERTSON
LKN - LINDA K. NEDEFF
LSA - LUCINDA S. ARNOLD
LSB - LESLIE S. BUCINA
MAH - MICALYN A. HARRIS
MDA - MICHAEL D. ALBERTSON
MDC - MICHAEL D. COCHRAN
MES - MARY E. SCHILLING
MKZ - MARILYN K. ZUMBRO
MLR - MARY L. ROCHOTTE
MLS - MICHAEL L. SCHIMMEL
MMB - MAREN M. BEERY
MSW - MATT S. WILSON
NJB - NATALIE J. BOOTH
OGT - OKEY G. TUCKER
PAS - PATRICK A. STREET
RB - ROBERT BUCHANAN
RDC - REBECCA D. CUTLIP
REK - ROBERT E. KYER
RWC - RODNEY W. CAMPBELL
SCM - SUSAN C. MOELLENDICK
SK - SANDRA KEENER
SLM - STEPHANIE L. MOSSBURG
SLP - SHERI L. PFALZGRAF
SMH - SHAUNA M. HYDE
TD - TIMOTHY DYSERT
TMM - TAMMY M. MORRIS
VC - VICKI COLLIER
VKL - VICKY K. LAUER

KEMRON Environmental Services, Inc.
List of Valid Qualifiers
March 14, 2005

These are KEMRON’s standard report qualifiers:

B	Present in the method blank
C	Confirmed by GC/MS
CG	Confluent growth
D	The analyte was quantified as a secondary dilution factor
DL	Surrogate or spike was diluted out
E	Estimated concentration due to sample matrix interference
FL	Free liquid
I	Semi-quantitative result, out of instrument calibration range
J	Present below normal reporting limit
L	Sample reporting limits elevated due to matrix interference
N	Tentatively Identified Compound (TIC)
NA	Not applicable
ND	Not detected at or above the reporting limit (RL)
NF	Not found
NFL	No free liquid
NI	Non-ignitable

NS	Not spiked
P	Concentration >40% difference between the two GC columns
QNS	Quantity not sufficient to perform analysis
RA	Reanalysis confirms reported results
RE	Reanalysis confirms sample matrix interference
S	Analyzed by method of standard addition
SMI	Sample matrix interference on surrogate
SP	Reported results are for spike compounds only
TNTC	Too numerous to count
U	Analyzed for but not detected
W	Post-digestion spike for furnace AA out out of control limits
X	Exceeds regulatory limit
Z	Can not be resolved from isomer.***
+	Correlation coefficient for the MSA is less than 0.995
<	Less than
>	Greater than
*	Surrogate or spike compound out of range

*****Special Notes for Organic Analytes**

1. Acrolein and acrylonitrile by method 624 are semi-quantitative screens only.
2. 1,2-Diphenylhydrazine is unstable and is reported as azobenzene.
3. N-nitrosodiphenylamine cannot be separated from diphenylamine.
4. 3-Methyphenol and 4-Methylphenol are unresolvable compounds.
5. m-Xylene and p-Xylene are unresolvable compounds.
6. The reporting limits for Appendix II/IX compounds by method 8270 are based on EPA estimated PQLs referenced in 40 CFR Part 264, Appendix IX. They are not always achievable for every compound and are matrix dependent.

AFCEE Qualifiers

These are KEMRON’s AFCEE Report Qualifiers

J	The analyte was positively identified, the quantitiation is an estimation.
U	The analyte was analyzed for, but not detected. The associated numerical value is at or below the MDL
F	The anlyte was positively identified by the associated numerical value is below the RL
R	The data is unusable due to deficiencies in the ability to analyze the sample and meet QC criteria
B	The analyte was found in an associated blank, as well as in the sample
M	The matrix effect was present
S	To be applied to all field screening data
T	Tentatively identified compound (using GC/MS)

Organic Instrument Data

Figure 1
Semi-Volatile GC Checklist

Run Date: 3-2-05

Analyst: ECL / RDC

Instrument: HPLC 4

Method: 8330

Login no.	Due Date	Priority
02-503	3/4	P1

		Analyst	Peer
System Performance Check:	Endrin/DDT Breakdown		
Initial Calibration:	ICAL summary	✓	✓
	Linear or quadriatic regression	✓	✓
	Alt Source Check	✓	✓
Continuing Calibration:	Continuing Calibration	✓	✓
	Ending standards	✓	✓
	Client Specific Requirements		
	Special Standards		
Blanks:	Quant Report/Chromatogram	✓	✓
	Surrogates	✓	✓
LCS/LCS DUP:	Quant Report/Chromatogram	✓	✓
	Surrogates	✓	✓
	Spike Compounds	✓	✓
	MS/MSD		
Samples:	Quant Reports/Chromatograms	✓	✓
	Mass spectra		
	Surrogates	✓	✓
	Dilution runs		
	Confirmations	✓	✓
	Correct Factors	✓	✓
	Manual integrations	✓	✓
Data Package:	Run logs	✓	✓
	Bench sheets	✓	✓
	Upload results	✓	✓
	QC forms	✓	✓
	Seedpak workgroups	✓	✓
Client Data	Data scanned		
	Integrations digitally signed	✓	
	Level 2 pdf files		
	Level 3/Level x	✓	
	Level 4 copies		
	Case narratives		

	Supervisor
Integrations digitally cosigned	✓
Corrective Action	
Results Reporting/Data Qualifiers	✓
Client Data/digital signatures	
Check for Completeness	✓
Check for compliance with method and project requirements	✓
Check the reasonableness of results	✓

√ = Checked & OK
NA = Not Applicable

Comments: All samples except -04 + 05 need dilutions

Primary Reviewer: ECL 3/4/05

Secondary Reviewer: mlc 3/4/05

Semi-Volatile HPLC Checklist

00091539

Login no.	Due Date	Priority
02-503	04-Mar-05	P1

Run Date: 03-MAR-2005

Analyst: ECL/ RDC

Instrument: HPLC4

Method: 8330

		Analyst	Peer
Initial Calibration:	**ICAL summary**		
	Linear or quadratic regression		
	Alt Source Check		
Continuing Calibration:	**Continuing Calibration**	√	✓
	Ending Standards	√	✓
	Client Specific Requirements	√	✓
	Special Standards		
Blanks:	**Quant Report/Chromatogram**		
	Surrogates		
LCS/LCS DUP:	**Quant Report/Chromatogram**		
	Surrogates		
	Spike Compounds		
	MS/MSD		
Samples:	**Quant Reports/Chromatograms**	√	✓
	TCL Hits	√	✓
	Surrogates	√	✓
	Dilution runs	√	✓
	Confirmations		
	Correct Factors		
	Manual integrations	√	✓
Data Package:	**Run logs**	√	✓
	Bench sheets	√	✓
	Upload results	√	✓
	QC forms	√	✓
	Seedpak workgroups	√	✓
Client Data	**Data scanned**		
	Level 2 pdf files		
	Level 3/Level x		
	Level 4 copies		
	Case narratives		
	Integrations digitally signed	√	

	Supervisor
Corrective Action:	
Results Reporting/Data Qualifiers:	✓
Client Data/digital signatures	
Check for Completeness:	✓
Check for compliance with method and project requirements:	✓
Check the reasonableness of results:	

√ = Checked & OK

NA = Not Applicable

Comments:

Primary Reviewer: RDC 3/7/05

Secondary Reviewer: [illegible] 3/7/05

Example 8330 Calculations

1.0 Calculating the Calibration Factor (RF) from the initial calibration (ICAL) data:

$$CF = \frac{C_s}{A_s}$$

where:	Example:
A_s = Area of the compound being measured in the standard	10000
C_s = Concentration of the compound being measured (nug/mL)	100
	CF = 0.01

2.0 Calculating the concentration (C) of a compuond in water using data from prep log and quantitation report:*

$$C = \frac{(A_x)(CF)(V_f)(D)}{V_i}$$

where:	Example:
A_x = Area of the compound being measured	10000
V_f = Final volume of sample extract (mL) (prep log)	1
D = Dilution factor for sample as a multiplier (10X = 10)	1
CF = Calibration factor from ICAL calculated above	0.01
V_i = Initial volume of sample (ml) (prep log)	1000
	C ($\mu g/l$) = 0.1

3.0 Calculating the concentration (C) of a compound in soil using data from prep log and quantitation report:*

$$C = \frac{(A_x)(CF)(V_f)(D)}{W_i}$$

where:	Example:
A_x = Area of the compound being measured	10000
V_f = Final volume of sample extract (mL) (prep log)	1
D = Dilution factor for sample as a multiplier (10X = 10)	1
CF = Calibration factor from ICAL calculated above	0.01
W_i = Initial weight of sample (g) (prep log)	30
	C ($\mu g/kg$) = 3.333333

* Concentrations appearing on instrument quantitation reports are on-column results and do not take into account initial volume, final volume and dilution factor.

KEMRON
ENVIRONMENTAL SERVICES

R870738

Sample Extraction Log Sheet – Method 8330 / Explosives

Analyst: CSH
Date: 3-2-5 @ 0800
SOP#: EXTNT01 REV. 6
Spike Analyst: CSH Witness: CEB
Sample Matrix: H2O
Ext Solvent: CH3CN Lot#: A42820
Ext Solvent: MeOH Lot#: A38E20
Ext Disk: SDB-RPS Lot#: 760098
Other: HPLC H2O Lot#: A29E07

Extract Relinquished By: CSH
Extract Received By: RWC
Date Extract Received: 3/2/05

Matrix Spike # / Conc: ES50050-34 @ 1.0 ppm
Surrogate Spike # / Conc: ES50050-27 @ 1.0 ppm

Extraction Work Group: WG184026
Analytical Work Group:

Sonic Bath On – Date: CEB 3/2/5
Time (1) Temp (1) Ctrl Bath
Time (2) Temp (2) Ctrol Bath
Sonic Bath Off – Date:
Time (3) Temp (3) Ctrl Bath
N/A

	Project ID	Sample ID	Sample Wt (g) / Vol (mL)	Surrogate Amount (uL)	Matrix Spike Amount (uL)	Extract F. Volume (mL)	Comments
1		BLK	1000mL	1000		10 mL	WG184026-01
2		LCS	|	|	1000	|	-02
3		LCS DUP	⊥	|	⊥	|	⊥ -03
4		02-503-01	950 mL	|		|	
5		-02	960 mL	|		|	
6		-03	|	|		|	
7		-04	⊥	|		|	
8		-05	970 mL	|		|	
9		-06	940 mL	|		|	
10		-07	970 mL	|		|	
11		-08	|	|		|	
12		-09	⊥	⊥		⊥	
13		-10	910 mL				
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							

CSH 3-2-5

All soil samples are air dried to a constant weight prior to extraction
All extracts are filtered through a 0.45 um teflon ***ACRODISC*** *prior to analysis*

Reviewed by:

```
Partial Sequence: C:\HPCHEM\1\SEQUENCE\030205.S                      Page 1 of 1

     Sel  Run  Location    Method     Datafile SeqTable Calib:RF:RT  Sample Name
     ---  ---  --------  --------- -------- -------- -----------  ---------------

     No     1  Vial 1     8330       4L007761    01:01               BLANK SOLVENT
     No     2  Vial 2     8330       4L007762    02:01               WG184085-01 STD6 -S0573-18
     No     3  Vial 3     8330       4L007763    03:01               WG184085-02 STD5
     No     4  Vial 4     8330       4L007764    04:01               WG184085-03 STD4
     No     5  Vial 5     8330       4L007765    05:01               WG184085-04 STD3
     No     6  Vial 6     8330       4L007766    06:01               WG184085-05 STD2
     No     7  Vial 7     8330       4L007767    07:01               WG184085-06 STD1
     No     8  Vial 8     8330       4L007768    08:01               WG184085-07 ALT -S0573-13
     No     9  Vial 9     8330       4L007769    09:01               WG184026-01 BLK
     No    10  Vial 10    8330       4L007770    10:01               WG184026-02 LCS
     No    11  Vial 11    8330       4L007771    11:01               WG184026-03 LCS2
     No    12  Vial 12    8330       4L007772    12:01               L0502503-01 833W-RR5X -*
     No    13  Vial 13    8330       4L007773    13:01               L0502503-02 833W -RR10X-*
     No    14  Vial 14    8330       4L007774    14:01               L0502503-03 833W -RR100X-*
     No    15  Vial 5     8330       4L007775    15:01               WG184085-08 CCV -S0573-18
     No    16  Vial 15    8330       4L007776    16:01               L0502503-04 833W
     No    17  Vial 16    8330       4L007777    17:01               L0502503-05 833W
     No    18  Vial 17    8330       4L007778    18:01               L0502503-06 833W-RR5X
     No    19  Vial 18    8330       4L007779    19:01               L0502503-07 833W -RR5X
     No    20  Vial 19    8330       4L007780    20:01               L0502503-08 833W -RR4X
     No    21  Vial 20    8330       4L007781    21:01               L0502503-09 833W -RR5X
     No    22  Vial 21    8330       4L007782    22:01               L0502503-10 833W-RR5X
     No    23  Vial 5     8330       4L007783    23:01               WG184085-09 CCV -S0573-18
```

ECR 3/4/05

TRC 3/4/05

KEMRON ENVIRONMENTAL SERVICES
Semivolatile Laboratory HPLC Routine Maintenance/Runlog

Analysis Date: 3-2-05
Analyst: RDC/ECL
Instrument ID: HPLC 4
Column ID: Ultra Carb 5-ODS
Data subdirectory: 030205

Routine maintenance
(manufacturer recommendation in parenthesis)
✓ Check eluent volume
✓ Check eluent waste container
✓ System pressure 280 bar

Method/SOP:
☐ 8310 Rev.5
✓ 8330 Rev. 5
☐ 830-MBA Rev. 0
☐ 8315a formaldehyde Rev. 0

Comments

* - Surrogate failed low due to SMI

Reviewed by: RDC 3/4/05

```
Partial Sequence: C:\HPCHEM\1\SEQUENCE\030305.S                                    Page 1 of 1

    Sel  Run  Location   Method    Datafile SeqTable Calib:RF:RT  Sample Name
    ---  ---  --------  --------- -------- -------- -----------  ------------

    No     1  Vial 1    8330      4L007784    01:01 ✓            BLANK SOLVENT
    No     2  Vial 2    8330      4L007785    02:01 ✓ SOS 73-18   WG184223-01 CCV
    No     3  Vial 3    8330      4L007786    03:01✓             L0502503-01 5X
    No     4  Vial 4    8330      4L007787    04:01✓             L0502503-02 10X
    No     5  Vial 5    8330      4L007788    05:01✓             L0502503-03 100X
    No     6  Vial 6    8330      4L007789    06:01✓             L0502503-06 5X
    No     7  Vial 7    8330      4L007790    07:01✓             L0502503-07 5X
    No     8  Vial 8    8330      4L007791    08:01✓             L0502503-08 4X
    No     9  Vial 9    8330      4L007792    09:01✓             L0502503-09 5X
    No    10  Vial 10   8330      4L007793    10:01 ✓            L0502503-10 5X
    No    11  Vial 2    8330      4L007794    11:01 ✓ SOS 73-18   WG184223-02 CCV
```

RFC 3/7/05

rdc 3/7/05

KEMRON ENVIRONMENTAL SERVICES
Semivolatile Laboratory HPLC Routine Maintenance/Runlog

Analysis Date: 3/03/05
Analyst: ECL/RDC
Instrument ID: HPLC4
Column ID: Ultracarb 5 ODS
Data subdirectory: 030305

Routine maintenance
(manufacturer recommendation in parenthesis)
✓ Check eluent volume
✓ Check eluent waste container
✓ System pressure 290 bar

Method/SOP:
☐ 8310 Rev.5
✓ 8330 Rev. 5
☐ 830-MBA Rev. 0
☐ 8315a formaldehyde Rev. 0

Comments

L0502503-01 surr. recovery < adv. limit —
SMI due to 2,4,6-TNT peak

L0502503-02, 03 - surr. DL

Reviewed by:

KEMRON Environmental Services
HOLDING TIMES
EQUIVALENT TO AFCEE FORM 9

Analytical Method: 8330

Login Number: L0502503

AAB#: WG184109

Client ID	Date Collected	Date Received	Date Extracted	Max Hold Time Ext.	Time Held Ext.	Date Analyzed	Max Hold Time Anal	Time Held Anal.	Q
29WL34-MH03-02	02/24/05	02/25/05	03/02/05	7	5.75	03/02/05	40	0.500	
29WL34-MH03-02	02/24/05	02/25/05	03/02/05	7	5.75	03/03/05	40	1.44	
29WL36-MH05-02	02/24/05	02/25/05	03/02/05	7	5.74	03/02/05	40	0.526	
29WL36-MH05-02	02/24/05	02/25/05	03/02/05	7	5.74	03/03/05	40	1.46	
29WL37-MH06-02	02/24/05	02/25/05	03/02/05	7	5.73	03/02/05	40	0.552	
29WL37-MH06-02	02/24/05	02/25/05	03/02/05	7	5.73	03/03/05	40	1.49	
29WL38-MH07-02	02/23/05	02/25/05	03/02/05	7	6.66	03/02/05	40	0.603	
29WL39-MH08-02	02/23/05	02/25/05	03/02/05	7	6.70	03/02/05	40	0.629	
29WL40-MH09-02	02/23/05	02/25/05	03/02/05	7	6.74	03/02/05	40	0.655	
29WL40-MH09-02	02/23/05	02/25/05	03/02/05	7	6.74	03/03/05	40	1.52	
29WL40-MH09-52	02/23/05	02/25/05	03/02/05	7	6.74	03/03/05	40	0.681	
29WL40-MH09-52	02/23/05	02/25/05	03/02/05	7	6.74	03/03/05	40	1.54	
29WL41-MH10-02	02/23/05	02/25/05	03/02/05	7	6.73	03/03/05	40	0.707	
29WL41-MH10-02	02/23/05	02/25/05	03/02/05	7	6.73	03/03/05	40	1.57	
29WL42-MH11-02	02/23/05	02/25/05	03/02/05	7	6.76	03/03/05	40	0.732	
29WL42-MH11-02	02/23/05	02/25/05	03/02/05	7	6.76	03/03/05	40	1.59	
29WL43-MH12-02	02/23/05	02/25/05	03/02/05	7	6.78	03/03/05	40	0.758	
29WL43-MH12-02	02/23/05	02/25/05	03/02/05	7	6.78	03/03/05	40	1.62	

* EXT = SEE PROJECT QAPP REQUIREMENTS

*ANAL = SEE PROJECT QAPP REQUIREMENTS

SURROGATE STANDARDS

Login Number: L0502503

Instrument Id: HPLC4

Workgroup (AAB#): WG184109

Method: 8330

CAL ID: HPLC4 - 02-MAR-05

Matrix: WATER

Sample Number	Dilution	Tag	1
L0502503-01	1.00	01	42.9
L0502503-01	5.00	DL01	42.7
L0502503-02	1.00	01	ND
L0502503-02	10.0	DL01	DL
L0502503-03	1.00	01	ND
L0502503-03	100	DL01	DL
L0502503-04	1.00	01	74.5
L0502503-05	1.00	01	61.7
L0502503-06	1.00	01	67.4
L0502503-06	5.00	DL01	56.1
L0502503-07	1.00	01	74.8
L0502503-07	5.00	DL01	68.3
L0502503-08	1.00	01	87.7
L0502503-08	4.00	DL01	83.7
L0502503-09	1.00	01	66.5
L0502503-09	5.00	DL01	66.5
L0502503-10	1.00	01	68.4
L0502503-10	5.00	DL01	60.7
WG184026-01	1.00	01	92.4
WG184026-02	1.00	01	101
WG184026-03	1.00	01	94.5

	Surrogates	Surrogate Limits
1	3,4-Dinitrotoluene	50 - 150

Underline = Result out of surrogate limits

DL = surrogate diluted out

ND = surrogate not detected

KEMRON Environmental Services
METHOD BLANK SUMMARY

Login Number:	L0502503	Work Group:	WG184109
Blank File ID:	4L007769.F	Blank Sample ID:	WG184026-01
Date Analyzed:	03/02/05	Instrument ID:	HPLC4
Time Analyzed:	18:08	Method:	8330
Analyst:	ECL		

This Method Blank Applies To The Following Samples:

Client ID	Lab Sample ID	Lab File ID	Time Analyzed	TAG
LCS	WG184026-02	4L007770.F	03/02/05 18:45	01
LCS2	WG184026-03	4L007771.F	03/02/05 19:22	01
29WL34-MH03-02	L0502503-01	4L007772.F	03/02/05 19:59	01
29WL36-MH05-02	L0502503-02	4L007773.F	03/02/05 20:36	01
29WL37-MH06-02	L0502503-03	4L007774.F	03/02/05 21:14	01
29WL38-MH07-02	L0502503-04	4L007776.F	03/02/05 22:28	01
29WL39-MH08-02	L0502503-05	4L007777.F	03/02/05 23:05	01
29WL40-MH09-02	L0502503-06	4L007778.F	03/02/05 23:43	01
29WL40-MH09-52	L0502503-07	4L007779.F	03/03/05 00:20	01
29WL41-MH10-02	L0502503-08	4L007780.F	03/03/05 00:57	01
29WL42-MH11-02	L0502503-09	4L007781.F	03/03/05 01:34	01
29WL43-MH12-02	L0502503-10	4L007782.F	03/03/05 02:12	01
29WL34-MH03-02	L0502503-01	4L007786.F	03/03/05 18:31	DL01
29WL36-MH05-02	L0502503-02	4L007787.F	03/03/05 19:09	DL01
29WL37-MH06-02	L0502503-03	4L007788.F	03/03/05 19:46	DL01
29WL40-MH09-02	L0502503-06	4L007789.F	03/03/05 20:23	DL01
29WL40-MH09-52	L0502503-07	4L007790.F	03/03/05 21:00	DL01
29WL41-MH10-02	L0502503-08	4L007791.F	03/03/05 21:38	DL01
29WL42-MH11-02	L0502503-09	4L007792.F	03/03/05 22:15	DL01
29WL43-MH12-02	L0502503-10	4L007793.F	03/03/05 22:52	DL01

KEMRON Environmental Services

METHOD BLANK REPORT

Login Number:	L0502503	Run Date:	03/02/2005	Sample ID:	WG184026-01
Instrument ID:	HPLC4	Run Time:	18:08	Prep Method:	3535
File ID:	4L007769.F	Analvst:	ECL	Method:	8330
Workgroup (AAB#):	WG184109	Matrix:	Water	Units:	ug/L
Contract #:	DACA56-94-D-0020	Cal ID:	HPLC4 - 02-MAR-05		

Analytes	MDL	RDL	Concentration	Dilution	Qualifier
1,3,5-Trinitrobenzene	0.250	1.00	0.250	1	U
1,3-Dinitrobenzene	0.250	1.00	0.250	1	U
2,4,6-Trinitrotoluene	0.250	1.00	0.250	1	U
2,4-Dinitrotoluene	0.250	1.00	0.250	1	U
2,6-Dinitrotoluene	0.250	1.00	0.250	1	U
2-Amino-4,6-dinitrotoluene	0.250	1.00	0.250	1	U
2-Nitrotoluene	0.250	1.00	0.250	1	U
3-Nitrotoluene	0.250	1.00	0.250	1	U
4-Nitrotoluene	0.250	1.00	0.250	1	U
4-Amino-2,6-dinitrotoluene	0.250	1.00	0.250	1	U
HMX	0.250	1.00	0.250	1	U
Nitrobenzene	0.250	1.00	0.250	1	U
RDX	0.250	1.00	0.250	1	U
Tetryl	0.250	1.00	0.250	1	U

Surrogates	% Recovery	Surrogate Limits	Qualifier
3,4-Dinitrotoluene	92.4	50 - 150	PASS

* Analyte detected above RDL

ND Analyte Not detected at or above reporting limit

KEMRON FORMS - Modified 11/05/2004
Version 1.5 PDF File ID: 200926
Report generated 03/10/2005 16:19

LABORATORY CONTROL SAMPLES

Login Number: L0502503 Analyst: ECL Prep Method: 3535
Instrument ID: HPLC4 Matrix: Water Method: 8330
Workgroup (AAB#): WG184109 Units: ug/L
Sample ID: WG184026-02 LCS File ID: 4L007770.F Run Date: 03/02/2005 18:45
Sample ID: WG184026-03 LCS2 File ID: 4L007771.F Run Date: 03/02/2005 19:22

Analytes	LCS			LCS2			%RPD	%Rec Limits	RPD Lmt	Q
	Known	Found	% REC	Known	Found	% REC				
1,3,5-Trinitrobenzene	1.00	0.879	87.9	1.00	0.928	92.8	5.41	58 - 120	40	
1,3-Dinitrobenzene	1.00	0.996	99.6	1.00	1.02	102	2.26	68 - 135	40	
2,4,6-Trinitrotoluene	1.00	0.934	93.4	1.00	0.934	93.4	0.0125	27 - 137	40	
2,4-Dinitrotoluene	1.00	0.979	97.9	1.00	1.01	101	3.51	69 - 109	40	
2,6-Dinitrotoluene	1.00	0.994	99.4	1.00	1.00	100	1.05	55 - 121	40	
2-Amino-4,6-dinitrotoluene	1.00	0.934	93.4	1.00	0.911	91.1	2.53	72 - 112	40	
2-Nitrotoluene	1.00	0.958	95.8	1.00	1.00	100	4.41	67 - 121	40	
3-Nitrotoluene	1.00	0.945	94.5	1.00	0.977	97.7	3.34	66 - 110	40	
4-Nitrotoluene	1.00	0.988	98.8	1.00	1.03	103	4.63	68 - 110	40	
4-Amino-2,6-dinitrotoluene	1.00	1.06	106	1.00	1.02	102	3.31	74 - 116	40	
HMX	1.00	0.847	84.7	1.00	0.849	84.9	0.203	54 - 99	40	
Nitrobenzene	1.00	1.08	108	1.00	1.01	101	7.24	70 - 131	40	
RDX	1.00	0.821	82.1	1.00	0.860	86.0	4.64	60 - 116	40	
Tetryl	1.00	0.832	83.2	1.00	0.828	82.8	0.477	10 - 147	40	

Surogates	LCS	LCS2	Surrogate Limits	Qualifier
	% Recovery	% Recovery		
3,4-Dinitrotoluene	101	94.5	50 - 150	PASS

* FAILS %REC LIMIT

FAILS RPD LIMIT

```
=====================================================================
                          Calibration Table
=====================================================================

ICAL WG184085 8330 HPLC4

Calib. Data Modified  :      3/3/2005 2:15:02 PM

Calculate             :      External Standard
Based on              :      Peak Area

Rel. Reference Window :      0.000 %
Abs. Reference Window :      0.000 min
Rel. Non-ref. Window  :      0.000 %
Abs. Non-ref. Window  :      0.500 min
Use Multiplier & Dilution Factor with ISTDs
Uncalibrated Peaks    :      using compound Nitrobenzene #6
Partial Calibration   :      Yes, identified peaks are recalibrated
Correct All Ret. Times:      Yes, even for non-identified peaks

Curve Type            :      Linear
Origin                :      Ignored
Weight                :      Equal

Recalibration Settings:
Average Response      :      Average all calibrations
Average Retention Time:      Floating Average New 75%

Calibration Report Options :
    Printout of recalibrations within a sequence:
        Calibration Table after Recalibration
        Normal Report after Recalibration
    If the sequence is done with bracketing:
        Results of first cycle (ending previous bracket)

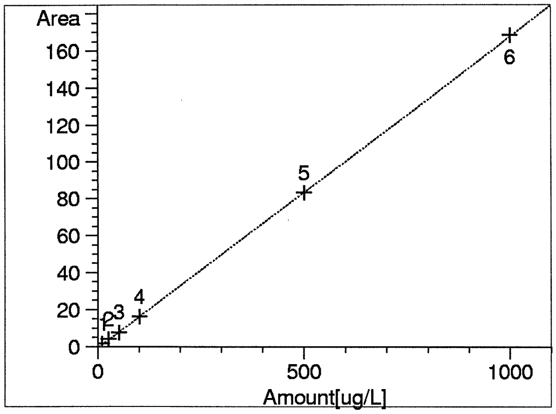
Signal 1: DAD1 B, Sig=254,16 Ref=360,100

RetTime  Lvl   Amount      Area      Amt/Area  Ref Grp Name
 [min] Sig     [ug/L]
-------|--|--|----------|----------|----------|---|--|---------------
  4.622  1  1   10.00000    1.44657    6.91290        HMX #1
            2   25.00000    3.85678    6.48210
            3   50.00000    7.55162    6.62109
            4  100.00000   16.09624    6.21263
            5  500.00000   83.06084    6.01968
            6 1000.00000  168.22462    5.94443
  7.156  1  1   10.00000    1.52740    6.54706        RDX #2
            2   25.00000    4.26468    5.86210
            3   50.00000    9.00214    5.55424
            4  100.00000   18.89868    5.29137
            5  500.00000   97.60657    5.12261
            6 1000.00000  198.12622    5.04729
  9.726  1  1   10.00000    4.22828    2.36503        1,3,5-Trinitrobenzene #3
            2   25.00000   10.70963    2.33435
            3   50.00000   21.61587    2.31312
            4  100.00000   44.45069    2.24968
            5  500.00000  224.03819    2.23176
            6 1000.00000  450.35959    2.22045
 11.905  1  1   10.00000    6.79459    1.47176        1,3-Dinitrobenzene #4
            2   25.00000   15.32882    1.63091
            3   50.00000   30.33624    1.64819
            4  100.00000   61.96233    1.61388
            5  500.00000  303.22598    1.64894
            6 1000.00000  610.60284    1.63773
 12.595  1  1   10.00000    4.10279    2.43737        Tetryl #5
            2   25.00000    8.12486    3.07698
            3   50.00000   16.29603    3.06823
```

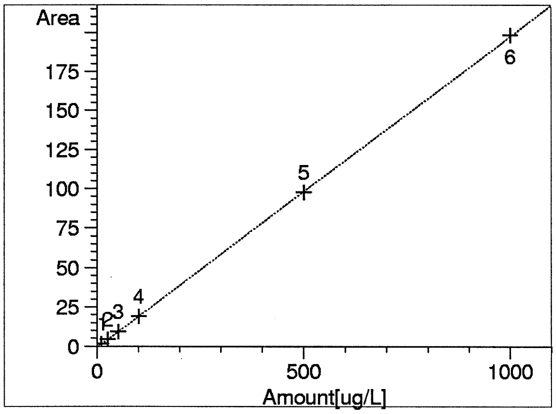
```
RetTime  Lvl  Amount      Area      Amt/Area  Ref Grp Name
 [min] Sig    [ug/L]
-------|--|--|----------|----------|----------|---|--|---------------
              4  100.00000   31.50425    3.17417
              5  500.00000  160.81532    3.10916
              6 1000.00000  322.53574    3.10043
 13.516  1    1   10.00000    4.31157    2.31934        Nitrobenzene #6
              2   25.00000    9.97288    2.50680
              3   50.00000   19.14519    2.61162
              4  100.00000   39.26730    2.54665
              5  500.00000  192.74368    2.59412
              6 1000.00000  385.12140    2.59658
 14.456  1    1   10.00000    2.55430    3.91497        3,4-Dinitrotoluene  #7 *
              2   25.00000    6.41116    3.89945
              3   50.00000   11.13751    4.48934
              4  100.00000   22.86400    4.37369
              5  500.00000  115.69042    4.32188
              6 1000.00000  231.68690    4.31617
 15.291  1    1   10.00000    4.17256    2.39661        2,4,6-Trinitrotoluene #8
              2   25.00000   11.51173    2.17170
              3   50.00000   20.14398    2.48213
              4  100.00000   41.79925    2.39239
              5  500.00000  209.21013    2.38994
              6 1000.00000  420.06686    2.38057
 15.974  1    1   10.00000    2.30618    4.33618        4-Amino-2,6-Dinitrotoluene #9
              2   25.00000    7.22222    3.46154
              3   50.00000   11.95746    4.18149
              4  100.00000   25.35186    3.94448
              5  500.00000  126.42713    3.95485
              6 1000.00000  253.37405    3.94673
 16.875  1    1   10.00000    3.28896    3.04047        2-Amino-4,6-Dinitrotoluene #10
              2   25.00000    9.56106    2.61477
              3   50.00000   17.44535    2.86609
              4  100.00000   35.89659    2.78578
              5  500.00000  180.40312    2.77157
              6 1000.00000  362.57553    2.75805
 17.835  1    1   10.00000    2.70280    3.69986        2,6-Dinitrotoluene #11
              2   25.00000    7.63130    3.27598
              3   50.00000   14.78704    3.38134
              4  100.00000   28.97582    3.45115
              5  500.00000  145.51337    3.43611
              6 1000.00000  293.94946    3.40195
 18.501  1    1   10.00000    4.96485    2.01416        2,4-Dinitrotoluene #12
              2   25.00000   12.89109    1.93932
              3   50.00000   26.29363    1.90160
              4  100.00000   51.16483    1.95447
              5  500.00000  256.94580    1.94594
              6 1000.00000  518.46100    1.92879
 21.707  1    1   10.00000    1.89515    5.27663        2-Nitrotoluene #13
              2   25.00000    5.06007    4.94064
              3   50.00000    9.95469    5.02276
              4  100.00000   21.44048    4.66407
              5  500.00000  108.98688    4.58771
              6 1000.00000  221.48364    4.51501
 23.241  1    1   10.00000    1.52266    6.56746        4-Nitrotoluene #14
              2   25.00000    4.00727    6.23865
              3   50.00000    7.87646    6.34803
              4  100.00000   17.27542    5.78857
              5  500.00000   91.24621    5.47968
              6 1000.00000  178.99739    5.58667
 25.075  1    1   10.00000    2.84725    3.51216        3-Nitrotoluene #15
              2   25.00000    5.41142    4.61986
              3   50.00000   11.93896    4.18797
              4  100.00000   23.79573    4.20243
              5  500.00000  124.08713    4.02943
              6 1000.00000  245.04230    4.08093
====================================================================
```

```
                           Peak Sum Table
=====================================================================

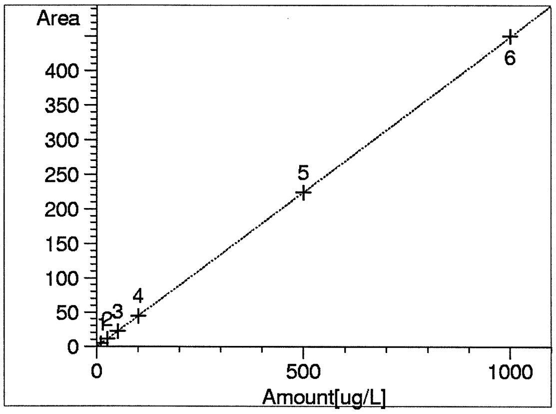
***No Entries in table***
=====================================================================
=====================================================================
                         Calibration Curves
=====================================================================
```



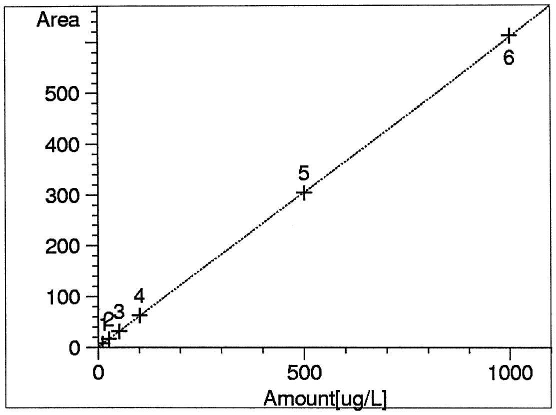
```
HMX #1 at exp. RT: 4.622
DAD1 B, Sig=254,16 Ref=360,100
Correlation:              0.99998
Residual Std. Dev.:       0.42968
Formula: y = mx + b
      m:      1.68544e-1
      b:     -6.26684e-1
      x: Amount[ug/L]
      y: Area
```



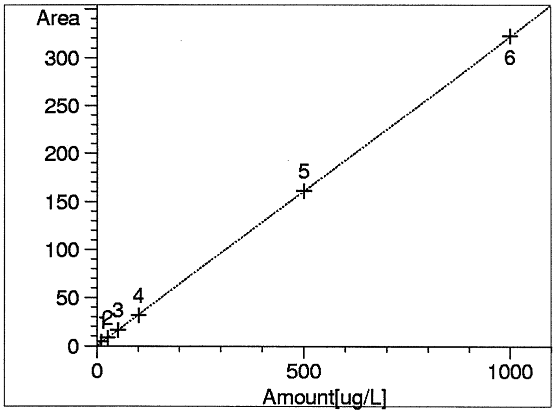
```
RDX #2 at exp. RT: 7.156
DAD1 B, Sig=254,16 Ref=360,100
Correlation:              0.99998
Residual Std. Dev.:       0.51094
Formula: y = mx + b
      m:      1.98574e-1
      b:     -8.61938e-1
      x: Amount[ug/L]
      y: Area
```



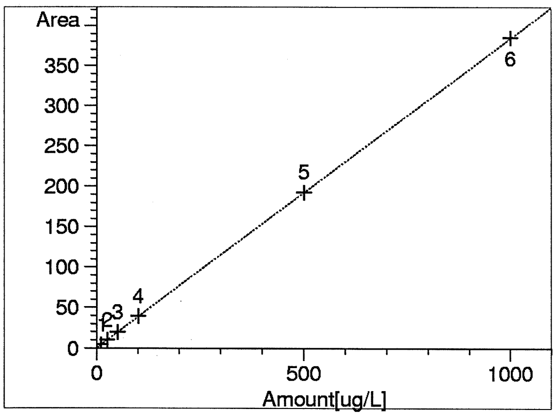
```
1,3,5-Trinitrobenzene #3 at exp. RT: 9.726
DAD1 B, Sig=254,16 Ref=360,100
Correlation:              1.00000
Residual Std. Dev.:       0.43322
Formula: y = mx + b
      m:      4.50713e-1
      b:     -6.74780e-1
      x: Amount[ug/L]
      y: Area
```



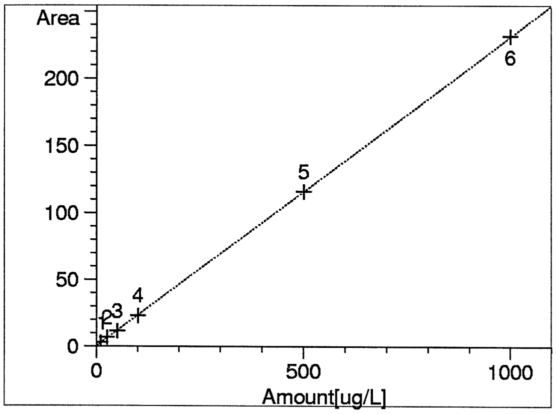
```
1,3-Dinitrobenzene #4 at exp. RT: 11.905
DAD1 B, Sig=254,16 Ref=360,100
Correlation:              0.99999
Residual Std. Dev.:       1.09677
Formula: y = mx + b
      m:       6.09621e-1
      b:       1.73360e-1
      x: Amount[ug/L]
      y: Area
```



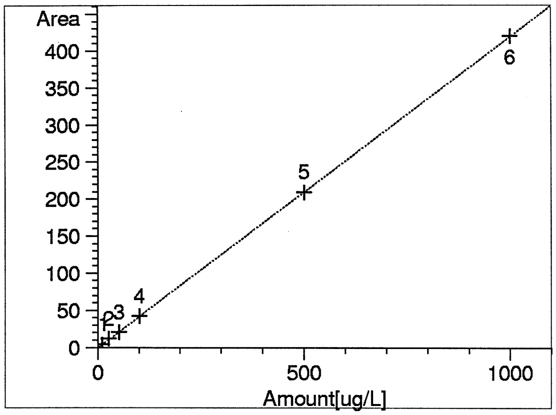
```
Tetryl #5 at exp. RT: 12.595
DAD1 B, Sig=254,16 Ref=360,100
Correlation:              0.99999
Residual Std. Dev.:       0.60912
Formula: y = mx + b
      m:       3.22212e-1
      b:       7.54201e-2
      x: Amount[ug/L]
      y: Area
```



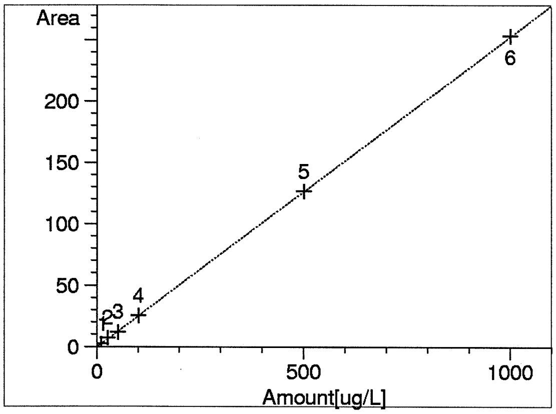
```
Nitrobenzene #6 at exp. RT: 13.516
DAD1 B, Sig=254,16 Ref=360,100
Correlation:              1.00000
Residual Std. Dev.:       0.31655
Formula: y = mx + b
      m:       3.84762e-1
      b:       3.72949e-1
      x: Amount[ug/L]
      y: Area
```



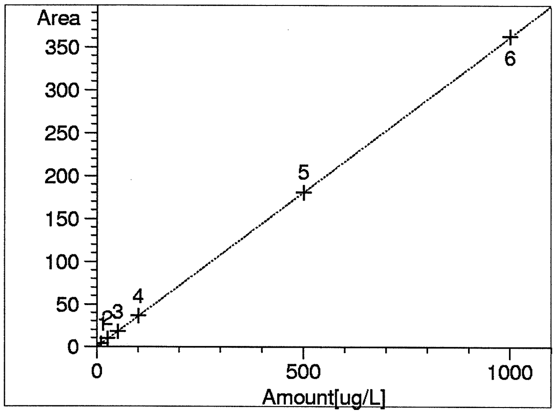
```
3,4-Dinitrotoluene  #7 * at exp. RT: 14.456
DAD1 B, Sig=254,16 Ref=360,100
Correlation:              0.99999
Residual Std. Dev.:       0.43096
Formula: y = mx + b
      m:       2.31563e-1
      b:       2.67966e-2
      x: Amount[ug/L]
      y: Area
```



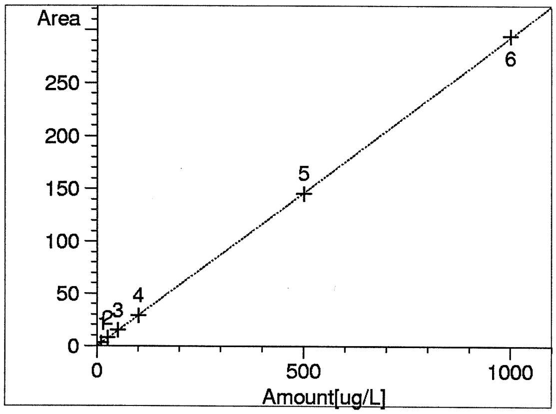
```
2,4,6-Trinitrotoluene #8 at exp. RT: 15.291
DAD1 B, Sig=254,16 Ref=360,100
Correlation:               0.99999
Residual Std. Dev.:        0.75740
Formula: y = mx + b
      m:       4.19820e-1
      b:      -8.19160e-2
      x: Amount[ug/L]
      y: Area
```



```
4-Amino-2,6-Dinitrotoluene #9 at exp. RT: 15.974
DAD1 B, Sig=254,16 Ref=360,100
Correlation:               0.99999
Residual Std. Dev.:        0.59042
Formula: y = mx + b
      m:       2.53297e-1
      b:      -2.77453e-2
      x: Amount[ug/L]
      y: Area
```

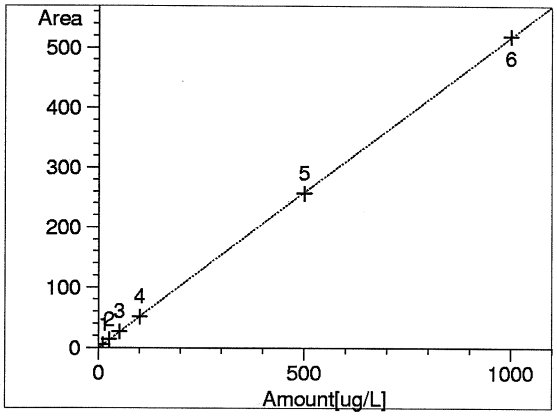


```
2-Amino-4,6-Dinitrotoluene #10 at exp. RT: 16.875
DAD1 B, Sig=254,16 Ref=360,100
Correlation:               0.99999
Residual Std. Dev.:        0.55190
Formula: y = mx + b
      m:       3.62567e-1
      b:      -2.92475e-1
      x: Amount[ug/L]
      y: Area
```

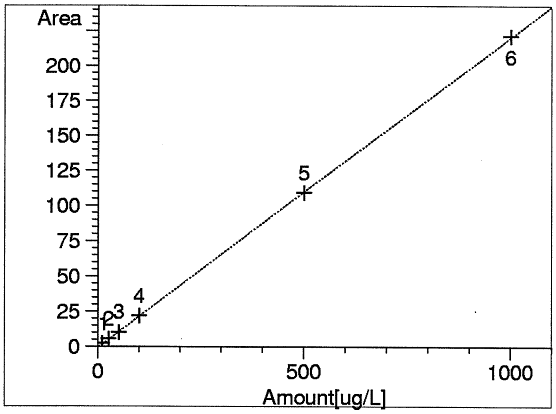


```
2,6-Dinitrotoluene #11 at exp. RT: 17.835
DAD1 B, Sig=254,16 Ref=360,100
Correlation:               0.99999
Residual Std. Dev.:        0.68063
Formula: y = mx + b
      m:       2.93603e-1
      b:      -1.93670e-1
      x: Amount[ug/L]
      y: Area
```

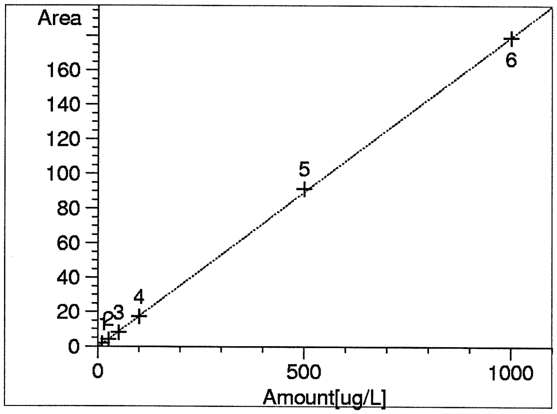
00091556



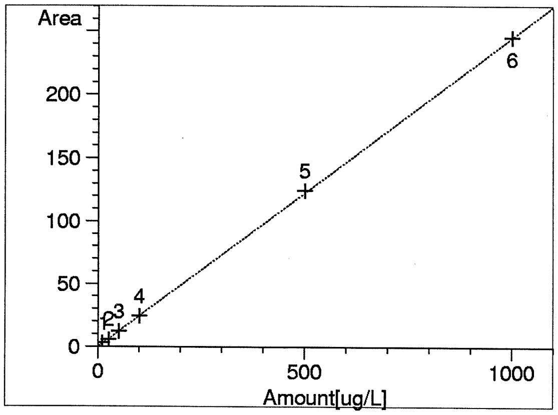
```
2,4-Dinitrotoluene #12 at exp. RT: 18.501
DAD1 B, Sig=254,16 Ref=360,100
Correlation:                 0.99999
Residual Std. Dev.:          1.03666
Formula: y = mx + b
      m:        5.17973e-1
      b:       -3.43882e-1
      x: Amount[ug/L]
      y: Area
```



```
2-Nitrotoluene #13 at exp. RT: 21.707
DAD1 B, Sig=254,16 Ref=360,100
Correlation:                 0.99998
Residual Std. Dev.:          0.69136
Formula: y = mx + b
      m:        2.21750e-1
      b:       -8.04638e-1
      x: Amount[ug/L]
      y: Area
```



```
4-Nitrotoluene #14 at exp. RT: 23.241
DAD1 B, Sig=254,16 Ref=360,100
Correlation:                 0.99993
Residual Std. Dev.:          0.96169
Formula: y = mx + b
      m:        1.80182e-1
      b:       -4.46821e-1
      x: Amount[ug/L]
      y: Area
```



```
3-Nitrotoluene #15 at exp. RT: 25.075
DAD1 B, Sig=254,16 Ref=360,100
Correlation:                 0.99997
Residual Std. Dev.:          0.89819
Formula: y = mx + b
      m:        2.45826e-1
      b:       -1.82276e-1
      x: Amount[ug/L]
      y: Area
```

```
=========================================================================
```

```
                              Check Standard Report
====================================================================

Data File C:\HPCHEM\1\DATA\030205\4L007768.D Sample Name: WG184085-07 ALT
HPLC4 3/3/2005 2:17:06 PM ECL/RDC

1,1 SOS73-13  50 ppb

====================================================================
Injection Date  : 3/2/2005 5:30:47 PM           Seq. Line :   8

Signal 1: DAD1 B, Sig=254,16 Ref=360,100

    Compound                     RT       Known Conc.     Cal. Conc.      %D
------------------------------------------------------------------------------


 HMX #1                        4.620         50.0          48.113        -3.8
 RDX #2                        7.148         50.0          50.374        0.7
 1,3,5-Trinitrobenzene #3      9.724         50.0          50.579        1.2
 1,3-Dinitrobenzene #4         11.903        50.0          48.623        -2.8
 Tetryl #5                     12.601        50.0          49.985        0.0
 Nitrobenzene #6               13.517        50.0          47.963        -4.1
 3,4-Dinitrotoluene  #7 *      14.438        50.0          48.787        -2.4
 2,4,6-Trinitrotoluene #8      15.278        50.0          50.883        1.8
 4-Amino-2,6-Dinitrotolue      15.965        50.0          51.879        3.8
 2-Amino-4,6-Dinitrotolue      16.863        50.0          51.788        3.6
 2,6-Dinitrotoluene #11        17.827        50.0          49.902        -0.2
 2,4-Dinitrotoluene #12        18.482        50.0          52.380        4.8
 2-Nitrotoluene #13            21.722        50.0          49.950        -0.1
 4-Nitrotoluene #14            23.220        50.0          46.576        -6.8
 3-Nitrotoluene #15            25.029        50.0          49.554        -0.9
-------------------------------------------------------------------------------
      # = Failed 15.0% Criteria
```

```
                            Check Standard Report
==================================================================

Data File C:\HPCHEM\1\DATA\030205\4L007775.D Sample Name: WG184085-08 CCV
HPLC4 3/3/2005 2:18:49 PM ECL/RDC

1,1 SOS73-18  50 ppb

==================================================================
Injection Date  : 3/2/2005 9:51:24 PM           Seq. Line :  15

Signal 1: DAD1 B, Sig=254,16 Ref=360,100

    Compound                        RT      Known Conc.     Cal. Conc.      %D
------------------------------------------------------------------------------

 HMX #1                          4.624         50.0          48.591        -2.8
 RDX #2                          7.156         50.0          49.943        -0.1
 1,3,5-Trinitrobenzene #3        9.723         50.0          49.405        -1.2
 1,3-Dinitrobenzene #4           11.900        50.0          49.319        -1.4
 Tetryl #5                       12.605        50.0          47.438        -5.1
 Nitrobenzene #6                 13.517        50.0          52.843        5.7
 3,4-Dinitrotoluene  #7 *        14.441        50.0          50.544        1.1
 2,4,6-Trinitrotoluene #8        15.283        50.0          49.457        -1.1
 4-Amino-2,6-Dinitrotolue        16.014        50.0          47.981        -4.0
 2-Amino-4,6-Dinitrotolue        16.900        50.0          49.528        -0.9
 2,6-Dinitrotoluene #11          17.849        50.0          48.725        -2.6
 2,4-Dinitrotoluene #12          18.497        50.0          49.095        -1.8
 2-Nitrotoluene #13              21.742        50.0          53.201        6.4
 4-Nitrotoluene #14              23.248        50.0          50.461        0.9
 3-Nitrotoluene #15              25.043        50.0          45.942        -8.1
-------------------------------------------------------------------------------
      # = Failed 15.0% Criteria
```

```
                         Check Standard Report
==================================================================

Data File C:\HPCHEM\1\DATA\030205\4L007783.D Sample Name: WG184085-09 CCV
HPLC4 3/3/2005 2:19:44 PM ECL/RDC

1,1 SOS73-18  50 ppb

==================================================================
Injection Date  : 3/3/2005 2:49:16 AM          Seq. Line :  23

Signal 1: DAD1 B, Sig=254,16 Ref=360,100

    Compound                   RT       Known Conc.     Cal. Conc.      %D
-----------------------------------------------------------------------------

 HMX #1                       4.618        50.0          48.171        -3.7
 RDX #2                       7.150        50.0          49.393        -1.2
 1,3,5-Trinitrobenzene #3     9.687        50.0          49.696        -0.6
 1,3-Dinitrobenzene #4        11.865       50.0          48.944        -2.1
 Tetryl #5                    12.570       50.0          44.310        -11.4
 Nitrobenzene #6              13.465       50.0          50.960        1.9
 3,4-Dinitrotoluene  #7 *     14.389       50.0          53.384        6.8
 2,4,6-Trinitrotoluene #8     15.211       50.0          50.149        0.3
 4-Amino-2,6-Dinitrotolue     16.017       50.0          50.489        1.0
 2-Amino-4,6-Dinitrotolue     16.899       50.0          49.209        -1.6
 2,6-Dinitrotoluene #11       17.771       50.0          48.344        -3.3
 2,4-Dinitrotoluene #12       18.420       50.0          48.466        -3.1
 2-Nitrotoluene #13           21.638       50.0          50.611        1.2
 4-Nitrotoluene #14           23.106       50.0          45.902        -8.2
 3-Nitrotoluene #15           24.901       50.0          48.745        -2.5
------------------------------------------------------------------------------
      # = Failed 15.0% Criteria
```

```
                          Check Standard Report
=====================================================================

Data File C:\HPCHEM\1\DATA\030305\4L007785.D Sample Name: WG184223-01 CCV
HPLC4 3/7/2005 12:11:29 PM ECL/RDC

1,1 SOS73-18  50 ppb

=====================================================================
Injection Date  : 3/3/2005 5:54:36 PM           Seq. Line :   2

Signal 1: DAD1 B, Sig=254,16 Ref=360,100

    Compound                  RT       Known Conc.     Cal. Conc.      %D
-----------------------------------------------------------------------------

 HMX #1                     4.616         50.0          50.475        0.9
 RDX #2                     7.135         50.0          50.891        1.8
 1,3,5-Trinitrobenzene #3   9.714         50.0          50.973        1.9
 1,3-Dinitrobenzene #4      11.886        50.0          49.913        -0.2
 Tetryl #5                  12.576        50.0          46.216        -7.6
 Nitrobenzene #6            13.509        50.0          46.577        -6.8
 3,4-Dinitrotoluene  #7 *   14.419        50.0          44.332        -11.3
 2,4,6-Trinitrotoluene #8   15.265        50.0          47.545        -4.9
 4-Amino-2,6-Dinitrotolue   15.943        50.0          47.111        -5.8
 2-Amino-4,6-Dinitrotolue   16.843        50.0          48.110        -3.8
 2,6-Dinitrotoluene #11     17.823        50.0          48.991        -2.0
 2,4-Dinitrotoluene #12     18.478        50.0          50.014        0.0
 2-Nitrotoluene #13         21.714        50.0          51.606        3.2
 4-Nitrotoluene #14         23.211        50.0          45.742        -8.5
 3-Nitrotoluene #15         25.038        50.0          45.768        -8.5
------------------------------------------------------------------------------
      # = Failed 15.0% Criteria
```

Check Standard Report

==

Data File C:\HPCHEM\1\DATA\030305\4L007794.D Sample Name: WG184223-~~01~~ CCV
HPLC4 3/7/2005 12:17:44 PM ECL/RDC

02

RDC 3/7/05

1,1 SOS73-18 50 ppb

==

```
Injection Date  : 3/3/2005 11:29:50 PM         Seq. Line :  11

Signal 1: DAD1 B, Sig=254,16 Ref=360,100

    Compound                        RT       Known Conc.     Cal. Conc.       %D
-------------------------------------------------------------------------------

 HMX #1                          4.608         50.0          49.755        -0.5
 RDX #2                          7.123         50.0          50.087        0.2
 1,3,5-Trinitrobenzene #3        9.682         50.0          50.782        1.6
 1,3-Dinitrobenzene #4           11.848        50.0          50.643        1.3
 Tetryl #5                       12.525        50.0          49.931        -0.1
 Nitrobenzene #6                 13.451        50.0          49.478        -1.0
 3,4-Dinitrotoluene  #7 *        14.357        50.0          50.408        0.8
 2,4,6-Trinitrotoluene #8        15.201        50.0          51.020        2.0
 4-Amino-2,6-Dinitrotolue        15.902        50.0          49.917        -0.2
 2-Amino-4,6-Dinitrotolue        16.804        50.0          50.791        1.6
 2,6-Dinitrotoluene #11          17.749        50.0          51.070        2.1
 2,4-Dinitrotoluene #12          18.403        50.0          50.068        0.1
 2-Nitrotoluene #13              21.630        50.0          51.261        2.5
 4-Nitrotoluene #14              23.138        50.0          48.898        -2.2
 3-Nitrotoluene #15              24.900        50.0          48.320        -3.4
--------------------------------------------------------------------------------
      # = Failed 15.0% Criteria
```

00091562

Shaw *Environmental & Infrastructure, Inc.*
1430 Enclave Parkway
Houston, TX 77077 (281) 368-4000

CHAIN-OF-CUSTODY

No. **01-KEMM-FEB05**

Laboratory Name: **Kemron**

Address: **109 Starlite Park**
Marietta, OH 45750

Contact: 740 373-4071

Project Name **Longhorn AAP**

Project Location **Manholes** ~~**Area 49 Acid Storage Area**~~ CHAAP-29 MAW

Project No. **845714**

Project Contact **Diane Meyer**

Project Telephone No. **281-368-4408**

USACE Point of contact: **Cliff Murray**

USACE Telephone No.

Project Manager/Supervisor **Praveen Srivastav**

Analysis and Method Desired (Indicate separate containers)

Item No.	Sample Number	Date	Time	Comp	Grab	Matrix	Sample Description, Location	Number of Containers	Nitroaromatics and Nitroamines by 8330							Remarks
1	29WL34-MH03-02	2/24/05	14:05			WATER	**29WL34-MH03**	2	X							
2	~~29WL35-MH04-02~~ MAW	~~2/24/05~~				~~WATER~~	~~**29WL35-MH04**~~ MAW	~~2~~	~~X~~							No Sample
3	29WL36-MH05-02	2/24/05	14:13			WATER	**29WL36-MH05**	2	X							
4	29WL37-MH06-02	2/24/05	14:22			WATER	**29WL37-MH06**	2	X							
5	29WL38-MH07-02	2/23/05	16:15			WATER	**29WL38-MH07**	2	X							
6	29WL39-MH08-02	2/23/05	15:17			WATER	**29WL39-MH08**	2	X							
7	29WL40-MH09-02	2/23/05	14:18			WATER	**29WL40-MH09**	2	X							
8	29WL40-MH09-52	2/23/05	14:18			WATER	**29WL40-MH09**	2	X							
9	29WL41-MH10-02	2/23/05	14:34			WATER	**29WL41-MH10**	2	X							
10	29WL42-MH11-02	2/23/05	13:43			WATER	**29WL42-MH11**	2	X							
11	29WL43-MH12-02	2/23/05	13:12			WATER	**29WL43-MH12**	2	X							

Transfers Relinquished By (Signature)	Date/Time	Transfers Accepted By (Signature)	Date/Time
M. Fll	2/24/05		
		Laboratory Cara Strickler	2/25/05 9:40

Special Instructions COC sealed, bx's intact CAS

FedEx Airbill No.:

Sampler's Signature M. Fll

TAT: 7day Standard _____ Rush Due: _________ Seals Intact? ✓ Y _____ N Received Good Condition ✓ Y _____ N _____ Cold 2°, 3°, 4° CAS

White - Lab Copy Canary - Field Copy Pink - File Copy

7-day TAT

KEMRON Environmental Services

Internal Chain of Custody Report

Login: L0502503
Account: SHAW-ALLIANCE-798
Project: 798-LONGHORN
Samples: 10
Due Date: 04-MAR-2005

Samplenum	**Container ID**	**Products**
L0502503-01	117553	8330

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN			25-FEB-2005 11:14	CLS	
2	PREP	W1	EXT	02-MAR-2005 08:16	CSH	CLS
3	DISP	EXT	DISP	02-MAR-2005 15:21	BRG	DEL

Bottle: 2

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN			25-FEB-2005 11:14	CLS	
2	STORE	W1	A1	03-MAR-2005 08:46	CEB	CEB

Samplenum	**Container ID**	**Products**
L0502503-02	117554	8330

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN			25-FEB-2005 11:14	CLS	
2	PREP	W1	EXT	02-MAR-2005 08:17	CSH	CLS
3	DISP	EXT	DISP	02-MAR-2005 15:21	BRG	DEL

Bottle: 2

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN			25-FEB-2005 11:14	CLS	
2	STORE	W1	A1	03-MAR-2005 08:46	CEB	CEB

Samplenum	**Container ID**	**Products**
L0502503-03	117555	8330

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN			25-FEB-2005 11:14	CLS	
2	PREP	W1	EXT	02-MAR-2005 08:17	CSH	CLS
3	DISP	EXT	DISP	02-MAR-2005 15:22	BRG	DEL

Bottle: 2

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN			25-FEB-2005 11:14	CLS	
2	STORE	W1	A1	03-MAR-2005 08:46	CEB	CEB

KEMRON Environmental Services
Internal Chain of Custody Report
Login: L0502503
Account: SHAW-ALLIANCE-798
Project: 798-LONGHORN
Samples: 10
Due Date: 04-MAR-2005

Samplenum	**Container ID**	**Products**
L0502503-04	117556	8330

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN			25-FEB-2005 11:14	CLS	
2	PREP	W1	EXT	02-MAR-2005 08:17	CSH	CLS
3	DISP	EXT	DISP	02-MAR-2005 15:22	BRG	DEL

Bottle: 2

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN			25-FEB-2005 11:14	CLS	
2	STORE	W1	A1	03-MAR-2005 08:46	CEB	CEB

Samplenum	**Container ID**	**Products**
L0502503-05	117557	8330

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN			25-FEB-2005 11:14	CLS	
2	PREP	W1	EXT	02-MAR-2005 08:16	CSH	CLS
3	DISP	EXT	DISP	02-MAR-2005 15:22	BRG	DEL

Bottle: 2

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN			25-FEB-2005 11:14	CLS	
2	STORE	W1	A1	03-MAR-2005 08:46	CEB	CEB

Samplenum	**Container ID**	**Products**
L0502503-06	117558	8330

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN			25-FEB-2005 11:14	CLS	
2	PREP	W1	EXT	02-MAR-2005 08:16	CSH	CLS
3	DISP	EXT	DISP	02-MAR-2005 15:22	BRG	DEL

Bottle: 2

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN			25-FEB-2005 11:14	CLS	
2	STORE	W1	A1	03-MAR-2005 08:46	CEB	CEB

KEMRON Environmental Services

Internal Chain of Custody Report

Login: L0502503
Account: SHAW-ALLIANCE-798
Project: 798-LONGHORN
Samples: 10
Due Date: 04-MAR-2005

Samplenum	Container ID	Products
L0502503-07	117559	8330

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN			25-FEB-2005 11:14	CLS	
2	PREP	W1	EXT	02-MAR-2005 08:16	CSH	CLS
3	DISP	EXT	DISP	02-MAR-2005 15:22	BRG	DEL

Bottle: 2

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN			25-FEB-2005 11:14	CLS	
2	STORE	W1	A1	03-MAR-2005 08:46	CEB	CEB

Samplenum	Container ID	Products
L0502503-08	117560	8330

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN			25-FEB-2005 11:14	CLS	
2	PREP	W1	EXT	02-MAR-2005 08:16	CSH	CLS
3	DISP	EXT	DISP	02-MAR-2005 15:22	BRG	DEL

Bottle: 2

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN			25-FEB-2005 11:14	CLS	
2	STORE	W1	A1	03-MAR-2005 08:46	CEB	CEB

Samplenum	Container ID	Products
L0502503-09	117561	8330

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN			25-FEB-2005 11:14	CLS	
2	PREP	W1	EXT	02-MAR-2005 08:16	CSH	CLS
3	DISP	EXT	DISP	02-MAR-2005 15:22	BRG	DEL

Bottle: 2

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN			25-FEB-2005 11:14	CLS	
2	STORE	W1	A1	03-MAR-2005 08:46	CEB	CEB

KEMRON Environmental Services

Internal Chain of Custody Report

Login: L0502503
Account: SHAW-ALLIANCE-798
Project: 798-LONGHORN
Samples: 10
Due Date: 04-MAR-2005

Samplenum	Container ID	Products
L0502503-10	117562	8330

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN			25-FEB-2005 11:14	CLS	
2	PREP	W1	EXT	02-MAR-2005 08:17	CSH	CLS
3	DISP	EXT	DISP	02-MAR-2005 15:21	BRG	DEL

Bottle: 2

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN			25-FEB-2005 11:14	CLS	
2	STORE	W1	A1	03-MAR-2005 08:46	CEB	CEB

SAMPLE RECEIPT FORM

00091567

156 STARLITE DRIVE
MARIETTA, OH
45750
(740) 373-4071

Date: 2/25/05 Client: Shaw- Houston

Shipped By: ( ) Fed-Ex (✓) UPS ( ) DHL ( ) KEMRON ( ) Client ( ) Other 9:40

Opened By: CLS

Logged By: CLS Login # L05 2-503

IR Temp Gun: ( ) D (✓) F

COOLER INFORMATION

Number	Cooler ID	Temp °C	Airbill#	COC#	Other
1	KL910	2	1266V725019083 4022		
2	LgGreen	3	1266V72501 9203 3410		
3	KL832	4	1266V725019420 7407		
4					
5					
6					

Were all coolers sealed?	[✓ Y]	N	N/A
Were custody seals used on all coolers?	[✓ Y]	N	N/A
Were custody seals intact?	[✓ Y]	N	N/A
Was visible ice present?	[✓ Y]	N	N/A
Were all coolers in the temperature range of 2-6C? (>6C*)	[✓ Y]	N	N/A
Were the samples frozen?*	Y	[✓ N]	N/A
Were COC papers provided?	[✓ Y]	N	N/A
Were all sample containers intact?*	[✓ Y]	N	N/A
Were all sample labels intact?	[✓ Y]	N	N/A
Were all sample labels legible?*	[✓ Y]	N	N/A
Did all sample labels match the COC?*	[✓ Y]	N	N/A
Was the label information complete?*	[✓ Y]	N	N/A
Were the correct containers used?*	[✓ Y]	N	N/A
Were the correct preservatives added to water samples?*	Y	N	[✓ N/A]
Was the pH tested on preserved water samples?	Y	N	[✓ N/A]
Were pH ranges acceptable?*	Y	N	[✓ N/A]
Was sufficient amount of sample provided?*	[✓ Y]	N	N/A
Were bubbles present in VOA samples?*	Y	N	[✓ N/A]
Were COC's signed and dated?	[✓ Y]	N	N/A
Did samples arrive before hold time expired?*	[✓ Y]	N	N/A
Are discrepancy forms attached?	Y	N	[✓ N/A]

* *Requires a discrepancy form*

Comments:

CRF #1
Revised 8/22/03

Appendix B

Additional Investigation Data Summary Report (2006 and 2008)

APPENDIX B
ADDITIONAL INVESTIGATION DATA SUMMARY REPORT

FINAL
FEASIBILITY STUDY
LHAAP-29, FORMER TNT PRODUCTION AREA, GROUP 2
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

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

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

April 2010

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Acronyms and Abbreviations

µg/L	micrograms per liter
bgs	below ground surface
DCA	dichloroethane
DCE	dichloroethene
DNB	dinitrobenzene
DNT	dinitrotoluene
DPE	dichloropropene
FID	flame-ionization detector
HMX	octohydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
LHAAP	Longhorn Army Ammunition Plant
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
PID	photo-ionization detector
PVC	polyvinyl chloride
RDX	cyclotrimethylenetrinitramine
Shaw	Shaw Environmental, Inc.
TCE	trichloroethene
TNB	trinitrobenzene
TNT	trinitrotoluene
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound

1.0 Introduction

Shaw Environmental, Inc. (Shaw) performed several field investigation activities at LHAAP-29 between September 2006 and February 2008. The purpose of the sampling events was to identify the extent of contamination within a former transite wastewater line and to further delineate sediment and groundwater in the shallow and intermediate groundwater zones at LHAAP-29.

1.1 TNT Wastewater Line Sampling

Four grab samples (32WL05, 29WL12, 29WL13, and 29WL14) of wastewater line contents were collected from the TNT wastewater transite pipe line. Samples were collected at two points along the gravity portion of the line that runs from the southern portion of the site to the former pump house location at the northern portion of the site. Samples were also collected at two points along the pressurized portion of the line that extends from the former pump house location to LHAAP-32, located north of LHAAP-29. The wastewater line content samples were analyzed for explosives to characterize any contents remaining in the wastewater line. A summary of the TNT wastewater line samples collected and analyses performed is presented in **Table B-1** and sample locations are provided in **Figure B-1**.

1.2 Sediment Sampling

Four sediment grab samples, including one duplicate, were collected from three locations (29SD47, 29SD48, and 29SD49) at 0 to 0.5 feet below ground surface (bgs) along the cooling water outfall ditch located at the northeastern portion of LHAAP-29. These samples were situated hydraulically downgradient from the location of previous sediment sample 29SD46, which exhibited elevated concentrations of the explosives compounds TNT and dinitrotoluene (DNT). These sediment samples were analyzed for explosives. A summary of the sediment samples collected and analyses performed are presented in **Table B-1,** and sample locations are provided in **Figure B-1**.

1.3 Groundwater Sampling

Between September 2006 and February 2008, a total of 23 groundwater samples, including three duplicate samples, were collected from nine monitoring wells at LHAAP-29. Shaw installed two monitoring wells (29WW36 and 29WW38) into the shallow groundwater zone (37 and 45 feet, respectively), three monitoring wells (29WW35, 29WW37, and 29WW39) into the intermediate groundwater zone (98, 95, and 92 feet, respectively), and one monitoring well (29WW40) into the deep groundwater zone (159 feet).

For this additional investigation, groundwater samples were first collected from all the newly installed wells during two sampling events in September and November 2006. Also, one groundwater sample was collected from existing intermediate monitoring well 29WW16 during the September 2006 sampling event. Groundwater sampling for natural attenuation evaluation at LHAAP-29 was conducted in February 2007. As part of the evaluation, groundwater samples were collected from three of the newly installed wells (29WW35, 29WW36, and 29WW38) as well as from two previously installed wells (29WW06 and 29WW15) in the shallow zone. In February 2008, two more groundwater samples were collected from wells 29WW37 and 29WW39 to further define the area of the methylene chloride plume in the intermediate zone.

The wells installed by Shaw were established at the various depths and locations at LHAAP-29 to better delineate the extent of methylene chloride in the shallow, intermediate and deep groundwater zones and perchlorate in the shallow groundwater zone. All groundwater samples were analyzed for volatile organic compounds (VOCs). The groundwater samples collected from the shallow zone in September and November 2006 were also analyzed for perchlorate. The groundwater samples collected in February 2007 for the evaluation of natural attenuation were analyzed for various analytes; however, only the data results for VOCs and perchlorate from this sampling event are presented here. The other analytes, bacteria, decomposition products, and general water chemistry are all presented in the Natural Attenuation Evaluation. A summary of the groundwater samples collected, which includes monitoring well locations, groundwater zones depths and analyses performed, is presented in **Table B-2**. The monitoring well locations are provided in **Figure B-2**.

2.0 Monitoring Well Installation

Monitoring wells were drilled and installed using a high-torque hollow stem auger or mud rotary drill rig. Each well was constructed with 4-inch diameter, flush-joint threaded, schedule 40, polyvinyl chloride (PVC). Soil was collected continuously using a 5-foot long, 2-inch diameter, split barrel core sampler advanced with the drill bit. The soil in the samplers was field screened using a photo-ionization detector (PID) or flame-ionization detector (FID). Soil stratigraphy was described according to ASTM D2488-00, *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)* (ASTM International, 2003), and logged on U.S. Army Corps of Engineers (USACE) Engineering Form 1836 (Drilling Log) or equivalent. The monitoring wells were installed in accordance with Appendix D, Field Procedures, of the *Final Installation-Wide Work Plan* (Shaw, 2006a).

The 4-inch diameter monitoring wells were installed in the annulus of hollow-stem augers. The PVC well screen installed for each well was of 0.01-inch slotted and 10 feet in length. A threaded PVC bottom cap was secured to the bottom of the screen interval. Solid PVC casing was 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) was 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) was placed above the sand filter pack and hydrated with potable water. The annular space from the top of the bentonite seal to the surface was filled with a bentonite-cement grout.

Procedures were followed to ensure that contamination in each of the groundwater zones remain isolated and does not have the potential to migrate to the other zones. For the wells installed in the intermediate groundwater zone, the shallow groundwater zone was isolated using 12-inch diameter steel casing. The casing was installed from near surface grade to the top of the first confining layer. Upon grouting and setting of the isolation casing, drilling proceeded into the intermediate zone. For the well installed in the deep groundwater zone, the shallow and intermediate groundwater zones were isolated using 16-inch diameter steel casing and 12-inch diameter steel casing, respectively.

The drilling equipment was decontaminated prior to arrival at the site and between well installations. Additional information on decontamination procedures can be found in Appendix D, Attachment 9, of the *Final Installation-Wide Work Plan* (Shaw, 2006a). Core samplers were washed between sampling intervals in a detergent/water solution and double rinsed with potable tap water in clean buckets. The decontamination wastewater and the drill cuttings were containerized separately and transported to an assigned staging area for proper handling as discussed in Appendix D of the *Final Installation-Wide Work Plan* (Shaw, 2006a).

Aboveground surface completions were constructed for each new monitoring well as described in Appendix D of the *Final Installation-Wide Work Plan* (Shaw, 2006a). The surface completions consist of a 6-inch-square protective steel casing, 5-feet long 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 were installed just outside the corners of the concrete pad.

The monitoring wells and surface completions were installed in general accordance with USACE and State of Texas requirements by a drilling subcontractor licensed in the State of Texas. Following the completion of the field work for monitoring well installation, a State of Texas Well Report was submitted to the Texas Department of Licensing and Regulations for construction of each well. Drilling logs for the monitoring wells installed during this sample event are included in **Attachment 1**.

2.1 Well Development

The newly installed monitoring wells were developed to remove drilling fines and enhance hydraulic communication between the well and the groundwater zone. The wells were developed no sooner than 48 hours and no later than 7 days after installation. Well development was 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 (including the diameter of the well borehole and assumed 30-percent filter pack porosity) was pumped from each well. The volume of groundwater removed from each well was calculated based on the static water level as measured from the top-of-casing. An electronic interface probe was used to measure the water levels. General water quality parameters (temperature, pH, conductivity, and turbidity) were measured using field instruments and recorded in the field logbook. Development was performed until the water quality parameters were stabilized to within 10 percent and the water was visually clear. Monitoring Well 29WW38 had stable water quality parameters, but did not reach visual clarity during well development. Well development procedures were performed in accordance with the guidance provided in Appendix D, Attachment 3, of the *Final Installation-Wide Work Plan* (Shaw, 2006a). Development records for the newly installed monitoring wells are included in **Attachment 2**.

A Shaw hydrogeologist supervised well development and documented the development process and measurements in a Well Development Record specific to each well. Downhole development equipment was 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 was placed in 55-gallon drums and handled in accordance with Appendix D of the *Final Installation-Wide Work Plan* (Shaw, 2006a).

2.2 Survey of Monitoring Well Locations

A State of Texas-licensed professional land surveyor surveyed the locations and elevations of the newly installed monitoring wells. The horizontal coordinates (northings and eastings) of the wells were surveyed to the nearest foot based on the North American Datum of 1983. The vertical elevations of the tops of the wells (top-of-casing) were surveyed to nearest 0.01 feet. The ground surface elevation at each well location was surveyed to the nearest 0.1 feet. The survey information is included on the drilling logs in **Attachment 1**.

3.0 Bench Scale Chemical Oxidation Testing

Due to the elevated levels of methylene chloride contamination in the intermediate zone, soil and groundwater samples were collected during the installation of the monitoring wells for bench scale testing of activated persulfate formulations. Approximately 5 kilograms of soil and 10 liters of groundwater were collected for the bench-scale testing. The soil was collected from the intermediate zone sands during well installation from an area representative of the contaminated zone. The groundwater was collected from 29WW16, which represents the methylene chloride plume hot spot in the intermediate zone.

Upon sample receipt at Shaw's Technology Development Laboratory in Knoxville, Tennessee, batch experiments were established to evaluate the following activation methods for persulfate oxidation of methylene chloride: chelated ferrous iron, heat, and caustic pH adjustment. The objective of the bench-scale testing was to identify the necessary activation methods and concentrations of persulfate that would be required to oxidize the levels of methylene chloride present in the intermediate groundwater should treatment be deemed necessary. The results of the bench-scale testing concluded that combined heat and an alkaline activated persulfate oxidation would be the best treatment, if necessary. *The Activated Persulfate Oxidation Treatability Study Report* is included in **Attachment 3**.

4.0 Sampling and Analysis

This section describes the sampling and analysis procedures applicable to groundwater, sediment and soil samples collected at LHAAP-29. Samples were collected and handled in accordance with the Chemical Data Acquisition Plan, Appendix C of the *Final Installation-Wide Work Plan* (Shaw, 2006a). Health and safety procedures, including screening methods, are presented in the Health and Safety Plan, Appendix A of the *Final Installation-Wide Work Plan* (Shaw, 2006a).

4.1 TNT Wastewater Line Sampling

Residual contents from the former transite TNT wastewater line were collected at the locations identified in **Figure B-1**. At each of the sample locations, trenches were excavated down to the depth of the former wastewater line, or approximately 3 feet bgs. A sample of the contents of the wastewater line sample was collected from each proposed location as discussed in Addendum 6, *Additional Investigation at LHAAP-29* (Shaw, 2006b). At each location, a grab sample was collected from the wastewater line and placed directly into a 4-ounce glass sample jar with a Teflon-lined cap. Each sample container was labeled as described in Section 4.6.3 of Appendix C of the *Final Installation-Wide Work Plan* (Shaw, 2006a), enclosed in a sealable plastic bag, and placed in a cooler containing ice to preserve the samples at 4 degrees Celsius or less. Following collection of the samples, the location and sample depth and/or field measurements were recorded in the field logbook and chain-of-custody documentation was completed. The samples were delivered to the analytical laboratory for analysis using U.S. Environmental Protection Agency (USEPA) Method SW 8330 for explosives.

4.2 Sediment Sampling

Sediment samples were collected along the former cooling water outfall ditch at the locations identified in **Figure B-1**. The sediment sampling interval at each of the locations was 0 to 0.5 feet bgs. At each location, a grab sediment sample was collected and placed directly into a 4-ounce glass sample jar with a Teflon-lined cap. Each sample container was labeled as described in Section 4.6.3 of Appendix C of the *Final Installation-Wide Work Plan* (Shaw, 2006a), enclosed in a sealable plastic bag, and placed in a cooler containing ice to preserve the samples at 4 degrees Celsius or less. Following collection of the samples, the location and sample depth and/or field measurements were recorded in the field logbook and chain-of-custody documentation was completed. The samples were delivered to the analytical laboratory for analysis using USEPA Method SW 8330 for explosives.

A field duplicate (quality control sample) was collected and analyzed to assess the precision of the field sampling and laboratory analytical process. The field duplicate was collected by filling a second sample container in rapid succession after collecting the primary sediment sample. The duplicate was collected for sediment sample 29SD49.

4.3 Groundwater Sampling

Groundwater samples were collected from monitoring wells identified in **Figure B-2**. The groundwater samples were collected as discussed in Addendum 6, *Additional Investigation at LHAAP-29* (Shaw, 2006b). Groundwater samples were collected using the low-flow sampling methodology in accordance with Appendix C of the *Final Installation-Wide Work Plan* (Shaw, 2006a). General water quality parameters (temperature, pH, conductivity, and turbidity) were measured throughout the sampling process at each well location using field instruments. This information was recorded in the field logbook. Each sample bottle was labeled as described in Section 4.6.3 of Appendix C of the *Final Installation-Wide Work Plan* (Shaw, 2006a), enclosed in a sealable plastic bag, and placed in a cooler containing ice to preserve the samples at 4 degrees Celsius or less. Following collection of the samples, the location and field measurements were recorded on groundwater sampling forms (**Attachment 4**) and a chain-of-custody documentation was completed. The analytical parameters for which the groundwater samples were submitted for laboratory analysis are presented in **Table B-2**.

A field duplicate (quality control sample) was collected during each sampling event. The field duplicates were collected by filling a second sample container in rapid succession after collecting the primary groundwater sample. The duplicate samples collected for each of the sample events are presented in **Table B-2**.

5.0 Results

This section discusses the results of the wastewater line contents, sediment and groundwater samples collected as part of the additional investigation sampling event. The results are presented in **Tables B-3, B-4** and **B-5,** respectively. The associated laboratory data reports are included as **Attachment 5** of this document.

5.1 TNT Wastewater Line

Various explosives in the TNT wastewater line, 1,3,5-trinitrobenzene (TNB), 1,3-dinitrobenzene (DNB), TNT, 2,4-DNT, 2-amino-4,6-DNT, 4-amino-2,6-DNT, octohydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) and cyclotrimethylenetrinitramine (RDX), were detected at the four sample locations. The highest concentrations of explosives (TNT at 526 milligrams per kilogram [mg/kg], 1,3,5-TNB at 53.4 mg/kg, 1,3-DNB at 1.08 mg/kg and 2,4-DNT at 89 mg/kg) were in sample 29WL13, which was collected from the southern (gravity) segment of the wastewater line. Results are summarized in **Table B-3**, and sample locations are shown on **Figure B-1**.

5.2 Sediment

Low concentrations of HMX were detected at two sediment sample locations, 29SD48 and the 29SD49 field duplicate, at estimated concentrations of 2.1J mg/kg and 0.88J mg/kg, respectively. A concentration of p-nitrotoluene was also detected at 29SD48 at 4.88 mg/kg. Results are summarized in **Table B-4**, and sample locations are shown in **Figure B-1**.

5.3 Groundwater

In the September 2006 sample event, newly installed intermediate zone wells (29WW35, 29WW37, and 29WW39) had detected concentrations of methylene chloride greater than the Maximum Contaminant Level (MCL) of 5 µg/L, the cleanup goal for methylene chloride. The highest concentration (7,110,000 µg/L) was at existing well 29WW16.

In the November 2006 sample event, methylene chloride concentrations in the intermediate wells around 29WW16 were less than before, with the exception of 29WW37 which maintained a relatively steady concentration as compared to the initial sample round.

In the February 2007 sample event, one intermediate well, 29WW35, had a detected methylene chloride concentration of 237 µg/L, which was a decrease of nearly 98% from the September 2006 concentration of 8,770 µg/L at that same well. In February 2008, subsequent sampling at the well locations assumed to be at the outer edge of the methylene chloride plume in the intermediate zone, 29WW37 and 29WW39, indicated that methylene chloride concentrations were below the MCL.

Based on the four intermediate zone monitoring wells (29WW16, 29WW35, 29WW37, and 29WW39) and results of the groundwater sample events conducted between September 2006 and February 2008, the methylene chloride plume in the intermediate groundwater zone has been adequately defined. Groundwater measurements suggest groundwater in the intermediate zone to be flowing towards to the northeast. This is further evidenced by the two wells with the highest methylene chloride concentrations, 29WW16 and 29WW35 (7,110,000 and 237 μg/L respectively) which indicate a decrease in concentrations in northeast direction.

An elevated methylene chloride concentration of 92.8 μg/L was detected in the deep well 29WW40 during the initial sample round in September 2006. Results were much lower in the subsequent November and December 2006 sample events at this well location. In the December 2006 sample round, the methylene chloride result was below the detection limit of 0.25 μg/L.

Other VOCs detected in the groundwater samples above the MCLs included trichloroethene (TCE), 1,2-dichloroethane (DCA), 1,1-dichloroethene (DCE), 1,1-dichloropropene (DPE) and vinyl chloride. The maximum concentrations for TCE and vinyl chloride as well as the only detect above the MCL for 1,1-DPE were at intermediate zone well 29WW16. TCE was detected in the intermediate groundwater zone at one other well location, 29WW35. The decrease in TCE concentrations between wells 29WW16 and 29WW35 (4,340 and 25.6 μg/L, respectively) and the east-northeasterly groundwater flow direction suggests that the TCE plume in the intermediate zone is predominantly isolated between the two well locations.

The maximum concentration of 1,2-DCA (5,520 μg/L) was detected at shallow zone well 29WW15 that is co-located with well 29WW16. Concentrations of TCE (344 μg/L) and 1,1-DCE (7.5 μg/L) were also identified at 29WW15 and is the only shallow well where these VOCs have been detected. The presence of TCE and 1,1-DCE solely at well 29WW15 and 1,2-DCA at co-located wells 29WW15 and 29WW16 indicates that these contaminants are isolated at this location. It appears that the 1,2-DCA plume is slowly migrating towards the intermediate zone; however, the maximum concentration detected in well 29WW16 (14.3 μg/L) is still nearly 400 times less than the shallow zone concentration.

Results are summarized in **Table B-5**. Methylene chloride results are shown on **Figure B-2** and other VOC Results are shown on **Figure B-3**.

6.0 References

ASTM International, 2003, ASTM D2488-00, *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*.

Shaw, 2006a, *Final Installation-Wide Work Plan, Longhorn Army Ammunition Plant, Karnack, Texas*, Final, Houston, Texas, January.

Shaw, 2006b, Addendum 6, *Additional Investigation at LHAAP-29 Former TNT Production Area, Longhorn Army Ammunition Plant, Karnack, Texas*, Final, Houston, Texas, April.

Tables

Table B-1
TNT Wastewater Line and Sediment Sampling Analysis
LHAAP-29

Media	Sample Locations	Primary Samples	Field Duplicates	Analytical Suite	Results Table
TNT Wastewater Line					
Contents of north segment of transite wastewater line that extends from former pump house location to LHAAP-32.	32WL05	1	0	Explosives	B-3
Contents of south segment of transite wastewater line (gravity portion) near center of LHAAP-29.	29WL13	1	0	Explosives	B-3
Contents of north segment of transite wastewater line (pressure portion) at former pump house location.	29WL12	1	0	Explosives	B-3
Contents of south end of transite wastewater line (gravity portion) at south end of LHAAP-29.	29WL14	1	0	Explosives	B-3
Sediment					
Intermediate locations between the cooling water outfall ditch and the northeast property boundary.	29SD47, 29SD48, 29SD49	3	1	Explosives	B-4

00091586

Table B-2
Groundwater Sampling and Analysis
LHAAP-29

Well Location	Well Depth (ft BTOC)	Groundwater Zone	September 2006	November 2006	December 2006	February 2007	February 2008	Field Duplicate	Analytical Suite	Results Table
29WW06	35	Shallow				1			VOCs, Perchlorate	B-5
29WW15	33	Shallow				1			VOCs	
29WW16	90	Intermediate	1						VOCs	
29WW35	98	Intermediate	1	1		1		1 (Feb 2007)	VOCs, Perchlorate[a]	
29WW36	37	Shallow	1	1		1			VOCs, Perchlorate	
29WW37	95	Intermediate	1	1			1		VOCs	
29WW38	45	Shallow	1	1		1		1 (Sept 2006)	VOCs, Perchlorate	
29WW39	92	Intermediate	1				1		VOCs	
29WW40	159	Deep	1	1	1			1 (Nov 2006)	VOCs	

Notes and Abbreviations

[a] *analyzed for perchlorate during the February 2007 sample event only.*

ft BTOC	*feet below top of casing*
VOCs	*volatile organic compounds*

Table B-3
Sample Results in Solids from TNT Wastewater Line
LHAAP-29

	Location:	32WL05	29WL12	29WL13	29WL14
	Sample Date:	09/28/06	09/28/06	09/28/06	09/27/06
	Sample ID:	32WL05-092806	29SB81-002	29SB82-001	29WL14-092706
	Sample Depth (ft bgs):	NA	NA	NA	NA
	Sample Type:	Reg	Reg	Reg	Reg
Parameter	Units				
Explosives					
1,3,5-Trinitrobenzene (1,3,5-TNB)	mg/kg	1.61 JL	<0.249	53.4	1.61 JH
1,3-Dinitrobenzene (1,3-DNB)	mg/kg	<0.245 JL	<0.249	1.08	<0.246
2,4,6-Trinitrotoluene (TNT)	mg/kg	17 JL	<0.249	526	58.4
2,4-Dintrotoluene (2,4-DNT)	mg/kg	5.15 JL	<0.249	89	7.21
2,6-Dinitrotoluene (2,6-DNT)	mg/kg	<0.255 JL	<0.259	<0.251	<0.256
2-Amino-4,6-dinitrotoluene	mg/kg	<0.255 JL	<0.259	<0.251	19 JH
4-Amino-2,6-dinitrotoluene	mg/kg	<0.255 JL	<0.259	<0.251	13.3
HMX	mg/kg	<2.16 JL	<2.19	<2.13	<2.17
m-Nitrotoluene	mg/kg	<0.245 JL	<0.249	<0.242	<0.246
Nitrobenzene	mg/kg	<0.255 JL	<0.259	<25.1	<0.256
o-Nitrotoluene	mg/kg	<0.245 JL	<0.249	<0.242	<0.246
p-Nitrotoluene	mg/kg	<0.245 JL	<0.249	<0.242	<0.246
RDX	mg/kg	<0.98 JL	<0.995	<0.966	<0.985
Tetryl	mg/kg	<0.637 JL	<0.647	<0.628	<0.64

Notes and Abbreviations:

<	*result is below detection limit*
J	*reported result was estimated*
L	*result may be biased low*
ft bgs	*feet below ground surface*
HMX	*octohydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine*
mg/kg	*milligrams per kilogram*
RDX	*cyclotrimethylenetrinitramine*

Table B-4
Sediment Sample Results
LHAAP-29

	Location:	29SD47	29SD48	29SD49	29SD49
	Sample Date:	08/31/06	08/31/06	08/31/06	08/31/06
	Sample ID:	29SD47-083106	29SD48-083106	29SD49-083106	29SD49-083106FD
	Sample Depth (ft bgs):	0.5	0.5	0.5	0.5
	Sample Type:	Reg	Reg	Reg	FD
Parameter	Units				
Explosives					
1,3,5-Trinitrobenzene (1,3,5-TNB)	mg/kg	<0.249	<0.239	<0.246	<0.242
1,3-Dinitrobenzene (1,3-DNB)	mg/kg	<0.249	<0.239	<0.246	<0.242
2,4,6-Trinitrotoluene (TNT)	mg/kg	<0.249	<0.239	<0.246	<0.242
2,4-Dintrotoluene (2,4-DNT)	mg/kg	<0.249	<0.239	<0.246	<0.242
2,6-Dinitrotoluene (2,6-DNT)	mg/kg	<0.259	<0.249	<0.256	<0.251
2-Amino-4,6-dinitrotoluene	mg/kg	<0.259	<0.249	<0.256	<0.251
4-Amino-2,6-dinitrotoluene	mg/kg	<0.259	<0.249	<0.256	<0.251
HMX	mg/kg	<2.19	2.11 J	<2.17 J	0.88 J
m-Nitrotoluene	mg/kg	<0.249	<0.239	<0.246	<0.242
Nitrobenzene	mg/kg	<0.259	<0.249	<0.256	<0.251
o-Nitrotoluene	mg/kg	<0.249	<0.239	<0.246	<0.242
p-Nitrotoluene	mg/kg	<0.249	4.88	<0.246 J	<0.242 J
RDX	mg/kg	<0.995	<0.957	<0.985	<0.966
Tetryl	mg/kg	<0.647	<0.622	<0.640	<0.628

Notes and Abbreviations:

<	*result is below detection limit*
J	*reported result was estimated*
FD	*field duplicate*
ft bgs	*feet below ground surface*
HMX	*octohydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine*
mg/kg	*milligrams per kilogram*
RDX	*cyclotrimethylenetrinitramine*
REG	*regular sample*

Table B-5
Groundwater Sample Results
LHAAP-29

	Location Code:	29WW06	29WW15	29WW16	29WW35	29WW35	29WW35
	Sample Date:	2/22/07	2/24/07	9/21/06	9/26/06	11/20/06	2/22/07
	Sample ID:	29WW06-FEB2007	29WW16-FEB2007	29WW16-060921	29WW35-060926	29WW35-061120	29WW35-FEB2007
	Sample Type:	REG	REG	REG	REG	REG	REG
ANALYTE	UNITS						
Non-Metallic Anion							
Perchlorate	µg/L	<20	NA	NA	NA	NA	21.5 J
Volatiles							
1,1,1,2-Tetrachloroethane	µg/L	NA	NA	<0.25	<0.25	<0.25	NA
1,1,1-Trichloroethane	µg/L	<0.37	<0.37	<0.25	<0.25	<0.25	<0.37
1,1,2,2-Tetrachloroethane	µg/L	<0.46	<0.46	<0.125	<0.125	<0.125	<0.46
1,1,2-Trichloroethane	µg/L	<0.66	1.9 J	<0.25	<0.25	<0.25	<0.66
1,1-Dichloroethane	µg/L	<0.52	3.4	<0.125	0.338 JH	<0.125	<0.52
1,1-Dichloroethene	µg/L	<0.68	7.5	<0.5	<0.5	<0.5	<0.68
1,1-Dichloropropene	µg/L	NA	NA	26.4	<0.25	<0.25	NA
1,2,3-Trichlorobenzene	µg/L	NA	NA	<0.125	<0.125	<0.125	NA
1,2,3-Trichloropropane	µg/L	NA	NA	<0.5	<0.5	<0.5	NA
1,2,4-Trichlorobenzene	µg/L	NA	NA	<0.2	<0.2	<0.2	NA
1,2,4-Trimethylbenzene	µg/L	NA	NA	<0.25	<0.25	<0.25	NA
1,2-Dibromo-3-chloropropane	µg/L	NA	NA	<1	<1	<1	NA
1,2-Dibromomethane	µg/L	NA	NA	<0.25	<0.25	<0.25	NA
1,2-Dichlorobenzene	µg/L	NA	NA	0.155 J	<0.125	<2.5	NA
1,2-Dichloroethane	µg/L	<0.53	5520	14.3	<0.25	<0.25	<0.53
1,2-Dichloropropane	µg/L	<0.59	<0.59	<0.2	<0.2	<0.2	<0.59
1,2-Dimethylbenzene (o-Xylene)	µg/L	NA	NA	<0.25	<0.25	<0.25	NA
1,3,5-Trimethylbenzene	µg/L	NA	NA	<0.25	<0.25	<0.25	NA
1,3-Dichlorobenzene	µg/L	NA	NA	<0.25	<0.25	<0.25	NA
1,3-Dichloropropane	µg/L	NA	NA	0.281 J	<0.2	<0.2	NA
1,4-Dichlorobenzene	µg/L	NA	NA	0.702 J	<0.125	<0.125	NA
2,2-Dichloropropane	µg/L	NA	NA	<0.25	<0.25	<0.25	NA
2-Butanone	µg/L	<3	<3	<2.5	<2.5	<2.5	<3
2-Chloroethyl vinyl ether	µg/L	NA	NA	<2	<200	<2	NA

Table B-5 (*Continued*)
Groundwater Sample Results
LHAAP-29

	Location Code:	29WW06	29WW15	29WW16	29WW35	29WW35	29WW35
	Sample Date:	2/22/07	2/24/07	9/21/06	9/26/06	11/20/06	2/22/07
	Sample ID:	29WW06-FEB2007	29WW16-FEB2007	29WW16-060921	29WW35-060926	29WW35-061120	29WW35-FEB2007
	Sample Type:	Reg	Reg	Reg	Reg	Reg	Reg
ANALYTE	UNITS						
2-Chlorotoluene	µg/L	NA	NA	<0.125	<0.125	<0.125	NA
2-Hexanone	µg/L	<1.9	<1.9	<2.5	<2.5	<2.5	<1.9
4-Chlorotoluene	µg/L	NA	NA	<0.25	<0.25	<0.25	NA
Acetone	µg/L	<2.8	<2.8	<2.5	<2.5	<2.5	<2.8
Benzene	µg/L	<0.23	0.47 J	0.245 J	<0.125	<0.125	<0.23
Bromobenzene	µg/L	NA	NA	<0.125	<0.125	<0.125	NA
Bromochloromethane	µg/L	NA	NA	49.6	11 JH	<0.2	NA
Bromodichloromethane	µg/L	<0.33	<0.33	<0.25	<0.25	<0.25	<0.33
Bromoform	µg/L	<0.65	<0.65	<0.5	<0.5	<0.5	<0.65
Bromomethane	µg/L	<0.47	<0.47	<0.5	<0.5	<0.5	<0.47
Carbon disulfide	µg/L	<0.62	<0.62	<0.5	<0.5	3.26	3.7
Carbon tetrachloride	µg/L	<0.52	<0.52	<0.25	<0.25	<0.25	<0.52
Chlorobenzene	µg/L	<0.54	<0.54	<0.125	<0.125	<0.125	<0.54
Chloroethane	µg/L	<0.46	<0.46	<0.5	<0.5	<0.5	<0.46
Chloroform	µg/L	<0.66	5.3	<0.125	<0.125	<0.125	<0.66
Chloromethane	µg/L	<0.6	<0.6	115	1.76 JH	0.549 J	<0.6
Cis-1,2-Dichloroethene	µg/L	<0.83	1.8 J	<0.25	2.27 JH	0.619 J	<0.83
Cis-1,3-Dichloropropene	µg/L	<0.59	<0.59	<0.25	<0.25	<0.25	<0.59
Dibromochloromethane	µg/L	<0.68	<0.68	<0.25	<0.25	<0.25	<0.68
Dibromomethane	µg/L	NA	NA	<0.25	<0.25	<0.25	NA
Dichlorodifluoromethane	µg/L	NA	NA	<0.25	<0.25	<0.25	NA
Ethylbenzene	µg/L	<0.48	<0.48	<0.25	<0.25	<0.25	<0.48
Hexochlorobutadiene	µg/L	NA	NA	<0.25	<0.25	<0.25	NA
Isopropylbenzene	µg/L	NA	NA	<0.25	<0.25	<0.25	NA
m,p-xylenes	µg/L	NA	NA	<0.5	<0.5	<0.5	NA
Methyl isobutyl ketone	µg/L	<7.3	<7.3	<2.5	<2.5	<2.5	<7.3
Methylene chloride	µg/L	<0.67	3 J	7,110,000	8,770	1,400	237
Naphthalene	µg/L	NA	NA	0.628 J	<0.2	<0.2	NA
n-Butylbenzene	µg/L	NA	NA	<0.25	<0.25	<0.25	NA
n-Propylbenzene	µg/L	NA	NA	0.126 J	<0.125	<0.125	NA

Table B-5 (*Continued*)
Groundwater Sample Results
LHAAP-29

	Location Code:	29WW06	29WW15	29WW16	29WW35	29WW35	29WW35
	Sample Date:	2/22/07	2/24/07	9/21/06	9/26/06	11/20/06	2/22/07
	Sample ID:	29WW06-FEB2007	29WW16-FEB2007	29WW16-060921	29WW35-060926	29WW35-061120	29WW35-FEB2007
	Sample Type:	Reg	Reg	Reg	Reg	Reg	Reg
ANALYTE	UNITS						
p-Isopropyltoluene	µg/L	NA	NA	<0.25	<0.25	<0.25	NA
sec-Butylbenzene	µg/L	NA	NA	<0.25	<0.25	<0.25	NA
Styrene	µg/L	<0.5	<0.5	<0.125	<0.125	<0.125	<0.5
tert-butylbenzene	µg/L	NA	NA	<0.25	<0.25	<0.25	NA
Tetrachloroethene	µg/L	<0.74	<0.74	6.47	<0.25	<0.25	<0.74
Toluene	µg/L	<0.54	<0.54	17.3	<0.25	<0.25	<0.54
Trans-1,2-Dichloroethene	µg/L	<0.75	15.6	<0.25	0.328 JH	<0.25	<0.75
Trans-1,3-Dichloropropene	µg/L	<0.61	<0.61	<0.5	<0.5	<0.5	<0.61
Trichloroethene	µg/L	<0.63	344	4340 J	123 JH	43.5	25.6
Trichlorofluoromethane	µg/L	NA	NA	<0.25	<0.25	<0.25	NA
Vinyl acetate	µg/L	NA	NA	<2.5	<2.5	<2.5	NA
Vinyl chloride	µg/L	<0.32	<0.32	22.4	<0.25	<0.25	<0.32
Xylenes, Total	µg/L	<1.1	<1.1	NA	NA	NA	<1.1

Table B-5 (*Continued*)
Groundwater Sample Results
LHAAP-29

Location Code:		29WW35	29WW36	29WW36	29WW36	29WW37	29WW37
Sample Date:		2/22/07	9/22/06	11/17/06	2/21/07	9/22/06	11/17/06
Sample ID:		29WW36-FEB2007-FD	29WW36-060922	29WW36-061117	29WW36-FEB2007	29WW37-060922	29WW37-061117
Sample Type:		FD	REG	REG	REG	REG	REG
ANALYTE	UNITS						
Non-Metallic Anion							
Perchlorate	µg/L	5.1 J	<5	NA	<4	NA	NA
Volatiles							
1,1,1,2-Tetrachloroethane	µg/L	NA	<0.25	<0.25	NA	<0.25	<0.25
1,1,1-Trichloroethane	µg/L	<0.37	<0.25	<0.25	<0.37	<0.25	<0.25
1,1,2,2-Tetrachloroethane	µg/L	<0.46	<0.125	<0.125	<0.46	<0.125	<0.125
1,1,2-Trichloroethane	µg/L	<0.66	<0.25	<0.25	<0.66	<0.25	<0.25
1,1-Dichloroethane	µg/L	<0.52	<0.125	<0.125	<0.52	<0.125	<0.125
1,1-Dichloroethene	µg/L	<0.68	<0.5	<0.5	<0.68	<0.5	<0.5
1,1-Dichloropropene	µg/L	NA	<0.25	<0.25	NA	<0.25	<0.25
1,2,3-Trichlorobenzene	µg/L	NA	<0.125	<0.125	NA	<0.125	<0.125
1,2,3-Trichloropropane	µg/L	NA	<0.5	<0.5	NA	<0.5	<0.5
1,2,4-Trichlorobenzene	µg/L	NA	<0.2	<0.2	NA	<0.2	<0.2
1,2,4-Trimethylbenzene	µg/L	NA	<0.25	<0.25	NA	<0.25	<0.25
1,2-Dibromo-3-chloropropane	µg/L	NA	<1	<1	NA	<1	<1
1,2-Dibromomethane	µg/L	NA	<0.25	<0.25	NA	<0.25	<0.25
1,2-Dichlorobenzene	µg/L	NA	<0.125	<0.125	NA	<0.125	<0.125
1,2-Dichloroethane	µg/L	<0.53	<0.25	<0.25	<0.53	<0.25	<0.25
1,2-Dichloropropane	µg/L	<0.59	<0.2	<0.2	<0.59	<0.2	<0.2
1,2-Dimethylbenzene (o-Xylene)	µg/L	NA	<0.25	<0.25	NA	<0.25	<0.25
1,3,5-Trimethylbenzene	µg/L	NA	<0.25	<0.25	NA	<0.25	<0.25
1,3-Dichlorobenzene	µg/L	NA	<0.25	<0.25	NA	<0.25	<0.25
1,3-Dichloropropane	µg/L	NA	<0.2	<0.2	NA	<0.2	<0.2
1,4-Dichlorobenzene	µg/L	NA	0.186 J	<0.125	NA	0.41 J	<0.125
2,2-Dichloropropane	µg/L	NA	<0.25	<0.25	NA	<0.25	<0.25
2-Butanone	µg/L	<3	<2.5	<2.5	<3	<2.5	<2.5
2-Chloroethyl vinyl ether	µg/L	NA	<2	<2	NA	<2	<2
2-Chlorotoluene	µg/L	NA	<0.125	<0.125	NA	<0.125	<0.125
2-Hexanone	µg/L	<1.9	<2.5	<2.5	<1.9	<2.5	<2.5

Table B-5 (*Continued*)
Groundwater Sample Results
LHAAP-29

	Location Code:	29WW35	29WW36	29WW36	29WW36	29WW37	29WW37
	Sample Date:	2/22/07	9/22/06	11/17/06	2/21/07	9/22/06	11/17/06
	Sample ID:	29WW36-FEB2007-FD	29WW36-060922	29WW36-061117	29WW36-FEB2007	29WW37-060922	29WW37-061117
	Sample Type:	FD	REG	REG	REG	REG	REG
ANALYTE	UNITS						
4-Chlorotoluene	µg/L	NA	<0.25	<0.25	NA	<0.25	<0.25
Acetone	µg/L	<2.8	3.06 J	<2.5	<2.8	5.47 J	11.2
Benzene	µg/L	<0.23	<0.125	<0.125	<0.23	<0.125	<0.125
Bromobenzene	µg/L	NA	<0.125	<0.125	NA	<0.125	<0.125
Bromochloromethane	µg/L	NA	<0.2	<0.2	NA	<0.2	<0.2
Bromodichloromethane	µg/L	<0.33	<0.25	<0.25	<0.33	<0.25	<0.25
Bromoform	µg/L	<0.65	<0.5	<0.5	<0.65	<0.5	<0.5
Bromomethane	µg/L	<0.47	<0.5	<0.5	<0.47	<0.5	<0.5
Carbon disulfide	µg/L	2.8	<0.5	<0.5	<0.62	8.14	2.14
Carbon tetrachloride	µg/L	<0.52	<0.25	<0.25	<0.52	<0.25	<0.25
Chlorobenzene	µg/L	<0.54	<0.125	<0.125	<0.54	<0.125	<0.125
Chloroethane	µg/L	<0.46	<0.5	<0.5	<0.46	<0.5	<0.5
Chloroform	µg/L	<0.66	<0.125	<0.125	<0.66	<0.125	<0.125
Chloromethane	µg/L	<0.6	<0.25	<0.25	<0.6	<0.25	<0.25
Cis-1,2-Dichloroethene	µg/L	<0.83	<0.25	<0.25	<0.83	<0.25	<0.25
Cis-1,3-Dichloropropene	µg/L	<0.59	<0.25	<0.25	<0.59	<0.25	<0.25
Dibromochloromethane	µg/L	<0.68	<0.25	<0.25	<0.68	<0.25	<0.25
Dibromomethane	µg/L	NA	<0.25	<0.25	NA	<0.25	<0.25
Dichlorodifluoromethane	µg/L	NA	<0.25	<0.25	NA	<0.25	<0.25
Ethylbenzene	µg/L	<0.48	<0.25	<0.25	<0.48	<0.25	<0.25
Hexochlorobutadiene	µg/L	NA	<0.25	<0.25	NA	<0.25	<0.25
Isopropylbenzene	µg/L	NA	<0.25	<0.25	NA	<0.25	<0.25
m,p-xylenes	µg/L	NA	<0.5	<0.5	NA	<0.5	<0.5
Methyl isobutyl ketone	µg/L	<7.3	<2.5	<2.5	<7.3	<2.5	<2.5
Methylene chloride	µg/L	168	5.59	1.1 J	<0.67	23.2	63.4
Naphthalene	µg/L	NA	<0.2	<0.2	NA	<0.2	<0.2
n-Butylbenzene	µg/L	NA	<0.25	<0.25	NA	<0.25	<0.25
n-Propylbenzene	µg/L	NA	<0.125	<0.125	NA	<0.125	<0.125
p-Isopropyltoluene	µg/L	NA	<0.25	<0.25	NA	<0.25	<0.25

Table B-5 (*Continued*)
Groundwater Sample Results
LHAAP-29

	Location Code:	29WW35	29WW36	29WW36	29WW36	29WW37	29WW37
	Sample Date:	2/22/07	9/22/06	11/17/06	2/21/07	9/22/06	11/17/06
	Sample ID:	29WW36-FEB2007-FD	29WW36-060922	29WW36-061117	29WW36-FEB2007	29WW37-060922	29WW37-061117
	Sample Type:	FD	REG	REG	REG	REG	REG
ANALYTE	UNITS						
sec-Butylbenzene	µg/L	NA	<0.25	<0.25	NA	<0.25	<0.25
Styrene	µg/L	<0.5	<0.125	<0.125	<0.5	<0.125	<0.125
tert-butylbenzene	µg/L	NA	<0.25	<0.25	NA	<0.25	<0.25
Tetrachloroethene	µg/L	<0.74	<0.25	<0.25	<0.74	<0.25	<0.25
Toluene	µg/L	<0.54	<0.25	<0.25	<0.54	<0.25	<0.25
Trans-1,2-Dichloroethene	µg/L	<0.75	<0.25	<0.25	<0.75	<0.25	<0.25
Trans-1,3-Dichloropropene	µg/L	<0.61	<0.5	<0.5	<0.61	<0.5	<0.5
Trichloroethene	µg/L	23.4	<0.25	<0.25	<0.63	<0.25	<0.25
Trichlorofluoromethane	µg/L	NA	<0.25	<0.25	NA	<0.25	<0.25
Vinyl acetate	µg/L	NA	<2.5	<2.5 J	NA	<2.5	<2.5
Vinyl chloride	µg/L	<0.32	<0.25	<0.25	<0.32	<0.25	<0.25
Xylenes, Total	µg/L	<1.1	NA	NA	<1.1	NA	NA

Table B-5 (*Continued*)
Groundwater Sample Results
LHAAP-29

	Location Code:	29WW37	29WW38	29WW38	29WW38	29WW38	29WW39
	Sample Date:	2/1/08	9/27/06	9/27/06	11/20/06	02/22/07	9/26/06
	Sample ID:	29WW37-020108	29WW38-060927	29WW38-060927-FD	29WW38-061120	29WW38-FEB2007	29WW39-060926
	Sample Type:	REG	REG	FD	REG	REG	REG
ANALYTE	UNITS						
Non-Metallic Anion							
Perchlorate	µg/L	NA	<0.5	<0.5	NA	<4	NA
Volatiles							
1,1,1,2-Tetrachloroethane	µg/L	<0.25	<0.25	<0.25	<0.25	NA	<0.25
1,1,1-Trichloroethane	µg/L	<0.25	<0.25	<0.25	<0.25	<0.37	<0.25
1,1,2,2-Tetrachloroethane	µg/L	<0.125	<0.125	<0.125	<0.125	<0.46	<0.125
1,1,2-Trichloroethane	µg/L	<0.25	<0.25	<0.25	<0.25	<0.66	<0.25
1,1-Dichloroethane	µg/L	<0.125	<0.125	<0.125	<0.125	<0.52	<0.125
1,1-Dichloroethene	µg/L	<0.5	<0.5	<0.5	<0.5	<0.68	<0.5
1,1-Dichloropropene	µg/L	<0.25	<0.25	<0.25	<0.25	NA	<0.25
1,2,3-Trichlorobenzene	µg/L	<0.125	<0.125	<0.125	<0.125	NA	<0.125
1,2,3-Trichloropropane	µg/L	<0.5	<0.5	<0.5	<0.5	NA	<0.5
1,2,4-Trichlorobenzene	µg/L	<0.2	<0.2	<0.2	<0.2	NA	<0.2
1,2,4-Trimethylbenzene	µg/L	<0.25	<0.25	<0.25	<0.25	NA	<0.25
1,2-Dibromo-3-chloropropane	µg/L	<1	<1	<1	<1	NA	<1
1,2-Dibromomethane	µg/L	<0.25	<0.25	<0.25	<0.25	NA	<0.25
1,2-Dichlorobenzene	µg/L	<0.125	<0.125	<0.125	<0.125	NA	<0.125
1,2-Dichloroethane	µg/L	<0.25	<0.25	<0.25	<0.25	<0.53	<0.25
1,2-Dichloropropane	µg/L	<0.2	<0.2	<0.2	<0.2	<0.59	<0.2
1,2-Dimethylbenzene (o-Xylene)	µg/L	<0.25	<0.25	<0.25	<0.25	NA	<0.25
1,3,5-Trimethylbenzene	µg/L	<0.25	<0.25	<0.25	<0.25	NA	<0.25
1,3-Dichlorobenzene	µg/L	<0.25	<0.25	<0.25	<0.25	NA	<0.25
1,3-Dichloropropane	µg/L	<0.2	<0.2	<0.2	<0.2	NA	<0.2
1,4-Dichlorobenzene	µg/L	<0.125	0.252 J	0.225 J	<0.125	NA	<0.125
2,2-Dichloropropane	µg/L	<0.25	<0.25	<0.25	<0.25	NA	<0.25
2-Butanone	µg/L	<2.5	<2.5	<2.5	<2.5	<3	<2.5
2-Chloroethyl vinyl ether	µg/L	<2	<2	<2	<2	NA	<2 J
2-Chlorotoluene	µg/L	<0.125	<0.125	<0.125	<0.125	NA	<0.125

Table B-5 (*Continued*)
Groundwater Sample Results
LHAAP-29

	Location Code:	29WW37	29WW38	29WW38	29WW38	29WW38	29WW39
	Sample Date:	2/1/08	9/27/06	9/27/06	11/20/06	02/22/07	9/26/06
	Sample ID:	29WW37-020108	29WW38-060927	29WW38-060927-FD	29WW38-061120	29WW38-FEB2007	29WW39-060926
	Sample Type:	REG	REG	FD	REG	REG	REG
ANALYTE	UNITS						
2-Hexanone	µg/L	<2.5	<2.5	<2.5	<2.5	<1.9	<2.5
4-Chlorotoluene	µg/L	<0.25	<0.25	<0.25	<0.25	NA	<0.25
Acetone	µg/L	<2.5	3.62 J	<2.5	3 J	<2.8	<2.5
Benzene	µg/L	<0.125	<0.125	<0.125	<0.125	<0.23	<0.125
Bromobenzene	µg/L	<0.125	<0.125	<0.125	<0.125	NA	<0.125
Bromochloromethane	µg/L	<0.2	<0.2	<0.2	<0.2	NA	<0.2
Bromodichloromethane	µg/L	<0.25	<0.25	<0.25	<0.25	<0.33	<0.25
Bromoform	µg/L	<0.5	<0.5	<0.5	<0.5	<0.65	<0.5
Bromomethane	µg/L	<0.5	<0.5	<0.5	<0.5	<0.47	<0.5
Carbon disulfide	µg/L	<0.5	<0.5	<0.5	0.72 J	<0.62	<0.5
Carbon tetrachloride	µg/L	<0.25	<0.25	<0.25	<0.25	<0.52	<0.25
Chlorobenzene	µg/L	<0.125	<0.125	<0.125	<0.125	<0.54	<0.125
Chloroethane	µg/L	<0.5	<0.5	<0.5	<0.5	<0.46	<0.5
Chloroform	µg/L	<0.125	0.332 J	0.312 J	0.321 J	<0.66	<0.125
Chloromethane	µg/L	<0.25	<0.25	<0.25	<0.25	<0.6	<0.25
Cis-1,2-Dichloroethene	µg/L	<0.25	<0.25	<0.25	<0.25	<0.83	<0.25
Cis-1,3-Dichloropropene	µg/L	<0.25	<0.25	<0.25	<0.25	<0.59	<0.25
Dibromochloromethane	µg/L	<0.25	<0.25	<0.25	<0.25	<0.68	<0.25
Dibromomethane	µg/L	<0.25	<0.25	<0.25	<0.25	NA	<0.25
Dichlorodifluoromethane	µg/L	<0.25	<0.25	<0.25	<0.25	NA	<0.25
Ethylbenzene	µg/L	<0.25	<0.25	<0.25	<0.25	<0.48	<0.25
Hexochlorobutadiene	µg/L	<0.25	<0.25	<0.25	<0.25	NA	<0.25
Isopropylbenzene	µg/L	<0.25	<0.25	<0.25	<0.25	NA	<0.25
m,p-xylenes	µg/L	<0.5	<0.5	<0.5	<0.5	NA	<0.5
Methyl acetate	µg/L	<2.5	NA	NA	NA	NA	NA
Methyl isobutyl ketone	µg/L	<2.5	<2.5	<2.5	<2.5	<7.3	<2.5
Methylene chloride	µg/L	1.03 J	12.7	12.5	0.568 J	<0.67	14.5
Naphthalene	µg/L	<0.2	<0.2	<0.2	<0.2	NA	<0.2
n-Butylbenzene	µg/L	<0.25	<0.25	<0.25	<0.25	NA	<0.25

Table B-5 (*Continued*)
Groundwater Sample Results
LHAAP-29

Location Code:		29WW37	29WW38	29WW38	29WW38	29WW38	29WW39
Sample Date:		2/1/08	9/27/06	9/27/06	11/20/06	02/22/07	9/26/06
Sample ID:		29WW37-020108	29WW38-060927	29WW38-060927-FD	29WW38-061120	29WW38-FEB2007	29WW39-060926
Sample Type:		REG	REG	FD	REG	REG	REG
ANALYTE	UNITS						
n-Propylbenzene	µg/L	<0.125	<0.125	<0.125	<0.125	NA	<0.125
p-Isopropyltoluene	µg/L	<0.25	<0.25	<0.25	<0.25	NA	<0.25
sec-Butylbenzene	µg/L	<0.25	<0.25	<0.25	<0.25	NA	<0.25
Styrene	µg/L	<0.125	<0.125	<0.125	<0.125	<0.5	<0.125
tert-butylbenzene	µg/L	<0.25	<0.25	<0.25	<0.25	NA	<0.25
Tetrachloroethene	µg/L	<0.25	<0.25	<0.25	<0.25	<0.74	<0.25
Toluene	µg/L	<0.25	<0.25	<0.25	<0.25	<0.54	<0.25
Trans-1,2-Dichloroethene	µg/L	<0.25	<0.25	<0.25	<0.25	<0.75	<0.25
Trans-1,3-Dichloropropene	µg/L	<0.5	<0.5	<0.5	<0.5	<0.61	<0.5
Trichloroethene	µg/L	<0.25	0.354 J	0.351 J	<0.25	<0.63	0.683 J
Trichlorofluoromethane	µg/L	<0.25	<0.25	<0.25	<0.25	NA	<0.25
Vinyl acetate	µg/L	<2.5	<2.5	<2.5	<2.5 J	NA	<2.5 J
Vinyl chloride	µg/L	<0.25	<0.25	<0.25	<0.25	<0.32	<0.25
Xylenes, Total	µg/L	NA	NA	NA	NA	<1.1	NA

Table B-5 (*Continued*)
Groundwater Sample Results
LHAAP-29

	Location Code:	29WW39	29WW39	29WW40	29WW40	29WW40	29WW40
	Sample Date:	11/20/06	2/1/08	9/21/06	11/21/06	11/21/06	12/19/06
	Sample ID:	29WW39-061120	29WW39-020108	29WW40-060921	29WW40-061121	29WW40-061121-FD	29WW40-061219
	Sample Type:	REG	REG	REG	REG	FD	REG
ANALYTE	UNITS						
Non-Metallic Anion							
Perchlorate	µg/L	NA	NA	NA	NA	NA	NA
Volatiles							
1,1,1,2-Tetrachloroethane	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	NA
1,1,1-Trichloroethane	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,1,2,2-Tetrachloroethane	µg/L	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125
1,1,2-Trichloroethane	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,1-Dichloroethane	µg/L	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125
1,1-Dichloroethene	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1-Dichloropropene	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	NA
1,2,3-Trichlorobenzene	µg/L	<0.125	<0.125	<0.125	<0.125	0.164 J	NA
1,2,3-Trichloropropane	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	NA
1,2,4-Trichlorobenzene	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,2,4-Trimethylbenzene	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	NA
1,2-Dibromo-3-chloropropane	µg/L	<1	<1	<1	<1	<1	<1
1,2-Dibromomethane	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,2-Dichlorobenzene	µg/L	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125
1,2-Dichloroethane	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,2-Dichloropropane	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
1,2-Dimethylbenzene (o-Xylene)	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	NA
1,3,5-Trimethylbenzene	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	NA
1,3-Dichlorobenzene	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
1,3-Dichloropropane	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2	NA
1,4-Dichlorobenzene	µg/L	<0.125	<0.125	0.529 J	<0.125	<0.125	<0.125
2,2-Dichloropropane	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	NA
2-Butanone	µg/L	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
2-Chloroethyl vinyl ether	µg/L	<2	<2	<2	<2	<2	NA
2-Chlorotoluene	µg/L	<0.125	<0.125	<0.125	<0.125	<0.125	NA

Table B-5 (*Continued*)
Groundwater Sample Results
LHAAP-29

	Location Code:	29WW39	29WW39	29WW40	29WW40	29WW40	29WW40
	Sample Date:	11/20/06	2/1/08	9/21/06	11/21/06	11/21/06	12/19/06
	Sample ID:	29WW39-061120	29WW39-020108	29WW40-060921	29WW40-061121	29WW40-061121-FD	29WW40-061219
	Sample Type:	REG	REG	REG	REG	FD	REG
ANALYTE	UNITS						
2-Hexanone	µg/L	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
4-Chlorotoluene	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	NA
Acetone	µg/L	5.11 J	<2.5	4.77 J	<2.5	<2.5	<2.5
Benzene	µg/L	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125
Bromobenzene	µg/L	<0.125	<0.125	<0.125	<0.125	<0.125	NA
Bromochloromethane	µg/L	<0.2	<0.2	0.474 J	<0.2	<0.2	NA
Bromodichloromethane	µg/L	<0.25	<0.25	1.15	<0.25	<0.25	<0.25
Bromoform	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Bromomethane	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Carbon disulfide	µg/L	<0.5	<0.5	<0.5	1.54	1.89	2.34 J
Carbon tetrachloride	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Chlorobenzene	µg/L	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125
Chloroethane	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Chloroform	µg/L	0.179 J	<0.125	3.55	<0.125	<0.125	<0.125
Chloromethane	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Cis-1,2-Dichloroethene	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Cis-1,3-Dichloropropene	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Cyclohexane	µg/L	NA	NA	NA	NA	NA	<0.25
Dibromochloromethane	µg/L	<0.25	<0.25	1.09	<0.25	<0.25	<0.25
Dibromomethane	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	NA
Dichlorodifluoromethane	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25 J
Ethylbenzene	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Freon 113	µg/L	NA	NA	NA	NA	NA	<0.25
Hexochlorobutadiene	µg/L	<0.25	<0.25	<0.25	<0.25	0.272 J	NA
Isopropylbenzene	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
m,p-xylenes	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	NA
Methyl acetate	µg/L	<2.5	<2.5	NA	NA	NA	<0.25
Methyl isobutyl ketone	µg/L	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5
Methyl tert-butyl ether	µg/L	NA	NA	NA	NA	NA	<0.5

Table B-5 (*Continued*)
Groundwater Sample Results
LHAAP-29

	Location Code:	29WW39	29WW39	29WW40	29WW40	29WW40	29WW40
	Sample Date:	11/20/06	2/1/08	9/21/06	11/21/06	11/21/06	12/19/06
	Sample ID:	29WW39-061120	29WW39-020108	29WW40-060921	29WW40-061121	29WW40-061121-FD	29WW40-061219
	Sample Type:	REG	REG	REG	REG	FD	REG
ANALYTE	UNITS						
Methylcyclohexane	µg/L	NA	NA	NA	NA	NA	<0.25
Methylene chloride	µg/L	1.82 J	<0.25	92.8	6.79	6.75	<0.25
Naphthalene	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2	NA
n-Butylbenzene	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	NA
n-Propylbenzene	µg/L	<0.125	<0.125	<0.125	<0.125	<0.125	NA
p-Isopropyltoluene	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	NA
sec-Butylbenzene	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	NA
Styrene	µg/L	<0.125	<0.125	<0.125	<0.125	<0.125	<0.125
tert-butylbenzene	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	NA
Tetrachloroethene	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Toluene	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Trans-1,2-Dichloroethene	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Trans-1,3-Dichloropropene	µg/L	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Trichloroethene	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Trichlorofluoromethane	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Vinyl acetate	µg/L	<2.5	<2.5	<2.5	<2.5	<2.5	NA
Vinyl chloride	µg/L	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25
Xylenes	µg/L	NA	NA	NA	NA	NA	<0.5

Notes:

µg/L	micrograms per liter
<	result is below detection limit
FD	field duplicate
H	result may be biased high
J	result or detection limit is estimated
L	result may be biased low
NA	not analyzed
REG	regular sample

Figures

FILE PATH T:\GIS\LHAAP\MXD\Site29_FS\LHAAP29_WLSD_Results.mxd

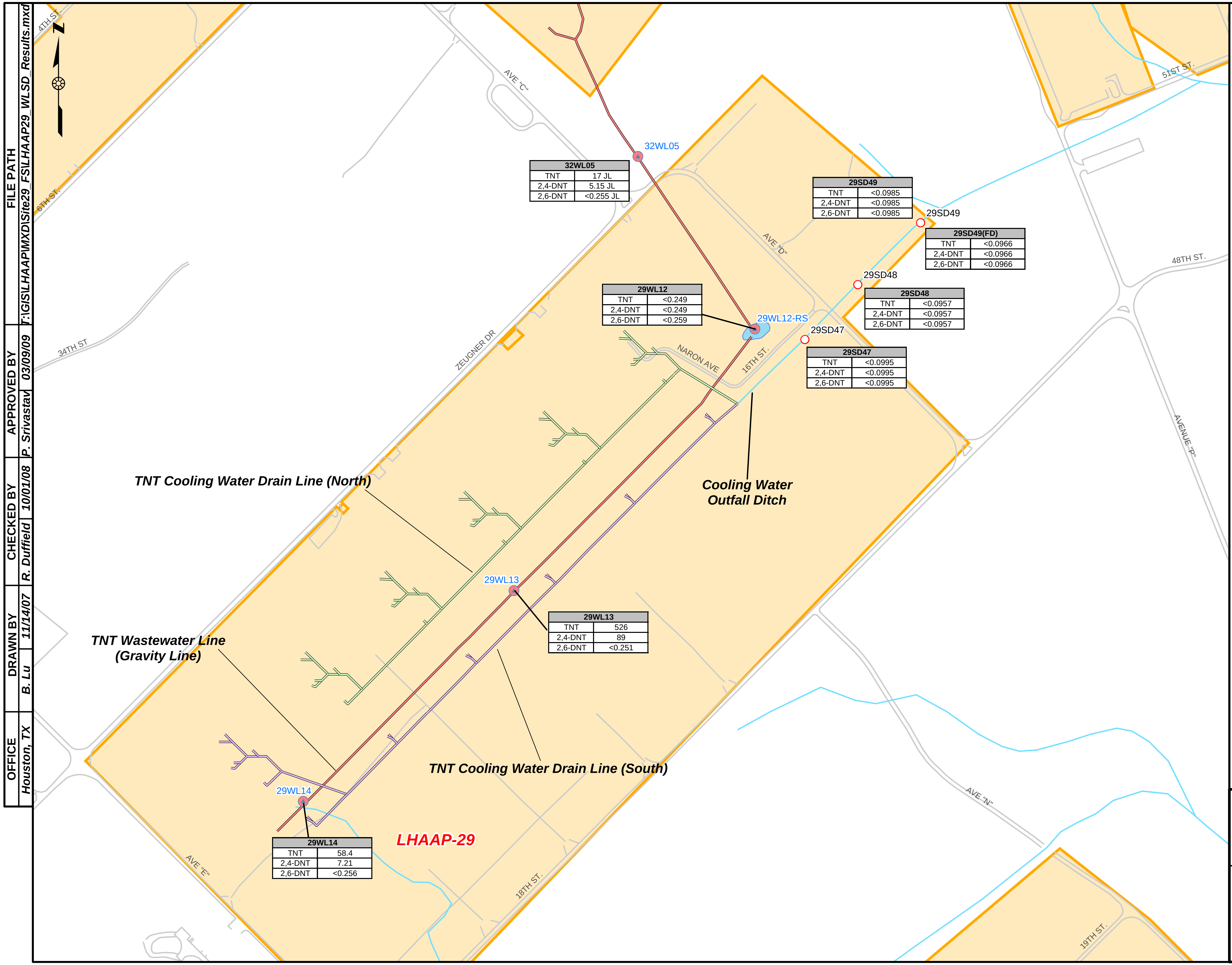
APPROVED BY P. Srivastav 03/09/09

CHECKED BY R. Duffield 10/01/08

DRAWN BY B. Lu 11/14/07

OFFICE Houston, TX

00091602



32WL05	
TNT	17 JL
2,4-DNT	5.15 JL
2,6-DNT	<0.255 JL

29SD49	
TNT	<0.0985
2,4-DNT	<0.0985
2,6-DNT	<0.0985

29SD49(FD)	
TNT	<0.0966
2,4-DNT	<0.0966
2,6-DNT	<0.0966

29SD48	
TNT	<0.0957
2,4-DNT	<0.0957
2,6-DNT	<0.0957

29WL12	
TNT	<0.249
2,4-DNT	<0.249
2,6-DNT	<0.259

29SD47	
TNT	<0.0995
2,4-DNT	<0.0995
2,6-DNT	<0.0995

29WL13	
TNT	526
2,4-DNT	89
2,6-DNT	<0.251

29WL14	
TNT	58.4
2,4-DNT	7.21
2,6-DNT	<0.256

Legend

●	Wasteline Sample Location
○	Sediment Sample Location
—	TNT Cooling Water Drain Line (South)
—	TNT Cooling Water Drain Line (North)
—	TNT Wastewater Line
—	Stream
—	Road
▭	Site
▭	Pond

Notes:

1. Sampling results reported in milligrams per kilogram (mg/kg).
2. TNT - Trinitrotoluene
   DNT - Dinitrotoluene
   FD - Field duplicate
3. J - Result or detection limit is estimated
   L - Result may be biased low
   < - Result is below detection limit.

0 205 410 820
Feet

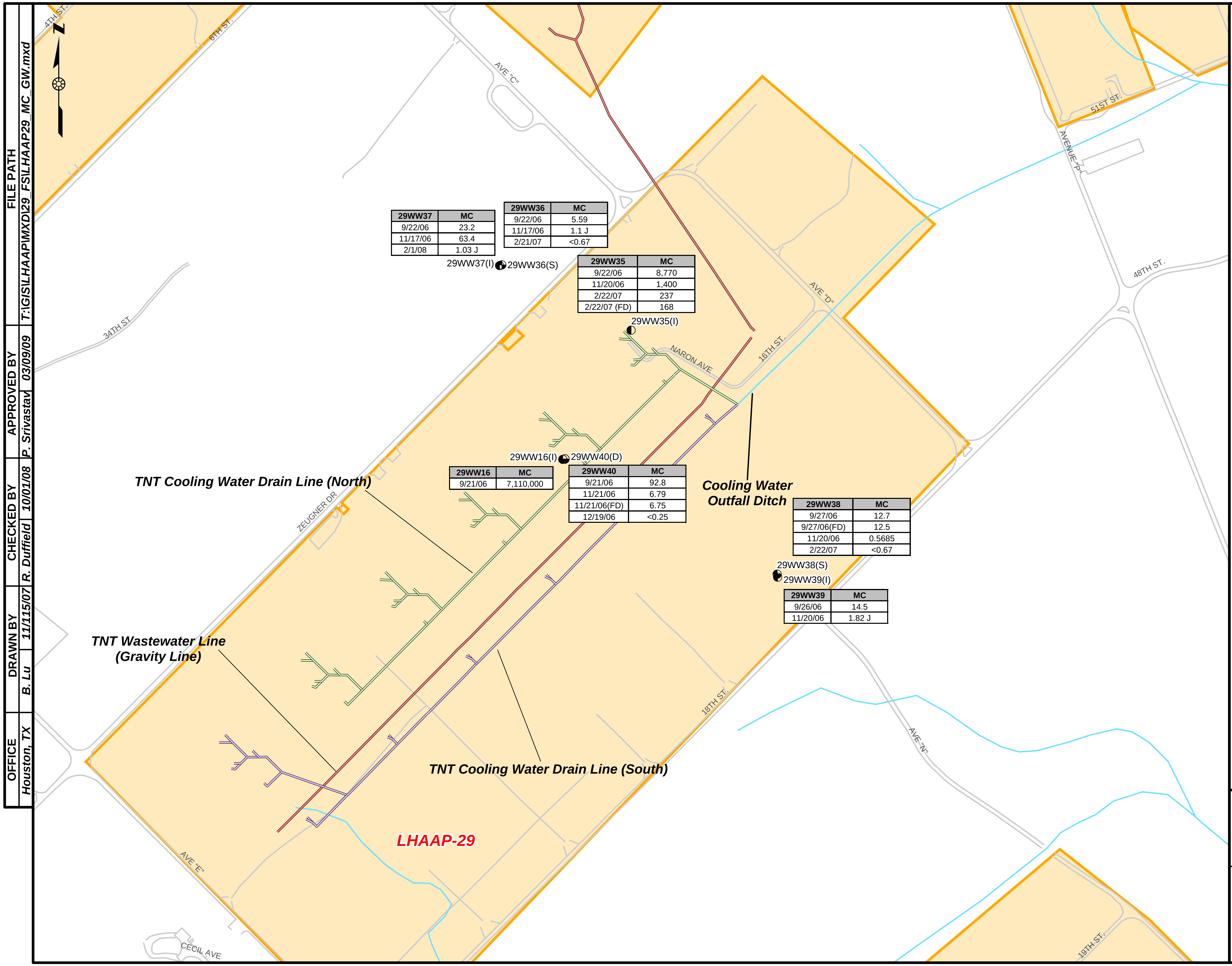
Shaw®

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

FIGURE B-1
SEPTEMBER 2006
WASTELINE/SEDIMENT SAMPLE RESULTS
LHAAP-29
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

00091603

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	*B. Lu*	*11/115/07*	*R. Duffield*	*10/01/08*	*P. Srivastav*	*03/09/09*	*T:\GIS\LHAAP\MXD\29_FS\LHAAP29_MC_GW.mxd*



29WW37	MC
9/22/06	23.2
11/17/06	63.4
2/1/08	1.03 J

29WW36	MC
9/22/06	5.59
11/17/06	1.1 J
2/21/07	<0.67

29WW35	MC
9/22/06	8,770
11/20/06	1,400
2/22/07	237
2/22/07 (FD)	168

29WW16	MC
9/21/06	7,110,000

29WW40	MC
9/21/06	92.8
11/21/06	6.79
11/21/06(FD)	6.75
12/19/06	<0.25

29WW38	MC
9/27/06	12.7
9/27/06(FD)	12.5
11/20/06	0.5685
2/22/07	<0.67

29WW39	MC
9/26/06	14.5
11/20/06	1.82 J

Legend

◕	Shallow Monitoring Well
◐	Intermediate Monitoring Well
◒	Deep Monitoring Well
═	TNT Cooling Water Drain Line (South)
═	TNT Cooling Water Drain Line (North)
═	TNT Wastewater Line
─	Stream
─	Road
▭	Site

Notes:

1. Sampling results reported in micrograms per liter (µg/L).
2. MC - Methylene chloride
3. FD - Field duplicate
   J - Result or detection limit is estimated
   < - Result is below detection limit.

0 200 400 800 Feet

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

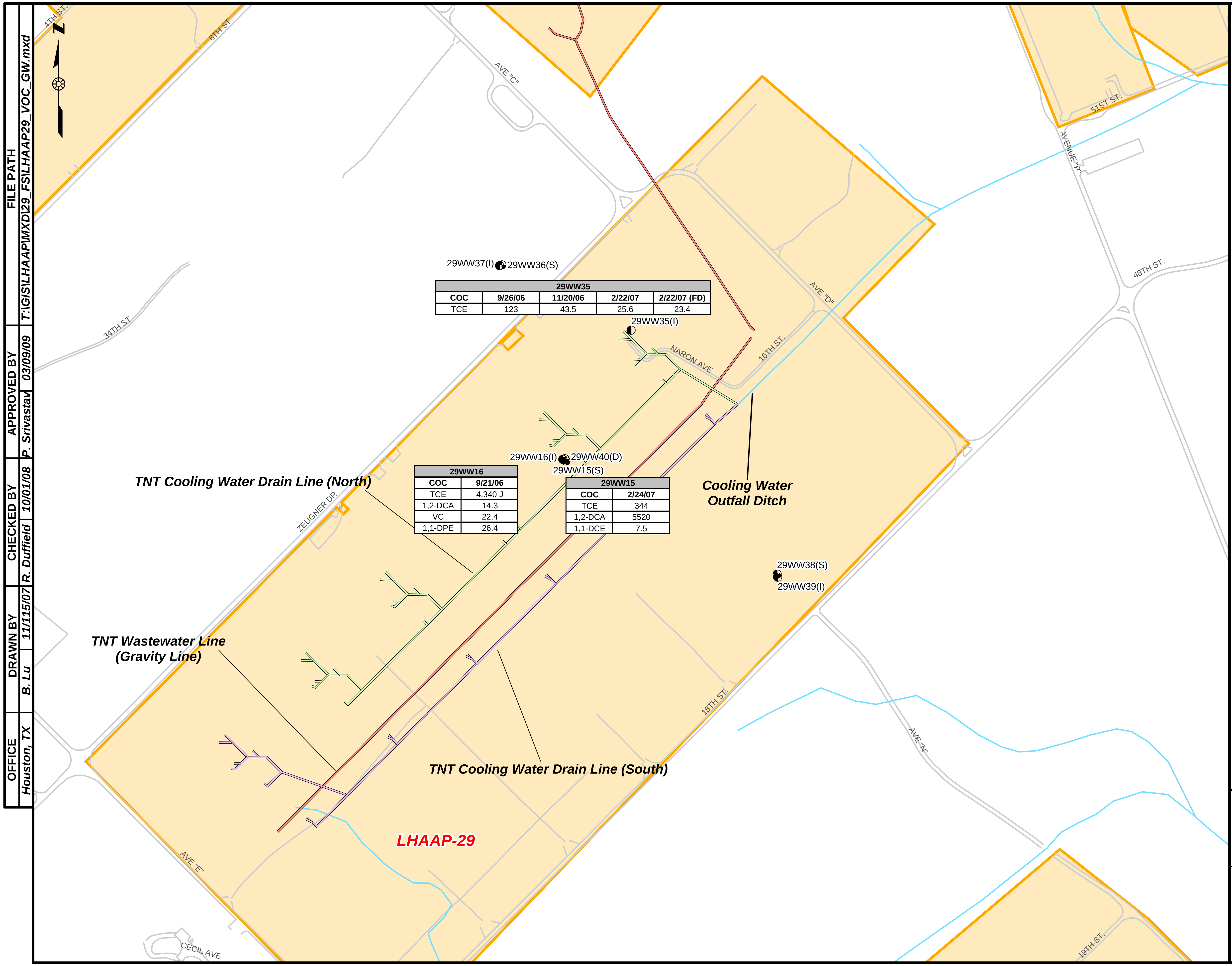
FIGURE B-2

METHYLENE CHLORIDE IN GROUNDWATER
LHAAP-29

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	FILE PATH
Houston, TX	*B. Lu 11/115/07*	*R. Duffield 10/01/08*	*P. Srivastav 03/09/09*	*T:\GIS\LHAAP\MXD\29_FS\LHAAP29_VOC_GW.mxd*

00091604



29WW35				
COC	**9/26/06**	**11/20/06**	**2/22/07**	**2/22/07 (FD)**
TCE	123	43.5	25.6	23.4

29WW16	
COC	**9/21/06**
TCE	4,340 J
1,2-DCA	14.3
VC	22.4
1,1-DPE	26.4

29WW15	
COC	**2/24/07**
TCE	344
1,2-DCA	5520
1,1-DCE	7.5

Legend

◕	Shallow Monitoring Well
◐	Intermediate Monitoring Well
◒	Deep Monitoring Well
═	TNT Cooling Water Drain Line (South)
═	TNT Cooling Water Drain Line (North)
═	TNT Wastewater Line
—	Stream
—	Road
▭	Site

Notes:

1. Sampling results reported in micrograms per liter (µg/L).
2. COC - Contaminant of concern
   TCE - Trichloroethylene
   DCA - Dichloroethane
   VC - Vinyl chloride
   DCE - Dichloroethene
   DPE - Dichloropropane
3. J - Result or detection limit is estimated

0 200 400 800
Feet

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

FIGURE B-3

OTHER ELEVATED VOCs IN GROUNDWATER
LHAAP-29

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Attachment 1

Monitoring Well Drilling Logs

Shaw™

Drilling Log

Monitoring Well **29WW35**

00091606

Page: 1 of 3

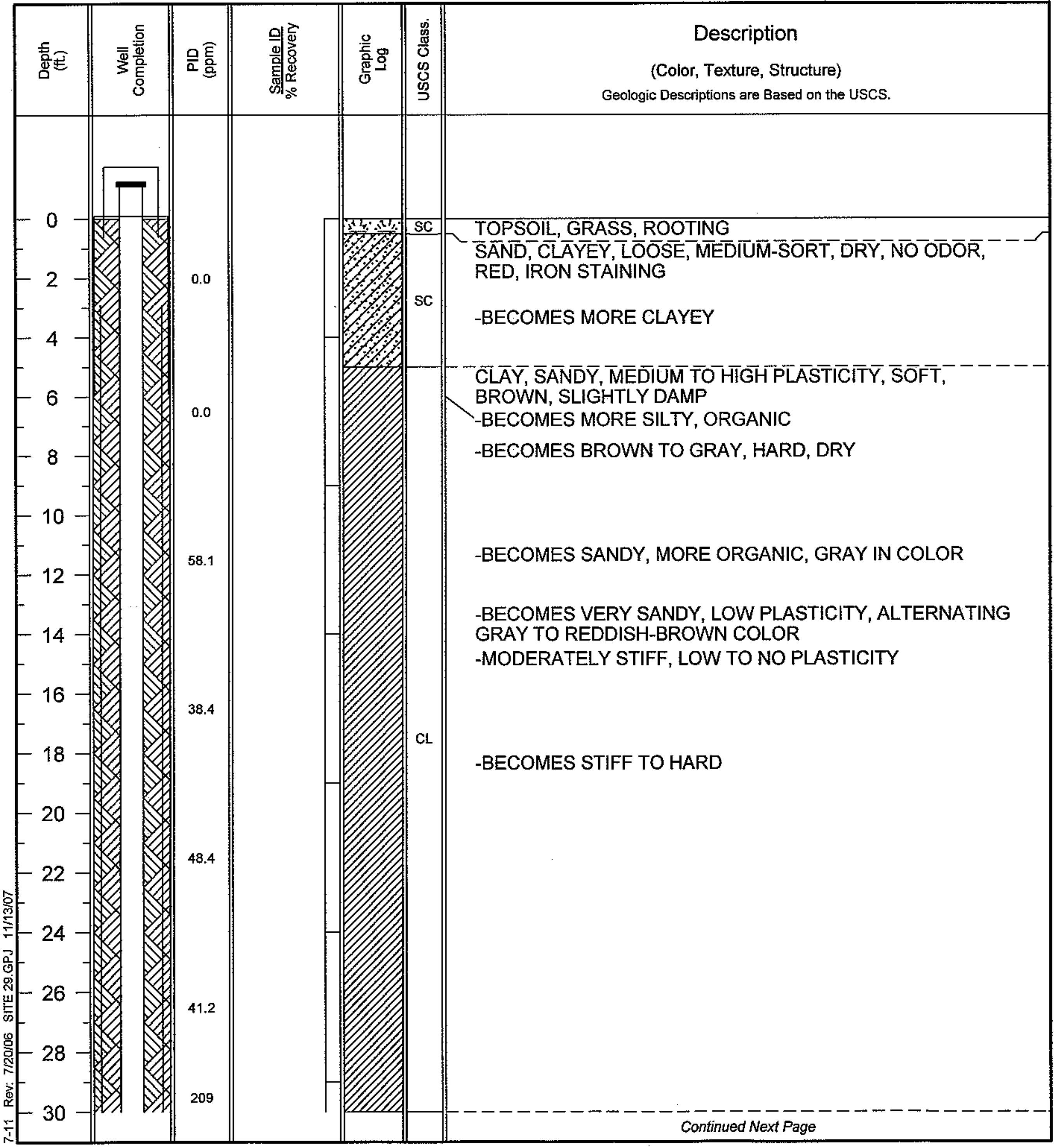
Project *Longhorn Army Ammunition Plant* Owner *USACE*
Location *Karnack, Texas* Proj. No. *117591*
Surface Elev. *225.2 ft.* Total Hole Depth *95.0 ft.* North *6956393.466 ft.* East *3306421.223 ft.*
Top of Casing *228.19* Water Level Initial ∇ *79.0 ft.* Static *NA* Diameter *8 in.*
Screen: Dia *4 in.* Length *10 ft.* Type/Size *Sch. 40 PVC/.01 in.*
Casing: Dia *4 in.* Length *88 (incl. ~3' of riser) ft.* Type *Sch. 40 PVC*
Fill Material *NA* Rig/Core *Mobil B5500*
Drill Co. *ETTL* Method *Mud Rotary*
Driller *T. Cook* Log By *A. Willmore/B. Hardmant* Date *9/14/06* Driller # *NA*
Checked By *K. Everett* License No. *Texas 379*

COMMENTS
Hand augered 0 to 5 feet bgs.

Shallow Zone 12" Isolation Casing set at 49' bgs.

13:05-Began drilling

8/24/06-Borehole was dry to 49' bgs.

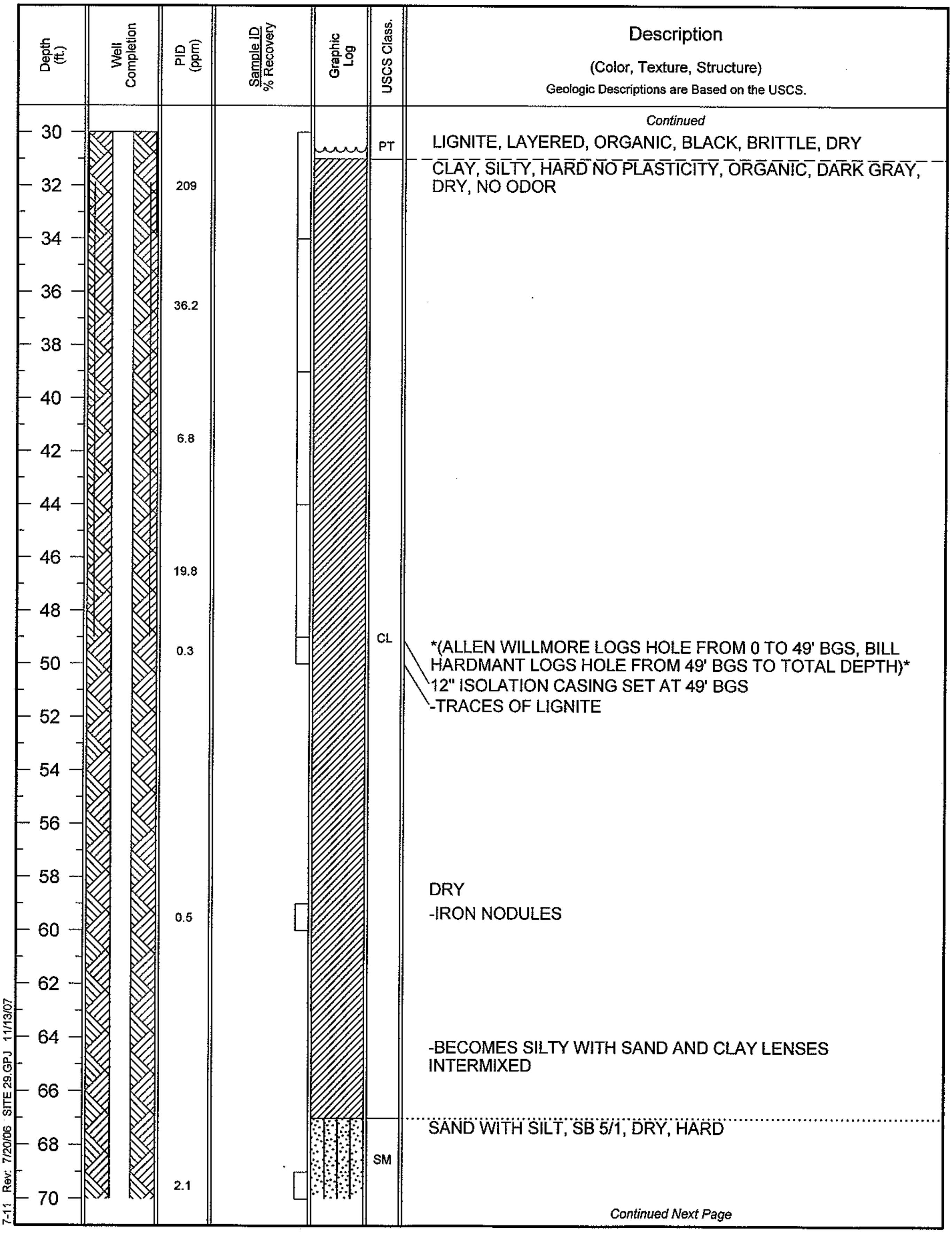


Depth (ft.)	PID (ppm)	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
0		SC	TOPSOIL, GRASS, ROOTING SAND, CLAYEY, LOOSE, MEDIUM-SORT, DRY, NO ODOR, RED, IRON STAINING
2	0.0	SC	-BECOMES MORE CLAYEY
4			CLAY, SANDY, MEDIUM TO HIGH PLASTICITY, SOFT, BROWN, SLIGHTLY DAMP -BECOMES MORE SILTY, ORGANIC
6	0.0		-BECOMES BROWN TO GRAY, HARD, DRY
8			
10	58.1		-BECOMES SANDY, MORE ORGANIC, GRAY IN COLOR
12			-BECOMES VERY SANDY, LOW PLASTICITY, ALTERNATING GRAY TO REDDISH-BROWN COLOR -MODERATELY STIFF, LOW TO NO PLASTICITY
14			
16	38.4	CL	
18			-BECOMES STIFF TO HARD
20			
22	48.4		
24			
26	41.2		
28			
30	209		

Continued Next Page

Project *Longhorn Army Ammunition Plant* Owner *USACE*

Location *Karnack, Texas* Proj. No. *117591*



Continued

Depth (ft.)	PID (ppm)	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
30		PT	LIGNITE, LAYERED, ORGANIC, BLACK, BRITTLE, DRY
			CLAY, SILTY, HARD NO PLASTICITY, ORGANIC, DARK GRAY, DRY, NO ODOR
32	209		
34			
36	36.2		
38			
40			
42	6.8		
44			
46	19.8		
48			
50	0.3	CL	*(ALLEN WILLMORE LOGS HOLE FROM 0 TO 49' BGS, BILL HARDMANT LOGS HOLE FROM 49' BGS TO TOTAL DEPTH)* 12" ISOLATION CASING SET AT 49' BGS -TRACES OF LIGNITE
52			
54			
56			
58			DRY
60	0.5		-IRON NODULES
62			
64			-BECOMES SILTY WITH SAND AND CLAY LENSES INTERMIXED
66			
68		SM	SAND WITH SILT, SB 5/1, DRY, HARD
70	2.1		

Continued Next Page

Drilling Log

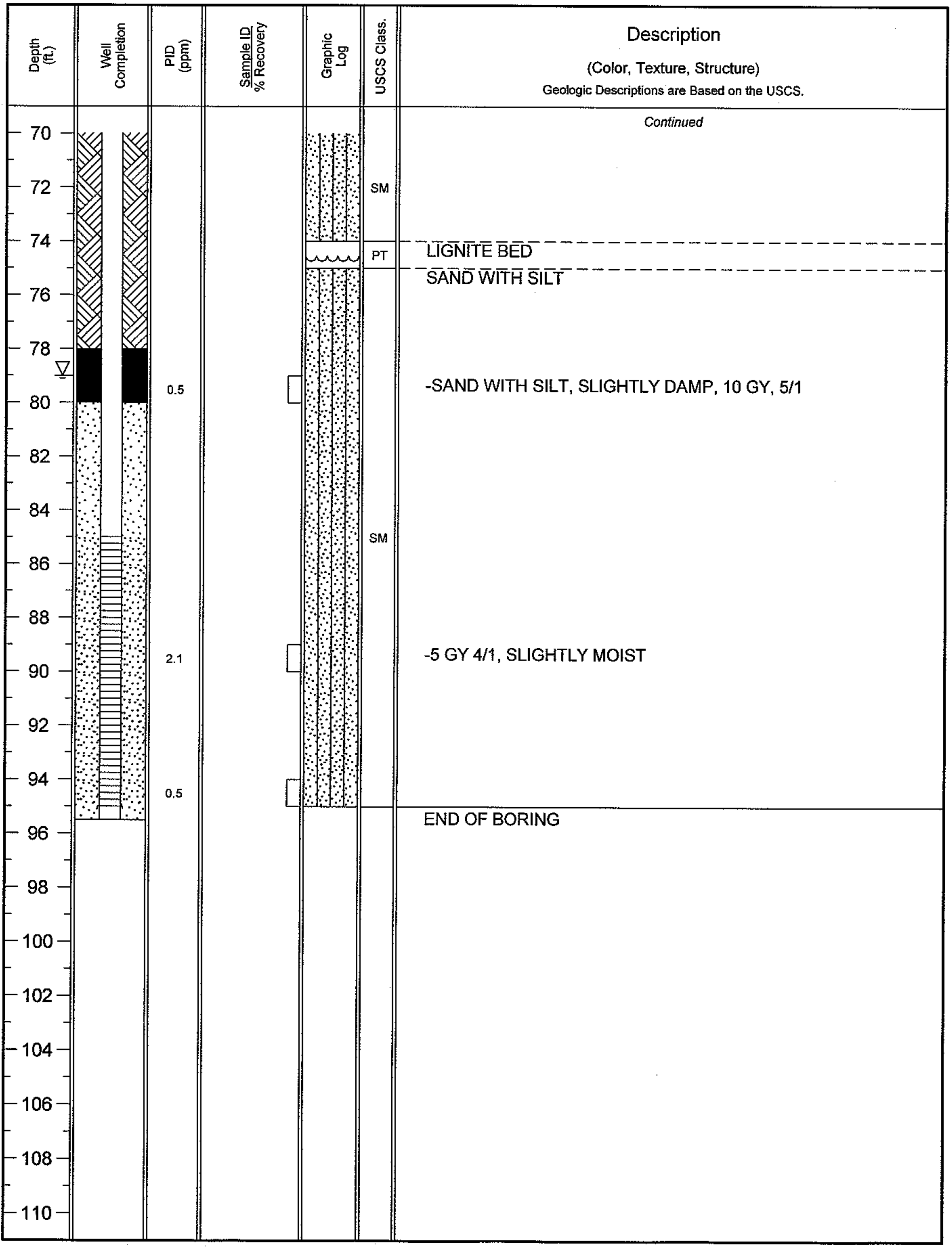
Monitoring Well **29WW35**

00091608

Page: 3 of 3

Project *Longhorn Army Ammunition Plant* Owner *USACE*

Location *Karnack, Texas* Proj. No. *117591*



PID (ppm)	Sample ID % Recovery	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
			Continued
		SM	
		PT	LIGNITE BED
			SAND WITH SILT
0.5			-SAND WITH SILT, SLIGHTLY DAMP, 10 GY, 5/1
		SM	
2.1			-5 GY 4/1, SLIGHTLY MOIST
0.5			
			END OF BORING

Shaw™

Drilling Log

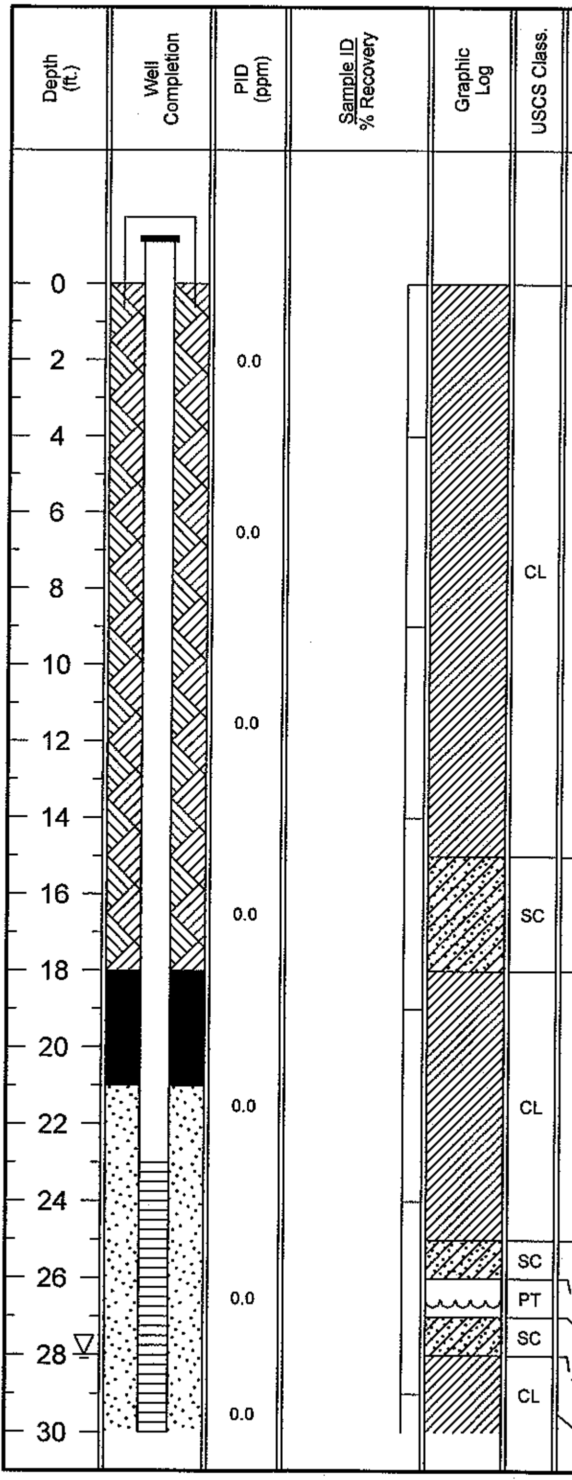
00091609

Monitoring Well **29WW36**

Page: 1 of 2

Project	Longhorn Army Ammunition Plant	Owner	USACE		
Location	Karnack, Texas	Proj. No.	117591		
Surface Elev.	231.01998	Total Hole Depth	34.0 ft.	North	6956665.96 ft.
				East	3305879.737 ft.
Top of Casing	234.02	Water Level Initial	∇ 28.0 ft.	Static	NA
				Diameter	8 in.
Screen: Dia	4 in.	Length	10 ft.	Type/Size	Sch. 40 PVC/.01 in.
Casing: Dia	4 in.	Length	27 ft.	Type	Sch. 40 PVC
Fill Material	NA	Rig/Core	Mayhew 500		
Drill Co.	ETTL	Method	Hollow Stem		
Driller	T. Cook	Log By	A. Willmore	Date	8/25/06
Driller #	NA				
Checked By	K. Everett	License No.	Texas 379		

COMMENTS
Hand augered 0 to 5 feet bgs.



Description

(Color, Texture, Structure)

Geologic Descriptions are Based on the USCS.

CLAY, SANDY, LOW TO NO PLASTICITY, DAMP (DUE TO RAIN), NO ODOR, BROWN

-BECOMES SILTY, HARD, NO PLASTICITY, IRON STAINING, REDDISH-BROWN, RED TO BROWN MOTTLING, SOME ORGANICS

-BECOMES LIGHT BROWN TO GRAY

SAND, CLAYEY, DAMP, BROWN, DENSE, NO ODOR

CLAY, SILTY, HARD, LOW TO NO PLASTICITY, BROWN TO LIGHT BROWN, NO ODOR, DRY

SAND, CLAYEY, DENSE, MOIST, MEDIUM-SORTED, GRAY, FINE-GRAINED, GRAY

LIGNITE TO ORGANIC CLAY, DRY, BLACK, NO ODOR

SAND, CLAYEY, DENSE, MOIST, MEDIUM-SORTED, FINE GRAINED, BROWN TO GRAY

CLAY, SANDY, STIFF, NO PLASTICITY, BROWN TO GRAY, DAMP, NO ODOR

Continued Next Page

Shaw™

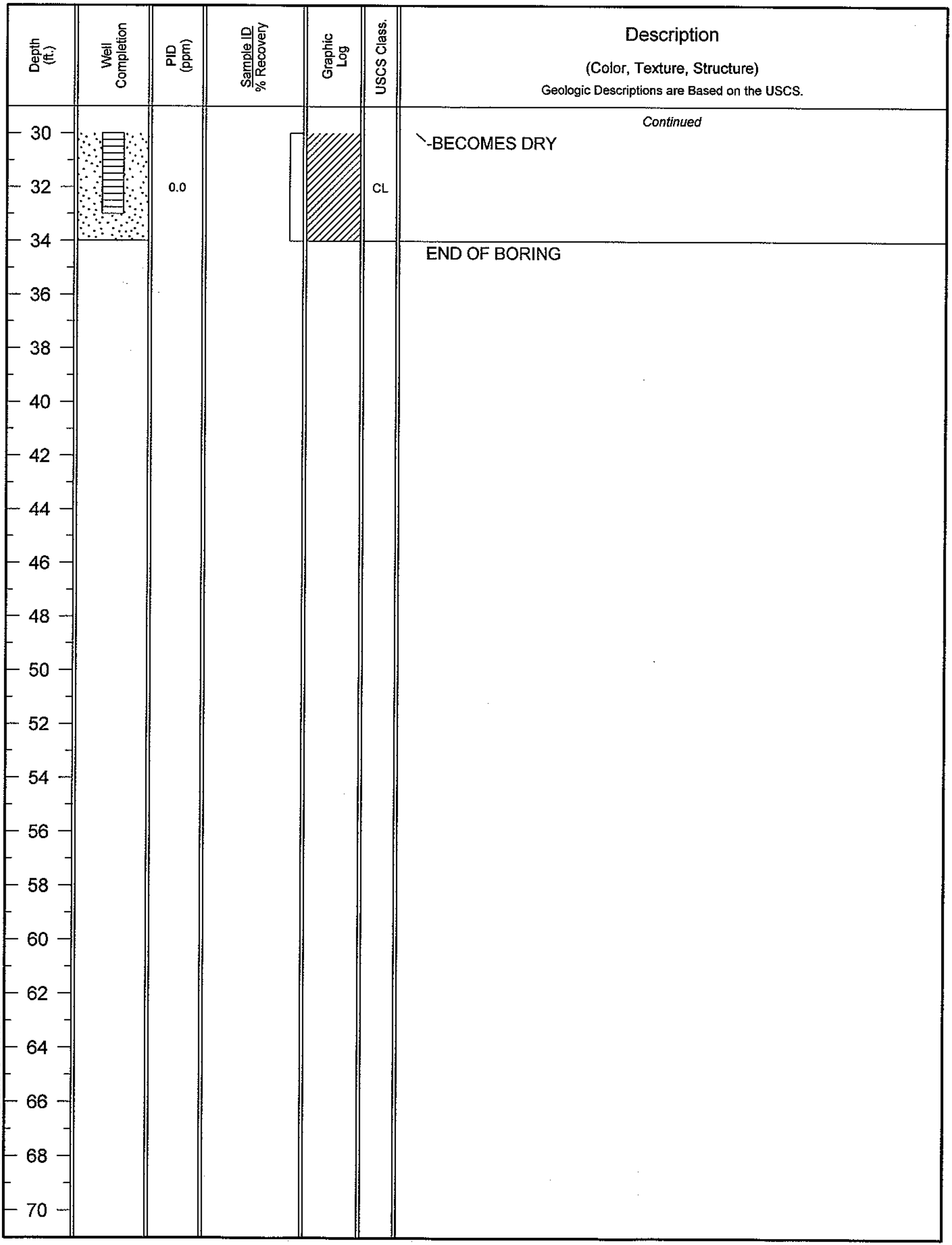
Drilling Log

Monitoring Well **29WW36**

Page: 2 of 2

Project *Longhorn Army Ammunition Plant* Owner *USACE*

Location *Karnack, Texas* Proj. No. *117591*



Depth (ft.)	Well Completion	PID (ppm)	Sample ID / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
						Continued
30						-BECOMES DRY
32		0.0			CL	
34						END OF BORING

Drilling Log

00091611

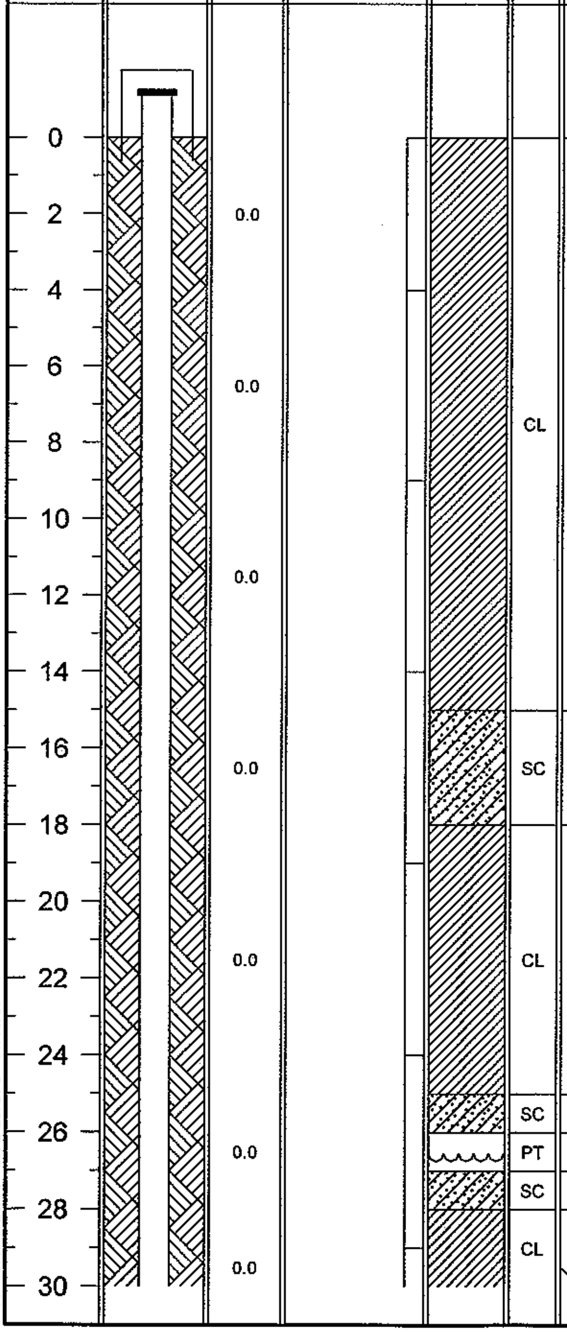
Monitoring Well **29WW37**

Page: 1 of 3

Project *Longhorn Army Ammunition Plant* Owner *USACE*
Location *Kamack, Texas* Proj. No. *117591*
Surface Elev. *231.58386* Total Hole Depth *91.0 ft.* North *6956663.149 ft* East *3305871.659 ft.*
Top of Casing *234.91* Water Level Initial ▽ *86.0 ft.* Static *NA* Diameter *8 in.*
Screen: Dia *4 in.* Length *10 ft.* Type/Size *Sch. 40 PVC/.01 in.*
Casing: Dia *4 in.* Length *84 ft.* Type *Sch. 40 PVC*
Fill Material *NA* Rig/Core *Mobil B5500*
Drill Co. *ETTL* Method *Mud Rotary*
Driller *T. Cook* Log By *A. Willmore* Date *9/8/06* Driller # *NA*
Checked By *K. Everett* License No. *Texas 379*

COMMENTS
Hand augered 0 to 5 feet bgs.

Shallow Zone 12" Isolation Casing set at 34' bgs.



Depth (ft.)	PID (ppm)	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
0			CLAY, SANDY, LOW TO NO PLASTICITY, DAMP (DUE TO RAIN), NO ODOR, BROWN
2	0.0		
4			-BECOMES SILTY, HARD, NO PLASTICITY, IRON STAINING, REDDISH-BROWN, RED TO BROWN MOTTLING, SOME ORGANICS
6	0.0		
8		CL	
10			
12	0.0		
14			-BECOMES LIGHT BROWN TO GRAY
			SAND, CLAYEY, DAMP, BROWN, DENSE, NO ODOR
16	0.0	SC	
18			CLAY, SILTY, HARD, LOW TO NO PLASTICITY, BROWN, NO ODOR, DRY
20			
22	0.0	CL	
24			
		SC	SAND, CLAYEY, DENSE, MOIST, MEDIUM-SORTED, GRAY, FINE-GRAINED, GRAY
26	0.0	PT	LIGNITE TO ORGANIC CLAY, DRY, BLACK, NO ODOR
		SC	SAND, CLAYEY, DENSE, MOIST, MEDIUM-SORTED, FINE GRAINED, BROWN TO GRAY
28			
		CL	CLAY, SANDY, STIFF, NO PLASTICITY, BROWN TO GRAY, DAMP, NO ODOR
30	0.0		

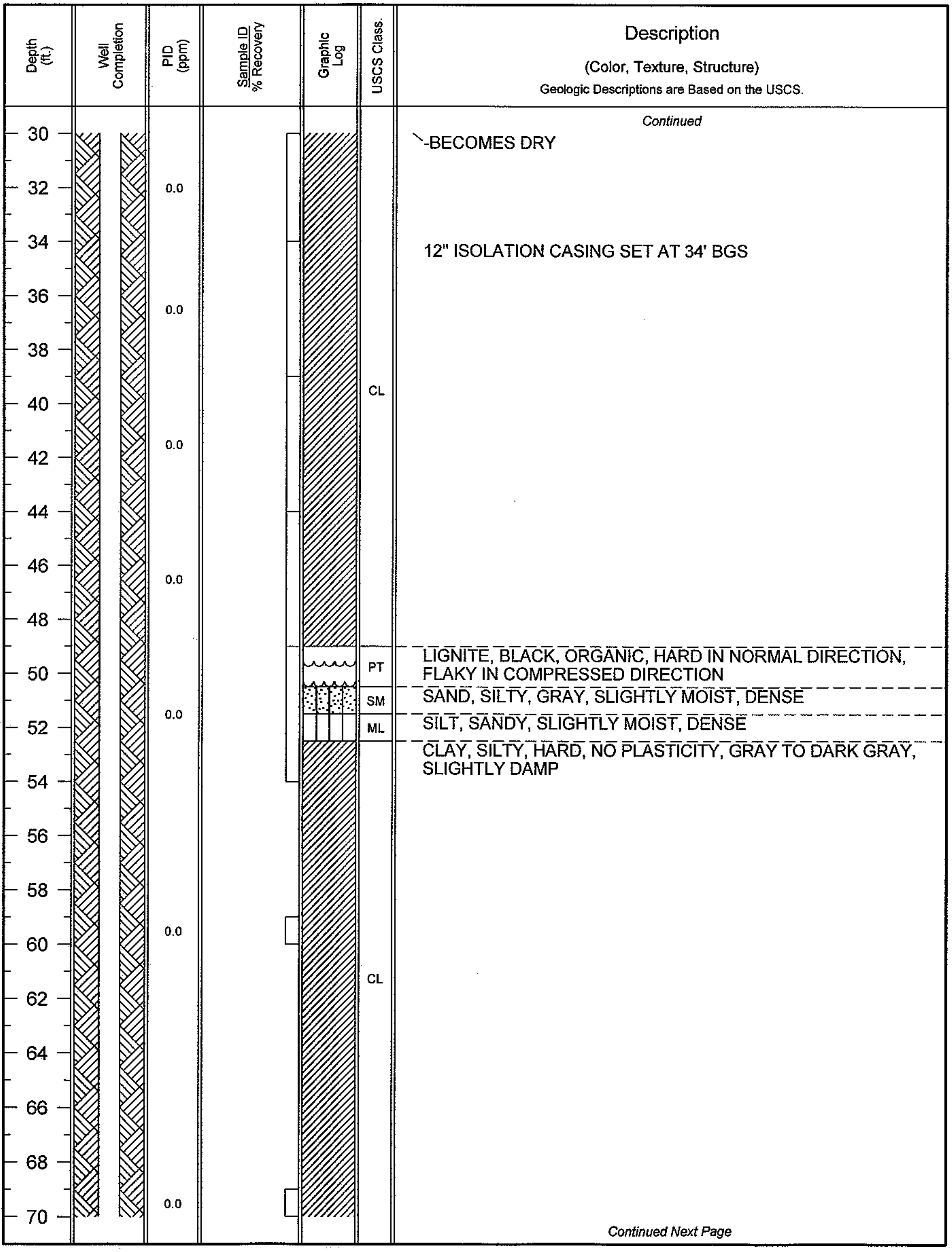
Continued Next Page

Drilling Log

Monitoring Well **29WW37**

Project *Longhorn Army Ammunition Plant* Owner *USACE*

Location *Karnack, Texas* Proj. No. *117591*



Description

(Color, Texture, Structure)

Geologic Descriptions are Based on the USCS.

Continued

-BECOMES DRY

12" ISOLATION CASING SET AT 34' BGS

CL

PT LIGNITE, BLACK, ORGANIC, HARD IN NORMAL DIRECTION, FLAKY IN COMPRESSED DIRECTION

SM SAND, SILTY, GRAY, SLIGHTLY MOIST, DENSE

ML SILT, SANDY, SLIGHTLY MOIST, DENSE

CLAY, SILTY, HARD, NO PLASTICITY, GRAY TO DARK GRAY, SLIGHTLY DAMP

CL

Continued Next Page

Drilling Log

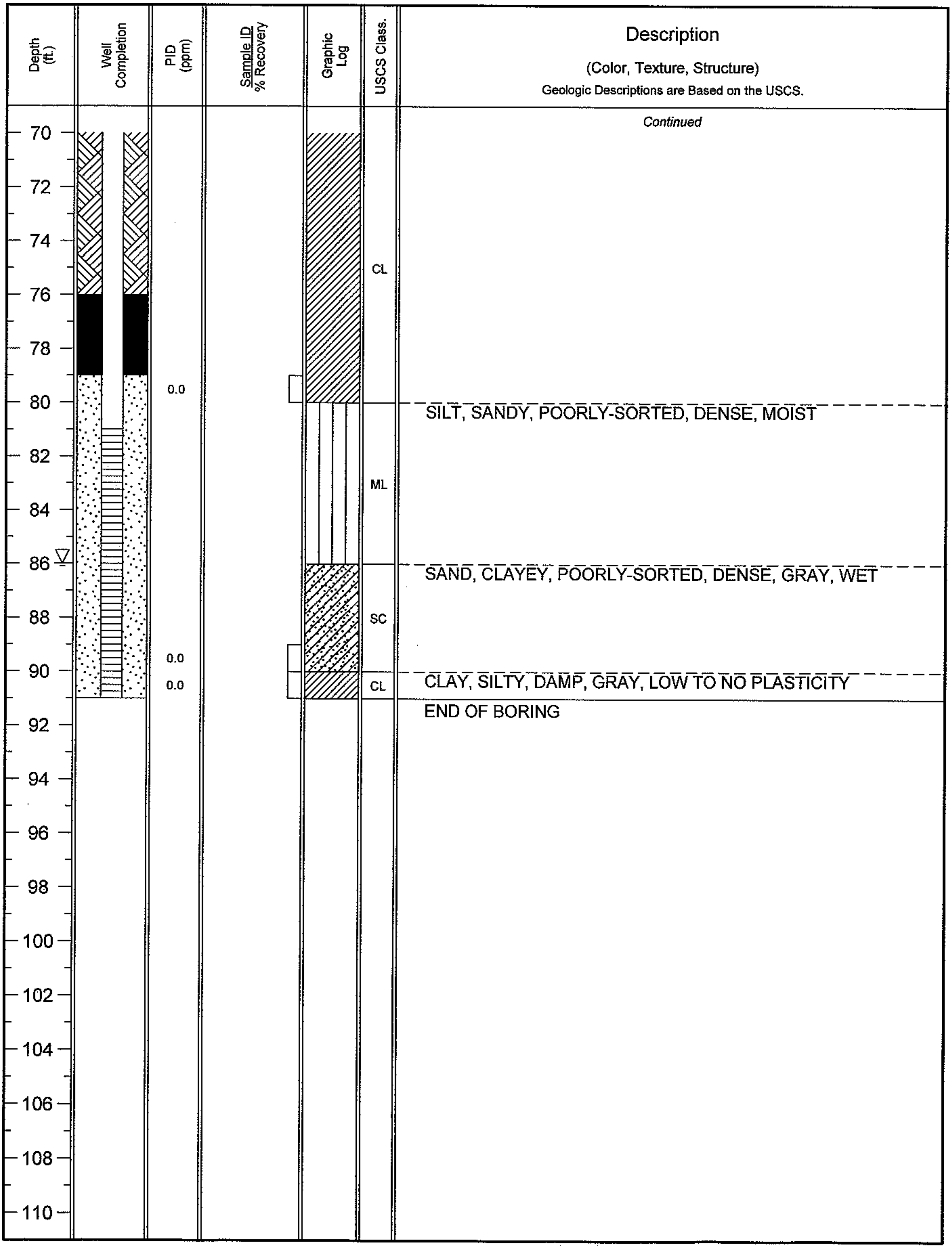
00091613

Monitoring Well **29WW37**

Page: 3 of 3

Project *Longhorn Army Ammunition Plant* Owner *USACE*

Location *Karnack, Texas* Proj. No. *117591*



Description

(Color, Texture, Structure)

Geologic Descriptions are Based on the USCS.

Continued

SILT, SANDY, POORLY-SORTED, DENSE, MOIST

SAND, CLAYEY, POORLY-SORTED, DENSE, GRAY, WET

CLAY, SILTY, DAMP, GRAY, LOW TO NO PLASTICITY

END OF BORING

Shaw™

Drilling Log

Monitoring Well **29WW38**

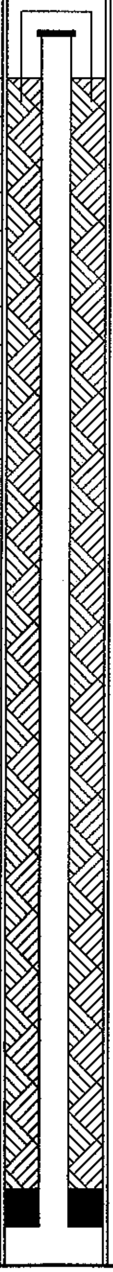
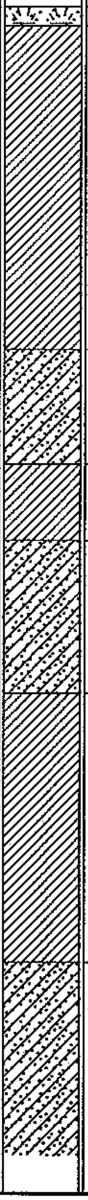
Page: 1 of 2

Project	*Longhorn Army Ammunition Plant*	Owner	*USACE*		
Location	*Kamack, Texas*	Proj. No.	*117591*		
Surface Elev.	*218.33704*	Total Hole Depth	*49.0 ft.*	North *6955376.315 ft.*	East *3307030.402 ft.*
Top of Casing	*220.99*	Water Level Initial	∇ *31.0 ft.*	Static *NA*	Diameter *8 in.*
Screen: Dia	*4 in.*	Length	*10 ft.*	Type/Size	*Sch. 40 PVC/.01 in.*
Casing: Dia	*4 in.*	Length	*37 ft.*	Type	*Sch. 40 PVC*
Fill Material	*NA*	Rig/Core	*Mayhew 500*		
Drill Co.	*ETTL*	Method	*Hollow Stem*		
Driller	*T. Cook*	Log By	*S. Oller/ A. Willmore*	Date *8/25/06*	Driller # *NA*
Checked By	*K. Everett*	License No.	*Texas 379*		

COMMENTS

Hand augered 0 to 5 feet bgs.

Backfilled with bentonite to 44' bgs.

Depth (ft.)	PID (ppm)	Sample ID % Recovery	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
0				TOPSOIL, SANDY, ROOTED
0.5				CLAY, SANDY, LOW PLASTICITY, DENSE, DRY, BROWN TO GRAY
2	0.0			
5			CL	
6.5	0.0			
9				SAND, CLAYEY, LOW PLASTICITY, DAMP, LIGHT BROWN
10.5			SC	
11.5	0.0			
12				CLAY, SANDY, DENSE, HIGH PLASTICITY, DAMP, BROWN
13			CL	
14				SAND, CLAYEY, FINE-GRAINED, MEDIUM- TO WELL-SORTED, DAMP, BROWN
16			SC	
16.5	0.0			
18				CLAY, SANDY, LOW PLASTICITY, DAMP, BROWN, DENSE
21.5	0.0		CL	
24				-BECOMES MORE CLAYEY
25				-BECOMES MORE SANDY
25				SAND, CLAYEY, FINE GRAINED, WELL-SORTED, DAMP, BROWN, SOME IRON STAINING
26.5	0.0			
27.5			SC	
29.5	0.0			
30				

Continued Next Page

Drilling Log

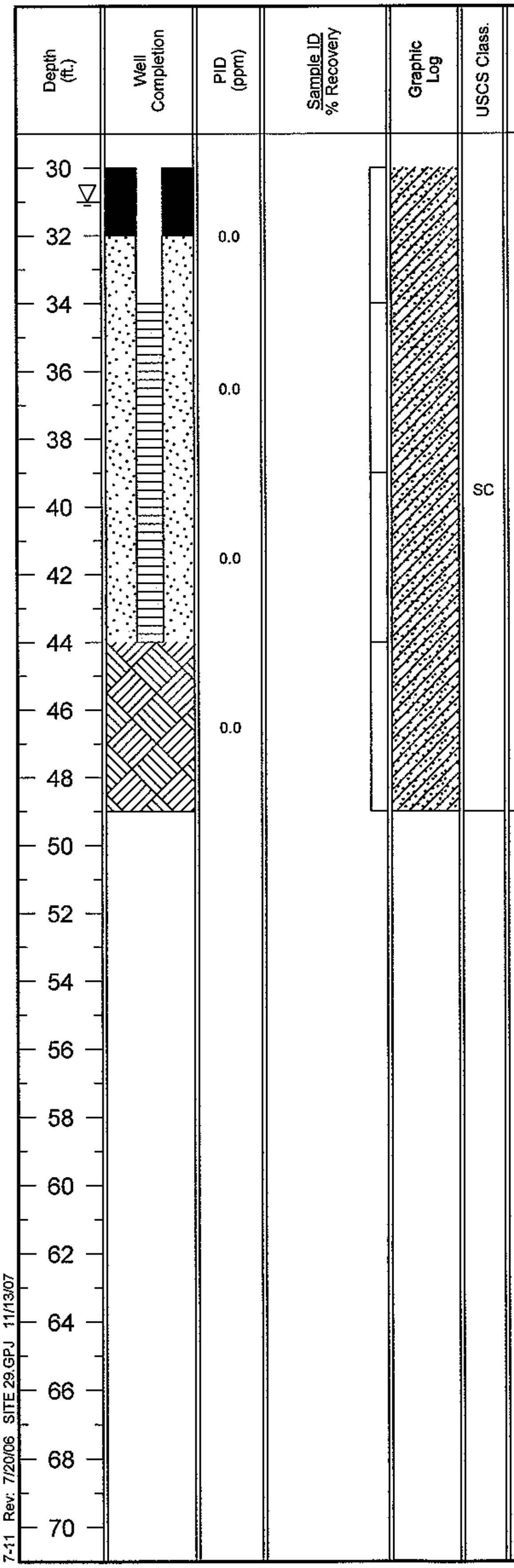
00091615

Monitoring Well **29WW38**

Page: 2 of 2

Project *Longhorn Army Ammunition Plant* Owner *USACE*

Location *Kamack, Texas* Proj. No. *117591*



Description

(Color, Texture, Structure)

Geologic Descriptions are Based on the USCS.

Continued

-BECOMES MORE SANDY

-BECOMES MOIST

-BECOMES SATURATED

WELL SET AT 44' BGS; BORING BACKFILLED WITH BENTONITE FROM 44' BGS TO 49' BGS

END OF BORING

Drilling Log

00091616

Monitoring Well **29WW39**

Page: 1 of 3

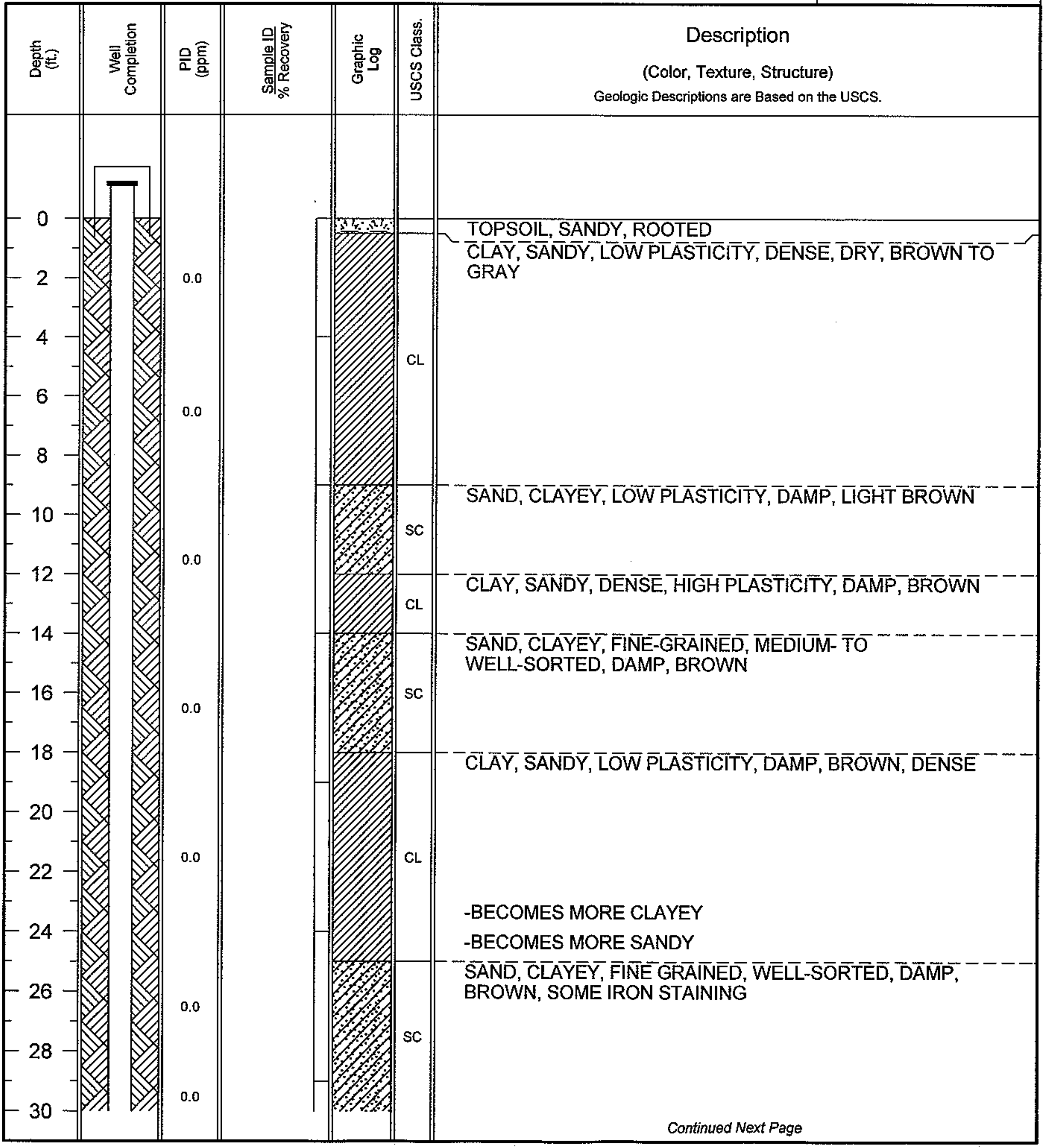
Project	Longhorn Army Ammunition Plant	Owner	USACE		
Location	Karnack, Texas	Proj. No.	117591		
Surface Elev.	218.25497	Total Hole Depth	87.0 ft.	North	6955363.733 ft
				East	3307033.519 ft.
Top of Casing	221.13	Water Level Initial	∇ 78.0 ft.	Static	NA
				Diameter	8 in.
Screen: Dia	4 in.	Length	10 ft.	Type/Size	Sch. 40 PVC/.01 in.
Casing: Dia	4 in.	Length	80 ft.	Type	Sch. 40 PVC
Fill Material	NA	Rig/Core	Mobil B5500		
Drill Co.	ETTL	Method	Mud Rotary		
Driller	J. Sartain	Log By	A. Willmore /D. Tibbals	Date	9/14/06
				Driller #	NA
Checked By	K. Everett	License No.	Texas 379		

COMMENTS

Hand augered 0 to 5 feet bgs.

No isolation casing set. No discernable lithologic separation of shallow and intermediate water-bearing zones

Backfilled with bentonite to 84' bgs.



Description

(Color, Texture, Structure)

Geologic Descriptions are Based on the USCS.

Depth (ft.)	PID (ppm)	USCS Class.	Description
0			TOPSOIL, SANDY, ROOTED
0.5	0.0 (2), 0.0 (6.5)	CL	CLAY, SANDY, LOW PLASTICITY, DENSE, DRY, BROWN TO GRAY
9	0.0 (11.5)	SC	SAND, CLAYEY, LOW PLASTICITY, DAMP, LIGHT BROWN
12		CL	CLAY, SANDY, DENSE, HIGH PLASTICITY, DAMP, BROWN
14	0.0 (16.5)	SC	SAND, CLAYEY, FINE-GRAINED, MEDIUM- TO WELL-SORTED, DAMP, BROWN
18	0.0 (21.5)	CL	CLAY, SANDY, LOW PLASTICITY, DAMP, BROWN, DENSE -BECOMES MORE CLAYEY -BECOMES MORE SANDY
25	0.0 (26.5), 0.0 (29.5)	SC	SAND, CLAYEY, FINE GRAINED, WELL-SORTED, DAMP, BROWN, SOME IRON STAINING

Continued Next Page

Drilling Log

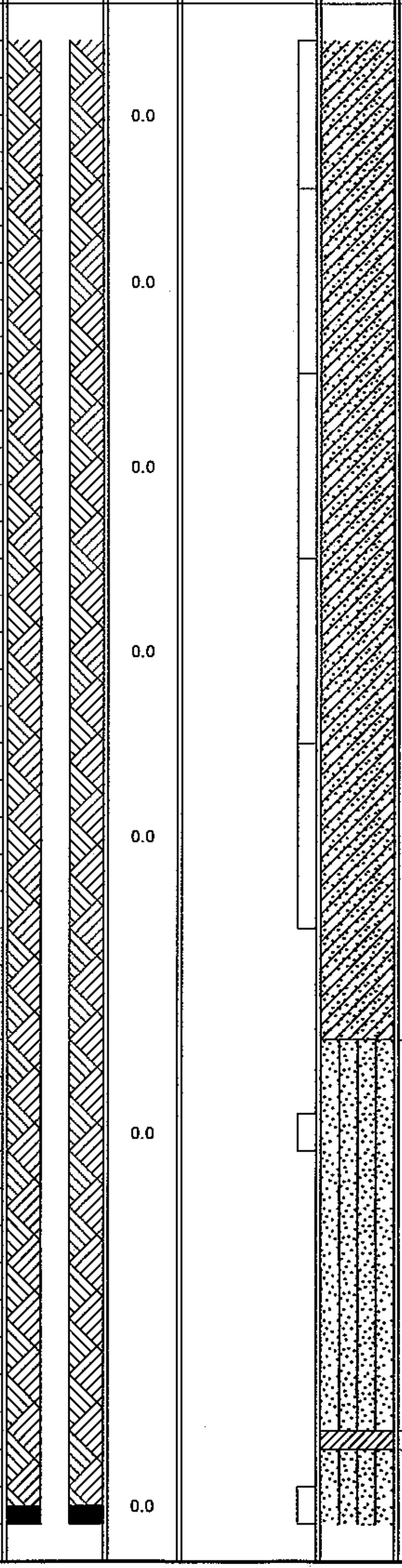
Monitoring Well **29WW39**

00091617

Page: 2 of 3

Project *Longhorn Army Ammunition Plant* Owner *USACE*

Location *Kamack, Texas* Proj. No. *117591*



Depth (ft.)	PID (ppm)	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
			Continued
30			-BECOMES MORE SANDY -BECOMES MOIST
32	0.0		
34			
36	0.0		
38			
40			
42	0.0		-BECOMES SATURATED
44		SC	
46	0.0		
48			
50			
52	0.0		
54			
56			
58			SAND, SILTY, SAND, GRAY, MOIST, FINE-GRAINED, WELL-GRADED
60	0.0		
62		SM	-SOME LAYERING
64			
66			
68		CL	CLAY, SILTY, GRAY, DRY, LOW PLASTICITY, HARD
		SM	SAND, SILTY, SAND, GRAY, MOIST, FINE-GRAINED, WELL-GRADED
70	0.0		

Continued Next Page

Drilling Log

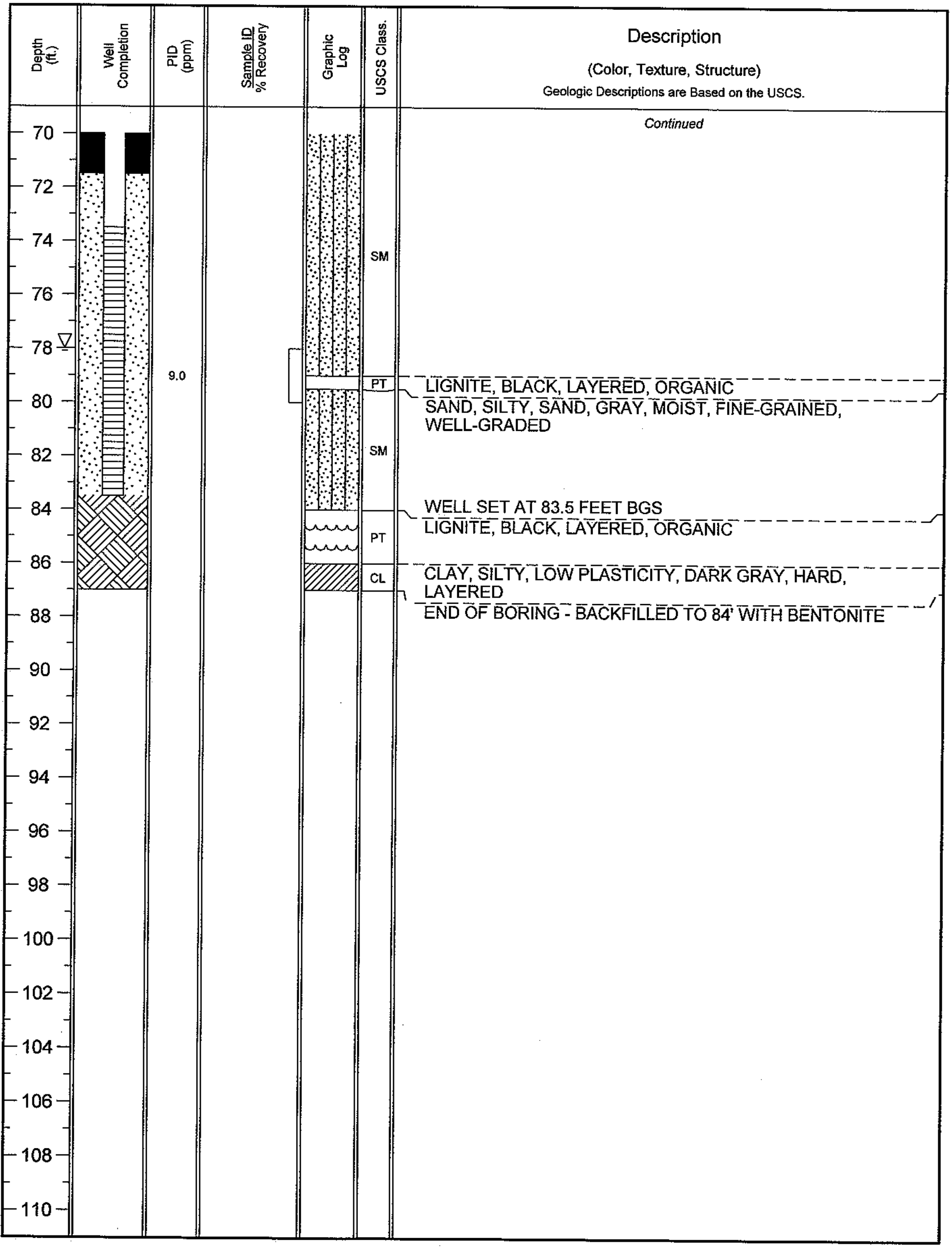
00091618

Monitoring Well **29WW39**

Page: 3 of 3

Project *Longhorn Army Ammunition Plant* Owner *USACE*

Location *Karnack, Texas* Proj. No. *117591*



Description

(Color, Texture, Structure)

Geologic Descriptions are Based on the USCS.

Continued

LIGNITE, BLACK, LAYERED, ORGANIC

SAND, SILTY, SAND, GRAY, MOIST, FINE-GRAINED, WELL-GRADED

WELL SET AT 83.5 FEET BGS

LIGNITE, BLACK, LAYERED, ORGANIC

CLAY, SILTY, LOW PLASTICITY, DARK GRAY, HARD, LAYERED

END OF BORING - BACKFILLED TO 84' WITH BENTONITE

Drilling Log

00091619

Monitoring Well **29WW40**

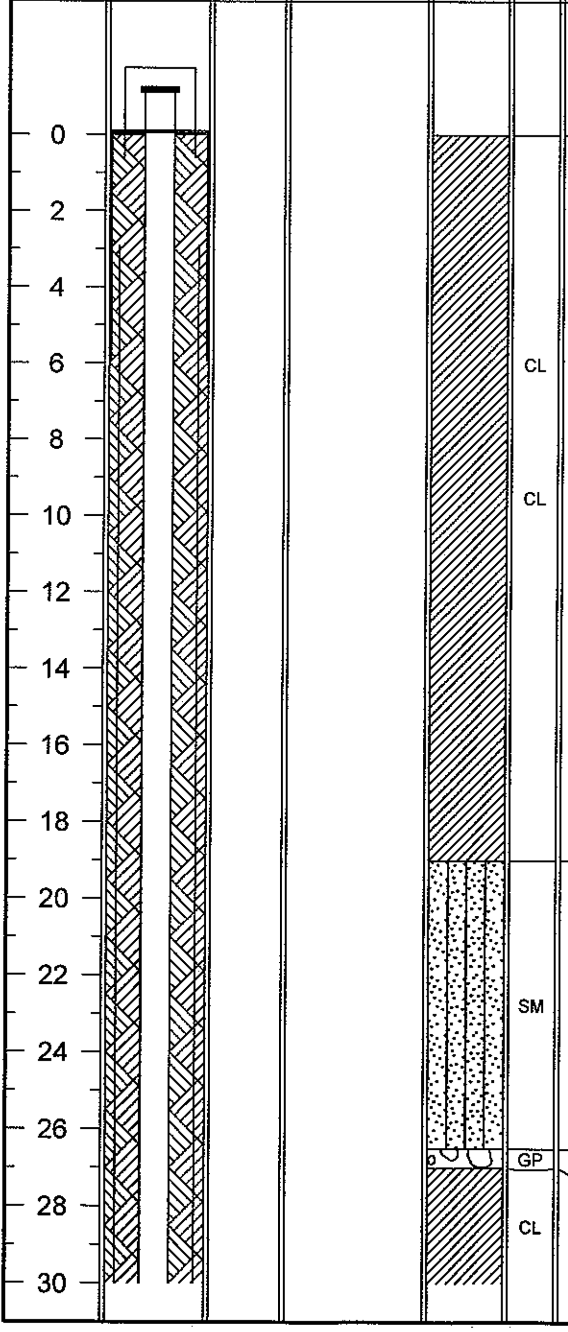
Project *Longhorn Army Ammunition Plant* Owner *USACE*
Location *Karnack, Texas* Proj. No. *117591*
Surface Elev. *229.65548* Total Hole Depth *159.0 ft.* North *6955855.435 ft* East *3306143.65 ft.*
Top of Casing *232.49* Water Level Initial ∇ *110.0 ft.* Static *NA* Diameter *6 in.*
Screen: Dia *2 in.* Length *10 ft.* Type/Size *Sch. 40 PVC/.01 in.*
Casing: Dia *2 in.* Length *152 ft.* Type *Sch. 40 PVC*
Fill Material *NA* Rig/Core *Mayhew 500/ Mobil B5500*
Drill Co. *ETTL* Method *Mud Rotary*
Driller *J. Sartain* Log By *A. Willmore/ D. Tibbals* Date *9/18/06* Driller # *NA*
Checked By *K. Everett* License No. *Texas 379*

COMMENTS
Hand augered 0 to 5 feet bgs.

16" Shallow Zone Isolation Casing set at 50' bgs.

8" Intermediate Zone Isolation Casing set at 90' bgs

(Note: 12" Casing stuck at 82' bgs.)



Depth (ft.)	Well Completion	PID (ppm)	Sample ID / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.
						0' - 31' Description taken from log 29WW15, Appendix II of the Draft Site Characterization Summary Report for the Phase III Group 2 Sites Remedial Investigation (RI) and Feasibility Study (FS), Sverdrup, January 2000.
0						CLAY, SILTY, MEDIUM BROWN, MOTTLED, ROOTS, IRON STAINING, BLACK STRIATION, MEDIUM STIFF, SLIGHTLY MOIST TO MOIST, TRACE GRAVEL
4						-BECOMES SOFT AND WET
6					CL	-BECOMES VERY STIFF WITH RED STRIATION, SLIGHTLY MOIST
10					CL	-BECOMES MEDIUM-BROWN TO GRAY WITH TRACE SAND AND ROOTS
19					SM	SAND, SILTY, MEDIUM BROWN WITH GRAY LAYERS, MOIST, MEDIUM DENSE TO LOOSE
27					GP	GRAVEL, POORLY-GRADED, BROWN, WET
27.5					CL	CLAY, SILTY, MEDIUM-BROWN TO GRAY, LAYERED, SLIGHTLY MOIST, GOLDEN BROWN LAYERS

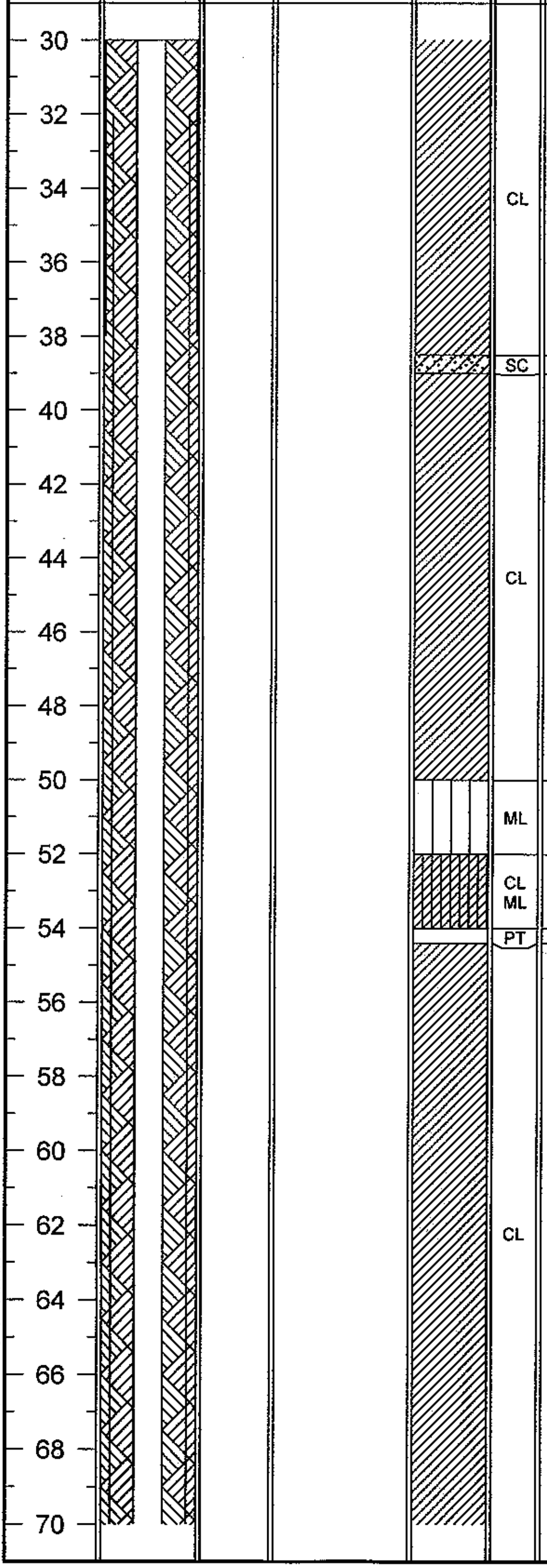
Continued Next Page

Drilling Log

Monitoring Well **29WW40**

Project	*Longhorn Army Ammunition Plant*	Owner	*USACE*
Location	*Kamack, Texas*	Proj. No.	*117591*

Depth (ft.)	Well Completion	PID (ppm)	Sample ID / % Recovery	Graphic Log	USCS Class.	Description (Color, Texture, Structure) Geologic Descriptions are Based on the USCS.



Continued

31' - 88' Description taken from log 29WW16, Appendix II of the Draft Site Characterization Summary Report for the Phase III Group 2 Sites RI/FS, Sverdrup, January 2000.

CLAY, SANDY, MEDIUM BROWN TO GRAY, LAMINATED, SLIGHTLY MOIST TO MOIST, SOME SILT, STIFF

CLAY, SILTY, DARK GRAY, VERY STIFF, TRACE SAND, SLIGHTLY MOIST TO MOIST

- 16" SHALLOW ZONE ISOLATION CASING SET AT 50' BGS

SILT, CLAYEY, SOME SAND, MEDIUM GRAY, MOIST

CLAY, SILTY, SOME SAND, MEDIUM GRAY, MOIST, STIFF, LAMINATED

LIGNITE, BLACK, LAYERED

CLAY, SILTY, DARK BROWN WITH BLACK INTERMITTENT ORGANIC CONTENT, VERY HARD, HIGH PLASTICITY, SLIGHTLY MOIST

-PLASTICITY INCREASES

Continued Next Page

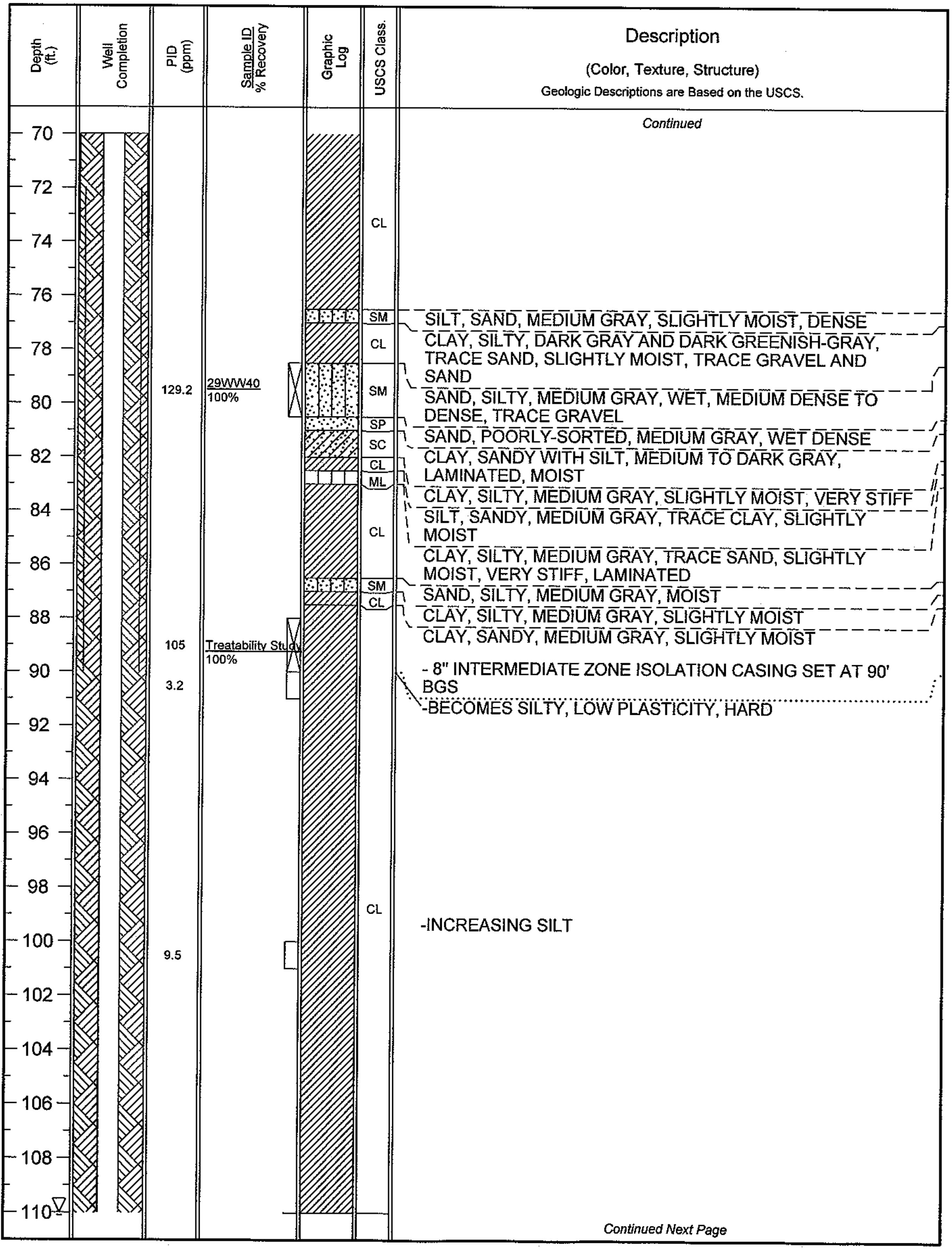
Drilling Log

Monitoring Well **29WW40**

Page: 3 of 5

Project *Longhorn Army Ammunition Plant* Owner *USACE*

Location *Karnack, Texas* Proj. No. *117591*



Description

(Color, Texture, Structure)

Geologic Descriptions are Based on the USCS.

Continued

SILT, SAND, MEDIUM GRAY, SLIGHTLY MOIST, DENSE

CLAY, SILTY, DARK GRAY AND DARK GREENISH-GRAY, TRACE SAND, SLIGHTLY MOIST, TRACE GRAVEL AND SAND

SAND, SILTY, MEDIUM GRAY, WET, MEDIUM DENSE TO DENSE, TRACE GRAVEL

SAND, POORLY-SORTED, MEDIUM GRAY, WET DENSE

CLAY, SANDY WITH SILT, MEDIUM TO DARK GRAY, LAMINATED, MOIST

CLAY, SILTY, MEDIUM GRAY, SLIGHTLY MOIST, VERY STIFF

SILT, SANDY, MEDIUM GRAY, TRACE CLAY, SLIGHTLY MOIST

CLAY, SILTY, MEDIUM GRAY, TRACE SAND, SLIGHTLY MOIST, VERY STIFF, LAMINATED

SAND, SILTY, MEDIUM GRAY, MOIST

CLAY, SILTY, MEDIUM GRAY, SLIGHTLY MOIST

CLAY, SANDY, MEDIUM GRAY, SLIGHTLY MOIST

- 8" INTERMEDIATE ZONE ISOLATION CASING SET AT 90' BGS

-BECOMES SILTY, LOW PLASTICITY, HARD

-INCREASING SILT

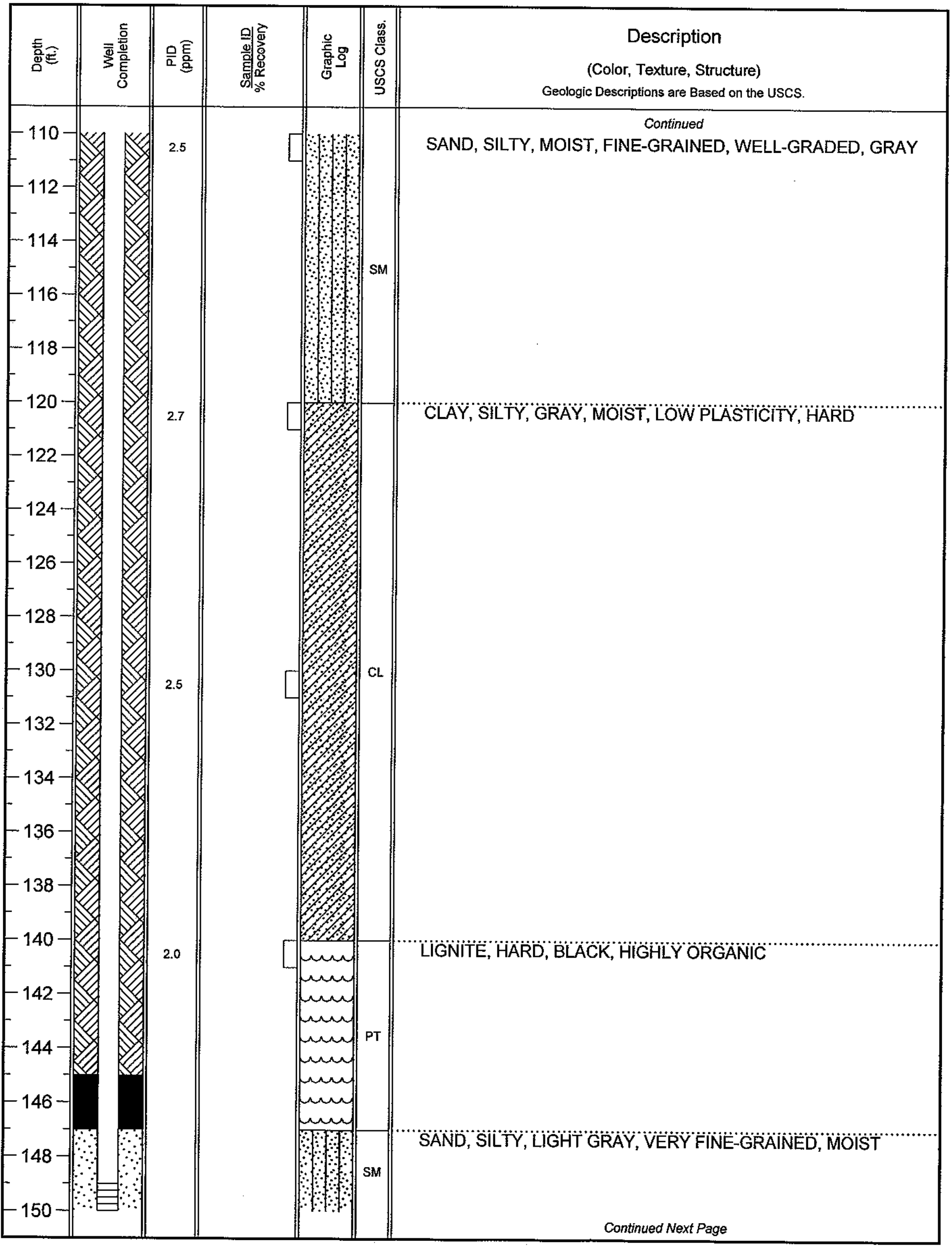
Continued Next Page

Drilling Log

Monitoring Well **29WW40**

Project *Longhorn Army Ammunition Plant* Owner *USACE*

Location *Karnack, Texas* Proj. No. *117591*



Description

(Color, Texture, Structure)

Geologic Descriptions are Based on the USCS.

Continued

SAND, SILTY, MOIST, FINE-GRAINED, WELL-GRADED, GRAY

CLAY, SILTY, GRAY, MOIST, LOW PLASTICITY, HARD

LIGNITE, HARD, BLACK, HIGHLY ORGANIC

SAND, SILTY, LIGHT GRAY, VERY FINE-GRAINED, MOIST

Continued Next Page

Drilling Log

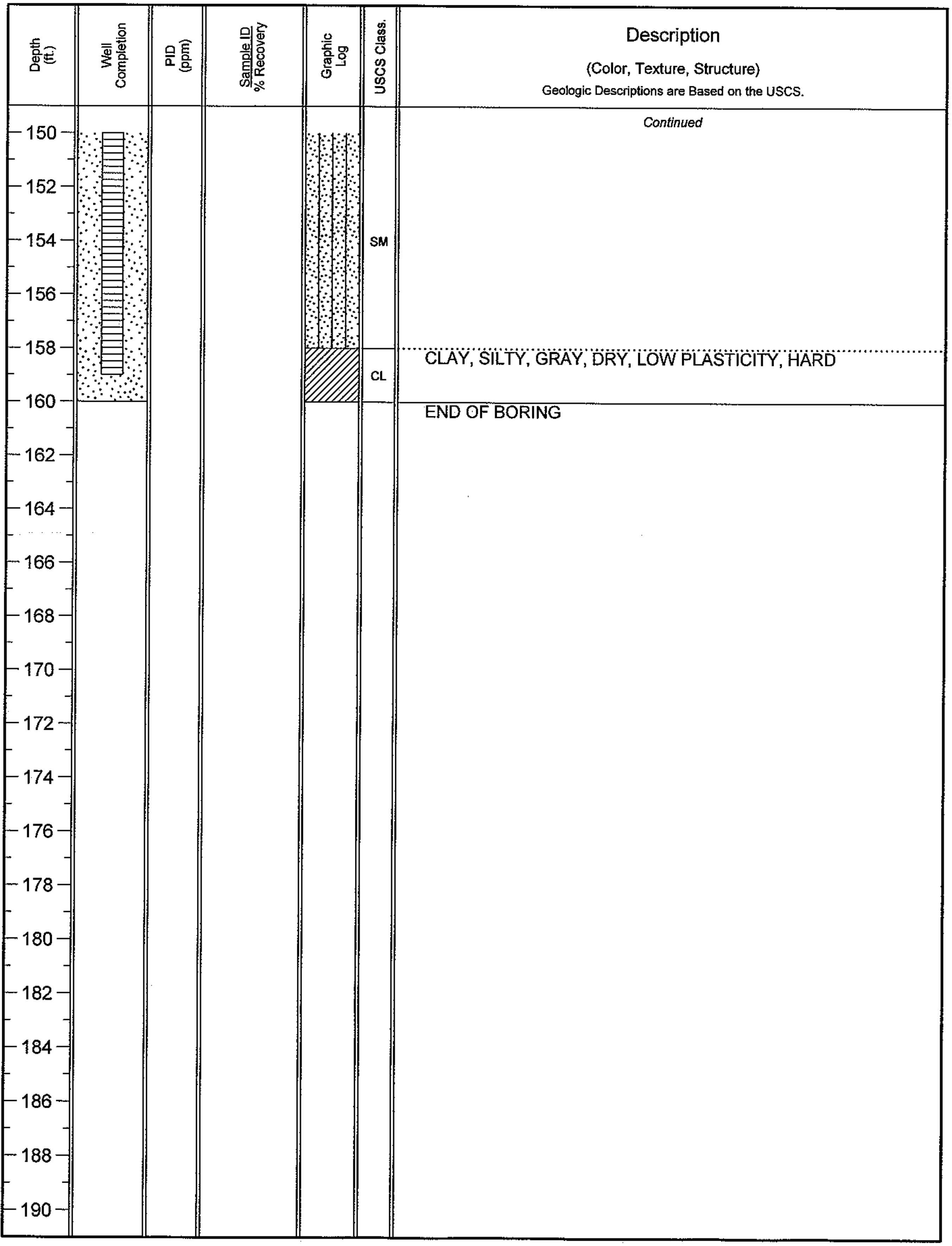
00091623

Monitoring Well **29WW40**

Page: 5 of 5

Project *Longhorn Army Ammunition Plant* Owner *USACE*

Location *Karnack, Texas* Proj. No. *117591*



Description

(Color, Texture, Structure)

Geologic Descriptions are Based on the USCS.

Continued

CLAY, SILTY, GRAY, DRY, LOW PLASTICITY, HARD

END OF BORING

Attachment 2

Monitoring Well Development Records

WELL DEVELOPMENT RECORD

WELL/PIEZOMETER ID 29WW35
SHEET 1 OF 1

PROJECT NAME: Longhorn PROJECT NO.: 117591.0006A100 DATE: 9/18/06
LOCATION: Karnack, Tx DATE INSTALLED: 9/14/06
TOTAL DEPTH (FTOC) ____ CASING DIAMETER 4" PVC

METHODS OF DEVELOPMENT

☐ Swabbing ☐ Bailing ☒ Pumping ☐ Describe ____
Equipment decontaminated prior to development ☐ Yes ☐ No
Describe ____

EQUIPMENT NUMBERS

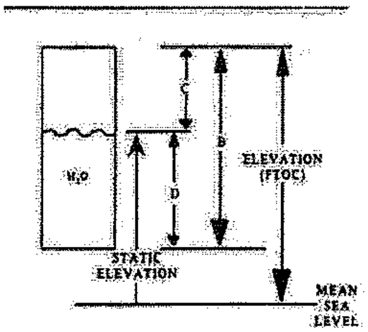
pH Meter YSI EC Meter YSI Turbidity Meter YSI Thermometer YSI

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 95' ft.
Measured Water Level Depth (C) 29.6 ft.
Length of Static Water Column (D) 95 (B) - 29.6 (C) = 65.4 ft.
Casing Water Volume (E) .65 (A) x 65.4 (D) = 42.51 gal
Total Purge Volume = ____ gal 42.51 x 5 = 213 gallons



Date	Time	Water Level (FTOC)	Volume Removed (gal)	pH	EC	Temperature F or C	Turbidity/ Sand (ppm)	Comments
9/18	11:19		5	8.39	.497	21.99	400.2	
	11:42		40	8.05	.830	21.73	1551.8	
	11:57		60	8.01	.808	22.24	291.2	
	14:02		85	8.05	.818	22.23	137.1	
	1421		135	7.84	.805	22.09	18.2	
	1441		160	7.85	.814	21.95	10.6	
	15:12		190	7.90	.822	22.09	57.6	
	15:33		210	7.8	.827	21.61	8.9	
	15:52		250	7.84	.822	21.30	5.6	
	16:32		270	7.76	.818	21.23	47.1	
	16:45		280	7.85	.848	20.56	19.3	

WELL DEVELOPMENT RECORD

WELL/PIEZOMETER ID 29WW36
SHEET 1 OF ____

PROJECT NAME: Longhorn PROJECT NO.: 117591.0007A100 DATE: 9/15/06

LOCATION: LHAAP-29 DATE INSTALLED: 8/26/06

TOTAL DEPTH (FTOC) ________ CASING DIAMETER 4" PVC

METHODS OF DEVELOPMENT

☐ Swabbing ☒ Bailing ☐ Pumping ☐ Describe________

Equipment decontaminated prior to development ☐ Yes ☐ No

Describe________

EQUIPMENT NUMBERS

pH Meter YSI EC Meter YSI Turbidity Meter YSI Thermometer YSI

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

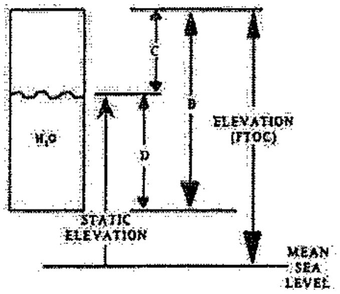
Measured Well Depth B 33.36 ft. bgs

Measured Water Level Depth (C) 25.34 ft. bgs

Length of Static Water Column (D) 33.36 (B) - 25.34 (C) = 8.02 ft.

Casing Water Volume (E) 0.65 (A) x 8.02 (D) = 5.213 gal

Total Purge Volume = ________ gal



5 x 5.213 =
26.065 gallons

Date	Time	Water Level (FTOC)	Volume Removed (gal)	pH	EC	Temperature F or C	Turbidity/ Sand (ppm)	Comments
9/16/06	10:06			6.08		20.85	13.2	
	10:33			6.79		19.63	338.2	
	10:53			6.81		19.5	407	
	11:31	34.19		6.91		21.56	830.7	
	12:00	34.2		6.97		20.9	259.3	
	12:40	34.4		7.18		20.82	1536.7	
	13:17	34.55		6.82		20.59	239.5	

9/19/06

WELL DEVELOPMENT RECORD

WELL/PIEZOMETER ID 29WW37
SHEET 1 OF 1

PROJECT NAME: Longhorn PROJECT NO.: 117591 DATE: 9/19/06
LOCATION: Karnack, Tx DATE INSTALLED: 9/8/06
TOTAL DEPTH (FTOC) 85.25 CASING DIAMETER 4" PVC

METHODS OF DEVELOPMENT

☐ Swabbing ☐ Bailing ☒ Pumping ☐ Describe

Equipment decontaminated prior to development ☐ Yes ☐ No

Describe

37.95

EQUIPMENT NUMBERS

pH Meter YSI EC Meter YSI Turbidity Meter YSI Thermometer YSI

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

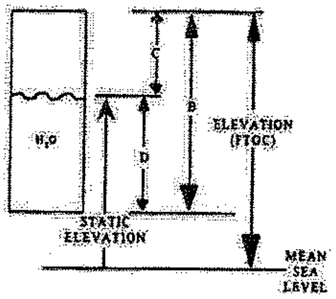
Measured Well Depth B 85.25 ft.

Measured Water Level Depth (C) 37.95 ft.

Length of Static Water Column (D) 85.25 (B) - 37.95 (C) = 47.3 ft.

Casing Water Volume (E) .65 (A) x 47.3 (D) = 30.74 gal

Total Purge Volume = ______ gal 30.74 x 7 volumes
215.18



Date	Time	Water Level (FTOC)	Volume Removed (gal)	pH	EC	Temperature F or C	Turbidity/ Sand (ppm)	Comments
9/19/06	956		4	9.68	656	18.83	-12.3	
	10:23		45	8.61	757	19.33	1519.8	
	10:50		55	9.54	810	19.65	1529.3	
	11:23		75	8.73	.700	20.44	1534.4	
	1337		90	8.92	.669	21.81	1552.4	
	14:06		145	8.27	.617	21.29	956.4	
	1516		185	8.2	.570	22.78	1564.8	
	15:45		205	8.05	.586	20.33	278.5	
	16:15		235	7.99	.575	20.43	80.3	
	16:40		250	8.11	.570	20.36	12.2	
	17:04		280	8.04	.564	14.8	2.7	

WELL DEVELOPMENT RECORD

WELL/PIEZOMETER ID 79WW38
SHEET 1 OF 1

PROJECT NAME: Longhorn PROJECT NO.: 117591.0007A100 DATE:

LOCATION: LHAAP DATE INSTALLED: 8/26/06

TOTAL DEPTH (FTOC) CASING DIAMETER 4"

METHODS OF DEVELOPMENT

☐ Swabbing ☑ Bailing ☐ Pumping ☐ Describe

Equipment decontaminated prior to development ☐ Yes ☐ No

Describe Equipment deconned by 3-step rinse, alconox + water, potable water, DI water.

EQUIPMENT NUMBERS

pH Meter YSI EC Meter YSI Turbidity Meter YSI Thermometer YSI

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 40.44 ft. bgs

Measured Water Level Depth (C) 27.30 ft. bgs

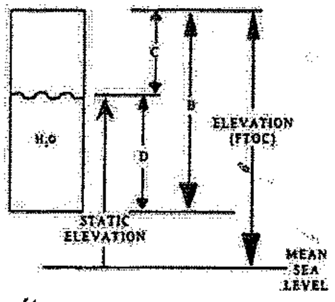
Length of Static Water Column (D) 40.44 (B) - 27.30 (C) = ~~8.541~~ 13.14 AC ft.

Casing Water Volume (E) 0.65 (A) x 13.14 (D) = ~~42.705~~ 8.541 gal AC

Total Purge Volume = ~~42.70~~ 5 gal AC

8.341 * 5

= 42.70 gallons



Date	Time	Water Level (FTOC)	Volume Removed (gal)	pH	EC	Temperature F or C	Turbidity/ Sand (ppm)	Comments
9/16/06	10:25	27.30	0.1 gallons	6.58	0.675	18.99	20.08	
9/16/06	10:31		8 gallons	6.40	0.837	19.28	1438.3	very silty
9/16/06	10:48	Dry	16.5	6.97	1.041	19.51	1443.2	brown silt
	12:10		24	7.84	0.773	19.94	1281.1	brown silt
	12:40		32	6.55	0.79	18.96	50.3	brown silt
	13:35		40	7.51	0.50	20.66	731.3	cloudy

WELL DEVELOPMENT RECORD

WELL/PIEZOMETER ID 29WW39
SHEET 1 OF 2

PROJECT NAME: Longhorn PROJECT NO.: 117591.0006A100 DATE: 9/18/06

LOCATION: Karnack, Tx DATE INSTALLED: 9/14/06

TOTAL DEPTH (FTOC) ~~95~~ 95' CASING DIAMETER 4" PVC

METHODS OF DEVELOPMENT

☐ Swabbing ☐ Bailing ☒ Pumping ☐ Describe

Equipment decontaminated prior to development ☐ Yes ☐ No

Describe

EQUIPMENT NUMBERS

pH Meter YSI EC Meter YSI Turbidity Meter YSI Thermometer YSI

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

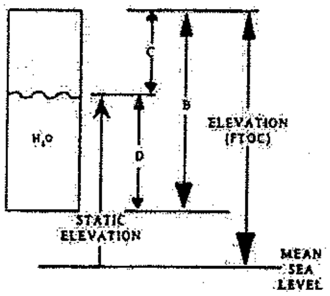
Measured Well Depth B 95' ft.

Measured Water Level Depth (C) 29.6 ft.

Length of Static Water Column (D) 95 (B) - 29.6 (C) = 65.4 ft.

Casing Water Volume (E) .65 (A) x 65.4 (D) = 42.51 gal

Total Purge Volume = ______ gal 42.51 x 5 = 213 gallons



Date	Time	Water Level (FTOC)	Volume Removed (gal)	pH	EC	Temperature F or C	Turbidity/ Sand (ppm)	Comments
9/18	11:19		5	8.39	.497	21.94	400.2	
	11:42		40	8.05	.830	21.73	1551.8	
	11:57		60	8.01	.808	22.24	291.2	
	14:02		85	8.05	.818	22.23	137.1	
	1421		135	7.84	.805	22.09	18.2	
	1441		160	7.85	.814	21.95	10.6	
	15:12		190	7.90	.822	22.09	57.6	
	15:33		210	7.8	.827	21.61	8.9	
	15:52		250	7.84	.822	21.30	5.6	
	16:32		270	7.76	.818	21.23	47.1	
	16:45		280	7.85	.845	20.56	19.3	

00091630

Well/Piezometer ID 29WW39
Sheet 2 of 2

WELL DEVELOPMENT RECORD
Continued

Date	Time	Vol (gal)	pH	EC	Temp	Redox	DO mg/l	Turbidity	Fe II
9/23	1200		5.98	1.01	20.73		7.33	902.9	
	1220		5.90	1.03	20.65		6.72	649.9	
	1240		5.88	1.04	20.62		7.56	419.8	
	1300		5.91	1.03	20.69		6.25	174.5	
	1320		5.93	103	20.55		7.84	95.7	
	1340		5.93	1.038	20.67		7.87	81.7	
	1400		5.9	1.038	20.7		7.86	54.8	
	1420		5.9	1.032	20.7		7.89	38.7	
	1440		5.9	1.03	20.73		7.93	35.1	
	1500	≈300 gal.	5.9	1.03	20.74		7.90	34.2	

WELL DEVELOPMENT RECORD

WELL/PIEZOMETER ID 29WW40
SHEET 1 OF 1

PROJECT NAME: Longhorn PROJECT NO.: 117591 DATE: 9/20/06
LOCATION: Karnack, Tx DATE INSTALLED: 9/19/06
TOTAL DEPTH (FTOC) 159' bgs CASING DIAMETER ~~4~~ 2" PVC

METHODS OF DEVELOPMENT

☐ Swabbing ☐ Bailing ☑ Pumping ☐ Describe

Equipment decontaminated prior to development ☐ Yes ☐ No

Describe

EQUIPMENT NUMBERS

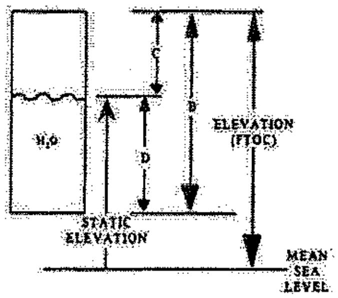
pH Meter YSI EC Meter YSI Turbidity Meter YSI Thermometer YSI

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 159 ft.
Measured Water Level Depth (C) 20.1 ft.
Length of Static Water Column (D) 159 (B) - 20.1 (C) = 138.9 ft
Casing Water Volume (E) .16 (A) x 138.9 (D) = 22.22 gal
Total Purge Volume = gal 22.22 x 7 = 155.5



Date	Time	Water Level (FTOC)	Volume Removed (gal)	pH	EC	Temperature F or C	Turbidity/ Sand (ppm)	Comments
9/20/06	924		7	11.90		21.27	1403.7	
↓	951		60	8.75		19.74	70.3	
	11:04		100	8.57		21.17	229.3	
	11:20		140	8.36		20.00	3.9	
	11:30		170	8.24		19.8	3.6	
	11:42		200	8.19		19.7	2.9	

Attachment 3

Activated Persulfate Oxidation Treatability Study Report

Shaw® Shaw Environmental, Inc.

ACTIVATED PERSULFATE OXIDATION TREATABILITY STUDY REPORT

LHAAP-29

Prepared By:

Shaw Environmental, Inc.
Technology Development Laboratory
304 Directors Drive
Knoxville, TN 37923

Project No. 117591.0006A200

Acronyms and Abbreviations

°C	degrees Celsius
µg/kg	micrograms per kilogram
BTEX	benzene, toluene, ethylbenzene, and xylenes
Cl^-	chloride ion
E°	reduction potential
FeEDTA	Iron (II) ethylenediamine tetra acetic acid
g	gram
g/L	grams per liter
GC/FID	gas chromatography with flame ionization detector
HSO_4^-	hydrogen sulfate
ISCO	in-situ chemical oxidation
kg	kilogram
MCL	maximum contaminant level
$MeCl_2$	methylene chloride
meq	milliequivalents
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mL	milliliter
Na_3PO_4	sodium phosphate
$OH\bullet$	hydroxyl radical
Shaw	Shaw Environmental, Inc.
$(S_2O_8)^{-2}$	persulfate ion
SO_4^{-2}	sulfate ion
$SO_4\bullet^-$	sulfate radical
SOD	soil oxidant demand
SOP	standard operating procedures
TDL	Technology Development Laboratory
UV	ultraviolet
V	volts
VOC	volatile organic compound

1.0 Introduction

The groundwater in the intermediate water-bearing zone at the LHAAP-29 site is contaminated with methylene chloride. Shaw Environmental, Inc. (Shaw) conducted a bench-scale treatability study to evaluate the effectiveness of in-situ chemical oxidation (ISCO) using activated sodium persulfate to treat the methylene chloride at the site. The treatability study was performed at Shaw's Technology Development Laboratory (TDL) in Knoxville, TN. This report describes treatability testing procedures and presents the results.

2.0 Technology Description

Persulfate ion ($S_2O_8^{-2}$) is a strong oxidant capable of oxidizing most organic compounds to carbon dioxide and other mineral products. The standard reduction potential for the half reaction shown below is +2.01 volts (V).

$$S_2O_8^{-2} + 2e^- \rightarrow 2SO_4^{-2} \qquad E^\circ = +2.01\ \text{V}$$

It is on the same order as ozone and higher than for permanganate and hydrogen peroxide, but less than the hydroxyl radical (Fenton's reagent intermediate). As shown in the half reaction above, the product of persulfate reduction is sulfate ion (SO_4^{-2}), which is a relatively benign species. Sulfate ion has a secondary federal drinking water standard maximum contaminant level (MCL), which is a recommended but unenforceable limit, of 250 milligrams per liter (mg/L). During in situ treatment the solubility of sulfate may be limited by natural calcium concentrations, which can precipitate a fraction of the aqueous sulfate concentration as calcium sulfate dihydrate.

It is believed that persulfate reacts with organic compounds primarily by the sulfate radical ($SO_4\bullet^-$), which can be generated in solution by several mechanisms. The sulfate radical, shown in the reaction below, is a powerful oxidizing species with a standard electrode reduction potential of +2.6 V, which is similar to that for the hydroxyl radical ($OH\bullet$) species (+2.8 V).

$$SO_4\bullet^- + e^- \rightarrow SO_4^{-2} \qquad E^\circ = +2.6\ \text{V}$$

The hydroxyl radical is a powerful oxidizing species that is generated with catalyzed hydrogen peroxide systems. The persulfate anion radical in contrast to the hydroxyl radical has a longer lifetime in solution and is more selective in its reactions (P. Neta, 1987). Generation of the sulfate radical may be accomplished by homolytic scission of the persulfate ion, which can be activated by heat or ultraviolet (UV) radiation (G. E. Hoag, 2000; P. Neta, 1987 and C. Liang, 2001):

$$S_2O_8^{-2} \text{ or } {}^{-}O_4S\text{-}SO_4^{-} \rightarrow 2\ SO_4\bullet^{-}$$

Heat activation can be accomplished at temperatures in the range of 20°C to 60°C, which can be accomplished in situ without extreme heat generation processes. Steam heating has been used as a practical means to provide persulfate activation for in situ treatment.

Sulfate radicals may also be generated by one-electron oxidation reactions, such as with metals (C. Liang, 2001; FMC, 2001 and G. E. Hoag, 2000):

$$S_2O_8^{-2} \text{ or } {}^{-}O_4S\text{-}SO_4^{-} + M^{+n} \rightarrow SO_4\bullet^{-} + SO_4^{-2} + M^{+(n+1)}$$

Recently, new methods of persulfate reaction activation have been developed using: chelated metals, such as iron (II) ethylenediamine tetraacetic acid (FeEDTA), hydrogen peroxide addition, or an alkaline pH (P. Block, 2004). These new methods most likely also involve the generation of the sulfate radical and possibly the hydroxyl radical and related species for reaction with organic compounds.

Metal complex activation of persulfate has been effective in treating aromatics and chlorinated ethenes, but chlorinated ethanes and chlorinated methanes have proven to be somewhat resistant to persulfate with this form of activation (P. Block, 2004). The chemistry of peroxide activation of persulfate is not clearly understood and results with the reagent combination mixture seem to be promising.

Alkaline activation of persulfate has been shown to be most effective for the treatment of chlorinated ethane and chlorinated methane compounds. Alkaline activation uses a base such as sodium hydroxide to adjust initial pH in the range of 11 to 12.5. The alkaline conditions are typically neutralized during treatment by the generation of hydrogen sulfate anion (HSO_4^-), which is an acid. This occurs during natural decomposition of the persulfate reagent that is catalyzed by high pH and species present in the soil. The equation for the decomposition reaction is shown below.

$$S_2O_8^{-2} + H_2O \rightarrow 2HSO_4^{-} + \tfrac{1}{2}\,O_2$$

Testing results show that persulfate can be effective on recalcitrant organics. Specifically, persulfate has been shown to degrade BTEX, chlorinated ethenes, chlorinated ethanes and chlorinated methane compounds such as the methylene chloride detected at LHAAP-29 (C. Liang, 2001 and P. Block, 2004).

The persulfate reagent is very soluble in water to concentrations of 30 to 40 percent and the solutions are relatively stable especially at lower concentrations (1 to 10 percent). These properties allow for optimum delivery and distribution to the subsurface matrix without the solubility limitations encountered with potassium permanganate. The reagent is similar to permanganate with respect to safety issues (e.g., handling and reactivity); however, there are materials of compatibility consideration due primarily to the potential for low pH from persulfate reactions.

3.0 Treatability Study and Approach

Testing was conducted to evaluate activated persulfate oxidation for the treatment of methylene chloride in soil and groundwater slurries. The two activation methods tested were heat activation and alkaline activation.

4.0 Objectives

The objectives of the bench-scale treatability tests were the following:

- Evaluate treatment effectiveness of heat-activated persulfate and alkaline activated persulfate for destruction of methylene chloride in soil/groundwater slurries;
- Provide an estimate of the oxidant dosing requirements by measuring the soil oxidant demand (SOD);
- Measure the alkaline buffering capacity of the soil to determine the dose of caustic required to increase pH to above 10.5 for persulfate activation.

5.0 Experimental Design and Procedures

The experimental approach was as described below and entailed site soil preparation, characterization of test soils and groundwater, SOD tests, acid/base titration of site soil and reagent treatment effectiveness tests on soil and groundwater mixtures.

5.1 Treatability Study Sample Collection and Homogenization

Monitoring well 29WW16 is an intermediate zone well approximately 90 feet deep and contains an extremely high concentration of methylene chloride. Water from this well was collected for the treatability study to ensure that the water contained high concentrations of methylene chloride. The soil for the treatability study was collected during drilling for deep well 29WW40, from the same soil interval where 29WW16 is installed.

Soil and groundwater samples were received at the TDL on September 12 and September 22, 2006 respectively. The samples were shipped on ice and stored at the TDL at 4°C until used in treatability testing. Samples were identified as follows:

Client Sample ID	Type	Amount	TDL Lab #
29WW40	SOIL	5 KG	10762
29WW16	GW	10 × 1-LITER	10828

The samples of soil received for batch slurry testing were mixed manually in the plastic container to apparent homogeneity at 4°C in a manner to minimize volatile organic compounds (VOC) loss. The 10 liters of site groundwater collected were homogenized in a sterile chilled glass container. Samples were stored with zero headspace at 4°C prior to testing. The homogenized site groundwater and site soil was sampled for VOCs of concern using a modified EPA SW-846 Method 8015, which uses purge-and-trap gas chromatography with flame ionization detection methodology (GC/FID).

The soil sample was also analyzed for alkalinity/buffering capacity at the TDL using laboratory standard operating procedures (SOP). These measurements were used to determine the amount of base needed to adjust pH conditions of the alkaline activated test systems to desired values and were used to determine sodium hydroxide dose for SOD and treatment effectiveness tests.

5.2 Soil Oxidant Demand Testing

SOD tests were performed to measure the amount of oxidant consumed in the course of treatment to destroy the target VOCs. The amount and rate of oxidant consumption is used to determine oxidant dosing and reaction condition requirements for treatment. The soil composite was used to measure the SOD with alkaline activated persulfate. Tests were performed on soil/groundwater slurries containing 200 g of soil and 200 mL of groundwater in 500-mL polyethylene sample bottles. The soil sample was also analyzed for percent solids. Two SOD tests were set up: alkaline activated persulfate SOD by adding 10 g of sodium persulfate and 2 mL of 50% (by weight) sodium hydroxide solution, resulting in a starting concentration of 50 g/L sodium persulfate and 0.5% sodium hydroxide, and peroxide activated persulfate SOD with 50 g/L persulfate and 119 g/L hydrogen peroxide (molar ratio of persulfate to peroxide = 1:5). The test bottles were capped, placed onto a temperature controlled oscillating shaker table at 15ºC and mixed periodically for the duration of the test. The sodium persulfate concentration was measured on a weekly basis by titrating 0.5 mL aliquots of the sample following laboratory SOP. Another 5 g of sodium persulfate was added on day 12 when its concentration dropped to 6.045 g/L.

Periodically, a small portion of the liquid (0.5-1 mL) from each test was sampled for persulfate analysis to determine the amount of oxidant consumed as a function of time to define the consumption characteristics for each oxidant system. Because of the impact of pH on persulfate and the potential for a pH decrease during treatment resulting from persulfate degradation, the pH of the sample was also monitored every two to three days and more sodium hydroxide solution (50% by weight) was added when the pH dropped to below 10. Tests were monitored for about a 4 week time period using sample points of 5, 7, 9, 12, 14, 21, 29 and 36 days.

5.3 Oxidation Effectiveness Tests

Slurry tests using alkaline and/or heat activated persulfate were performed on site soil and groundwater mixtures. The bench scale testing designed to evaluate the two activation methods is described in detail below.

The test samples were prepared by mixing 100 g site soil and 150 mL groundwater in 210 mL test bottles. A small volume of headspace was left in each bottle to allow for slurry mixing. Initial characterization of site soil and groundwater indicated the methylene chloride concentration was 7 g/L in groundwater and non detectable in soil (10 μg/kg detection limit). The stoichiometric demand for 7 g/L methylene chloride oxidation is 42 g/L sodium persulfate. Considering the SOD, a persulfate dose of 50 g/L was used in this test. All test bottles were allowed to equilibrate overnight before adding any reagent. All bottles were hand mixed periodically at 24 to 72 hour intervals by gently turning each bottle end over end. Test bottles were temperature controlled at 15ºC for the test duration.

Alkaline activation

Four bottles were prepared for alkaline activated persulfate oxidation. One bottle was amended with 7.5 g sodium persulfate and 1.5 mL 50% sodium hydroxide, one bottle was amended with 1.5 mL 50% sodium hydroxide alone to serve as an alkaline control, and another two without any amendment to serve as initial and final time point controls.

At pre-determined sampling points, T-0 and T-14 days, the reaction was quenched by placing the test bottle in the refrigerator at ~4°C. The low temperature also helps to minimize the volatilization loss of VOC of concern. A portion of the water phase was transferred to 50 mL plastic vials for analysis for remaining persulfate and pH. Both the soil and groundwater phases were sampled for VOC analysis. The soil phase was also analyzed for moisture content. **Table 5-1** below describes the slurry batch tests and sampling schedule.

Table 5-1

Alkaline-Activated Persulfate Oxidation Batch Test Experimental Details

Test	Sodium persulfate conc. (g/L)	Temperature (°C)	Sample Points (Days)		Soil (g)	Water (ml)	Sodium persulfate (g)	50% Sodium hydroxide (mL)
			T-0	T-14				
C	0	15	X	X	100	150	0	0
CB	0	15		X	100	150	0	1.5
B	50	15		X	100	150	7.5	1.5

Heat activated persulfate oxidation at 60°C

Three bottles (2 sampling points and one control) were prepared for heat activated persulfate oxidation at 60°C. Two of them were amended with 7.5 g sodium persulfate to result in a nominal concentration of 50 g/L. The third had no amendment to serve as a heated control. All three test bottles were placed in the oven set at 60°C. The temperature inside the oven was monitored on a daily base and it varied between 59°C and 61°C.

Once the pre-determined treatment time had elapsed, the test bottle(s) was placed in the refrigerator at ~4°C to quench the persulfate reaction. The sample was then prepared for analyses as detailed above for the alkaline activation tests. **Table 5-2** below describes the slurry batch tests and sampling schedule for the heat activated tests.

Table 5-2

Heat-Activated Persulfate Oxidation (60°C) Batch Test Experimental Details

Test	Sodium persulfate conc. (g/L)	Temperature (°C)	Sample Points (Days)		Soil (g)	Water (ml)	Sodium persulfate (g)
			T-7	T-14			
CH	0	60		X	100	150	
H	50	60	X	X	100	150	7.5

Heat and alkaline activated persulfate oxidation at 40°C

The above two treatment options were not very successful in oxidizing the methylene chloride in groundwater. Therefore, another batch of tests was setup to evaluate the combined persulfate activation methods of heat and alkaline. However, to reduce the rate of persulfate degradation, in an attempt to increase the persulfate radical longevity, the heat was reduced from 60°C to 40°C. Four bottles were prepared in this batch, one was set at room temperature to serve as a control without amendments to monitor volatilization loss, one heated control was setup without amendment to monitor if heat accelerated the loss of methylene chloride, and the remaining two bottles were established for heat activated persulfate with alkaline catalysts of sodium phosphate (Na_3PO_4) and sodium hydroxide, respectively. The two treated samples were amended with 9.0 g sodium persulfate to result in a nominal concentration of 60 g/L. Sodium phosphate was added to get a concentration of 62 g/L. For sodium hydroxide activation, the dose was double that of the previous batch by adding 3 mL of 50% sodium hydroxide solution to get a concentration of 15 g/L (density of 50% sodium hydroxide is 1.5 g/mL). The doses of both alkaline catalysts were equal to the stoichiometric demand to neutralize the protons released from the degradation of 60 g/L sodium persulfate. The heated control and the two treated samples were placed in an incubator set at 40°C.

The sampling point for all tests in this batch was 7 days. After 7 days, all the test bottles were placed in the refrigerator at ~4°C to quench the persulfate reaction. The samples were then prepared for analyses as detailed above for the alkaline activation tests. **Table 5-3** below describes the slurry batch tests and sampling schedule for the heat and alkaline activated tests.

Table 5-3
Heat and Alkaline Activated Persulfate Oxidation (40°C) Batch Test Experimental Details

Test	Sodium persulfate conc. (g/L)	Temperature (°C)	Sampling point	Soil (g)	Water (ml)	Sodium persulfate (g)	Alkaline catalyst
			7 days				
C-7	0	22	X	100	150	0	NA
CH-7	0	40	X	100	150	0	NA
PP-7	60	40	X	100	150	9	21.6 g $Na_3PO_4 \cdot 12H_2O$
PH-7	60	40	X	100	150	9	3 mL 50% NaOH

6.0 Results

6.1 Sample Characterization Results

Results from the VOC analyses of site soil and groundwater sample composites determined there was 7,113 mg/L (~7 g/L) methylene chloride in the groundwater and non-detectable VOCs in soil, which is consistent with the previously reported contaminant levels. Soil buffering capacity test indicated sodium hydroxide dose of 120 milli-equivalents (meq) per kg soil increased the pH of the soil/groundwater slurry to 11.46. A sodium hydroxide dose of 125 meq per kg soil was used in the alkaline activated SOD and treatment effectiveness tests. Measurement data for the soil buffering capacity are included in **Attachment 1**.

6.2 Soil Oxidant Demand Results

Results from the SOD tests are tabulated below in **Table 6-1** and included in **Attachment 2**. The value given is the total grams of persulfate consumed per kilogram of wet soil.

The SOD tests indicated rapid oxidant consumption. On day 12, the persulfate concentration in the alkaline-activated sample dropped from the initial 41.3 g/L to 6.05 g/L. The sample was then redosed with another 5 g of persulfate. As measured on day 36, the SOD was 54.7 g persulfate per kg of wet soil.

Table 6-1

Summary of Persulfate Consumption Rates in SOD Tests

Test	**Description**[a]	**Oxidant consumption** **g oxidant / kg wet soil**
Alkaline activation	50 g/l persulfate + 50 g/L sodium hydroxide	54.7[b]
Peroxide activation	50 g/L persulfate + 119 g/L hydrogen peroxide	> 50[c]

[a] Both tests in 200 g soil composite: 200 mL GW;

[b] Based on measurement on day 29;

[c] based on measurement on day 6 when no persulfate was detected in the sample and this sample was terminated.

The pH behavior from the persulfate tests is typically characterized by a shift to low pH over time. This is caused by the acid product from persulfate decomposition and the low site soil buffering capacity. This is particularly of concern in alkaline-activated persulfate oxidation. The pH of the alkaline-activated sample dropped to 7.22 on day 7, so 2 mL of 50% sodium hydroxide solution was added to increase the pH. Sodium hydroxide was again re-dosed on day 9 and day 28 by adding 1 mL 50% sodium hydroxide. This is consistent with the high persulfate SOD, which produces protons and lowers the pH of the system.

A SOD sample with hydrogen peroxide activated persulfate was set up with 50 g/L persulfate and 119 g/L hydrogen peroxide (molar ratio of persulfate to peroxide = 1:5). The persulfate was depleted to non-detectable levels (detection limit 30 mg/L) on day 6 and the pH dropped to 2.44, due to the rapid decomposition of persulfate with the presence of peroxide. As a result, this activation option was eliminated in the subsequent treatment effectiveness test. Nevertheless, this SOD sample was analyzed for methylene chloride and inorganic anions and the results were discussed in this report.

6.3 Batch Slurry Test Results

The analytical results are summarized below in **Table 6-2**. Initial sample characterization indicated that the percent solids on the site soil composite was 79.0%, and that methylene chloride concentration was 7,113 mg/L in the groundwater composite, and 56.2 µg/kg in the soil composite. The methylene chloride concentration measured in the initial baseline control sample decreased to 5,611 mg/L, probably due to systematic loss during test set up and sampling procedure. This value was used as the initial methylene chloride level to calculate the treatment efficiency.

Table 6-2
Analytical Results of Methylene Chloride Treatment Effectiveness Tests

Treatment	Sample ID	Chloride mg/L	Sulfate mg/L	Persulfate mg/L	pH	Methylene chloride	
						water mg/L	dry soil mg/kg
0 day control	**C-0**				8.05	5611	0
14 days control	**C-14**	217.5	290.27	0	7.92	4133	0
14 days base control	**CB-14**	221.72	81.06	0	12.58	5762	0
14 days base-activated persulfate	**B-14**	284.72	17408.72	16,452	9.22*	5279	0
14 days heated control	**CH-14**	274.2	40.43	0	7.25	90.1	0
7 days heat activated persulfate	**H-7**	1274.63	29221.23	<20	2.02	24.2	0
14 days heat-activated persulfate	**H-14**	1303.91	23910.68	<20	2.59	46.6	0
6 days, peroxide-activated persulfate	**P-6**	763.16	28001.11	<20	2.44	622	0

* 1 mL 50% sodium hydroxide added on day 6.

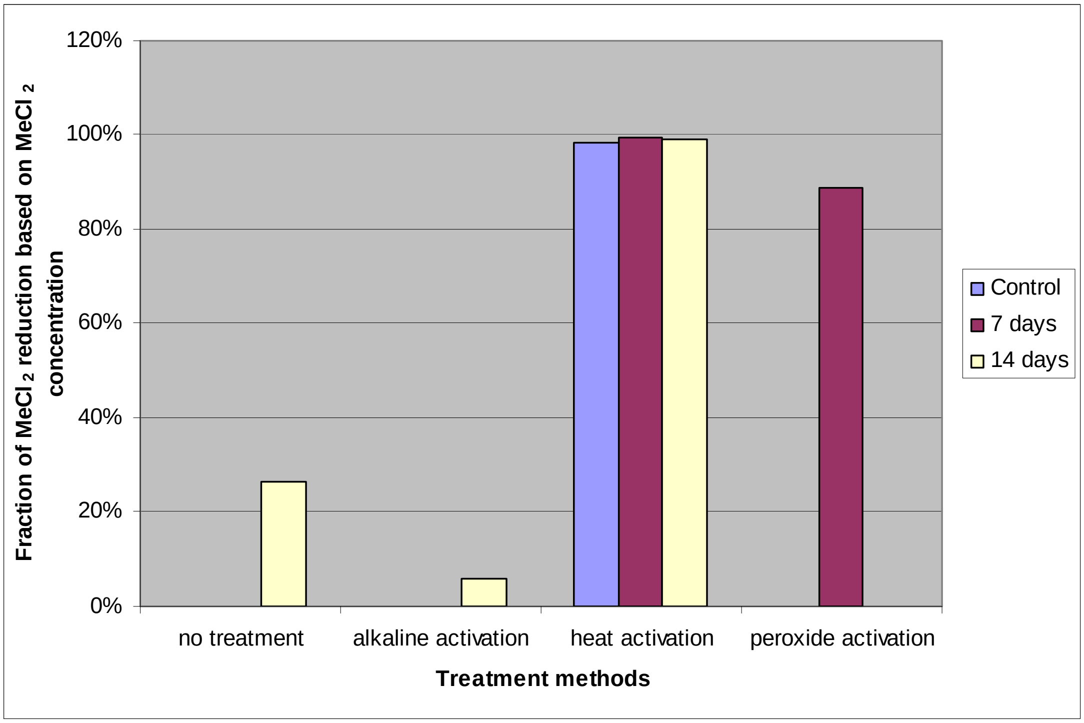


Figure 6-1. Methylene chloride ($MeCl_2$) reductions with different treatment methods, based on $MeCl_2$ concentrations

Figure 6-1 presents a plot of the methylene chloride reduction based on methylene chloride measured at the end of each test. The 14 days control (C-14) sample had 4,133 mg/L methylene chloride, indicating a 26% loss compared to the 0 day control, possibly due to volatilization, hydrolysis, or intrinsic biodegradation.

Heat Activation at 60°C

The heat activated persulfate samples had very low pH (2.02 for 7 days sample H-7, and 2.59 for 14 days sample H-14) due to the rapid decomposition of persulfate. Correspondingly, persulfate concentration dropped to below the detection limit (20 mg/L) at the end of each test. Methylene chloride concentrations decreased to less than 1% of the initial level both for 7 days and 14 days treatment. However, the heated control (CH-14) also showed 98% reduction of methylene chloride. So the decrease in methylene chloride concentration in H-7 and H-14 are due to volatilization loss as well as oxidation by persulfate. To differentiate the oxidation from volatilization loss, one of the oxidation products from methylene chloride, chloride ion, was used as the indicator. **Figure 6-2** presents a plot of the methylene chloride reduction for different treatment methods based on chloride concentrations. This figure indicates that with heat activated persulfate, approximately 23% of the methylene chloride was oxidized to chloride within either 7 days or 14 days of treatment. The heated control (CH-14) also showed a slight increase in chloride concentrations (5%), probably due to accelerated hydrolysis of methylene chloride at the elevated temperatures.

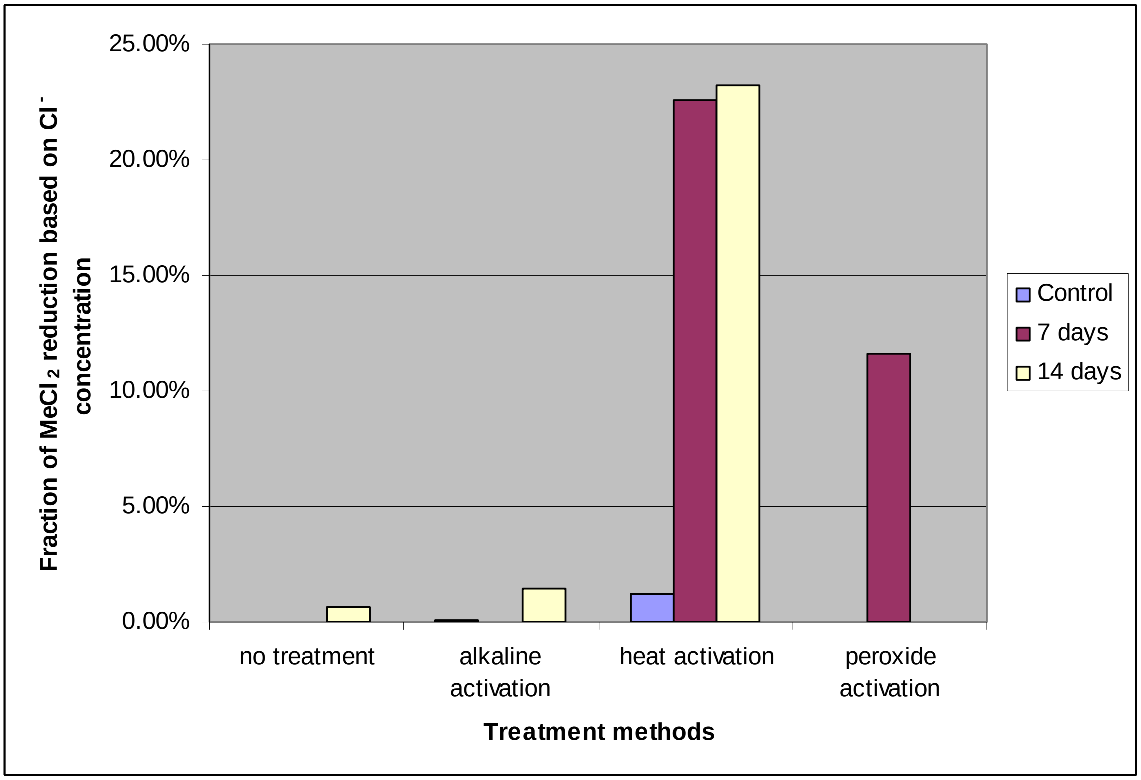


Figure 6-2. Methylene chloride ($MeCl_2$) reduction with different treatment methods, based on chloride (Cl^-) concentration

Alkaline Activation

The pH of the alkaline activated persulfate oxidation sample (B-14) was 11.38 on day 4, and 1 mL 50% sodium hydroxide was added when the pH dropped to 8.35 on day 6. The pH was then increased to 12.68 as measured on day 11, but dropped to 9.22 on day 14 at the end of test. This treatment resulted in a 6% reduction in methylene chloride concentration. The persulfate concentration at the end of test was 16.45 g/L, which is not too low to treat the contaminant. Therefore the possible reasons for the failure of significant treatment efficiency are: 1) low pH. As stated above, the pH of the sample dropped dramatically due to reaction between persulfate and methylene chloride, and the alkaline activation requires a pH above 10.5. 2) Recalcitrance of methylene chloride to alkaline-activated persulfate oxidation, or slow reaction kinetics. Chloride analysis showed there was 63 mg/L more chloride in B-14 than in C-14, which translates to 1.44% reduction of methylene chloride. This indicates that oxidation of methylene chloride did occur in B-14, but just at a too slow rate to show significant reduction within the time frame tested.

The 14 days base control (CB-14) which was amended with sodium hydroxide showed slightly increased methylene chloride concentration (5,762 mg/L), indicating the systematic losses are minimal (plotted as 0% reduction on **Figure 6-1**). The pH of this alkaline control was 12.70 on day 4, and dropped slightly to 12.58 on day 14.

Peroxide Activation

The peroxide activated persulfate SOD sample was also analyzed for inorganic anions and methylene chloride and the results were plotted in **Figure 6-1** and **Figure 6-2**. It showed 89% reduction by looking at methylene chloride concentrations, and 12% reduction based on chloride concentrations, and the pH of the sample was 2.44 on day 6 when the test was terminated.

Alkaline and Heat Activation at 40°C

The above test results indicated that alkaline or peroxide activation was not effective on methylene chloride contamination, and that heat activation alone resulted in a too acidic condition and short longevity of persulfate. So an additional batch of test was performed with combined heat and alkaline activation. The temperature of heat activation was also lowered to 40°C to increase the longevity of persulfate and mitigate volatilization loss of methylene chloride.

Table 6-3

Analytical Results of Heat and Alkaline Activated Persulfate Oxidation Tests

Treatment	sample ID	Cl-, mg/L	Sulfate, mg/L	persulfate, mg/L	pH	Methylene chloride (mg/L)
7 day room temperature control	**C-7**	235.23	49.76	NA	7.72	5458
7 day heated control	**CH-7**	233.47	63.47	NA	7.59	5338
Phosphate activated persulfate	**PP-7**	1385.57	33402.34	7,854	7.55	4039
hydroxide activated persulfate	**PH-7**	2435.19	49672.46	12,733	6.39	3382

The analytical results (**Table 6-3**) showed that the volatilization loss of methylene chloride at 40°C heated condition was negligible (2.2% relative to the control at room temperature), and the decomposition rate of persulfate was much slower compared to 60°C, as there were 13% and 21% of the original persulfate left after 7 days in the phosphate activated (PP-7) and hydroxide activated (PH-7) persulfate samples, respectively.

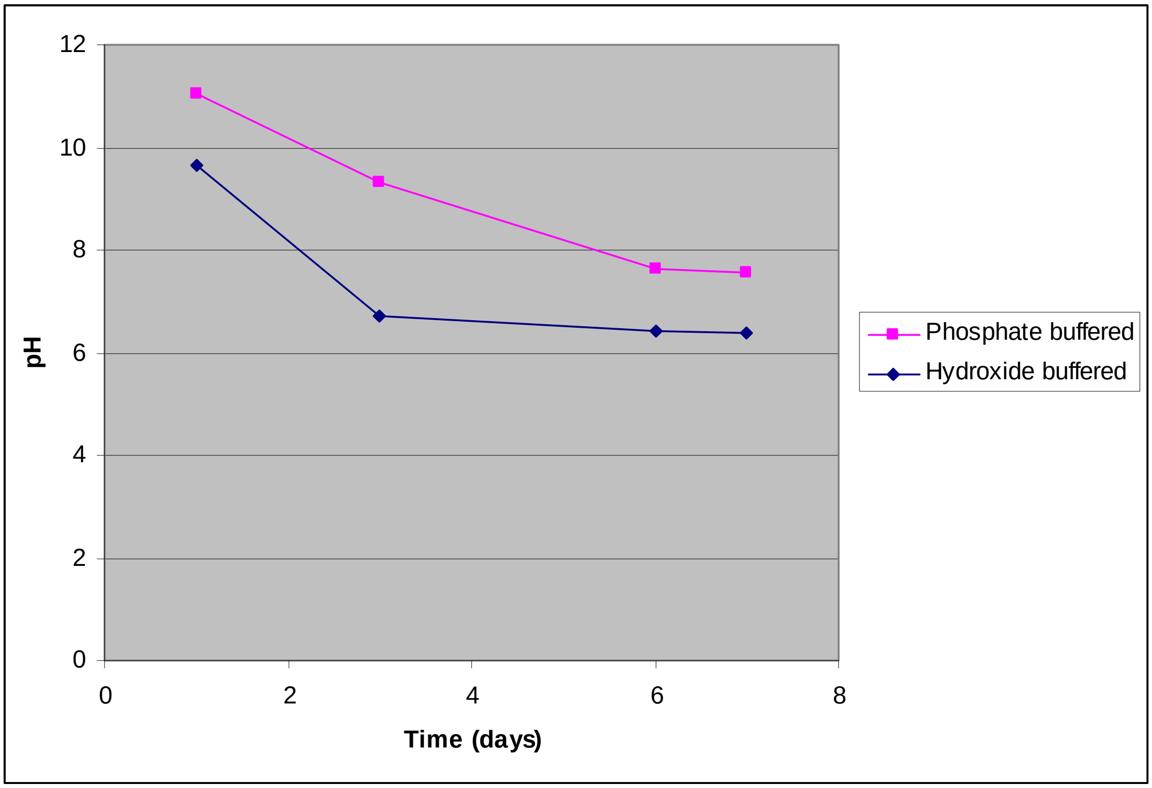


Figure 6-3. pH change over time in heat and alkaline activated persulfate oxidation tests

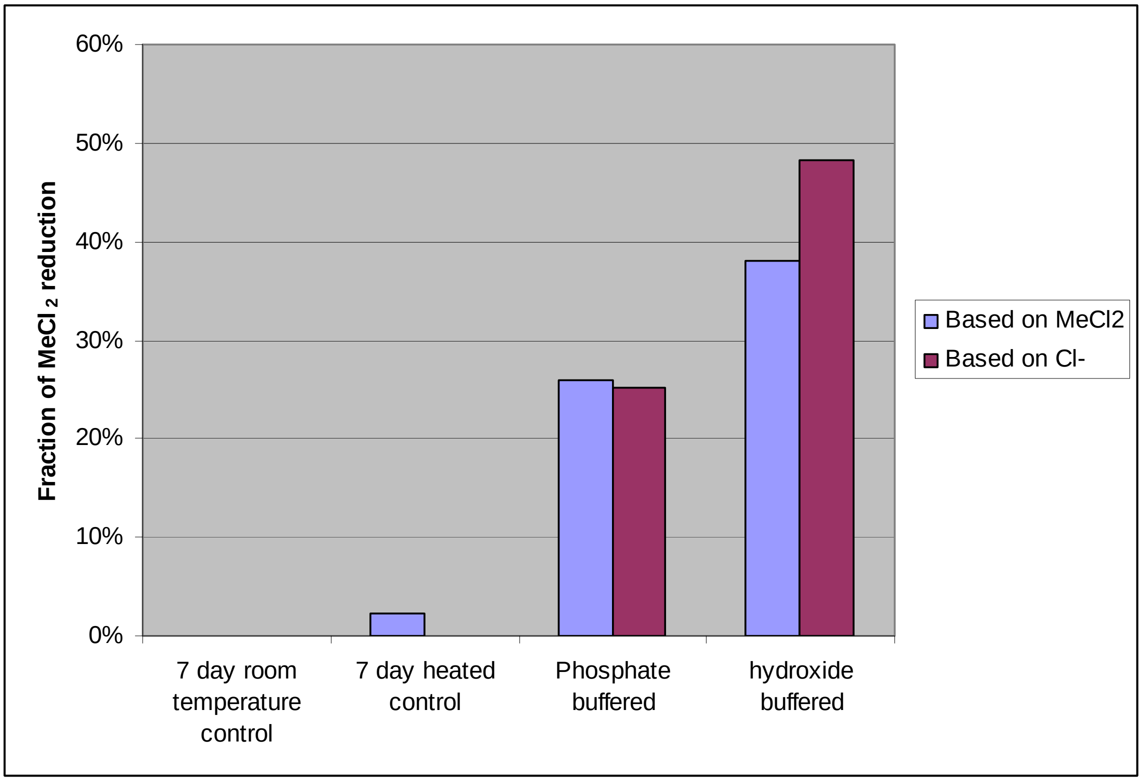


Figure 6-4. Methylene chloride reduction with heat and alkaline activated persulfate oxidation, based on methylene chloride analysis and chloride ion analysis.

Figure 6-3 indicated the pH dropped over time in hydroxide activated and phosphate activated samples. Apparently phosphate performed better as a pH buffering reagent since the pH in phosphate activated treatment was always higher than that of the hydroxide activated. However, the treatment efficiency was not positively correlated with the pH buffering capacity, as hydroxide activated persulfate treatment achieved 48% methylene chloride removal compared to 26% removal of phosphate activated. More importantly, treatment efficiency calculated based on chloride analysis showed similar results, indicating the removal of methylene chloride is through oxidation to carbon dioxide and chloride, rather than volatilization.

7.0 Conclusions and Recommendations

This treatability study determined that alkaline activated persulfate did not result in significant reduction of methylene chloride found at the Longhorn site within 14 days. Heat activated persulfate treatment at 60°C achieved 99% reduction of methylene chloride concentration. However, the majority of this reduction was due to volatilization loss, and oxidation accounted for no more than one fourth of this reduction. The treatment efficiency of peroxide activated persulfate was moderate with 89% reduction of methylene chloride concentration, but only a 12% reduction due to oxidation when considering chloride concentrations. The peroxide activation also resulted in rapid loss of oxidants, which would limit treatment effectiveness.

Combined heat at 40°C and alkaline activated persulfate oxidation appear to be the best treatment option for methylene chloride at the Longhorn site. Two alkaline catalysts were tested, phosphate and hydroxide. Between two of the alkaline catalysts tested, the hydroxide buffered treatment achieved more removal of methylene chloride through oxidation. The hydroxide removed 48% of methylene chloride through oxidation whereas phosphate removed 26% in 7 days. The dosage of 60 g/L persulfate and 15 g/L sodium hydroxide is recommended for the site. A lower temperature of heat activation, 40°C instead of 60°C, is recommended as it minimized the volatilization of methylene chloride and extended the longevity of persulfate. However, re-dosing of both persulfate and alkaline catalyst will likely be necessary after 7 to 10 days, as the pH dropped to neutral, and more than 80% of persulfate was consumed in 7 days in the test samples. The rate of persulfate and caustic consumption is expected to decrease upon subsequent treatment, due to depletion of methylene chloride reactant and natural oxidant demand.

8.0 References

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Attachment 1

Soil Alkalinity Measurement Data

Project/No.: Long Horn/117591

Date: 9/27/2006

Sample: TDL 10762

Reagent/G.W.: TDL 10828

Sample Wt. (g): 100

Water Volume (mL): 150

Base Reagent/Conc.: NaOH 1 N

Initials: XZ

Reading No.	Time	Base Add'n (mL)	Total Vol Base (mL)	pH	Base meq. per kg Soil		Comments
1		0	0	8.03	0.00		
2		2.6	2.6	10.06	26.00		
3		0.4	3	10.19	30.00		
4		0.5	3.5	10.3	35.00		
5		0.5	4	10.5	40.00		
6		1	5	10.73	50.00		
7		1	6	11	60.00		
8		1	7	11.15	70.00		Slurry appears to be thickened
9		1	8	11.35	80.00		
10		1	9	11.35	90.00		
11		1	10	11.39	100.00		
12		1	11	11.42	110.00		,
13		1	12	11.46	120.00		
14							
15							
16							
17							
18							
19							
20							
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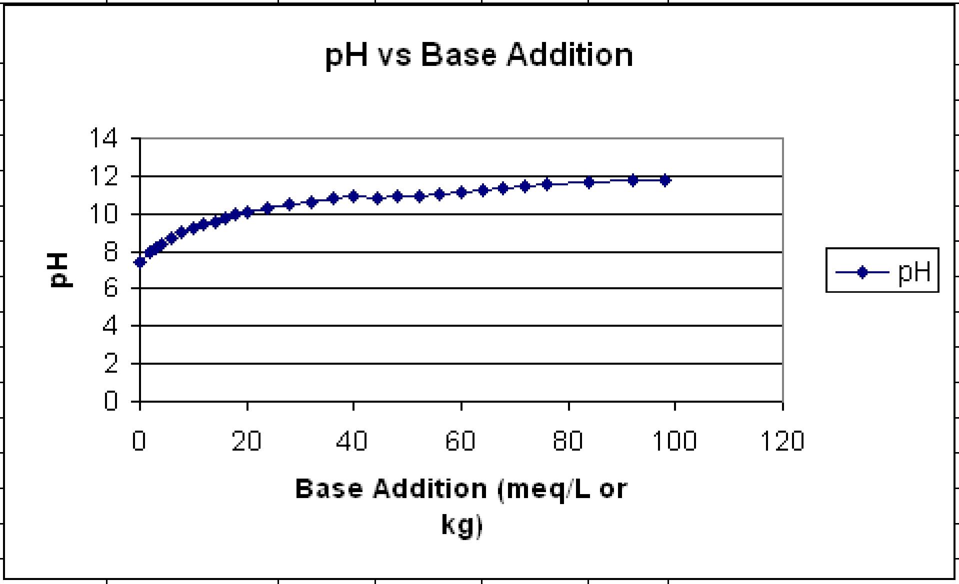


Notes:

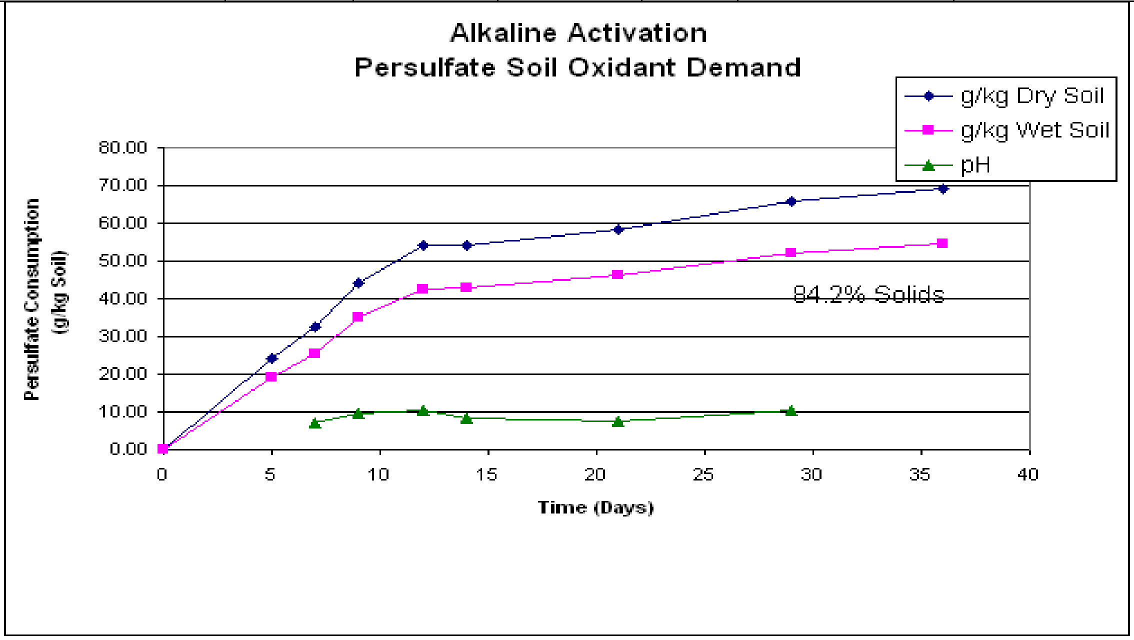
Attachment 2

Soil Oxidant Demand Test Data

Project Name:	Long Horn	Date Started:	9/27/2006
Project Number:	117591.0006A200	Analyst Initials:	XZ
Client Sample No. (Soil):	29WW40	Client Sample No. (Water):	29WW16
Description:	Silty soil, dark grey	Description:	Groundwater, smells solvent
TAL Sample No.:	10762	TAL Sample No.:	10828
Solids (%):	79.00%	Volume Used (mL):	200
Fraction -4 mm particle size :	NA		
Weight Used (g):	200	Initial Weight $Na_2S_2O_8$ (g):	10.00
Test Temp (°C)	15	Initial Conc. $Na_2S_2O_8$ (mg/L):	50,000

NaOH at 0.5%

Time (Days)	Persulfate Conc. (mg/L)	Persulfate Addition (g)	Total persulfate Added (g)	pH (SI)	Persulfate Consumed (g/kg Dry Soil)	Persulfate Consumed (g/kg Wet Soil)
0	41,322	0.0	10.00		0.00	0.00
5	25,466	0.0	10.00		24.29	19.19
7	20,230	0.0	10.00	7.22	32.31	25.52
9	12,376	0.0	10.00	9.4	44.34	35.03
12	6,045	0.0	10.00	10.36	54.03	42.69
14	26,537	5.0	15.00	8.4	54.29	42.89
21	23,847	0.0	15.00	7.67	58.41	46.15
29	19,040	0.0	15.00	10.32	65.77	51.96
36	16,779	0.0	15.00	9.06	69.24	54.70



Notes:	NaOH was redosed with 50% NaOH solution as following:
	2 mL on day 7,
	1 mL on day 9,
	1 mL on day 28.

Attachment 4

Groundwater Sampling Forms

GROUNDWATER SAMPLING FORM

Sheet 1 of 2

TREATABILITY SAMPLE

Operable Unit/Site ID: 29WW16
Project Name/#: 117591
Weather: Clear 70's to 80's
Sampling location ID: 29WW16
Sample ID: 29WW16
Collection Time/Date: 9/21/06

Pump Installation

Pump installation crew: A. Willmore / A. Gilchrist / C. Mabe
PID/FID reading (well head/background): 0.0
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 90.41
Initial (pre-installation) DTW/time: 44.14 btoc
Final (after pump priming) DTW/time:
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL):
Discharge tube length (ft.): ~100'
Installation date/beginning time: 9/21/06
Installation date/completion time: 9/21/06
Screen Interval (ft. BTOC): 80.41 to 90.41
Pump intake depth (ft BTOC): 85
Post-Installation DTW/time:
Max. sustainable pump rate (mL/min): 170
Appearance of product: none
Discharge tube diameter (3/8" or 1/4"): 1/4"
Inlet reducer used (Y/N): N

Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = 50 psi

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

Purging

Purging/sampling crew: A. Willmore / A. Gilchrist / C. Mabe
Purge date/beginning time: 9/21/06
Initial (pre-purging) DTW (ft. BTOC):
Calculated tubing + pump volume: NA
PID/FID reading (well head/background): 0.0
Purge date/completion time: 9/21/06
Final (post-purging) DTW (ft. BTOC):
No. of tubing + pump volumes purged:

Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = 50 psi

	Initial	2	3	4	5	6	7	8	Final
Pressure (psi)	50	45	50						50
Refill Setting	11	10	11						11
Discharge Setting	4	5	4						4
Flow rate (mL/min)	156	120	170						170

Water Quality Parameter Measurements

Time	DTW (ft. BTOC)	Purge Rate (mL/min)	Cumulative Volume Purged (L)	Temp. (degree C)	Electrical Conductivity mS/cm ~~(uMhos/cm)~~	pH	Eh (mv)	DO (mg/L)	Turbidity (NTU)
09:48	44.32	170	850	19.53	1.519	7.04	-72.1	0.71	1.7
09:53	44.32	180	1700	19.42	1.503	7.04	-85.6	0.69	1.3
09:58	44.32	170	2550	19.31	1.490	7.04	-91.3	0.51	1.2
10:03	44.32	170	3400	19.21	1.482	7.03	-96.1	0.80 0.99	0.5
10:08	44.32	170	42.5	19.16	1.479	7.02	-99.4	~~99.4~~	0.3
10:13	44.32	170	49.0	19.09	1.481	7.03	-103.2	0.77	0.2
10:18	44.32	170	57.5	19.36	1.489	7.05	-99.7	0.78	0.1

00091656

GROUNDWATER SAMPLING FORM

Sheet 2 of 2

Water Quality Parameter Measurements (continued)

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)
				±10%	±3%	±0.1	±10	±10%	±10%

10-[illegible] / 20

9/21/06

Sampling

Sampling beginning time: 10:30

Sampling completion time: 11:30

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)
1140	44.32	170	~120	19.39	1.491	7.04	~100.1	0.72	0.1

Sample Information

Sample ID: 12WW.16

Duplicate sample collected (Y/N): No

Split sample collected (Y/N): No

COC No(s):

Sample collection date/time: 9/21/06

Duplicate sample ID: None

Split sample ID: Non

Requested Analysis	Method	Containers	Requested Analysis	Method	Containers
Bacteria		~~Bacteria~~ 10-1 Liter			
VOCs		3-40mL VOAs Ambers			

Comments:

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

Shaw

GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: 29ww35
Project Name/#: Longhorn 117591
Weather: clear 80's
Sampling location ID: 29WW35
Sample ID: 29WW35
Collection Time/Date: 9/26/06

Pump Installation

Pump installation crew: A. Gilchrist J. Rodriguez
PID/FID reading (well head/background): 0.0
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 98.32
Initial (pre-installation) DTW/time: 41.20 0848
Final (after pump priming) DTW/time:
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL):
Discharge tube length (ft.): ~110'
Installation date/beginning time: 9/26/06
Installation date/completion time: 9/26/06
Screen Interval (ft. BTOC): 88 to 98
Pump intake depth (ft BTOC): 93'
Post-installation DTW/time: 41.25 0920
Max. sustainable pump rate (mL/min): 270
Appearance of product: None
Discharge tube diameter (3/8" or 1/4"): 1/4"
Inlet reducer used (Y/N): N

Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = 55 psi

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

Purging

Purging/sampling crew: A. Gilchrist J. Rodriguez
Purge date/beginning time: 9/26/06
Initial (pre-purging) DTW (ft. BTOC):
Calculated tubing + pump volume: NA
PID/FID reading (well head/background): 0.0
Purge date/completion time: 9/26/06
Final (post-purging) DTW (ft. BTOC):
No. of tubing + pump volumes purged:

Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = 55 psi

	Initial	2	3	4	5	6	7	8	Final
Pressure (psi)	55								55
Refill Setting	10								10
Discharge Setting	5								5
Flow rate (mL/min)	280								280

Water Quality Parameter Measurements

Time	DTW (ft. BTOC)	Purge Rate (mL/min)	Cumulative Volume Purged (L)	Temp. (degree C)	Electrical Conductivity mS/cm^c ~~(uMhos/cm)~~	pH	Eh (mv)	DO (mg/L)	Turbidity (NTU)
0955	41.82	280	1.25	20.62	1.07	9.46		7.19	4.5
1000	41.80	280	1.80	20.65	1.04	9.29		7.92	1.7
1005	41.84	280	2.0	20.69	1.03	9.25		9.41	2.3
1010	41.85	280	2.5	20.72	1.02	9.03		10.47	0
1015	41.86	280	2.7	20.8	1.01	8.98		10.76	0
1020	41.86	280	3	20.85	1.01	8.95		12.36	0
1025	41.86	280	3.4	20.89	1.0	8.92		11.68	0
1030	41.86	280	3.7	20.98	1.0	8.89		13.28	0

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GROUNDWATER SAMPLING FORM

Sheet 2 of 2

Water Quality Parameter Measurements (continued)

Time	DTW (ft. BTOC)	Purge Rate (mL/min)	Cumulative Volume Purged (L)	Temp. (degree C) ±10%	±3% Electrical Conductivity mS/cm ~~(uMhos/cm)~~	pH ±0.1	Eh (mv) ±10	DO (mg/L) ±10%	Turbidity (NTU) ±10%
10:35	41.87	280	4.0	21.08	1.0	8.86		13.46	0
10:40	41.86	280	4.2	21.19	1.0	8.85		13.27	0

10-
20

Sampling

Sampling beginning time: 1041

Sampling completion time: 10:45

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)
1045	41.86	280	4.5	21.37	1.0	8.36		12.76	0

Sample Information

Sample ID: 29WW35

Duplicate sample collected (Y/N):

Split sample collected (Y/N):

COC No(s):

Sample collection date/time: 1045 9/26/06

Duplicate sample ID:

Split sample ID:

Requested Analysis	Method	Containers	Requested Analysis	Method	Containers
VOC's	8260	3 Voa Containers			

Comments:

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

00091659

1084

GROUNDWATER SAMPLING FORM

Sheet 1 of 1

Operable Unit/Site ID: ~~LHAAP-36~~ LHAAP
Project Name/#: Longhorn 117591
Weather: Clear 80's

Sampling location ID: 29WW 36
Sample ID: 29WW 36
Collection Time/Date: 0955 9/22/06

Pump Installation

Pump installation crew: C. Mabe, A. Gilchrist
PID/FID reading (well head/background): 0.0
Casing diameter (inches): 4
Total well Depth (ft. BTOC): 36.70
Initial (pre-installation) DTW/time: 28.50
Final (after pump priming) DTW/time:
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL):
Discharge tube length (ft.): ~45'

Installation date/beginning time: 9/22/06
Installation date/completion time: 9/22/06
Screen Interval (ft. BTOC): 26.7 to 36.7
Pump intake depth (ft BTOC): 31.7
Post-installation DTW/time: 28.5
Max. sustainable pump rate (mL/min): 230
Appearance of product: none
Discharge tube diameter (3/8" or 1/4"): 1/4"
Inlet reducer used (Y/N): N

Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = 50 psi

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

Purging

Purging/sampling crew: C. Mabe, A. Gilchrist
Purge date/beginning time: 9/22/06
Initial (pre-purging) DTW (ft. BTOC):
Calculated tubing + pump volume: NA

PID/FID reading (well head/background): 0.0
Purge date/completion time: 9/22/06
Final (post-purging) DTW (ft. BTOC):
No. of tubing + pump volumes purged:

Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = 50 psi

	Initial	2	3	4	5	6	7	8	Final
Pressure (psi)	50								50
Refill Setting	10								10
Discharge Setting	5								5
Flow rate (mL/min)	230								230

Water Quality Parameter Measurements

Time 920	DTW (ft. BTOC)	Purge Rate (mL/min)	Cumulative Volume Purged (L)	Temp. (degree C)	Electrical Conductivity ~~(uMhos/cm)~~ mS/cm	pH	Eh (mv)	DO (mg/L)	Turbidity (NTU)
920	28.98	230	2.0	20.47	~~5.37~~ 5.37	6.73		7.44	1.0
930	29.55	230	2.5	19.9	5.378	6.63		7.5	0
940	29.71	230	3.75	19.96	5.343	6.61		7.27	0
945	29.91	230	4.5	20.13	5.392	6.6		7.36	0
950	29.89	230	6.0	20.07	5.365	6.58		7.34	0

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GROUNDWATER SAMPLING FORM

Sheet ___ of 2

Water Quality Parameter Measurements (continued)

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

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Sampling

Sampling beginning time: 950

Sampling completion time: 1000

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)
955	29.89	230	6.3	20.09	5.38	6.58		7.35	0

Sample Information

Sample ID: 29WW36

Duplicate sample collected (Y/N): ______

Split sample collected (Y/N): ______

COC No(s): ______

Sample collection date/time: 0955 9/22/06

Duplicate sample ID: ______

Split sample ID: ______

Requested Analysis	Method	Containers	Requested Analysis	Method	Containers
VOC's	8260	3 voa containers			

Comments:

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

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GROUNDWATER SAMPLING FORM

Sheet 1 of ___

Operable Unit/Site ID: LHAAP -29
Project Name/#: Longhorn 117591
Weather: clear 80's
Sampling location ID: 29WW37
Sample ID: 29WW37
Collection Time/Date: 9/22/06

Pump Installation

Pump installation crew: A.Gilchrist C.Mabe
PID/FID reading (well head/background): 0.0
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 95.15
Initial (pre-installation) DTW/time: 48.55
Final (after pump priming) DTW/time:
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL):
Discharge tube length (ft.): ~105'
Installation date/beginning time: 9/22/06
Installation date/completion time: 9/22/06
Screen Interval (ft. BTOC): 85.15 to 95.15
Pump intake depth (ft BTOC): 90.15
Post-installation DTW/time: 48.55
Max. sustainable pump rate (mL/min): 110
Appearance of product: none
Discharge tube diameter (3/8" or 1/4"): 1/4"
Inlet reducer used (Y/N): N

Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = 55 psi

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

Purging

Purging/sampling crew: A.Gilchrist C.Mabe
Purge date/beginning time: 9/22/06
Initial (pre-purging) DTW (ft. BTOC):
Calculated tubing + pump volume: NA
PID/FID reading (well head/background): 0.0
Purge date/completion time: 9/22/06
Final (post-purging) DTW (ft. BTOC):
No. of tubing + pump volumes purged:

Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = 55 psi

	Initial	2	3	4	5	6	7	8	Final
Pressure (psi)	55								55
Refill Setting	10								10
Discharge Setting	5								5
Flow rate (mL/min)	110								110

Water Quality Parameter Measurements

Time	DTW (ft. BTOC)	Purge Rate (mL/min)	Cumulative Volume Purged (L)	Temp. (degree C)	Electrical Conductivity ~~(uMhos/cm)~~ mS/cm	pH	Eh (mv)	DO (mg/L)	Turbidity (NTU)
1100	49.0	110	1.110	21.31	1.04	11.14		5.37	0
1105	49.12	110	3.22	21.59	1.017	11.10		4.71	0
1110	49.20	110	5.33	21.65	1.011	11.09		4.62	0
1115	49.23	110	7.44	21.6	.976	11.02		5.21	2.70
1120	49.22	110	9.55	21.62	.962	10.95		5.09	0
1125	49.26	110	10.88	21.73	.946	10.86		4.79	0
1130	49.35	110	11.5	21.7	.944	10.79		4.7	0
1135	49.33	110	13.[illegible]	21.66	.945	10.73		4.64	0

GROUNDWATER SAMPLING FORM

Sheet 2 of 2

Water Quality Parameter Measurements (continued)

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

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9/22/06

Sampling

Sampling beginning time: 1035

Sampling completion time: 1140

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)
1040	49.34	110	~3.25g	21.68	.945	10.74		4.63	0

Sample Information

Sample ID: 29WW37

Sample collection date/time: 9/22/06 1040

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
VOC's	8260	3 voa containers			

Comments:

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

Shaw

GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: 29WW38
Project Name/#: Longhorn 117591
Weather: clear 80's
Sampling location ID: 29WW38
Sample ID: 29WW38
Collection Time/Date: 10:42 9/23/06

Pump Installation

Pump installation crew: A Gilchrist J Rodriguez
PID/FID reading (well head/background): 0.0
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 45.3
Initial (pre-installation) DTW/time: 30.72'
Final (after pump priming) DTW/time:
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL):
Discharge tube length (ft.): ~55'
Installation date/beginning time: 9/23/06 0800
Installation date/completion time:
Screen Interval (ft. BTOC): 45 to 35
Pump intake depth (ft BTOC): 40'
Post-installation DTW/time:
Max. sustainable pump rate (mL/min): 100
Appearance of product: none
Discharge tube diameter (3/8" or 1/4"): 1/4"
Inlet reducer used (Y/N): N

Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = 20 psi

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

Purging

Purging/sampling crew: A Gilchrist J Rodriguez
Purge date/beginning time: 9/23/06
Initial (pre-purging) DTW (ft. BTOC):
Calculated tubing + pump volume: NA
PID/FID reading (well head/background): 0
Purge date/completion time: 9/23/06
Final (post-purging) DTW (ft. BTOC):
No. of tubing + pump volumes purged:

Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = 20 psi

	Initial	2	3	4	5	6	7	8	Final
Pressure (psi)	20	20	30						
Refill Setting	40	40	30						
Discharge Setting	20	20	30						
Flow rate (mL/min)	<100	<100	100						

Water Quality Parameter Measurements

Time	DTW (ft. BTOC)	Purge Rate (mL/min)	Cumulative Volume Purged (L)	Temp. (degree C)	Electrical Conductivity ~~(uMhos/cm)~~ mS/cm	pH	Eh (mv)	DO (mg/L)	Turbidity (NTU)
0940	31.25	100	.5	18.28	.747	6.18		7.36	18.0
955	31.4	100	.7	19.10	.751	6.20		.58	17.2
1000	30.18	100	.9	19.57	.755	6.20		2.57	20.3
1005	30.18	100	1	19.79	0.758	6.21		4.16	17.1
1010	31.19	100	1.2	20.0	0.757	6.22		6.03	11.4
1015	31.19	100	1.4	20.11	0.755	6.22		2.40	54.5
1020	31.20	100	1.5	20.26	0.752	6.22		3.40	127.0
1025	31.19	100	2.0	20.44	0.748	6.22		2.98	533.7

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GROUNDWATER SAMPLING FORM

Sheet 2 of 2

Water Quality Parameter Measurements (continued)

Time	DTW (ft. BTOC)	Purge Rate (mL/min)	Cumulative Volume Purged (L)	Temp. (degree C) ±10%	±3% Electrical Conductivity (uMhos/cm)	pH ±0.1	Eh (mv) ±10	DO (mg/L) ±10%	Turbidity (NTU) ±10%
1030	31.18	100	2.5	20.54	0.748	6.23		3.30	1662.1
1035	31.19	100	2.75	20.57	0.743	6.23		9.06	1663.5
10:40	31.19	100	3.0 gal	20.70	0.742	6.23		9.06	1665.5

Sampling

Sampling beginning time: 1042

Sampling completion time: 1055

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)
1055	31.2	100	3.0	22.01	0.749	6.25		5.93	0

Sample Information

Sample ID: 29WW38

Sample collection date/time: 1055 9/23/06

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
VOC's	8260	3 VOA Container			

Comments:

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

Shaw

GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: 29WW39
Project Name/#: Longhorn 117591
Weather: clear
Sampling location ID: 29WW39
Sample ID: 29WW39
Collection Time/Date: 14:55

Pump Installation

Pump installation crew: A Gilchrist J. Rodriguez
PID/FID reading (well head/background): 0.0
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 92.0
Initial (pre-installation) DTW/time: 31.12 1310
Final (after pump priming) DTW/time:
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL):
Discharge tube length (ft.): ~105'
Installation date/beginning time: 9/27/06
Installation date/completion time: 9/27/06
Screen Interval (ft. BTOC): 82 to 92
Pump intake depth (ft BTOC): 87'
Post-installation DTW/time: 31.4
Max. sustainable pump rate (mL/min): 180
Appearance of product: none
Discharge tube diameter (3/8" or 1/4"): 1/4"
Inlet reducer used (Y/N): N

Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = 50 psi

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

Purging

Purging/sampling crew: A. Gilchrist J. Rodriguez
Purge date/beginning time: 9/27/06
Initial (pre-purging) DTW (ft. BTOC):
Calculated tubing + pump volume: NA
PID/FID reading (well head/background): 0.0
Purge date/completion time: 9/27/06
Final (post-purging) DTW (ft. BTOC):
No. of tubing + pump volumes purged:

Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = 50 psi

	Initial	2	3	4	5	6	7	8	Final
Pressure (psi)	50								50
Refill Setting	10								10
Discharge Setting	5								5
Flow rate (mL/min)	180								180

Water Quality Parameter Measurements

Time	DTW (ft. BTOC)	Purge Rate (mL/min)	Cumulative Volume Purged (L)	Temp. (degree C)	Electrical Conductivity mS/cm^c ~~(uMhos/cm)~~	pH	Eh (mv)	DO (mg/L)	Turbidity (NTU)
1340	31.35	180	1.0	22.29	1.135	7.42		12.58	16.0
1345	31.35	180	1.2	21.66	1.15	6.44		9.97	18.3
1350	31.36	180	1.3	21.58	1.15	6.29		2.07	21.7
1355	31.36	180	1.5	21.74	1.15	6.26		.07	27.7
1400	31.34	180	1.7	21.96	1.15	6.26		-.73	30.0
1405	31.6	180	1.9	22.33	1.15	6.27		-9.6	23.1
1410	31.25	180	2.1	22.5	1.15	6.28		-.39	21.1
1415	31.17	180	2.25	22.6	1.16	6.27		-.2	22.2

GROUNDWATER SAMPLING FORM

Sheet 2 of 2

Water Quality Parameter Measurements (continued)

Time	DTW (ft. BTOC)	Purge Rate (mL/min)	Cumulative Volume Purged (L)	Temp. (degree C) ±10%	±3% Electrical Conductivity ~~(uMhos/cm)~~ mS/cm	pH ±0.1	Eh (mv) ±10	DO (mg/L) ±10%	Turbidity (NTU) ±10%
1420	31.21	180	2.5	22.64	1.16	6.25		.42	21.9
1425	31.19	180	3.0	22.87	1.16	6.24		1.09	20.7
1430	31.17	180	3.25	22.95	1.171	6.22		1.85	19.3
1435	31.16	180	3.7	23.09	1.17	6.20		2.26	18.4
1440	31.18	180	3.9	23.18	1.17	6.18		3.08	17.2
1445	31.19	180	4.0	23.34	1.17	6.17		3.34	15.7
1450	31.18	180	4.3	23.23	1.17	6.17		3.87	17.8

10–20

Sampling

Sampling beginning time: 1455

Sampling completion time: 1500

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)
1500	31.19	130	4.5	23.42	1.17	6.16		3.72	19.8

Sample Information

Sample ID: 29WW39

Duplicate sample collected (Y/N):

Split sample collected (Y/N):

COC No(s):

Sample collection date/time: 1500 9/27/06

Duplicate sample ID:

Split sample ID:

Requested Analysis	Method	Containers	Requested Analysis	Method	Containers
VOC's	8260	3 VOA Containers			

Comments:

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

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GROUNDWATER SAMPLING FORM

Sheet 1 of 3

Operable Unit/Site ID: LHAAP-29
Project Name/#: LHAAP 117591
Weather: ptly cloudy 80's
Sampling location ID: 29WW40
Sample ID: 29WW40
Collection Time/Date: 9/21/06 12:40

Pump Installation

Pump installation crew: A. Willmore, A. Gilchrist, C. Mabe
PID/FID reading (well head/background): 0.0
Casing diameter (inches): 2"
Total well Depth (ft. ~~BTOC~~ bgs): 159' bgs
Initial (pre-installation) DTW/time: 51.25 bgs
Final (after pump priming) DTW/time:
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL):
Discharge tube length (ft.): ~170'
Installation date/beginning time: 9/21/06 11:29
Installation date/completion time: 9/21/06 11:31
Screen Interval (ft. ~~BTOC~~ bgs): 149 to 159
Pump intake depth (ft ~~BTOC~~ bgs): 154 bgs
Post-installation DTW/time: 51.25
Max. sustainable pump rate (mL/min): 300
Appearance of product: None
Discharge tube diameter (3/8" or 1/4"): 1/4"
Inlet reducer used (Y/N): No

Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = 250 psi

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

Purging

Purging/sampling crew: A. Willmore / A. Gilchrist / C. Mabe
Purge date/beginning time: 9/21/06
Initial (pre-purging) DTW (ft. BTOC): 11:44
Calculated tubing + pump volume: NA
PID/FID reading (well head/background): 0.0
Purge date/completion time: 9/21/06
Final (post-purging) DTW (ft. BTOC): 12:50
No. of tubing + pump volumes purged:

Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = 250 psi

	Initial	2	3	4	5	6	7	8	Final
Pressure (psi)	250								250
Refill Setting	10								10
Discharge Setting	20								20
Flow rate (mL/min)	300								300

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)

See Next Page

GROUNDWATER SAMPLING FORM

Sheet 3 of 3

Water Quality Parameter Measurements (continued)

Time	DTW (ft. BTOC)	Purge Rate (mL/min)	Cumulative Volume Purged (~~L~~) gal	Temp. (degree C) ±10%	±3% Electrical Conductivity (uMhos/cm)	pH ±0.1	Eh (mv) ±10	DO (mg/L) ±10%	Turbidity (NTU) ±10%
11:44	51.25	300		24.4	2.0	9.93	98.7	146.2	110.6
11:52	51.32			24.22	2.6	8.96	124.7	106.3	95.6
11:57	51.26			24.21	2.7	8.13	127.1	97.7	59.7
12:02	51.28			24.22	2.8	8.8	127.6	93.2	37.2
1207	51.30			24.22	2.9	8.77	128.1	7.97	23.7
1212	51.32			24.24	3.135	8.75	127.5	7.27	15.8
1217	51.37			24.24	3.19	8.74	126.4	7.19	9.2
1222	51.40			24.21	3.2	8.73	125.4	7.08	7.0
1227	51.32			24.27	3.24	8.72	125.6	7.05	4.0
1232	51.30			24.2	3.25	8.71	124.5	7.01	3.0
			3.5 gal				123.2		

10 - ml
20

Sampling

Sampling beginning time: 12:35

Sampling completion time: 12:40

Water Quality Parameter Measurements

Time	DTW (ft. BTOC)	Purge Rate (mL/min)	Cumulative Volume Purged (~~L~~) gal	Temp. (degree C)	Electrical Conductivity (uMhos/cm)	pH	Eh (mv)	DO (mg/L)	Turbidity (NTU)
12:50	51.30	300	4 gal.	24.26	3.28	8.72		7.06	4.7

Sample Information

Sample ID: 29WW40

Duplicate sample collected (Y/N): No

Split sample collected (Y/N): No

COC No(s):

Sample collection date/time: 9/21/06 12:35

Duplicate sample ID: N/A

Split sample ID: N/A

Requested Analysis	Method	Containers	Requested Analysis	Method	Containers
VOCs	8260	3 voa vials			

Comments:

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

GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: LHAAP-29
Project Name/#: LHAAP 117591
Weather: clear, 60's
Sampling location ID: 29WW35 - 2nd
Sample ID: 29WW35 - 2nd
Collection Time/Date: 15:25 11/20/06

Pump Installation

Pump installation crew: A. Willmore / S. Becsinger
PID/FID reading (well head/background): 0.0
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 98.30
Initial (pre-installation) DTW/time: 41.14
Final (after pump priming) DTW/time: 41.10
Free product (circle): LNAPL / DNAPL NR
Volume of water removed during priming (mL): N
Discharge tube length (ft.): ~100
Installation date/beginning time: 11/20/06 14:52
Installation date/completion time: 11/20/06 14:54
Screen Interval (ft. BTOC): 88 to 98
Pump intake depth (ft BTOC): 93'
Post-installation DTW/time: 41.10
Max. sustainable pump rate (mL/min):
Appearance of product: None
Discharge tube diameter (3/8" or 1/4"): 1/4"
Inlet reducer used (Y/N): N

Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = NR psi

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

11/20/06

Purging

Purging/sampling crew: A. Willmore / S. Becsinger
Purge date/beginning time: 11/20/06 1454
Initial (pre-purging) DTW (ft. BTOC): NR
Calculated tubing + pump volume: NA
PID/FID reading (well head/background): 0.0
Purge date/completion time: 11/20/06 1535
Final (post-purging) DTW (ft. BTOC):
No. of tubing + pump volumes purged:

Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = NR psi

	Initial	2	3	4	5	6	7	8	Final
Pressure (psi)	150								150
Refill Setting	10								10
Discharge Setting	5								5
Flow rate (mL/min)	150								150

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)
14:57	41.09	150	0.75	20.05	0.824	8.32	-222.1	6.96	14.1
15:02	41.08	150	1.5	20.04	0.824	8.32	-217.1	0.95	13.1
15:07	41.08	150	2.25	20.04	0.823	8.31	-205.4	0.92	11.2
15:12	41.08	150	3.0	19.99	0.822	8.22	-210.5	0.80	10.3
15:17	41.08	150	3.75	19.71	0.822	8.20	-218.3	0.84	10.8

11/20/06

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GROUNDWATER SAMPLING FORM

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Water Quality Parameter Measurements (continued)

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)

11/20/06

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)
1530	41.08	150	5.0	19.67	0.821	8.17	-215.3	0.50	9.1

Sample Information

Sample ID: 29WW85 -2nd

Duplicate sample collected (Y/N): N

Split sample collected (Y/N): N

COC No(s): NR

Sample collection date/time: 11/20/06

Duplicate sample ID: None

Split sample ID: None

Requested Analysis	Method	Containers	Requested Analysis	Method	Containers
VOC	8260	3- 40 mL Voas			

Comments:

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

GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: Site29
Project Name/#: LHAAP 117591
Weather: clear, Hi 50's to 60's
Sampling location ID: 29WW36-2ND
Sample ID: 29WW36-2ND
Collection Time/Date:

Pump Installation

Pump installation crew: A. Willmore S. Beesinger
PID/FID reading (well head/background): 0.0
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 36.69
Initial (pre-installation) DTW/time: 29.20
Final (after pump priming) DTW/time: 36.41
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL): NA
Discharge tube length (ft.): NA
Installation date/beginning time: 11:15 11/17/06
Installation date/completion time: 11:17 11/17/06
Screen Interval (ft. BTOC): ~27 to ~37
Pump intake depth (ft BTOC): ~32'
Post-installation DTW/time: 36.41
Max. sustainable pump rate (mL/min): NA
Appearance of product: None
Discharge tube diameter (3/8" or 1/4"): 3/8"
Inlet reducer used (Y/N): No

Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = NA psi

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

Purging

Purging/sampling crew: A. Willmore S. Beesinger
Purge date/beginning time: 11/17/06 11:20
Initial (pre-purging) DTW (ft. BTOC): NR
Calculated tubing + pump volume: NA
PID/FID reading (well head/background): 0.0
Purge date/completion time: 11/17/06
Final (post-purging) DTW (ft. BTOC): 36.39
No. of tubing + pump volumes purged: NA

Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = NR psi

	Initial	2	3	4	5	6	7	8	Final
Pressure (psi)	22								22
Refill Setting	11								11
Discharge Setting	4								4
Flow rate (mL/min)	100								100

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)
11:29	36.48	110	0.5	17.28	4,442	6.36	57.1	2.99	1.3
11:34	36.39	100	1.0	17.33	4,479	6.38	55.0	2.85	1.0
11:39	36.39	100	1.5	17.27	4.488	6.39	54.0	2.64	1.0
11:44	36.39	100	2.0	17.26	4.490	6.39	52.9	2.60	0.8
11:49	36.39	100	2.5	17.17	4.496	6.39	51.1	2.55	1.0

GROUNDWATER SAMPLING FORM

Sheet 2 of 2

Water Quality Parameter Measurements (continued)

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)

NA
11/17/06

Sampling

Sampling beginning time: 11:50

Sampling completion time: 11:55

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)
1200	86.58	100	~3.5	17.14	4.491	6.39	50.9	2.31	7.0

Sample Information

Sample ID:

Sample collection date/time: 11/17/06 11:50

Duplicate sample collected (Y/N): No

Duplicate sample ID:

Split sample collected (Y/N): No

Split sample ID:

COC No(s): NA

Requested Analysis	Method	Containers	Requested Analysis	Method	Containers
VOCs	8260	3 - 40mL Voas			

Comments:

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

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29WW37

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GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: LHAAP-29
Project Name/#: LHAAP-29 117591
Weather: clear, 50's
Sampling location ID: 29WW37-2nd
Sample ID: 29WW37
Collection Time/Date: 10:56 11/17/06

Pump Installation

Pump installation crew: A. Willmore, S. Beesinger
PID/FID reading (well head/background): 0.0
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): ~95
Initial (pre-installation) DTW/time: 47.54
Final (after pump priming) DTW/time:
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL): NA
Discharge tube length (ft.): ~100'
Installation date/beginning time: 11/17/06 10:05
Installation date/completion time: 11/17/06 10:08
Screen Interval (ft. BTOC): 85 to 95
Pump intake depth (ft BTOC): 90'
Post-installation DTW/time: 47.83
Max. sustainable pump rate (mL/min):
Appearance of product: None
Discharge tube diameter (3/8" or 1/4"): 3/8"
Inlet reducer used (Y/N): N

Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = NA psi

	Initial	2	3	4	5	6	7	8	Final
Pressure (psi)									
Refill Setting									
Discharge Setting						11/17/06			
Flow rate (mL/min)									

Purging

Purging/sampling crew: A. Willmore, S. Beesinger
Purge date/beginning time: 11/17/06
Initial (pre-purging) DTW (ft. BTOC): 47.83
Calculated tubing + pump volume: NA
PID/FID reading (well head/background): 0.0
Purge date/completion time: 11/17/06
Final (post-purging) DTW (ft. BTOC): 47.86
No. of tubing + pump volumes purged: NA

Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = NA psi

	Initial	2	3	4	5	6	7	8	Final
Pressure (psi)	66								60
Refill Setting	11								11
Discharge Setting	4								4
Flow rate (mL/min)	200								

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)
10:17	47.86	200	1	16.66	~~1.89~~ 2.916	12.07	-134.2	1.83	23.2
10:22	47.86		2	16.72	~~1.69~~ 3.145	12.09	-135.1	1.68	24.8
10:27	47.86		3	17.03	3.300	12.13	-145.8	1.24	27.9
10:32	47.86		4	17.03	3.272	12.13	-145.7	1.24	29.2
10:37	47.86		5	17.26	3.254	12.14	-153.7	1.10	27.1
10:42	47.86		6	16.84	3.198	12.16	-158.9	1.01	25.3

29.20
36.69

GROUNDWATER SAMPLING FORM

Sheet 2 of 2

Water Quality Parameter Measurements (continued)

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)

11/17/06

Sampling

Sampling beginning time: 10:50

Sampling completion time: 10:54

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)
11:05	47.86	200	~ 11	16.56	3.201	12.14	-159.0	1.06	19.6

Sample Information

Sample ID: 29WW37 - 2nd

Sample collection date/time: 11/17/06 10:56

Duplicate sample collected (Y/N): No

Duplicate sample ID: No

Split sample collected (Y/N): No

Split sample ID: No

COC No(s):

Requested Analysis	Method	Containers	Requested Analysis	Method	Containers
VOCs	8260	40 mL Voas			

Comments:

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

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GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: LHAAP-29
Project Name/#: LHAAP 117591
Weather: clear, 60's
Sampling location ID: 29WW38-2nd
Sample ID: 29WW38-2nd
Collection Time/Date:

Pump Installation

Pump installation crew: A. Willmore / S. Beesinger
PID/FID reading (well head/background): 0.0
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 46
Initial (pre-installation) DTW/time: 31.29
Final (after pump priming) DTW/time: 31.31
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL): NR
Discharge tube length (ft.): ~~NR~~ AW 45'
Installation date/beginning time: 11/20/06 13:52
Installation date/completion time: 11/20/06 13:54
Screen Interval (ft. BTOC): 35 to 45
Pump intake depth (ft BTOC): ~40'
Post-installation DTW/time: 31.31
Max. sustainable pump rate (mL/min): 220
Appearance of product: None
Discharge tube diameter (3/8" or 1/4"): 1/4"
Inlet reducer used (Y/N):

Pneumatic Controller Tuning:

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

	Initial	2	3	4	5	6	7	8	Final
Pressure (psi)									
Refill Setting									
Discharge Setting							11/20/06		
Flow rate (mL/min)									

Purging

Purging/sampling crew: A. Willmore / S. Beesinger
Purge date/beginning time: 11/20/06 1400
Initial (pre-purging) DTW (ft. BTOC): 31.29
Calculated tubing + pump volume: NA
PID/FID reading (well head/background): 0.0
Purge date/completion time:
Final (post-purging) DTW (ft. BTOC):
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)	35								35
Refill Setting	10								10
Discharge Setting	5								5
Flow rate (mL/min)	220								220

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)
1402	31.31	220	1	17.91	0.691	9.8	-92.3	0.91	9.6
1407	31.31	220	2	17.90	0.683	9.7	-92.0	0.90	9.6
1412	31.31	220	3	17.87	0.682	9.7	-92.7	0.89	9.5
1417	31.31	220	4	17.84	0.651	9.6	-92.7	0.88	9.5

GROUNDWATER SAMPLING FORM

Sheet 2 of 2

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Water Quality Parameter Measurements (continued)

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)

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)
1435	31.30	~~25~~ 220	~6	17.81	0.654	9.5	-93.1	8.92	9.7

Sample Information

Sample ID: 29WW38 -2nd

Sample collection date/time: 11/20/06 14:25

Duplicate sample collected (Y/N): N

Duplicate sample ID: None

Split sample collected (Y/N): N

Split sample ID: None

COC No(s): NR

Requested Analysis	Method	Containers	Requested Analysis	Method	Containers
VOC	8260	3-40mL Voas			

Comments:

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

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GROUNDWATER SAMPLING FORM

Sheet 1 of 2

117591

Operable Unit/Site ID: LHAAP-29
Project Name/#: Longhorn Army Ammunition Plant
Weather: clear, cool 60's
Sampling location ID: LHAAP-29 29WW39-2
Sample ID: 29WW39
Collection Time/Date: 13:40 11/20/06

Pump Installation

Pump installation crew: A. Willmore, S. Beesinger
PID/FID reading (well head/background): 0.0
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): ~91'
Initial (pre-installation) DTW/time: 31.61
Final (after pump priming) DTW/time: 31.68
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL): NA
Discharge tube length (ft.): ~ 95'
Installation date/beginning time: 11/20/06 13:10
Installation date/completion time: 11/20/06 13:12
Screen Interval (ft. BTOC): 81' to 91
Pump intake depth (ft BTOC): 86'
Post-installation DTW/time: 31.68
Max. sustainable pump rate (mL/min): 220
Appearance of product: Non
Discharge tube diameter (3/8" or 1/4"): 1/4"
Inlet reducer used (Y/N): N

Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = NA psi

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

Purging

Purging/sampling crew: A. Willmore
Purge date/beginning time: 11/20/06
Initial (pre-purging) DTW (ft. BTOC):
Calculated tubing + pump volume: NA
PID/FID reading (well head/background): 0.6
Purge date/completion time: 11/20/06
Final (post-purging) DTW (ft. BTOC):
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)	35								
Refill Setting	10								
Discharge Setting	5								
Flow rate (mL/min)	220								

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)
13:18	31.68	220	1	18.12	0.819	9.40	-212.4	0.71	6.1
13:23	31.68	220	2	18.11	0.819	9.41	-213.6	0.61	5.5
13:28	31.68	220	3	18.11	0.808	9.41	-215.5	0.54	5.4
13:33	31.68	220	4	18.12	0.808	9.41	-217.7	0.51	5.4
13:38	31.68	220	5	18.20	0.808	9.40	-219.2	0.49	5.6

GROUNDWATER SAMPLING FORM

Sheet 2 of 2

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Water Quality Parameter Measurements (continued)

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)

11/20/06

Sampling

Sampling beginning time: 13:40

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)
13:45	31.68	~~[illegible]~~ 220	~8	18.19	0.808	9.41	-218.1	0.50	5.3

Sample Information

Sample ID: 29WW39 - 2nd

Sample collection date/time: 11/20/06 13:40

Duplicate sample collected (Y/N): No

Duplicate sample ID: None

Split sample collected (Y/N): No

Split sample ID: None

COC No(s):

Requested Analysis	Method	Containers	Requested Analysis	Method	Containers
VOCs	8260	3 - 40mL Voas			

Comments:

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

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GROUNDWATER SAMPLING FORM

Sheet 1 of 2

117591

Operable Unit/Site ID: LHAAP-29
Project Name/#: LHAAP
Weather: sunny, cool, 40's to 50's
Sampling location ID: 29WW40-2nd
Sample ID: 29WW46.2nd
Collection Time/Date: 0950 11/21/06

Pump Installation

Pump installation crew: A. Willmore, Robert Owens
PID/FID reading (well head/background): 0.0
Casing diameter (inches): 2"
Total well Depth (ft. BTOC): 159' bgs
Initial (pre-installation) DTW/time: 49.00
Final (after pump priming) DTW/time: NR
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL): NR
Discharge tube length (ft.): ~165'
Installation date/beginning time: 11/21/06 0841
Installation date/completion time: 11/21/06 0843
Screen Interval (ft. BTOC): 149 to 159
Pump intake depth (ft BTOC): 154 bgs
Post-installation DTW/time: 49.60
Max. sustainable pump rate (mL/min): 300
Appearance of product: None
Discharge tube diameter (3/8" or 1/4"): 1/4"
Inlet reducer used (Y/N): No

Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = NR psi

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

Purging

Purging/sampling crew: Allen Willmore, Robert Owens
Purge date/beginning time: 0850 11/15/06
Initial (pre-purging) DTW (ft. BTOC): 49.00
Calculated tubing + pump volume: NA
PID/FID reading (well head/background): 0.0
Purge date/completion time:
Final (post-purging) DTW (ft. BTOC):
No. of tubing + pump volumes purged:

Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = NR 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)
0855	49.00	300	1.5	21.06	~~8.99~~ 3.241	8.79	123.6	7.13	6.2
0900	49.00	300	3.0	21.11	3.240	8.75	122.9	7.12	5.4
0905	49.00	300	4.5	21.17	3.239	8.76	120.1	7.14	4.3
0910	49.00	300	6.0	21.18	3.237	8.78	121.3	7.13	4.4
0915	49.00	300	7.5	21.21	3.237	8.78	122.4	7.14	4.5
0920	49.00	300	9.0	21.18	3.237	8.78	121.4	7.16	3.2
0925	49.00	300	10.5	21.20	3.237	8.78	121.6	7.14	2.2
0930	49.00	300	12.0	21.21	3.237	8.77	123.2	7.15	1.7

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GROUNDWATER SAMPLING FORM

Sheet 2 of 3

Water Quality Parameter Measurements (continued)

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)
0935	49.00	300	13.5	21.22	3.238	8.77	124.1	7.15	1.1
0940	49.00	300	15.0	21.21	3.238	8.78	123.9	7.15	0.4
0945	49.00	300	16.5	21.22	3.239	8.78	123.7	7.15	0.3

11/21/06

Sampling

Sampling beginning time: 0950

Sampling completion time: 0955

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)
0957	49.00	300	13.5	21.06	3.238	8.78	123.4	7.10	0.1

Sample Information

Sample ID: 29WW40-2nd

Duplicate sample collected (Y/N): Yes

Split sample collected (Y/N): N

COC No(s): NA

Sample collection date/time: 0950 11/21/06

Duplicate sample ID: 29WW40-Dup & MS/MSD

Split sample ID: NA

Requested Analysis	Method	Containers	Requested Analysis	Method	Containers
VOCs.	8260	12-40 mL Voa Vials			

Comments: Took Field Duplicates & MS/MSD.

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

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GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: LHAAP Site 29
Project Name/#: Well Sampling @ 29 117591
Weather: Wet 70°
Sampling location ID: Site 29
Sample ID: 29WW46
Collection Time/Date: 12-19-06 / 1536

Pump Installation

Pump installation crew: A. Willmore, S. McAdoo
PID/FID reading (well head/background): 0.0
Casing diameter (inches): 2"
Total well Depth (ft. BTOC): ~163'
Initial (pre-installation) DTW/time: 158'
Final (after pump priming) DTW/time: 48.99
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL): NA
Discharge tube length (ft.): 166'
Installation date/beginning time: 12-19-06 / 1420
Installation date/completion time: 12-19-06 / 1422
Screen Interval (ft. BTOC): 153 to 163
Pump intake depth (ft BTOC): 158
Post-installation DTW/time: 48.99
Max. sustainable pump rate (mL/min): 350
Appearance of product: None
Discharge tube diameter (3/8" or 1/4"): 1/4"
Inlet reducer used (Y/N): No

Pneumatic Controller Tuning:

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

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

Purging

Purging/sampling crew: A. Willmore S. McAdoo
Purge date/beginning time: 1425 12-19-06
Initial (pre-purging) DTW (ft. BTOC): 48.99
Calculated tubing + pump volume: NA
PID/FID reading (well head/background): 0.0
Purge date/completion time: 12-19-06
Final (post-purging) DTW (ft. BTOC): 48.99
No. of tubing + pump volumes purged: NR

Pneumatic Controller Tuning:

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

	Initial	2	3	4	5	6	7	8	Final
Pressure (psi)	250								250
Refill Setting	10								10
Discharge Setting	5								5
Flow rate (mL/min)	350								350

Water Quality Parameter Measurements

Time	DTW (ft. BTOC)	Purge Rate (mL/min)	Cumulative Volume Purged (mL)	Temp. (degree C)	Electrical Conductivity (uMhos/cm)	pH	Eh (mv)	DO (mg/L)	Turbidity (NTU)
1430	48.98	350	700	21.03	3.238	8.80	124.7	7.09	8.2
1435	48.98	350	2450	21.04	3.238	8.81	123.2	7.08	6.1
1440	48.98	350	4200	21.07	3.239	8.82	123.1	7.05	4.2
1445	48.98	350	5950	21.06	3.238	8.80	122.9	7.06	3.1
1450	48.98	350	7700	21.07	3.239	8.80	122.9	7.11	4.8
1455	48.98	350	9450	21.07	3.237	8.81	122.8	7.12	5.0
1500	48.98	350	11200	21.07	3.238	8.80	123.4	7.13	2.1
1505	48.98	350	12950	21.04	3.239	8.82	123.6	7.14	1.6

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GROUNDWATER SAMPLING FORM

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117591

Water Quality Parameter Measurements (continued)

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)
1510	48.98	350	14700	21.06	323 8	8.80	124.1	7.08	0.0
1515	48.98	350	16450	21.06	3.237	8.80	123.9	7.09	0.0
1520	48.98	350	18200	21.04	3.237	8.80	123.6	7.03	0.0

12/19/06

Sampling

Sampling beginning time: 15:30

Sampling completion time: 1532

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)
1540	48.98	350	~20	21.03	3.240	8.79	124.0	7.01	0.0

Sample Information

Sample ID: SITE 29

Duplicate sample collected (Y/N): N

Split sample collected (Y/N): N

COC No(s): NA

Sample collection date/time: 12·19·06 15:30

Duplicate sample ID: NA

Split sample ID: NA

Requested Analysis	Method	Containers	Requested Analysis	Method	Containers
VOC	8240	3- 40 mL Voa vials			

Comments:

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

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Sample Collection Log

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117591 - Longhorn Army Ammunition Plant

Manager: Praveen Srivastav

RFA / COC Number: 10957

Location Code: 29WW06
Sample Number: 29WW06- Feb 2007
Sample Name: 29WW06-GW-29WW06- -REG
Sampling Method: SP
Sample Type: GW *Sample Purpose:* REG
Sampling Equip: Stainless Steel Bladder Pump

Task: MNA_EVENT_FEB07
Collection Date: 2-22-07
Collection Time: 1500
Start Depth: 32.5'
End Depth: 29.85
Sample Matrix: WATER

QC Partners:
(TB) (ER) (FB)

Sample Team: Willemore, McAdoo

ERPIMS Values:
Sacode:
Lot Control#:

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
VOC-FULL	N	A	3	40	mL	VOA VIAL
ANIONS	N	B	1	500	mL	HDPE
PERC	N	C	1	500	mL	HDPE
GASES	N	D	2	40	mL	VOA Vial
ALKALINITY	N	E	1	100	mL	HDPE
TOC_415	N	F	1	100	mL	HDPE
DHC	N	G	1	1	L	Amb. Glass

Groundwater Information:

Measured Well Depth: 35.19' **Depth To Water:** 29.81'

Comments:

Sketch Location:

Logged BY / Date: Sherry McAdoo 2-22-07 *Reviewed BY / Date:*

Shaw E & I, Inc.

Sample Collection Log

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117591 - Longhorn Army Ammunition Plant

Manager: Praveen Srivastav

Location Code: 29WW06
Sample Number: 29WW06Feb2007

PURGE RECORD:

Initial	Time(24hr)	DepthtoWater (ft)	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)	Purge Volume (gal)
Sample:	1535	29.85	268.7	6.5	3.517	0.7	1.51	20.22	100

SKm

Logged BY / Date: Sherry McAdoo 2-22-07 *Reviewed BY / Date:* ____________

GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: Longhorn, Site29
Project Name/#: Longhorn AAP
Weather: Sunny 85°
Sampling location ID: 29WW06
Sample ID: 29WW06 - Feb 2007
Collection Time/Date: 2-22-07, 1500

Pump Installation

Pump installation crew: Willemore, McAdoo
PID/FID reading (well head/background): 0.0 / 0 %
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 35.19'
Initial (pre-installation) DTW/time: 29.81'
Final (after pump priming) DTW/time:
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL):
Discharge tube length (ft.): 35'
Installation date/beginning time: 2-22-07, 1420
Installation date/completion time: 2-22-07, 1430
Screen Interval (ft. BTOC): 29.81 to 35.19
Pump intake depth (ft BTOC): 32.5'
Post-installation DTW/time: 29.85
Max. sustainable pump rate (mL/min): 100
Appearance of product: yellowish
Discharge tube diameter (3/8" or 1/4"): 3/8"
Inlet reducer used (Y/N): 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					SKM				
Discharge Setting									
Flow rate (mL/min)									

Purging

Purging/sampling crew: Willemore, McAdoo
Purge date/beginning time: 2-22-07, 1445
Initial (pre-purging) DTW (ft. BTOC): 29.85
Calculated tubing + pump volume: NA
PID/FID reading (well head/background): 0.0 / 0 %
Purge date/completion time: 2-22-07, 1540
Final (post-purging) DTW (ft. BTOC): 29.85
No. of tubing + pump volumes purged:

Pneumatic Controller Tuning:

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

	Initial	2	3	4	5	6	7	8	Final
Pressure (psi)	20	20	20	20					
Refill Setting	10	10	10	10					
Discharge Setting	5	5	5	5					
Flow rate (mL/min)	100	100	100	100					

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)
1445	29.85	100	100	19.91	3.510	6.41	224.6	1.81	2.3
1450	29.85	100	200	19.89	3.504	6.41	227.6	1.61	2.3
1455	29.85	100	300	19.89	3.501	6.44	234.6	1.42	1.5
1500	29.85	100	400	19.94	3.504	6.45	240.1	1.39	1.4

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GROUNDWATER SAMPLING FORM

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Sheet 2 of 2

Water Quality Parameter Measurements (continued)

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

10/20

Sampling

Sampling beginning time: 1500

Sampling completion time: 1530

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)
1535	29.85	100	500	~~[illegible]~~	3.517	6.5	268.7	1.51	0.7
			SKms	20.22					

Sample Information

Sample ID: 29WW06-Feb 2007

Sample collection date/time: 2-22-07

Duplicate sample collected (Y/N): N

Duplicate sample ID: N

Split sample collected (Y/N): N

Split sample ID: N

COC No(s): 10757

Requested Analysis	Method	Containers	Requested Analysis	Method	Containers
VOC	8260B	3	Perchlorate	314.0	1
Gases-CO2	Sop175	3	Alkalinity	310.0	1
TOC	415.1	3	Explosives		2
Anions	300.0	1			
Sulfides	376.2	1			

Comments: Water is yellowish tannic

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

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Sample Collection Log

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117591 - Longhorn Army Ammunition Plant

Manager: Praveen Srivastav

RFA / COC Number: ______________________

Location Code: 29WW15

Sample Number: 29WW15-

Sample Name: 29WW15-GW-29WW15- -REG

Sampling Method: SP

Sample Type: GW *Sample Purpose:* REG

Sampling Equip: ______________________

Task: MNA_EVENT_FEB07

Collection Date: ______________________

Collection Time: ______________________

Start Depth: ______________________

End Depth: ______________________

Sample Matrix: WATER

Sample Team: AW / CW

QC Partners:

(TB) ____________ (ER) ____________ (FB) ____________

ERPIMS Values:

Sacode: ____________

Lot Control#: ____________

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
VOC-FULL	N	A	3	40	mL	VOA VIAL
ANIONS	N	B	1	500	mL	HDPE
PERC	N	C	1	500	mL	HDPE
GASES	N	D	3	40	mL	VOA Vial
ALKALINITY	N	E	1	1000	mL	HDPE
TOC_415	N	F	1	40	mL	~~HDPE~~ VOA
DHC	N	G	1	1	L	Amb. Glass

Sulfides -
Explosives - 1 L Amber

Groundwater Information:

Measured Well Depth: ____________ **Depth To Water:** ____________

Comments:

Sketch Location:

Logged BY / Date: CWinter 2/24/07 *Reviewed BY / Date:* ____________

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Sample Collection Log

117591 - Longhorn Army Ammunition Plant

Manager: **Praveen Srivastav**

Location Code: **29WW15**
Sample Number: **29WW15-**

PURGE RECORD:

Initial	Time(24hr)	DepthtoWater (ft)	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)	Purge Volume (gal)
Sample:									

CW

Logged BY / Date: C.Winter 2/24/07 *Reviewed BY / Date:* ____________

GROUNDWATER SAMPLING FORM

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Sheet 1 of ___

Operable Unit/Site ID: LHAAP
Project Name/#: LHAAP-29
Weather: Overcast, Rainy 65-70°
Sampling location ID: 29 WW 15
Sample ID: 29 WW 15 - FEB 2007
Collection Time/Date: ___

Pump Installation

Pump installation crew: A Willmore/C. Winzer
PID/FID reading (well head/background): 0.
Casing diameter (inches): 4" / Stainless Steel
Total well Depth (ft. BTOC): 33.32
Initial (pre-installation) DTW/time: 31.46
Final (after pump priming) DTW/time: ___
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL): ___
Discharge tube length (ft.): ___
Installation date/beginning time: NA
Installation date/completion time: NA
Screen Interval (ft. BTOC): 23.32 to 33.32
Pump intake depth (ft BTOC): NA
Post-installation DTW/time: NA
Max. sustainable pump rate (mL/min): NA
Appearance of product: None
Discharge tube diameter (3/8" or 1/4"): NA
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)									

BAILED DRY

Purging

Purging/sampling crew: A. Willmore / C. Winzer
Purge date/beginning time: 2/24/07 8:32
Initial (pre-purging) DTW (ft. BTOC): 31.46
Calculated tubing + pump volume: NA
PID/FID reading (well head/background): 0.0
Purge date/completion time: 2/24/07 8:46
Final (post-purging) DTW (ft. BTOC): DTB
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)									

BAILED

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)

Bailed DRY

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GROUNDWATER SAMPLING FORM

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Sheet ___ of ___

Water Quality Parameter Measurements (continued)

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

10/20

CW

Sampling

Sampling beginning time: 10:30

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)

CW

Sample Information

Sample ID: 29WW15

Sample collection date/time: 2/24/07 10:30

Duplicate sample collected (Y/N): N

Duplicate sample ID: Na

Split sample collected (Y/N): N

Split sample ID: Na

COC No(s): ___

Requested Analysis	Method	Containers	Requested Analysis	Method	Containers
VOC	8260B	3	Perchlorate	314.0	1
Gases - CO2	SOP175	3	Alkalinity	310.0	1
TOC	415.1	3	Explosives		2
Anions	300.0	1			
Sulfides	376.2	1			

Comments:

~2' of water in well. Bailed dry @ 8:30am, 2/24/07.

Sal ferr - 2.33

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

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Sample Collection Log

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117591 - Longhorn Army Ammunition Plant

Manager: Praveen Srivastav

RFA / COC Number: 10957

Location Code: 29WW35
Sample Number: 29WW35-Feb2007
Sample Name: 29WW35-GW-29WW35- -REG
Sampling Method: SP
Sample Type: GW
Sample Purpose: REG
Sampling Equip: Stainless Steel Bladder Pump

Task: MNA_EVENT_FEB07
Collection Date: 2-22-07
Collection Time: 1245
Start Depth: 90'
End Depth: 42.70
Sample Matrix: WATER
Sample Team: Willemore, McAdoo

QC Partners:
(TB) ______ **(ER)** ______ **(FB)** ______

ERPIMS Values:
Sacode: ______
Lot Control#: ______

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
VOC-FULL	N	A	3	40	mL	VOA VIAL
ANIONS	N	B	1	500	mL	HDPE
PERC	N	C	1	500	mL	HDPE
GASES	N	D	2	40	mL	VOA Vial
ALKALINITY	N	E	1	100	mL	HDPE
TOC_415	N	F	1	100	mL	HDPE
DHC	N	G	1	1	L	Amb. Glass

Groundwater Information:
Measured Well Depth: 95'
Depth To Water: ~~31.45~~ 42.84

Comments:

Sketch Location:

Logged BY / Date: Sherry McAdoo 2-22-07
Reviewed BY / Date: ______

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Sample Collection Log

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117591 - Longhorn Army Ammunition Plant

Manager: Praveen Srivastav

Location Code: 29WW35
Sample Number: 29WW35-Feb2007

PURGE RECORD:

Initial	Time(24hr)	DepthtoWater (ft)	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)	Purge Volume (gal)
Sample:	1355	42.70	-106.5	7.38	0.872	1.6 ~~7.38~~	0.80 ~~-106.5~~	25.96	200

SKM

Logged BY / Date: Sherry McAlee
2-22-07

Reviewed BY / Date: ______

GROUNDWATER SAMPLING FORM

00091693

Sheet 1 of 2

Operable Unit/Site ID: Longhorn, Site 29
Project Name/#: Longhorn AAP
Weather: Sunny 60s
Sampling location ID: 29WW35
Sample ID: 29WW35-Feb 2007
Collection Time/Date: 2-22-07, 1245

Pump Installation

Pump installation crew: Willemore, McAdoo
PID/FID reading (well head/background): 3.2/0 %
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 95'
Initial (pre-installation) DTW/time: 42.84
Final (after pump priming) DTW/time: ~~31.45~~ SKm:
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL):
Discharge tube length (ft.): 93'
Installation date/beginning time: 2-22-07, 1125
Installation date/completion time: 2-2207,
Screen Interval (ft. BTOC): 85 to 95
Pump intake depth (ft BTOC): 90'
Post-installation DTW/time: 42.70
Max. sustainable pump rate (mL/min): 200
Appearance of product: NA
Discharge tube diameter (3/8" or 1/4"): 3/8"
Inlet reducer used (Y/N): 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					SKm:				
Discharge Setting									
Flow rate (mL/min)									

Purging

Purging/sampling crew: Willemore, McAdoo
Purge date/beginning time: 2-22-07, 1130
Initial (pre-purging) DTW (ft. BTOC): 42.70
Calculated tubing + pump volume: NA
PID/FID reading (well head/background): 3.2/0 %
Purge date/completion time: 2-22-07, 1240
Final (post-purging) DTW (ft. BTOC): 42.70
No. of tubing + pump volumes purged:

Pneumatic Controller Tuning:

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

	Initial	2	3	4	5	6	7	8	Final
Pressure (psi)	55	55	55	55	55	55	55	55	
Refill Setting	20	20	20	20	20	20	20	20	
Discharge Setting	10	10	10	10	10	10	10	10	
Flow rate (mL/min)	200	200	200	200	200	200	200	200	

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)
1205	42.70	200	200	20.66	0.875	8.63	166.8	0.63	14.6
1210	42.70	200	400	20.64	0.865	7.77	266.	0.55	19.6
1215	42.70	200	600	20.65	0.861	7.49	-46.4	0.52	1.4
1220	42.70	200	800	20.72	0.859	7.43	-78.5	0.48	1.1
1225	42.70	200	1000	20.75	0.859	7.45	-111.0	0.47	1.3
1230	42.70	200	1200	20.75	0.861	7.47	-129.7	0.47	0.9
1235	42.70	200	1400	20.89	0.860	7.44	-137.9	0.38	0.7
1240	42.70	200	1600	20.87	0.860	7.41	-140.8	0.37	0.8

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Sheet 2 of 2

GROUNDWATER SAMPLING FORM

Water Quality Parameter Measurements (continued)

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

10/20

Sampling

Sampling beginning time: 1245
Sampling completion time: ~~1~~1355

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)
1355	42.70	200	1800	25.96	0.872	7.38	-106.5	0.80	1.6

Sample Information

Sample ID: 29WW35-Feb2007
Sample collection date/time: 2-22-07
Duplicate sample collected (Y/N): [redacted] Y
Duplicate sample ID: ~~R~~29WW35-Feb2007-FD
Split sample collected (Y/N): N
Split sample ID: N
COC No(s): 10957

Requested Analysis	Method	Containers	Requested Analysis	Method	Containers
VOC	8260B	3	Perchlorate	314.0	1
Gases - CO2	Sop175	3	Alkalinity	310.0	1
TOC	415.1	3	Explosives		2
Anions	300.0	1			
Sulfides	376.2	1			

Comments:

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

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Sample Collection Log

00091695
Page 1 of 2

117591 - Longhorn Army Ammunition Plant

Manager: Praveen Srivastav

RFA / COC Number: 10495

Location Code: 29WW36
Sample Number: 29WW36-Feb2007
Sample Name: 29WW36-GW-29WW36- -REG
Sampling Method: SP
Sample Type: GW *Sample Purpose:* REG
Sampling Equip: Stainless Steel Bladder Pump

QC Partners:
(TB) (ER) (FB)

Task: MNA_EVENT_FEB07
Collection Date: 2-21-07
Collection Time: 1515
Start Depth: 31'
End Depth: 28.88
Sample Matrix: WATER
Sample Team: Willemore | McAdoo

ERPIMS Values:
Sacode:
Lot Control#:

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
VOC-FULL	N	A	3	40	mL	VOA VIAL
ANIONS	N	B	1	500	mL	HDPE
PERC	N	C	1	500	mL	HDPE
GASES	N	D	2	40	mL	VOA Vial
ALKALINITY	N	E	1	100	mL	HDPE
TOC_415	N	F	1	100	mL	HDPE
DHC	N	G	1	1	L	Amb. Glass

Groundwater Information:

Measured Well Depth: 36.70 **Depth To Water:** 28.9

Comments:

Sketch Location:

Logged BY / Date: Sherry McAdoo 2-21-07 *Reviewed BY / Date:*

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Sample Collection Log

117591 - Longhorn Army Ammunition Plant

Manager: Praveen Srivastav

Location Code: 29WW36
Sample Number: 29WW36Feb2007

PURGE RECORD:

Initial	Time(24hr)	DepthtoWater (ft)	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)	Purge Volume (gal)
				SKm					
Sample:	1545	28.92	302.8	6.44	4.633	1.2	0.94	20.63	105

Logged BY / Date: Sherry McAdoo 2-21-07 *Reviewed BY / Date:* ____________

GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: Longhorn, Site 29
Project Name/#: Longhorn AAP
Weather: Sunny 80°

Sampling location ID: 29WW36
Sample ID: 29WW36-Feb 2007
Collection Time/Date: 2-21-07 / 1515

Pump Installation

Pump installation crew: Willemore/McAdoo
PID/FID reading (well head/background): 0.0/0%
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 36.70
Initial (pre-installation) DTW/time: 28.9'
Final (after pump priming) DTW/time: 28.88
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL):
Discharge tube length (ft.):

Installation date/beginning time: 2-21-07/1430
Installation date/completion time: 2-21-07/1450
Screen Interval (ft. BTOC): to
Pump intake depth (ft BTOC): 31'
Post-installation DTW/time: 28.88
Max. sustainable pump rate (mL/min):
Appearance of product:
Discharge tube diameter (3/8" or 1/4"): 3/8"
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					SKMS				
Discharge Setting									
Flow rate (mL/min)									

Purging

Purging/sampling crew: Willmore/McAdoo
Purge date/beginning time: 2-21-07/1455
Initial (pre-purging) DTW (ft. BTOC): 28.88
Calculated tubing + pump volume: NA

PID/FID reading (well head/background): 0.0/0%
Purge date/completion time: 2-21-07/1515
Final (post-purging) DTW (ft. BTOC): 28.92
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)	21	21	21	21					21
Refill Setting	10	10	10	10					10
Discharge Setting	5	5	5	5					5
Flow rate (mL/min)	105	105	105	105					105

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)
1455	28.88	105	105	20.06	4.704	6.4	269.8	1.49	2.0
1500	28.88	105	210	20.00	4.675	6.4	275.5	1.24	2.0
1505	28.88	105	315	19.92	4.659	6.40	280.9	1.00	1.7
1510	28.92	105	420	19.86	4.647	6.41	284.2	0.92	1.2

GROUNDWATER SAMPLING FORM

Sheet 2 of 2

Water Quality Parameter Measurements (continued)

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

10/20

SKMS

Sampling

Sampling beginning time: 1515

Sampling completion time: 1515

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)
1545	28.92	105	525	20.63	4.633	6.44	302.8	0.94	1.2

Sample Information

Sample ID: 29WW36-Feb 2007

Sample collection date/time: 2-21-07

Duplicate sample collected (Y/N): N

Duplicate sample ID: N

Split sample collected (Y/N): N

Split sample ID: N

COC No(s): 10495

Requested Analysis	Method	Containers	Requested Analysis	Method	Containers
VOC	8260B	3	Perchlorate	314.0	1
Bases/Co2	SOP175	3	Alkalinity	310.1	1
TOC	415.1	3	Explosives		2
ANIONS	300.0	1			
Sulfides	376.2	1			

Comments:

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

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Sample Collection Log

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Page 1 of 2

117591 - Longhorn Army Ammunition Plant

Manager: Praveen Srivastav

RFA / COC Number: 10494

Location Code: 29WW38

Task: MNA_EVENT_FEB07

Sample Number: 29WW38-Feb 2007

Collection Date: 2-22-07

Sample Name: 29WW38-GW-29WW38- -REG

Collection Time: 0930

Sampling Method: SP

Start Depth: 39

Sample Type: GW *Sample Purpose:* REG

End Depth: 30.64

Sampling Equip: Stainless Steel Bladder Pump

Sample Matrix: WATER

QC Partners:

(TB) ______ **(ER)** ______ **(FB)** ______

Sample Team: Willemore, McAdoo

ERPIMS Values:

Sacode: ______

Lot Control#: ______

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
VOC-FULL	N	A	3	40	mL	VOA VIAL
ANIONS	N	B	1	500	mL	HDPE
PERC	N	C	1	500	mL	HDPE
GASES	N	D	2	40	mL	VOA Vial
ALKALINITY	N	E	1	100	mL	HDPE
TOC_415	N	F	1	100	mL	HDPE
DHC	N	G	1	1	L	Amb. Glass

Groundwater Information:

Measured Well Depth: 44.' **Depth To Water:** 30.64

Comments:

Sketch Location:

Logged BY / Date: Sherry McAdoo 2-22-07 *Reviewed BY / Date:* ______

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Sample Collection Log

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Page 2 of 2

117591 - Longhorn Army Ammunition Plant

Manager: Praveen Srivastav

Location Code: 29WW38
Sample Number: 29WW38-Feb 2007

PURGE RECORD:

Initial	Time(24hr)	DepthtoWater (ft)	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)	Purge Volume (gal)
					SKMc				
Sample:	1010	30.64	307.1	6.31	0.550	0.4	1.04	18.45	140

Logged BY / Date: Sherry McAdoo
2-22-07
Reviewed BY / Date: ____________

00091701

GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: Longhorn - Site 29
Project Name/#: Longhorn AAP
Weather: Sunny-Clear -50's
Sampling location ID: 29WW38
Sample ID: 29WW38-Feb 2007
Collection Time/Date: 2-22-07/0930

Pump Installation

Pump installation crew: Willemore, McAdoo
PID/FID reading (well head/background): 0.0/0%
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): ~~3~~44'
Initial (pre-installation) DTW/time: 30.83
Final (after pump priming) DTW/time: 30.64
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL):
Discharge tube length (ft.): 42
Installation date/beginning time: 2-22-07/0840
Installation date/completion time: 2-22-07 0900
Screen Interval (ft. BTOC): 34 to 44
Pump intake depth (ft BTOC): 39'
Post-installation DTW/time: 30.64'
Max. sustainable pump rate (mL/min): 140
Appearance of product: Clear
Discharge tube diameter (3/8" or 1/4"): 3/8"
Inlet reducer used (Y/N): 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				SAME					
Discharge Setting									
Flow rate (mL/min)									

Purging

Purging/sampling crew: Willemore, McAdoo
Purge date/beginning time: 2-22-07, 0905
Initial (pre-purging) DTW (ft. BTOC): 30.64
Calculated tubing + pump volume: NA
PID/FID reading (well head/background): 0.0/0%
Purge date/completion time: 2-22-07/1020
Final (post-purging) DTW (ft. BTOC): 30.64
No. of tubing + pump volumes purged:

Pneumatic Controller Tuning:

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

	Initial	2	3	4	5	6	7	8	Final
Pressure (psi)	27	27	27	27	27				
Refill Setting	10	10	10	10	10				
Discharge Setting	5	5	5	5	5				
Flow rate (mL/min)	140	140	140	140	140				

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)
0910	30.64	140	140	16.02	0.530	6.41	274.2	180	2.9
0915	30.64	~~280~~ 140	280	16.68	0.519	6.40	277.5	1.49	3.2
0920	30.64	140	420	17.07	0.524	6.39	280.9	1.38	3.1
0925	30.64	140	560	17.32	0.529	6.37	282.4	1.26	2.6
0930	30.64	140	700	17.45	0.537	6.36	284.7	1.21	2.5

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GROUNDWATER SAMPLING FORM

00091702

Sheet 2 of 2

Water Quality Parameter Measurements (continued)

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

10/20

SKMS

Sampling

Sampling beginning time: 0930

Sampling completion time: 0930

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)
1010	30.64	140	840	18.45	0.550	6.31	307.1	1.04	0.4

Sample Information

Sample ID: 29WW38-Feb 2007

Sample collection date/time: 2-22-07

Duplicate sample collected (Y/N): N

Duplicate sample ID: N

Split sample collected (Y/N): N

Split sample ID: N

COC No(s): 10494

Requested Analysis	Method	Containers	Requested Analysis	Method	Containers
VOC	8260B	3	Perchlorate	314.0	1
GASES-CO2	Sop175	3	Alkalinity	310.0	1
TOC	415.1	3	Explosives		2
Anions	300.0	1			
Sulfides	376.2	1			

Comments:

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

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Sample Collection Log

117591 - Longhorn Army Ammunition Plant

Manager: Praveen Srivastav

Location Code: **29WW15**
Sample Number: **29WW15-**

PURGE RECORD:

Initial	Time(24hr)	DepthtoWater (ft)	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)	Purge Volume (gal)
Sample:									

Logged BY / Date: C.Winter 2/24/07 *Reviewed BY / Date:* ______

00091704

GROUNDWATER SAMPLING FORM

Sheet 1 of ___

Operable Unit/Site ID: LHAAP
Project Name/#: LHAAP-29
Weather: Overcast, Rainy 65-70°
Sampling location ID: 29 WW 15
Sample ID: 29 WW 15 - FEB 2007
Collection Time/Date: ___

Pump Installation

Pump installation crew: A Willmore / C. Winzer
PID/FID reading (well head/background): 0.
Casing diameter (inches): 4" / Stainless Steel
Total well Depth (ft. BTOC): 33.32
Initial (pre-installation) DTW/time: 31.46
Final (after pump priming) DTW/time: ___
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL): ___
Discharge tube length (ft.): ___
Installation date/beginning time: NA
Installation date/completion time: NA
Screen Interval (ft. BTOC): 23.32 to 33.32
Pump intake depth (ft BTOC): NA
Post-installation DTW/time: NA
Max. sustainable pump rate (mL/min): NA
Appearance of product: None
Discharge tube diameter (3/8" or 1/4"): NA
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		BAILED			DRY				
Discharge Setting									
Flow rate (mL/min)									

Purging

Purging/sampling crew: A. Willmore / C. Winzer
Purge date/beginning time: 2/24/07 8:32
Initial (pre-purging) DTW (ft. BTOC): 31.46
Calculated tubing + pump volume: NA
PID/FID reading (well head/background): 0.0
Purge date/completion time: 2/24/07 8:46
Final (post-purging) DTW (ft. BTOC): DTB
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		BAILED							
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)
			Bailed			DRY			

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GROUNDWATER SAMPLING FORM

00091705

Sheet ___of ___

Water Quality Parameter Measurements (continued)

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

Sampling

Sampling beginning time: 10:30

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)
					CW				

Sample Information

Sample ID: 29WW15

Sample collection date/time: 2/24/07 10:30

Duplicate sample collected (Y/N): N

Duplicate sample ID: Na

Split sample collected (Y/N): N

Split sample ID: Na

COC No(s):

Requested Analysis	Method	Containers	Requested Analysis	Method	Containers
VOC	8260B	3	Perchlorate	314.0	1
Gases-CO2	SOP175	3	Alkalinity	310.0	1
TOC	415.1	3	Explosives		2
Anions	300.0	1			
Sulfides	376.2	1			

Comments:

~2' of water in well. Bailed dry @ 8:30am, 2/24/07.

Sal ferr- 2.33

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

MNA GROUNDWATER SAMPLING FORM

Sheet _____ of _____

Site ID 29

Sampling Event FEB 2007

Well ID	Date	Ferrous Iron	Salinity	Sample Crew
29WW15	2/24/07	2.33		AW/CW

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Sample Collection Log 00091707

Page 1 of

117591 - Longhorn Army Ammunition Plant

Manager: Praveen Srivastav

RFA / COC Number:

Location Code: 29WW15
Sample Number: 29WW15-
Sample Name: 29WW15-GW-29WW15- -REG
Sampling Method: SP
Sample Type: GW
Sample Purpose: REG
Sampling Equip:

Task: MNA_EVENT_FEB07
Collection Date:
Collection Time:
Start Depth:
End Depth:
Sample Matrix: WATER
Sample Team: AW / CW

QC Partners:
(TB) **(ER)** **(FB)**

ERPIMS Values:
Sacode:
Lot Control#:

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
VOC-FULL	N	A	3	40	mL	VOA VIAL
ANIONS	N	B	1	500	mL	HDPE
PERC	N	C	1	500	mL	HDPE
GASES	N	D	3	40	mL	VOA Vial
ALKALINITY	N	E	1	1000	mL	HDPE
TOC_415	N	F	1	40	mL	~~HDPE~~VOA
DHC	N	G	1	1	L	Amb. Glass

Sulfides -
Explosives - 1 L Am

Groundwater Information:

Measured Well Depth: **Depth To Water:**

Comments:

Sketch Location:

Logged BY / Date: CWinter 2/24/07 *Reviewed BY / Date:*

00091708

Sheet 1 of 2

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GROUNDWATER SAMPLING FORM

Operable Unit/Site ID: Longhorn - Site 29
Project Name/#: Longhorn AAP
Weather: Sunny-Clear -50's
Sampling location ID: 29WW38
Sample ID: 29WW38-Feb 2007
Collection Time/Date: 2-22-07/0930

Pump Installation

Pump installation crew: Willemore, McAdoo
PID/FID reading (well head/background): 0.0/0%
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 844'
Initial (pre-installation) DTW/time: 30.83
Final (after pump priming) DTW/time: 30.64
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL):
Discharge tube length (ft.): 42
Installation date/beginning time: 2-22-07/0840
Installation date/completion time: 2-22-07 0900
Screen Interval (ft. BTOC): 29 to 39
Pump intake depth (ft BTOC): 39'
Post-installation DTW/time: 30.64'
Max. sustainable pump rate (mL/min): 140
Appearance of product: Clear
Discharge tube diameter (3/8" or 1/4"): 3/8"
Inlet reducer used (Y/N): 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)									

SRMc

Copy

Purging/sampling crew: Willemore
Purge date/beginning time: 2-22-0
Initial (pre-purging) DTW (ft. BTOC): 3
Calculated tubing + pump volume:
eading (well head/background): 0.0/0%
e/completion time: 2-22-07/1020
st-purging) DTW (ft. BTOC): 30.64
ing + pump volumes purged:

Pneumatic Controller Tuning:

Initial air pressure = H (ft.) X 0.43 = N

	Initial	2	3	4	5	6	7	8	Final
Pressure (psi)	27	27	27	27	27				
Refill Setting	10	10	10	10	10				
Discharge Setting	5	5	5	5	5				
Flow rate (mL/min)	140	140	140	140	140				

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)
0910	30.64	140	140	16.02	0.530	6.41	274.2	1.80	2.9
0915	30.64	~~280~~ 140	280	16.68	0.519	6.40	277.5	1.49	3.2
0920	30.64	140	420	17.07	0.524	6.39	280.9	1.38	3.1
0925	30.64	140	560	17.32	0.529	6.37	282.4	1.26	2.6
0930	30.64	140	700	17.45	0.537	6.36	284.7	1.21	2.5

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GROUNDWATER SAMPLING FORM

00091709

Sheet 2 of 2

Water Quality Parameter Measurements (continued)

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

10/20

SHMS

Sampling

Sampling beginning time: 0930

Sampling completion time: 0930

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)
1010	30.64	140	840	18.45	0.550	6.31	307.1	1.04	0.4

Sample Information

Sample ID: 29WW38-Feb 2007

Sample collection date/time: 2-22-07

Duplicate sample collected (Y/N): N

Duplicate sample ID: N

Split sample collected (Y/N): N

Split sample ID: N

COC No(s): 10494

Requested Analysis	Method	Containers	Requested Analysis	Method	Containers
VOC	8260B	3	Perchlorate	314.0	1
GASES-CO2	Sop175	3	Alkalinity	310.0	1
TOC	415.1	3	Explosives		2
ANIONS	300.0	1			
Sulfides	376.2	1			

Comments:

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

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Sample Collection Log

00091710

Page 1 of 2

117591 - Longhorn Army Ammunition Plant

Manager: Praveen Srivastav

RFA / COC Number: 10494

Location Code: 29WW38
Sample Number: 29WW38-Feb 2007
Sample Name: 29WW38-GW-29WW38- -REG
Sampling Method: SP
Sample Type: GW *Sample Purpose:* REG
Sampling Equip: Stainless Steel Bladder Pump

Task: MNA_EVENT_FEB07
Collection Date: 2-22-07
Collection Time: 0930
Start Depth: 39
End Depth: 30.64
Sample Matrix: WATER
Sample Team: Willemore, McAdoo

QC Partners:
(TB) (ER) (FB)

ERPIMS Values:
Sacode:
Lot Control#:

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
VOC-FULL	N	A	3	40	mL	VOA VIAL
ANIONS	N	B	1	500	mL	HDPE
PERC	N	C	1	500	mL	HDPE
GASES	N	D	2	40	mL	VOA Vial
ALKALINITY	N	E	1	100	mL	HDPE
TOC_415	N	F	1	100	mL	HDPE
DHC	N	G	1	1	L	Amb. Glass

Groundwater Information:
Measured Well Depth: 44.' **Depth To Water:** 30.64

Comments:

Sketch Location:

Logged BY / Date: Sherry McAdoo 2-22-07 *Reviewed BY / Date:*

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Sample Collection Log

00091711
Page 2 of 2

117591 - Longhorn Army Ammunition Plant

Manager: Praveen Srivastav

Location Code: 29WW38
Sample Number: 29WW38-Feb 2007

PURGE RECORD:

Initial	Time(24hr)	DepthtoWater (ft)	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)	Purge Volume (gal)
					SKMc				
Sample:	1010	3964	307.1	6.31	0.550	0.4	1.04	18.45	140

Logged BY / Date: Sherry McAdoo
2-22-07
Reviewed BY / Date: ______________

00091712
Sheet 1 of 2

GROUNDWATER SAMPLING FORM

Operable Unit/Site ID: Longhorn, Site29
Project Name/#: Longhorn AAP
Weather: Sunny 85°
Sampling location ID: 29WW06
Sample ID: 29WW06-Feb 2007
Collection Time/Date: 2-22-07, 1500

Pump Installation

Pump installation crew: Willemore, McAdoo
PID/FID reading (well head/background): 0.0 / 0%
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 35.19'
Initial (pre-installation) DTW/time: 29.81'
Final (after pump priming) DTW/time:
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL):
Discharge tube length (ft.): 35'
Installation date/beginning time: 2-22-07, 1420
Installation date/completion time: 2-22-07 1430
Screen Interval (ft. BTOC): 25.19 to 35.19
Pump intake depth (ft BTOC): 32.5'
Post-installation DTW/time: 29.85
Max. sustainable pump rate (mL/min): 100
Appearance of product: yellowish
Discharge tube diameter (3/8" or 1/4"): 3/8"
Inlet reducer used (Y/N): 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					SKM				
Discharge Setting									
Flow rate (mL/min)									

Copy

Purging/sampling crew: Willemor
Purge date/beginning time: 2-22-
Initial (pre-purging) DTW (ft. BTOC): 2
Calculated tubing + pump volume:
eading (well head/background): 0.0 / 0%
te/completion time: 2-22-07, 1540
st-purging) DTW (ft. BTOC): 29.85
ping + pump volumes purged:

Pneumatic Controller Tuning:

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

	Initial	2	3	4	5	6	7	8	Final
Pressure (psi)	25	20	20	20					
Refill Setting	10	10	10	10					
Discharge Setting	5	5	5	5					
Flow rate (mL/min)	100	100	100	100					

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)
1445	29.85	100	100	19.91	3.510	6.41	224.6	1.81	2.3
1450	29.85	100	200	19.89	3.504	6.41	227.6	1.61	2.3
1455	29.85	100	300	19.89	3.501	6.44	234.6	1.42	1.5
1500	29.85	100	400	19.94	3.504	6.45	240.1	1.39	1.4

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GROUNDWATER SAMPLING FORM

00091713

Sheet 2 of 2

Water Quality Parameter Measurements (continued)

Time	DTW (ft. BTOC)	Purge Rate (mL/min)	Cumulative Volume Purged (L)	Temp. (degree C) ± 10%	±3% Electrical Conductivity (uMhos/cm)	pH ± 0.1	Eh (mv) ± 10	DO (mg/L) ± 10%	Turbidity (NTU) ± 10% 10/20

SKM

Sampling

Sampling beginning time: 1500

Sampling completion time: 1530

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)
1535	29.85	100	500	~~[illegible]~~	3.517	6.5	248.7	1.51	0.7
			SKM	20.22					

Sample Information

Sample ID: 29WW06-Feb 2007

Sample collection date/time: 2-22-07

Duplicate sample collected (Y/N): N

Duplicate sample ID: N

Split sample collected (Y/N): N

Split sample ID: N

COC No(s): 10757

Requested Analysis	Method	Containers	Requested Analysis	Method	Containers
VOC	8260B	3	Perchlorate	314.0	1
Gases-CO2	Sop175	3	Alkalinity	310.0	1
TOC	415.1	3	Explosives		2
Anions	300.0	1			
Sulfides	376.2	1			

Comments: Water is yellowish tannic

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

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Sample Collection Log

117591 - Longhorn Army Ammunition Plant
Manager: **Praveen Srivastav**

RFA / COC Number: 10957

Location Code: 29WW06
Sample Number: 29WW06- Feb 2007
Sample Name: 29WW06-GW-29WW06- -REG
Sampling Method: SP
Sample Type: GW
Sample Purpose: REG
Sampling Equip: Stainless Steel Bladder Pump

Task: MNA_EVENT_FEB07
Collection Date: 2-22-07
Collection Time: 1500
Start Depth: 32.5'
End Depth: 29.85
Sample Matrix: WATER

QC Partners:
(TB) ____ **(ER)** ____ **(FB)** ____

Sample Team: Willemore, McAdoo

ERPIMS Values:
Sacode: ____
Lot Control#: ____

Analytical Suite	**Flt**	**Frtn**	**Containers** **Qty**	**Size**	**Units**	**Type**
VOC-FULL	N	A	3	40	mL	VOA VIAL
ANIONS	N	B	1	500	mL	HDPE
PERC	N	C	1	500	mL	HDPE
GASES	N	D	2	40	mL	VOA Vial
ALKALINITY	N	E	1	100	mL	HDPE
TOC_415	N	F	1	100	mL	HDPE
DHC	N	G	1	1	L	Amb. Glass

Groundwater Information:
Measured Well Depth: 35.19' **Depth To Water:** 29.81'

Comments:

Sketch Location:

Logged BY / Date: Sherry McAdoo 2-22-07
Reviewed BY / Date: ____

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Sample Collection Log

00091715
Page 2 of 2

117591 - Longhorn Army Ammunition Plant

Manager: Praveen Srivastav

Location Code: **29WW06**
Sample Number: **29WW06**Feb2007

PURGE RECORD:

Initial	Time(24hr)	DepthtoWater (ft)	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)	Purge Volume (gal)
					SKmS				
Sample:	1535	29.85	268.7	6.5	3.517	0.7	1.51	20.22	100

Logged BY / Date: Sherry Mc[illegible]
9-22-07

Reviewed BY / Date: ____________

GROUNDWATER SAMPLING FORM

00091716
Sheet 1 of 2

Operable Unit/Site ID: Longhorn, Site 29
Project Name/#: Longhorn AAP
Weather: Sunny 60s
Sampling location ID: 29WW35
Sample ID: 29WW35-Feb 2007
Collection Time/Date: 2-22-07, 1245

Pump Installation

Pump installation crew: Willemore, McAdoo
PID/FID reading (well head/background): 3.2/0 %
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 95'
Initial (pre-installation) DTW/time: 42.84
Final (after pump priming) DTW/time: ~~31.45~~ SKmc
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL):
Discharge tube length (ft.): 93'
Installation date/beginning time: 2-22-07, 1125
Installation date/completion time: 2-22-07,
Screen Interval (ft. BTOC): 85 to 95
Pump intake depth (ft BTOC): 90'
Post-installation DTW/time: 42.70
Max. sustainable pump rate (mL/min):
Appearance of product:
Discharge tube diameter (3/8" or 1/4"): 3/8"
Inlet reducer used (Y/N): 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				SKmc					
Discharge Setting									
Flow rate (mL/min)									

Purging/sampling crew: Willemore, M
Purge date/beginning time: 2-22-07, 11
Initial (pre-purging) DTW (ft. BTOC): 42.
Calculated tubing + pump volume:
Copy
g (well head/background): 3.2/0 %
npletion time: 2-22-07, 1240
ging) DTW (ft. BTOC): 42.70
pump volumes purged:

Pneumatic Controller Tuning:
Initial air pressure = H (ft.) X 0.43 = NR psi

	Initial	2	3	4	5	6	7	8	Final
Pressure (psi)	55	55	55	55	55	55	55	55	
Refill Setting	20	20	20	20	20	20	20	20	
Discharge Setting	10	10	10	10	10	10	10	10	
Flow rate (mL/min)	200	200	200	200	200	200	200	200	

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)
1205	42.70	200	200	20.66	0.875	8.63	166.8	0.63	14.6
1210	42.70	200	400	20.64	0.865	7.77	266.	0.55	19.6
1215	42.70	200	600	20.65	0.861	7.49	-46.4	0.52	1.4
1220	42.70	200	800	20.72	0.859	7.43	-78.5	0.48	1.1
1225	42.70	200	1000	20.75	0.859	7.45	-111.0	0.47	1.3
1230	42.70	200	1200	20.75	0.861	7.47	-129.7	0.47	0.9
1235	42.70	200	1400	20.89	0.860	7.44	-137.9	0.38	0.7
1240	42.70	200	1600	20.87	0.860	7.41	-140.8	0.37	0.8

GROUNDWATER SAMPLING FORM

Sheet 2 of 2

Water Quality Parameter Measurements (continued)

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

10/20

Same

Sampling

Sampling beginning time: 1245

Sampling completion time: 1355

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)
1355	42.70	200	1800	25.96	0.872	7.38	-106.5	0.80	1.6

Sample Information

Sample ID: 29WW35-Feb 2007

Sample collection date/time: 2-22-07

Duplicate sample collected (Y/N): Y

Duplicate sample ID: 29WW35-Feb2007-FD

Split sample collected (Y/N): N

Split sample ID: N

COC No(s): 10957

Requested Analysis	Method	Containers	Requested Analysis	Method	Containers
VOC	8260B	3	Perchlorate	314.0	1
Gases-CO2	Sop175	3	Alkalinity	310.0	1
TOC	415.1	3	Explosives		2
Anions	300.0	1			
Sulfides	376.2	1			

Comments:

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

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Sample Collection Log

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Page 1 of 2

117591 - Longhorn Army Ammunition Plant

Manager: Praveen Srivastav

RFA / COC Number: 10957

Location Code: 29WW35
Task: MNA_EVENT_FEB07
Sample Number: 29WW35-Feb2007
Collection Date: 2-22-07
Sample Name: 29WW35-GW-29WW35- -REG
Collection Time: 1245
Sampling Method: SP
Start Depth: 90'
Sample Type: GW
Sample Purpose: REG
End Depth: 42.70
Sampling Equip: Stainless Steel Bladder Pump
Sample Matrix: WATER

QC Partners:
(TB) ______ **(ER)** ______ **(FB)** ______

Sample Team: Willemore, McAdoo

ERPIMS Values:
Sacode:
Lot Control#:

Containers

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
VOC-FULL	N	A	3	40	mL	VOA VIAL
ANIONS	N	B	1	500	mL	HDPE
PERC	N	C	1	500	mL	HDPE
GASES	N	D	2	40	mL	VOA Vial
ALKALINITY	N	E	1	100	mL	HDPE
TOC_415	N	F	1	100	mL	HDPE
DHC	N	G	1	1	L	Amb. Glass

Groundwater Information:

Measured Well Depth: 95'
Depth To Water: ~~31.45~~ 42.84

Comments:

Sketch Location:

Logged BY / Date: Sherry McAdoo
2-22-07

Reviewed BY / Date:

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Sample Collection Log

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Page 2 of 2

117591 - Longhorn Army Ammunition Plant

Manager: Praveen Srivastav

Location Code: 29WW35
Sample Number: 29WW35-Feb2007

PURGE RECORD:

Initial	Time(24hr)	DepthtoWater (ft)	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)	Purge Volume (gal)
Sample:	1355	42.70	-106.5	7.38	0.872	~~7.38~~ 1.6	~~-106.5~~ 0.80	25.96	200

SKMS

Logged BY / Date: Sherry McAlpo
2-22-07

Reviewed BY / Date: ______________

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Sample Collection Log

117591 - Longhorn Army Ammunition Plant

Manager: Praveen Srivastav

RFA / COC Number: 10495

Location Code: 29WW36
Sample Number: 29WW36-Feb2007
Sample Name: 29WW36-GW-29WW36- -REG
Sampling Method: SP
Sample Type: GW *Sample Purpose:* REG
Sampling Equip: Stainless Steel Bladder Pump

Task: MNA_EVENT_FEB07
Collection Date: 2-21-07
Collection Time: 1515
Start Depth: 31'
End Depth: 28.88
Sample Matrix: WATER
Sample Team: Willemore|McAdo

QC Partners:
(TB)
(ER)
(FB)

ERPIMS Values:
Sacode:
Lot Control#:

Analytical Suite	Flt	Frtn	Qty	Size	Units	Type
VOC-FULL	N	A	3	40	mL	VOA VIAL
ANIONS	N	B	1	500	mL	HDPE
PERC	N	C	1	500	mL	HDPE
GASES	N	D	2	40	mL	VOA Vial
ALKALINITY	N	E	1	100	mL	HDPE
TOC_415	N	F	1	100	mL	HDPE
DHC	N	G	1	1	L	Amb. Glass

Groundwater Information:

Measured Well Depth: 36.70 **Depth To Water:** 28.9

Comments:

Sketch Location:

Logged BY / Date: Sherry McAdoo
2-21-07

Reviewed BY / Date:

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Sample Collection Log

00091721
Page 2 of 2

117591 - Longhorn Army Ammunition Plant

Manager: Praveen Srivastav

Location Code: 29WW36
Sample Number: 29WW36Feb2007

PURGE RECORD:

Initial	Time(24hr)	DepthtoWater (ft)	Eh (mV)	pH (SU)	Conductivity (mS/cm)	Turbidity (NTU)	DissOxygen (ppm)	Temperature (C)	Purge Volume (gal)
					SKMc				
Sample:	1545	28.92	302.8	6.44	4.633	1.2	0.94	20.63	105

Logged BY / Date: Sherry McAdoo
2-21-07

Reviewed BY / Date: ______________

GROUNDWATER SAMPLING FORM

Sheet 1 of 2.

Operable Unit/Site ID: Longhorn, Site29
Project Name/#: Longhorn AAP
Weather: Sunny 80°
Sampling location ID: 29WW36
Sample ID: 29WW36-Feb 2007
Collection Time/Date: 2-21-07 / 1515

Pump Installation

Pump installation crew: Willemore/McAdoo
PID/FID reading (well head/background): 0.0/0%
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 36.70
Initial (pre-installation) DTW/time: 28.9'
Final (after pump priming) DTW/time: 28.88
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL):
Discharge tube length (ft.):
Installation date/beginning time: 2-21-07/1430
Installation date/completion time: 2-21-07/1450
Screen Interval (ft. BTOC): to
Pump intake depth (ft BTOC): 31'
Post-installation DTW/time: 28.88
Max. sustainable pump rate (mL/min):
Appearance of product:
Discharge tube diameter (3/8" or 1/4"): 3/8"
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					SKmps				
Discharge Setting									
Flow rate (mL/min)									

Purging

Purging/sampling crew: Willmore/McAdoo
Purge date/beginning time: 2-21-07/1455
Initial (pre-purging) DTW (ft. BTOC): 28.88
Calculated tubing + pump volume: NA
PID/FID reading (well head/background): 0.0/0%
Purge date/completion time: 2-21-07/1515
Final (post-purging) DTW (ft. BTOC): 28.92
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)	21	21	21	21					21
Refill Setting	10	10	10	10					10
Discharge Setting	5	5	5	5					5
Flow rate (mL/min)	105	105	105	105					105

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)
1455	28.88	105	105	20.06	4.704	6.4	2698	1.49	2.0
1500	28.88	105	210	20.00	4.675	6.4	275.5	1.24	2.0
1505	28.88	105	315	19.92	4.659	6.40	280.9	1.00	1.7
1510	28.92	105	420	19.86	4.647	6.41	284.2	0-92	1.2

00091723

GROUNDWATER SAMPLING FORM

Sheet 2 of 2

Water Quality Parameter Measurements (continued)

Time	DTW (ft. BTOC)	Purge Rate (mL/min)	Cumulative Volume Purged (L)	Temp. (degree C) ± 10%	±3% Electrical Conductivity (uMhos/cm)	pH ± 0.1	Eh (mv) ± 10	DO (mg/L) ± 10%	Turbidity (NTU) ± 10%	10/20

SKMs

Sampling

Sampling beginning time: 1515

Sampling completion time: 1515

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)
1545	28.92	105	525	20.63	4.633	6.44	302.8	0.94	1.2

Sample Information

Sample ID: 29WW36-Feb 2007

Sample collection date/time: 2-21-07

Duplicate sample collected (Y/N): N

Duplicate sample ID: N

Split sample collected (Y/N): N

Split sample ID: N

COC No(s): 10495

Requested Analysis	Method	Containers	Requested Analysis	Method	Containers
VOC	8260B	3	Perchlorate	314.0	1
Gases/CO2	SOP175	3	Alkalinity	310.1	1
TOC	415.1	3	Explosives		2
Anions	300.0	1			
Sulfides	376.2	1			

Comments:

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

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GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: LHAAP
Project Name/#: 117591.0009B800
Weather: Sunny 50°F
Sampling location ID: Site 29
Sample ID: 29WW37-020108
Collection Time/Date: 1:35 2/1/08

Pump Installation

Pump installation crew: Beesinger
PID/FID reading (well head/background):
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 95.00
Initial (pre-installation) DTW/time: 48.20
Final (after pump priming) DTW/time:
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL):
Discharge tube length (ft.):
Installation date/beginning time: 2/1/08 12:15
Installation date/completion time: 2/1/08 12:30
Screen Interval (ft. BTOC): 85.00 to 95.00
Pump intake depth (ft BTOC): 90.00
Post-installation DTW/time: 48.10
Max. sustainable pump rate (mL/min):
Appearance of product:
Discharge tube diameter (3/8" or 1/4"):
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: Beesinger
Purge date/beginning time: 2/1/08
Initial (pre-purging) DTW (ft. BTOC): 48.10
Calculated tubing + pump volume: NA
PID/FID reading (well head/background):
Purge date/completion time: 2/1/08 1:35
Final (post-purging) DTW (ft. BTOC): 48.35
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)	50								
Refill Setting	48								
Discharge Setting	45								
Flow rate (mL/min)	150								

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)
12:35	48.20	150	750	16.29	0.665	8.36	144.5	3.43	3.4
12:40	48.25	150	1500	16.62	0.668	7.94	149.6	2.73	2.3
12:45	48.30	150	2250	17.02	0.669	7.48	157.8	2.34	1.7
12:50	48.32	150	3000	17.26	0.670	7.11	158.7	1.99	1.8
12:55	48.34	150	3750	17.35	0.672	6.98	147.3	1.76	0.9
1:00	48.35	150	4500	17.38	0.671	6.85	125.3	1.67	0.9
1:05	48.35	150	5250	17.49	0.671	6.78	111.2	1.60	0.6
1:10	48.35	150	6000	17.54	0.672	6.72	100.9	1.57	0.8

Shaw

GROUNDWATER SAMPLING FORM

Sheet 2 of 2

Water Quality Parameter Measurements (continued)

Time	DTW (ft. BTOC)	Purge Rate (mL/min)	Cumulative Volume Purged (L)	Temp. (degree C) ± 10%	±3% Electrical Conductivity (uMhos/cm)	pH ± 0.1	Eh (mv) ± 10	DO (mg/L) ± 10%	Turbidity (NTU) ± 10%
1:15	48.35	150	6750	17.32	0.674	6.68	81.3	1.57	0.6
1:20	48.35	150	7500	16.87	0.674	6.58	72.5	1.56	0.6
1:25	48.35	150	8250	16.98	0.672	6.56	60.7	1.48	0.6
1:30	48.35	150	9000	17.09	0.672	6.55	59.8	1.44	0.5
1:35	48.35	150	9750	17.11	0.673	6.55	57.6	1.43	0.3

10/20

Sampling

Sampling beginning time: 1:35

Sampling completion time: 1:37

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: 29WW37-020108

Sample collection date/time: 2/1/08 1:35

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
VOC		3-40mL glass			

Comments:

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

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GROUNDWATER SAMPLING FORM

Sheet 1 of 2

Operable Unit/Site ID: LHAAP
Project Name/#: 117591.0009B800
Weather: Sunny 50°F
Sampling location ID: Site 29
Sample ID: 29WW39-020108
Collection Time/Date: 3:30 2/1/08

Pump Installation

Pump installation crew: Beesinger
PID/FID reading (well head/background):
Casing diameter (inches): 4"
Total well Depth (ft. BTOC): 87.22
Initial (pre-installation) DTW/time: 32.15
Final (after pump priming) DTW/time:
Free product (circle): LNAPL / DNAPL
Volume of water removed during priming (mL):
Discharge tube length (ft.):
Installation date/beginning time: 2/1/08 2:05
Installation date/completion time: 2/1/08 2:20
Screen Interval (ft. BTOC): 77.22 to 87.22
Pump intake depth (ft BTOC): 82.00
Post-installation DTW/time:
Max. sustainable pump rate (mL/min):
Appearance of product:
Discharge tube diameter (3/8" or 1/4"):
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: Beesinger
Purge date/beginning time: 2/1/08 2:20
Initial (pre-purging) DTW (ft. BTOC): 32.08
Calculated tubing + pump volume: NA
PID/FID reading (well head/background):
Purge date/completion time: 2/1/08 3:30
Final (post-purging) DTW (ft. BTOC): 32.20
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)	50								
Refill Setting	50								
Discharge Setting	45								
Flow rate (mL/min)	100								

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)
2:25	32.15	100	500	17.58	0.620	10.37	21.2	1.33	3.5
2:30	32.17	100	1000	17.79	0.621	10.32	15.5	0.89	2.3
2:35	32.19	100	1500	17.84	0.620	10.28	12.9	0.62	2.2
2:40	32.20	100	2000	17.81	0.612	10.20	14.5	0.48	2.5
2:45	32.20	100	2500	17.79	0.604	10.10	16.8	0.38	1.7
2:50	32.20	100	3000	17.90	0.594	9.98	19.7	0.29	3.6
2:55	32.20	100	3500	17.68	0.585	9.88	22.4	0.24	4.1
3:00	32.20	100	4000	17.65	0.580	9.81	24.3	0.23	3.7

Shaw

GROUNDWATER SAMPLING FORM

Sheet 2 of 2

Water Quality Parameter Measurements (continued)

Time	DTW (ft. BTOC)	Purge Rate (mL/min)	Cumulative Volume Purged (L)	Temp (degree C) ± 10%	±3% Electrical Conductivity (uMhos/cm)	pH ± 0.1	Eh (mv) ± 10	DO (mg/L) ± 10%	Turbidity (NTU) ± 10%
3:05	32.20	100	4500	17.60	0.574	9.73	25.9	0.20	3.4
3:10	32.20	100	5000	17.58	0.568	9.67	27.1	0.19	3.6
3:15	32.20	100	5500	17.55	0.564	9.60	28.6	0.18	5.1
3:20	32.20	100	6000	17.54	0.560	9.58	30.3	0.17	5.3
3:25	32.20	100	6500	17.53	0.566	9.55	30.1	0.17	5.0
3:30	32.20	100	7000	17.53	0.559	9.53	29.5	0.17	5.5

10 / 20

Sampling

Sampling beginning time: 3:30

Sampling completion time: 3:32

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: 29WW39-020108

Sample collection date/time: 2/1/08 3:30

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
VOC		3-40ml glass			

Comments:

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

Attachment 5

Laboratory Reports

Available on the attached CD

KEMRON
ENVIRONMENTAL SERVICES

156 Starlite Drive, Marietta, OH 45750 • TEL 740-373-4071 • FAX 740-373-4835 • http://www.kemron.com

Laboratory Report Number: L0609004

Please find enclosed the analytical results for the samples you submitted to KEMRON Environmental Services.

Review and compilation of your report was completed by KEMRON's Sales and Service Team. If you have questions, comments or require further assistance regarding this report, please contact your team member noted in the reviewed box bleow at 800-373-4071. Team member e-mail addresses also appear here for your convenience.

Debra Elliott - Team Leader
delliott@kemron-lab.com

Cheryl Koelsch - Team Chemist/Data Specialist
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Amanda Fickiesen - Client Services Specialist
afickiesen@kemron-lab.com

Annie Bock - Client Services Specialist
abock@kemron-lab.com

This report was reviewed on September 13, 2006.

Stephanie Mossburg

STEPHANIE MOSSBURG - Team Chemist/Data Specialist

I certify that all test results meet all of the requirements of the NELAP standards and other applicable contract terms and conditions. All results for soil samples are reported on a 'dry-weight' basis unless specified otherwise. Analytical results for water and wastes are reported on a 'as received' basis unless specified otherwise. A statement of uncertainty for each analysis is available upon request. This laboratory report shall not be reproduced, except in full, without the written approval of KEMRON Environmental Services.

This report was certified on September 13, 2006.

David E. Vandenberg

David Vandenberg - Vice President

FL DOH NELAP ID: E8755
This report contains a total of 44 pages.

Protecting Our Environmental Future

KEMRON ENVIRONMENTAL SERVICES
REPORT NARRATIVE

KEMRON Login No.: L0609004

CHAIN OF CUSTODY: The chain of custody number was 10407.

SHIPMENT CONDITIONS: The chain of custody forms were received sealed in a cooler. The cooler temperature was 3 degrees C.

SAMPLE MANAGEMENT: All samples received were intact.

I certify that this data package is in compliance with the terms and conditions agreed to by the client and KEMRON Environmental Services, both technically and for completeness, except for the conditions noted above. Release of the data contained in this hardcopy data package has been authorized by the Laboratory Manager or designated person, as verified by the following signature.

Approved: 05-SEP-06
Stephanie Mossburg

Laboratory Data Package Cover Page

This data Package consists of:

This signature page, the laboratory review checklists, and the following reportable data:

- R1 Field chain-of-custody documentation;
- R2 sample identification cross-reference;
- R3 Test reports (analytical data sheets) for each enviornmental sample that includes:
  - a) Items consistant with NELAC 5.13 or ISO/IEC 17025 Section 5.10
  - b) dilution factors,
  - c) preparation methods,
  - d) Cleanup methods, and
  - e) If required for the project, tentatively identified compounds (TICs)
- R4 Surrogate recovery data including:
  - a) Calculated recovery (%R) for each analyte, and
  - b) The laboratory’s surrogate QC limits.
- R5 Test reports/summary forms for blank samples;
- R6 Test reports/summary forms FOR laboratory control samples (LCSs) including:
  - a) LCS spiking amount,
  - b) Calculated %R for each analyte, and
  - c) The laboratory”s LCS QC limits.
- R7 Test reports for project matrix spike/matrix spike duplicates (MS/MSDs) including:
  - a) Samples associated with the MS/MSD clearly identified,
  - b) MS/MSD spiking amounts,
  - c) Concentration of each MS/MSD analyte measured in the parent and spiked samples,
  - d) Calculated %R and relative percent differences (RPDs), and
  - e) The laboratory’s MS/MSD QC limits
- R8 Laboratory analytical duplicate (if applicable) revocery and precision:
  - a) the amount of analyte measured in the duplicate,
  - b) the calculated RPD, and
  - c) the laboratory’s QC limits for anlytical duplicates.
- R9 List of method quantitation limits (MQLs) for each analyte for each method and matrix;
- R10 Other problems or anomalies.

The exception Report for every ”No” or ”Not Reviewed (NR)” item in laboratory review checklist.

Release statement: I am responsible for the release of this laboratory data package. This data package has been reviewed by the laboratory and is complete and technically compliant with the requirements of the methods used, except where noted by the laboratory in the attached exceptions reports. By my signature below, I affirm to the best of my knowledge, all problems/anomalies, observed by the laboratory as having the potential to affect the quality of the data, have been identified by the laboratoy in the Laboratory Review Checklist, and no information or data have been knowingly withheld that would affect the quality of the data.

Check, If applicable: [] This laboratory is an in-house laboratory controlled by the person repsonding to rule. The official signing the cover page of the rule-required report (for example, the APAR) in which these data are used is responsible for releasing this data package and is by signature affirming the above release statement is trus.

DEANNA I. HESSON	Deanna Hesson	Conventional Lab Supervisor	September 12, 2006
Name (Printed)	Signature	Official Title (printed)	DATE

KEMRON Environmental Services

Laboratory Review Checklist

Laboratory Name:	KEMRON
Laboratory Log Number:	L0609004
Project Name:	798-LONGHORN
Method:	PCTSOLIDS
Prep Batch Number(s):	WG221779
Reviewer Name:	DEANNA I. HESSON
LRC Date:	September 12, 2006

Description	Yes	No	NA(1)	NR(2)	ER(3)
Chain-Of-Custody (C-O-C)					
Did samples meet the laboratory's standard conditions of sample acceptability upon receipt?	✓				
Were all departures from standard conditions described in an exception report?	✓				
Sample and quality control (QC) identification					
Are all field sample ID numbers cross-referenced to the laboratory ID numbers?	✓				
Are all laboratory ID numbers cross-referenced to the corresponding QC data?	✓				
Test reports					
Were all samples prepared and analyzed within holding times?	✓				
Other than those results <MQL, were all other raw values bracketed by calibration standards?			✓		
Were calculations checked by a peer or supervisor?	✓				
Were all analyte identifications checked by a peer or supervisor?			✓		
Were sample quantitation limits reported for all analytes not detected?			✓		
Were all results for soil and sediment samples reported on a dry weight basis?	✓				
Were % moisture (or solids) reported for all soil and sediment samples?	✓				
If required for the project, TICs reported?			✓		
Surrogate recovery data					
Were surrogates added prior to extraction?			✓		
Were surrogate percent recoveries in all samples within the laboratory QC limits?			✓		
Test reports/summary forms for blank samples					
Were appropriate type(s) of blanks analyzed?			✓		
Were blanks analyzed at the appropriate frequency?			✓		
Were method blanks taken through the entire analytical process, including preparation and, if applicable, cleanup procedures?			✓		
Were blank concentrations <MQL?			✓		
Laboratory control samples (LCS):					
Were all COCs included in the LCS?			✓		
Was each LCS taken through the entire analytical procedure, including prep and cleanup steps?			✓		
Were LCSs analyzed at the required frequency?			✓		
Were LCS (and LCSD, if applicable) %Rs within the laboratory QC limits?			✓		
Does the detectability data document the laboratorys capability to detect the COCs at the MDL used to calculate the SQLs?			✓		
Was the LCSD RPD within QC limits?			✓		
Matrix spike (MS) and matrix spike duplicate (MSD) data					
Were the project/method specified analytes included in the MS and MSD?			✓		
Were MS/MSD analyzed at the appropriate frequency?			✓		
Were MS (and MSD, if applicable) %Rs within the laboratory QC limits?			✓		

Description	Yes	No	NA(1)	NR(2)	ER(3)
Were MS/MSD RPDs within laboratory QC limits?			✓		
Analytical duplicate data					
Were appropriate analytical duplicates analyzed for each matrix?	✓				
Were analytical duplicates analyzed at the appropriate frequency?	✓				
Were RPDs or relative standard deviations within the laboratory QC limits?	✓				
Method quantitation limits (MQLs):					
Are the MQLs for each method analyte included in the laboratory data package?			✓		
Do the MQLs correspond to the concentration of the lowest non-zero calibration standard?			✓		
Are unadjusted MQLs included in the laboratory data package?			✓		
Other problems/anomalies					
Are all known problems/anomalies/special conditions noted in this LRC and ER?	✓				
Were all necessary corrective actions performed for the reported data?	✓				
Was applicable and available technology used to lower the SQL minimize the matrix interference affects on the sample results?			✓		
Were response factors and/or relative response factors for each analyte within QC limits?			✓		
Were percent RSDs or correlation coefficient criteria met?			✓		
Was the number of standards recommended in the method used for all analytes?			✓		
Were all points generated between the lowest and highest standard used to calculate the curve?			✓		
Are ICAL data available for all instruments used?			✓		
Has the initial calibration curve been verified using an appropriate second source standard?			✓		
Initial and continuing calibration verification (ICV and CCV) and continuing calibration blank (CCB):					
Was the CCV analyzed at the method-required frequency?			✓		
Were percent differences for each analyte within the method-required QC limits?			✓		
Was the ICAL curve verified for each analyte?			✓		
Was the absolute value of the analyte concentration in the inorganic CCB <MDL?			✓		
Mass spectral tuning:					
Was the appropriate compound for the method used for tuning?			✓		
Were ion abundance data within the method-required QC limits?			✓		
Internal standards (IS):					
Were IS area counts and retention times within the method-required QC limits?			✓		
Raw data (NELAC section 1 appendix A glossary, and section 5.12 or ISO/IEC 17025 section 4.12.2)					
Were the raw data (for example, chromatograms, spectral data) reviewed by an analyst?	✓				
Were data associated with manual integrations flagged on the raw data?			✓		
Dual column confirmation					
Did dual column confirmation results meet the method-required QC?			✓		
Tentatively identified compounds (TICs):					
If TICs were requested, were the mass spectra and TIC data subject to appropriate checks?			✓		
Interference Check Sample (ICS) results:					
Were percent recoveries within method QC limits?			✓		
Serial dilutions, post digestion spikes, and method of standard additions					
Were percent differences, recoveries, and the linearity within the QC limits specified in the method?			✓		
Method detection limit (MDL) studies					
Was a MDL study performed for each reported analyte?			✓		
Is the MDL either adjusted or supported by the analysis of DCSs?			✓		
Proficiency test reports:					
Was the laboratory's performance acceptable on the applicable proficiency tests or evaluation studies?			✓		

Description	Yes	No	NA(1)	NR(2)	ER(3)
Standards documentation					
Are all standards used in the analyses NIST-traceable or obtained from other appropriate sources?			✓		
Compound/analyte identification procedures					
Are the procedures for compound/analyte identification documented?			✓		
Demonstration of analyst competency (DOC)					
Was DOC conducted consistent with NELAC Chapter 5C or ISO/IEC 4?	✓				
Is documentation of the analyst’s competency up-to-date and on file?	✓				
Verification/validation documentation for methods (NELAC Chap 5 or ISO/IEC 17025 Section 5)					
Are all the methods used to generate the data documented, verified, and validated, where applicable?	✓				
Laboratory standard operating procedures (SOPs):					
Are laboratory SOPs current and on file for each method performed?	✓				

KEMRON Environmental Services
Laboratory Review Checklist

Laboratory Name:	KEMRON
Laboratory Log Number:	L0609004
Project Name:	798-LONGHORN
Method:	PCTSOLIDS
Prep Batch Number(s):	WG221779
Reviewer Name:	DEANNA I. HESSON
LRC Date:	September 12, 2006

EXCEPTIONS REPORT

ER# - Description

Footnotes:
(1) NA = Not applicable to method or project
(2) NR = Not reviewed
(3) ER# = Exception report number

LABORATORY REPORT

L0609004

09/13/06 08:30

Submitted By

KEMRON Environmental Services
156 Starlite Drive
Marietta , OH 45750
(740) 373 - 4071

For

Account Name: Shaw E & I, Inc.
ABB Lummus Biulding
3010 Briarpark
Houston, TX 77042
Attention: Diane Meyer

Account Number: 2773
Work ID: LHAAP/TRANSIT LIVE/KARNACK,TX

P.O. Number: 200328

Sample Summary

Client ID	Lab ID	Date Collected	Date Received
29-WL-12	L0609004-01	31-AUG-06	01-SEP-06
32-WL-05	L0609004-02	31-AUG-06	01-SEP-06
29-SD-48	L0609004-03	31-AUG-06	01-SEP-06
29-SD-49	L0609004-04	31-AUG-06	01-SEP-06
29-SD-47	L0609004-05	31-AUG-06	01-SEP-06
29-SD-49-QC	L0609004-06	31-AUG-06	01-SEP-06

Sample Number:**L0609004-01**
Client ID:**29-WL-12**
Matrix:**Soil**
Workgroup Number:**WG221826**
Collect Date:**08/31/2006 11:30**
Sample Tag:**01**

PrePrep Method:**NONE**
Prep Method:**METHOD**
Analytical Method:**8330**
Analyst:**JLS**
Dilution:**1**
Units:**mg/kg**

Instrument:**HPLC4**
Prep Date:**09/07/2006 08:00**
Cal Date:**08/10/2006 19:30**
Run Date:**09/08/2006 18:26**
File ID:**4L009141.F**

Analyte	CAS. Number	Result	Qual	PQL	SQL
1,3,5-Trinitrobenzene	**99-35-4**	**0.554**		**0.249**	**0.0995**
1,3-Dinitrobenzene	**99-65-0**	**0.386**		**0.249**	**0.0995**
2,4,6-Trinitrotoluene	**118-96-7**	**25.6**	**I**	**0.249**	**0.0995**
2,4-Dinitrotoluene	**121-14-2**	**6.25**		**0.249**	**0.0995**
2,6-Dinitrotoluene	**606-20-2**		**U**	**0.259**	**0.0995**
2-Amino-4,6-dinitrotoluene	**35572-78-2**		**U**	**0.259**	**0.0995**
2-Nitrotoluene	**88-72-2**		**U**	**0.249**	**0.0995**
3-Nitrotoluene	**99-08-1**		**U**	**0.249**	**0.0995**
4-Nitrotoluene	**99-99-0**		**U**	**0.249**	**0.0995**
4-Amino-2,6-dinitrotoluene	**19406-51-0**		**U**	**0.259**	**0.0995**
HMX	**2691-41-0**		**U**	**2.19**	**0.0995**
Nitrobenzene	**98-95-3**		**U**	**0.259**	**0.129**
RDX	**121-82-4**		**U**	**0.995**	**0.0995**
Tetryl	**479-45-8**		**U**	**0.647**	**0.199**

Surrogate	% Recovery	Lower	Upper	Qual
3,4-Dinitrotoluene	**93.6**	**50**	**150**	

I Semiquantitative result (out of instrument calibration range)
U Not detected at or above adjusted sample detection limit

Sample Number:**L0609004-01**
Client ID:**29-WL-12**
Matrix:**Soil**
Workgroup Number:**WG221826**
Collect Date:**08/31/2006 11:30**
Sample Tag:**DL1**

PrePrep Method:**NONE**
Prep Method:**METHOD**
Analytical Method:**8330**
Analyst:**JLS**
Dilution:**10**
Units:**mg/kg**

Instrument:**HPLC4**
Prep Date:**09/07/2006 08:00**
Cal Date:**08/10/2006 19:30**
Run Date:**09/11/2006 16:57**
File ID:**4L009152.F**

Analyte	CAS. Number	Result	Qual	PQL	SQL
1,3,5-Trinitrobenzene	**99-35-4**		**U**	**2.49**	**0.995**
1,3-Dinitrobenzene	**99-65-0**		**U**	**2.49**	**0.995**
2,4,6-Trinitrotoluene	**118-96-7**	**38.2**		**2.49**	**0.995**
2,4-Dinitrotoluene	**121-14-2**	**8.81**		**2.49**	**0.995**
2,6-Dinitrotoluene	**606-20-2**		**U**	**2.59**	**0.995**
2-Amino-4,6-dinitrotoluene	**35572-78-2**		**U**	**2.59**	**0.995**
2-Nitrotoluene	**88-72-2**		**U**	**2.49**	**0.995**
3-Nitrotoluene	**99-08-1**		**U**	**2.49**	**0.995**
4-Nitrotoluene	**99-99-0**		**U**	**2.49**	**0.995**
4-Amino-2,6-dinitrotoluene	**19406-51-0**		**U**	**2.59**	**0.995**
HMX	**2691-41-0**		**U**	**21.9**	**0.995**
Nitrobenzene	**98-95-3**		**U**	**2.59**	**1.29**
RDX	**121-82-4**		**U**	**9.95**	**0.995**
Tetryl	**479-45-8**		**U**	**6.47**	**1.99**

Surrogate	% Recovery	Lower	Upper	Qual
3,4-Dinitrotoluene	**13.9**	**50**	**150**	*****

*** Surrogate or spike compound out of range**
U Not detected at or above adjusted sample detection limit

Sample Number:**L0609004-01**
Client ID:**29-WL-12**
Matrix:**Soil**
Workgroup Number:**WG221779**
Collect Date:**08/31/2006 11:30**

PrePrep Method:**NONE**
Prep Method:**D2216-90**
Analytical Method:**D2216-90**
Analyst:**TMM**
Dilution:**1**
Units:**weight %**

Instrument:**OVEN**
Prep Date:**09/08/2006 08:20**
Cal Date:
Run Date:**09/08/2006 08:20**
File ID:**OV.0609080820-08**

Analyte	CAS. Number	Result	Qual	PQL	SQL
Percent Solids	**10-02-6**	**51.5**		**1.00**	**1.00**

Sample Number:**L0609004-02**
Client ID:**32-WL-05**
Matrix:**Soil**
Workgroup Number:**WG221826**
Collect Date:**08/31/2006 10:50**
Sample Tag:**01**

PrePrep Method:**NONE**
Prep Method:**METHOD**
Analytical Method:**8330**
Analyst:**JLS**
Dilution:**1**
Units:**mg/kg**

Instrument:**HPLC4**
Prep Date:**09/07/2006 08:00**
Cal Date:**08/10/2006 19:30**
Run Date:**09/08/2006 19:03**
File ID:**4L009142.F**

Analyte	CAS. Number	Result	Qual	PQL	SQL
1,3,5-Trinitrobenzene	**99-35-4**		**U**	**0.245**	**0.0980**
1,3-Dinitrobenzene	**99-65-0**		**U**	**0.245**	**0.0980**
2,4,6-Trinitrotoluene	**118-96-7**		**U**	**0.245**	**0.0980**
2,4-Dinitrotoluene	**121-14-2**		**U**	**0.245**	**0.0980**
2,6-Dinitrotoluene	**606-20-2**		**U**	**0.255**	**0.0980**
2-Amino-4,6-dinitrotoluene	**35572-78-2**	**27.8**	**I**	**0.255**	**0.0980**
2-Nitrotoluene	**88-72-2**		**U**	**0.245**	**0.0980**
3-Nitrotoluene	**99-08-1**		**U**	**0.245**	**0.0980**
4-Nitrotoluene	**99-99-0**		**U**	**0.245**	**0.0980**
4-Amino-2,6-dinitrotoluene	**19406-51-0**		**U**	**0.255**	**0.0980**
HMX	**2691-41-0**		**U**	**2.16**	**0.0980**
Nitrobenzene	**98-95-3**		**U**	**0.255**	**0.127**
RDX	**121-82-4**		**U**	**0.980**	**0.0980**
Tetryl	**479-45-8**		**U**	**0.637**	**0.196**

Surrogate	% Recovery	Lower	Upper	Qual
3,4-Dinitrotoluene	**97.3**	**50**	**150**	

I Semiquantitative result (out of instrument calibration range)
U Not detected at or above adjusted sample detection limit

Sample Number:**L0609004-02**
Client ID:**32-WL-05**
Matrix:**Soil**
Workgroup Number:**WG221826**
Collect Date:**08/31/2006 10:50**
Sample Tag:**DL1**

PrePrep Method:**NONE**
Prep Method:**METHOD**
Analytical Method:**8330**
Analyst:**JLS**
Dilution:**10**
Units:**mg/kg**

Instrument:**HPLC4**
Prep Date:**09/07/2006 08:00**
Cal Date:**08/10/2006 19:30**
Run Date:**09/11/2006 17:34**
File ID:**4L009153.F**

Analyte	CAS. Number	Result	Qual	PQL	SQL
1,3,5-Trinitrobenzene	**99-35-4**		**U**	**2.45**	**0.980**
1,3-Dinitrobenzene	**99-65-0**		**U**	**2.45**	**0.980**
2,4,6-Trinitrotoluene	**118-96-7**		**U**	**2.45**	**0.980**
2,4-Dinitrotoluene	**121-14-2**		**U**	**2.45**	**0.980**
2,6-Dinitrotoluene	**606-20-2**		**U**	**2.55**	**0.980**
2-Amino-4,6-dinitrotoluene	**35572-78-2**	**72.4**		**2.55**	**0.980**
2-Nitrotoluene	**88-72-2**		**U**	**2.45**	**0.980**
3-Nitrotoluene	**99-08-1**		**U**	**2.45**	**0.980**

Sample Number:	**L0609004-02**	PrePrep Method:	**NONE**	Instrument:	**HPLC4**
Client ID:	**32-WL-05**	Prep Method:	**METHOD**	Prep Date:	**09/07/2006 08:00**
Matrix:	**Soil**	Analytical Method:	**8330**	Cal Date:	**08/10/2006 19:30**
Workgroup Number:	**WG221826**	Analyst:	**JLS**	Run Date:	**09/11/2006 17:34**
Collect Date:	**08/31/2006 10:50**	Dilution:	**10**	File ID:	**4L009153.F**
Sample Tag:	**DL1**	Units:	**mg/kg**		

Analyte	CAS. Number	Result	Qual	PQL	SQL
4-Nitrotoluene	99-99-0		U	2.45	0.980
4-Amino-2,6-dinitrotoluene	19406-51-0		U	2.55	0.980
HMX	2691-41-0		U	21.6	0.980
Nitrobenzene	98-95-3		U	2.55	1.27
RDX	121-82-4		U	9.80	0.980
Tetryl	479-45-8		U	6.37	1.96

Surrogate	% Recovery	Lower	Upper	Qual
3,4-Dinitrotoluene	11.4	50	150	*

* Surrogate or spike compound out of range
U Not detected at or above adjusted sample detection limit

Sample Number:	**L0609004-02**	PrePrep Method:	**NONE**	Instrument:	**OVEN**
Client ID:	**32-WL-05**	Prep Method:	**D2216-90**	Prep Date:	**09/08/2006 08:20**
Matrix:	**Soil**	Analytical Method:	**D2216-90**	Cal Date:	
Workgroup Number:	**WG221779**	Analyst:	**TMM**	Run Date:	**09/08/2006 08:20**
Collect Date:	**08/31/2006 10:50**	Dilution:	**1**	File ID:	**OV.0609080820-09**
		Units:	**weight %**		

Analyte	CAS. Number	Result	Qual	PQL	SQL
Percent Solids	10-02-6	80.9		1.00	1.00

Sample Number:	**L0609004-03**	PrePrep Method:	**NONE**	Instrument:	**HPLC4**
Client ID:	**29-SD-48**	Prep Method:	**METHOD**	Prep Date:	**09/07/2006 08:00**
Matrix:	**Soil**	Analytical Method:	**8330**	Cal Date:	**08/10/2006 19:30**
Workgroup Number:	**WG221826**	Analyst:	**JLS**	Run Date:	**09/08/2006 19:40**
Collect Date:	**08/31/2006 09:15**	Dilution:	**1**	File ID:	**4L009143.F**
Sample Tag:	**01**	Units:	**mg/kg**		

Analyte	CAS. Number	Result	Qual	PQL	SQL
1,3,5-Trinitrobenzene	99-35-4		U	0.239	0.0957
1,3-Dinitrobenzene	99-65-0		U	0.239	0.0957
2,4,6-Trinitrotoluene	118-96-7		U	0.239	0.0957
2,4-Dinitrotoluene	121-14-2		U	0.239	0.0957
2,6-Dinitrotoluene	606-20-2		U	0.249	0.0957
2-Amino-4,6-dinitrotoluene	35572-78-2		U	0.249	0.0957
2-Nitrotoluene	88-72-2		U	0.239	0.0957
3-Nitrotoluene	99-08-1		U	0.239	0.0957
4-Nitrotoluene	99-99-0	4.88		0.239	0.0957
4-Amino-2,6-dinitrotoluene	19406-51-0		U	0.249	0.0957
HMX	2691-41-0		J	2.11	0.0957
Nitrobenzene	98-95-3		U	0.249	0.124
RDX	121-82-4		U	0.957	0.0957
Tetryl	479-45-8		U	0.622	0.191

Sample Number:	**L0609004-03**	PrePrep Method:	**NONE**	Instrument:	**HPLC4**
Client ID:	**29-SD-48**	Prep Method:	**METHOD**	Prep Date:	**09/07/2006 08:00**
Matrix:	**Soil**	Analytical Method:	**8330**	Cal Date:	**08/10/2006 19:30**
Workgroup Number:	**WG221826**	Analyst:	**JLS**	Run Date:	**09/08/2006 19:40**
Collect Date:	**08/31/2006 09:15**	Dilution:	**1**	File ID:	**4L009143.F**
Sample Tag:	**01**	Units:	**mg/kg**		

Surrogate	% Recovery	Lower	Upper	Qual
3,4-Dinitrotoluene	**105**	**50**	**150**	

J The analyte was positively identified, but the quantitation was below the RL
U Not detected at or above adjusted sample detection limit

Sample Number:	**L0609004-03**	PrePrep Method:	**NONE**	Instrument:	**OVEN**
Client ID:	**29-SD-48**	Prep Method:	**D2216-90**	Prep Date:	**09/08/2006 08:20**
Matrix:	**Soil**	Analytical Method:	**D2216-90**	Cal Date:	
Workgroup Number:	**WG221779**	Analyst:	**TMM**	Run Date:	**09/08/2006 08:20**
Collect Date:	**08/31/2006 09:15**	Dilution:	**1**	File ID:	**OV.0609080820-10**
		Units:	**weight %**		

Analyte	CAS. Number	Result	Qual	PQL	SQL
Percent Solids	**10-02-6**	**75.3**		**1.00**	**1.00**

Sample Number:	**L0609004-04**	PrePrep Method:	**NONE**	Instrument:	**HPLC4**
Client ID:	**29-SD-49**	Prep Method:	**METHOD**	Prep Date:	**09/07/2006 08:00**
Matrix:	**Soil**	Analytical Method:	**8330**	Cal Date:	**08/10/2006 19:30**
Workgroup Number:	**WG221826**	Analyst:	**JLS**	Run Date:	**09/08/2006 20:17**
Collect Date:	**08/31/2006 09:30**	Dilution:	**1**	File ID:	**4L009144.F**
Sample Tag:	**01**	Units:	**mg/kg**		

Analyte	CAS. Number	Result	Qual	PQL	SQL
1,3,5-Trinitrobenzene	**99-35-4**		**U**	**0.246**	**0.0985**
1,3-Dinitrobenzene	**99-65-0**		**U**	**0.246**	**0.0985**
2,4,6-Trinitrotoluene	**118-96-7**		**U**	**0.246**	**0.0985**
2,4-Dinitrotoluene	**121-14-2**		**U**	**0.246**	**0.0985**
2,6-Dinitrotoluene	**606-20-2**		**U**	**0.256**	**0.0985**
2-Amino-4,6-dinitrotoluene	**35572-78-2**		**U**	**0.256**	**0.0985**
2-Nitrotoluene	**88-72-2**		**U**	**0.246**	**0.0985**
3-Nitrotoluene	**99-08-1**		**U**	**0.246**	**0.0985**
4-Nitrotoluene	**99-99-0**		**U**	**0.246**	**0.0985**
4-Amino-2,6-dinitrotoluene	**19406-51-0**		**U**	**0.256**	**0.0985**
HMX	**2691-41-0**		**U**	**2.17**	**0.0985**
Nitrobenzene	**98-95-3**		**U**	**0.256**	**0.128**
RDX	**121-82-4**		**U**	**0.985**	**0.0985**
Tetryl	**479-45-8**		**U**	**0.640**	**0.197**

Surrogate	% Recovery	Lower	Upper	Qual
3,4-Dinitrotoluene	**96.3**	**50**	**150**	

U Not detected at or above adjusted sample detection limit

Sample Number:**L0609004-04**
Client ID:**29-SD-49**
Matrix:**Soil**
Workgroup Number:**WG221779**
Collect Date:**08/31/2006 09:30**

PrePrep Method:**NONE**
Prep Method:**D2216-90**
Analytical Method:**D2216-90**
Analyst:**TMM**
Dilution:**1**
Units:**weight %**

Instrument:**OVEN**
Prep Date:**09/08/2006 08:20**
Cal Date:
Run Date:**09/08/2006 08:20**
File ID:**OV.0609080820-11**

Analyte	CAS. Number	Result	Qual	PQL	SQL
Percent Solids	**10-02-6**	**79.1**		**1.00**	**1.00**

Sample Number:**L0609004-05**
Client ID:**29-SD-47**
Matrix:**Soil**
Workgroup Number:**WG221826**
Collect Date:**08/31/2006 09:00**
Sample Tag:**01**

PrePrep Method:**NONE**
Prep Method:**METHOD**
Analytical Method:**8330**
Analyst:**JLS**
Dilution:**1**
Units:**mg/kg**

Instrument:**HPLC4**
Prep Date:**09/07/2006 08:00**
Cal Date:**08/10/2006 19:30**
Run Date:**09/08/2006 20:55**
File ID:**4L009145.F**

Analyte	CAS. Number	Result	Qual	PQL	SQL
1,3,5-Trinitrobenzene	**99-35-4**		**U**	**0.249**	**0.0995**
1,3-Dinitrobenzene	**99-65-0**		**U**	**0.249**	**0.0995**
2,4,6-Trinitrotoluene	**118-96-7**		**U**	**0.249**	**0.0995**
2,4-Dinitrotoluene	**121-14-2**		**U**	**0.249**	**0.0995**
2,6-Dinitrotoluene	**606-20-2**		**U**	**0.259**	**0.0995**
2-Amino-4,6-dinitrotoluene	**35572-78-2**		**U**	**0.259**	**0.0995**
2-Nitrotoluene	**88-72-2**		**U**	**0.249**	**0.0995**
3-Nitrotoluene	**99-08-1**		**U**	**0.249**	**0.0995**
4-Nitrotoluene	**99-99-0**		**U**	**0.249**	**0.0995**
4-Amino-2,6-dinitrotoluene	**19406-51-0**		**U**	**0.259**	**0.0995**
HMX	**2691-41-0**		**U**	**2.19**	**0.0995**
Nitrobenzene	**98-95-3**		**U**	**0.259**	**0.129**
RDX	**121-82-4**		**U**	**0.995**	**0.0995**
Tetryl	**479-45-8**		**U**	**0.647**	**0.199**

Surrogate	% Recovery	Lower	Upper	Qual
3,4-Dinitrotoluene	**97.8**	**50**	**150**	

U Not detected at or above adjusted sample detection limit

Sample Number:**L0609004-05**
Client ID:**29-SD-47**
Matrix:**Soil**
Workgroup Number:**WG221779**
Collect Date:**08/31/2006 09:00**

PrePrep Method:**NONE**
Prep Method:**D2216-90**
Analytical Method:**D2216-90**
Analyst:**TMM**
Dilution:**1**
Units:**weight %**

Instrument:**OVEN**
Prep Date:**09/08/2006 08:20**
Cal Date:
Run Date:**09/08/2006 08:20**
File ID:**OV.0609080820-12**

Analyte	CAS. Number	Result	Qual	PQL	SQL
Percent Solids	**10-02-6**	**78.7**		**1.00**	**1.00**

Sample Number:	**L0609004-06**	PrePrep Method:	**NONE**	Instrument:	**HPLC4**
Client ID:	**29-SD-49-QC**	Prep Method:	**METHOD**	Prep Date:	**09/07/2006 08:00**
Matrix:	**Soil**	Analytical Method:	**8330**	Cal Date:	**08/10/2006 19:30**
Workgroup Number:	**WG221826**	Analyst:	**JLS**	Run Date:	**09/08/2006 21:32**
Collect Date:	**08/31/2006 09:30**	Dilution:	**1**	File ID:	**4L009146.F**
Sample Tag:	**01**	Units:	**mg/kg**		

Analyte	CAS. Number	Result	Qual	PQL	SQL
1,3,5-Trinitrobenzene	99-35-4		U	0.242	0.0966
1,3-Dinitrobenzene	99-65-0		U	0.242	0.0966
2,4,6-Trinitrotoluene	118-96-7		U	0.242	0.0966
2,4-Dinitrotoluene	121-14-2		U	0.242	0.0966
2,6-Dinitrotoluene	606-20-2		U	0.251	0.0966
2-Amino-4,6-dinitrotoluene	35572-78-2		U	0.251	0.0966
2-Nitrotoluene	88-72-2		U	0.242	0.0966
3-Nitrotoluene	99-08-1		U	0.242	0.0966
4-Nitrotoluene	99-99-0		U	0.242	0.0966
4-Amino-2,6-dinitrotoluene	19406-51-0		U	0.251	0.0966
HMX	2691-41-0	0.880	J	2.13	0.0966
Nitrobenzene	98-95-3		U	0.251	0.126
RDX	121-82-4		U	0.966	0.0966
Tetryl	479-45-8		U	0.628	0.193

Surrogate	% Recovery	Lower	Upper	Qual
3,4-Dinitrotoluene	95.1	50	150	

J The analyte was positively identified, but the quantitation was below the RL
U Not detected at or above adjusted sample detection limit

Sample Number:	**L0609004-06**	PrePrep Method:	**NONE**	Instrument:	**OVEN**
Client ID:	**29-SD-49-QC**	Prep Method:	**D2216-90**	Prep Date:	**09/08/2006 08:20**
Matrix:	**Soil**	Analytical Method:	**D2216-90**	Cal Date:	
Workgroup Number:	**WG221779**	Analyst:	**TMM**	Run Date:	**09/08/2006 08:20**
Collect Date:	**08/31/2006 09:30**	Dilution:	**1**	File ID:	**OV.0609080820-13**
		Units:	**weight %**		

Analyte	CAS. Number	Result	Qual	PQL	SQL
Percent Solids	10-02-6	79.6		1.00	1.00

WORKGROUP SUMMARY BY METHOD

WORKGROUP SUMMARY BY METHOD

Analysis: Explosives
Extraction Method: METHOD
Workgroup: WG221670

Lab ID	Client ID	Tclp Date	Prep Date	Analysis Date	Tag	Inst Id	Analyst
L0609004-01	29-WL-12		09/07/06 08:00			SONICATION	CEB
L0609004-02	32-WL-05		09/07/06 08:00			SONICATION	CEB
L0609004-03	29-SD-48		09/07/06 08:00			SONICATION	CEB
L0609004-04	29-SD-49		09/07/06 08:00			SONICATION	CEB
L0609004-05	29-SD-47		09/07/06 08:00			SONICATION	CEB
L0609004-06	29-SD-49-QC		09/07/06 08:00			SONICATION	CEB

Analysis: Percent Solids
Analytical Method: D2216-90
Workgroup: WG221779

Lab ID	Client ID	Tclp Date	Prep Date	Analysis Date	Tag	Inst Id	Analyst
L0609004-01	29-WL-12			09/08/06 08:20		OVEN	TMM
L0609004-02	32-WL-05			09/08/06 08:20		OVEN	TMM
L0609004-03	29-SD-48			09/08/06 08:20		OVEN	TMM
L0609004-04	29-SD-49			09/08/06 08:20		OVEN	TMM
L0609004-05	29-SD-47			09/08/06 08:20		OVEN	TMM
L0609004-06	29-SD-49-QC			09/08/06 08:20		OVEN	TMM

Analysis: Explosives
Analytical Method: 8330
Workgroup: WG221826

Lab ID	Client ID	Tclp Date	Prep Date	Analysis Date	Tag	Inst Id	Analyst
L0609004-01	29-WL-12		09/07/06 08:00	09/08/06 18:26	01	HPLC4	JLS
L0609004-01	29-WL-12		09/07/06 08:00	09/11/06 16:57	DL1	HPLC4	JLS
L0609004-02	32-WL-05		09/07/06 08:00	09/08/06 19:03	01	HPLC4	JLS
L0609004-02	32-WL-05		09/07/06 08:00	09/11/06 17:34	DL1	HPLC4	JLS
L0609004-03	29-SD-48		09/07/06 08:00	09/08/06 19:40	01	HPLC4	JLS
L0609004-04	29-SD-49		09/07/06 08:00	09/08/06 20:17	01	HPLC4	JLS
L0609004-05	29-SD-47		09/07/06 08:00	09/08/06 20:55	01	HPLC4	JLS
L0609004-06	29-SD-49-QC		09/07/06 08:00	09/08/06 21:32	01	HPLC4	JLS

Kemron Environmental Services
Analyst Listing
September 13, 2006

AJF - AMANDA J. FICKIESEN
ALB - ANNIE L. BOCK
ALT - ANN L. THAYER
ARA - ADRIAN R. ACHTERMANN
BRG - BRENDA R. GREGORY
CAA - CASSIE A. AUGENSTEIN
CAF - CHERYL A. FLOWERS
CAK - CHERYL A. KOELSCH
CEB - CHAD E. BARNES
CFB - CHAD F. BOOK
CLC - CHRYS L. CRAWFORD
CLS - CARA L. STRICKLER
CLW - CHARISSA L. WINTERS
CM - CHARLIE MARTIN
CMS - CRYSTAL M. STEPHENS
CPD - CHAD P. DAVIS
CRC - CARLA R. COCHRAN
CSA - LUCINDA S. ARNOLD
CSH - CHRIS S. HILL
DAS - DALLAS A. SULLIVAN
DD - DIANE M. DENNIS
DDE - DEBRA D. ELLIOTT
DEL - DON E. LIGHTFRITZ
DEV - DAVID E. VANDENBERG
DGB - DOUGLAS G. BUTCHER
DIH - DEANNA I. HESSON
DLB - DAVID L. BUMGARNER
DLP - DOROTHY L. PAYNE
DLR - DIANNA L. RAUCH
DR - DEANNA ROBERTS
DRP - DAVE R. PITZER
DSM - DAVID S. MOSSOR
DST - DENNIS S. TEPE
ECL - ERIC C. LAWSON
ED - EMILY E. DECKER
FJB - FRANCES J. BOLDEN
HAV - HEMA VILASAGAR
JAL - JOHN A. LENT
JKT - JANE K. THOMPSON
JLS - JANICE L. SCHIMMEL
JNB - JOSHUA N. BOOTH
JS - JENNIFER L. SOUTHALL
JWR - JOHN W. RICHARDS
JWS - JACK W. SHEAVES
JYH - JI Y. HU
KCZ - KEVIN C. ZUMBRO
KEB - KATHRYN E. BARNES
KHR - KIM H. RHODES
KRA - KATHY R. ALBERTSON
LKN - LINDA K. NEDEFF
LSB - LESLIE S. BUCINA
MDA - MIKE D. ALBERTSON
MDC - MICHAEL D. COCHRAN
MES - MARY E. SCHILLING
MKZ - MARILYN K. ZUMBRO
MLR - MARY L. ROCHOTTE
MLS - MICHAEL L. SCHIMMEL
MMB - MAREN M. BEERY
MSW - MATT S. WILSON
NJB - NATALIE J. BOOTH
PAS - PATRICK A. STREET
PJM - PAUL J. MILLER
RB - ROBERT BUCHANAN
RDC - REBECCA D. CUTLIP
REK - ROBERT E. KYER
RNP - RICK N. PETTY
RWC - RODNEY W. CAMPBELL
SCM - SUSAN C. MOELLENDICK
SLM - STEPHANIE L. MOSSBURG
SLP - SHERI L. PFALZGRAF
SMH - SHAUNA M. HYDE
SRM - SAMUEL R. MCFEE
TMB - TIFFANY M. BAILEY
TMM - TAMMY M. MORRIS
VC - VICKI COLLIER
WFM - WALTER F. MARTIN

KEMRON Environmental Services
List of Valid Qualifiers
September 13, 2006

Qualkey: STD

Qualifier	Description
*	Surrogate or spike compound out of range
+	Correlation coefficient for the MSA is less than 0.995
<	Result is less than the associated numerical value.
>	Result is greater than the associated numerical value.
A	See the report narrative
B	Analyte present in method blank
C	Confirmed by GC/MS
CG	Confluent growth
DL	Surrogate or spike compound was diluted out
E	Estimated concentration due to sample matrix interference
EDL	Elevated sample reporting limits, presence of non-target analytes
EMPC	Estimated Maximum Possible Concentration
FL	Free Liquid
I	Semiquantitative result (out of instrument calibration range)
J	The analyte was positively identified, but the quantitation was below the RL
J,B	Analyte detected in both the method blank and sample above the MDL.
J,P	ESTIMATE & COLUMNS DON'T AGREE TO WITHIN 40%
L	Sample reporting limits elevated due to matrix interference
M	Matrix effect; the concentration is an estimate due to matrix effect.
N	Tentatively identified compound(TIC)
NA	Not applicable
ND	Not detected at or above the reporting limit
NF	Not found by library search
NFL	No free liquid
NI	Non-ignitable
NR	Analyte is not required to be analyzed
NS	Not spiked
P	Concentrations >40% difference between the two GC columns
Q	One or more quality control criteria fail. See narrative.
QNS	Quantity of sample not sufficient to perform analysis
RA	Reanalysis confirms reported results
RE	Reanalysis confirms sample matrix interference
S	Analyzed by method of standard addition
SMI	Sample matrix interference on surrogate
SP	Reported results are for spike compounds only
TIC	Library Search Compound
TNTC	Too numerous to count
U	Undetected; the concentration is below the reported MDL.
UJ	Undetected; the MDL and RL are estimated due to quality control discrepancies.
W	Post-digestion spike for furnace AA out of control limits
X	Exceeds regulatory limit
Z	Cannot be resolved from isomer - see below

*****Special Notes for Organic Analytes**

1. Acrolein and acrylonitrile by method 624 are semi-quantitative screens only.
2. 1,2-Diphenylhydrazine is unstable and is reported as azobenzene.
3. N-nitrosodiphenylamine cannot be separated from diphenylamine.
4. 3-Methylphenol and 4-Methylphenol are unresolvable compounds.
5. m-Xylene and p-Xylene are unresolvable compounds.
6. The reporting limits for Appendix II/IX compounds by method 8270 are based on EPA estimated PQLs referenced in 40 CFR Part 264, Appendix IX. They are not always achievable for every compound an are matrix dependent.

Organic QA/QC

KEMRON Environmental Services
Data Checklist

Date: 10-AUG-2006
Analyst: JLS
Analyst: NA
Method: 8330
Instrument: HPLC4
Curve Workgroup: NA
Runlog ID: 11718
Analytical Workgroups: L0607001,002 QMDL'S L0607333 DUE 8/1/06

Initial Calibration	X
Average RF	X
Linear Reg or Higher Order Curve	X
Second Source standard % Difference	X
Continuing Calibration /Check Standards	X
Project/Client Specific Requirements	X
Special Standards	NA
Blanks	X
TCL's	X
Surrogates	X
LCS (Laboratory Control Sample)	X
Recoveries	X
Surrogates	X
MS/MSD/Duplicates	X
Samples	X
TCL Hits	X
Confirmations	X
Surrogates	X
Calculations & Correct Factors	X
Dilutions Run	NA
Reruns	NA
Manual Integrations	X
Integrations digitally signed	X
Case Narrative	NA
KEMRON .pdf forms	X
Results Reporting/Data Qualifiers	X
KOBRA Workgroup Data	X
Check for Completeness	X
Primary Reviewer	JLS
Secondary Reviewer	MDC
Check for compliance with method and project specific requirements	X
Check the completeness of reported information	X
Check the information for the report narrative	NA
Check the resonableness of the results	X
Comments	

Primary Reviewer:
14-AUG-2006
Janice Schimmel

Secondary Reviewer:
14-AUG-2006

Generated: AUG-14-2006 13:02:33

Checklist ID: 9842

KEMRON Environmental Services
Data Checklist

00091749

Date: 08-SEP-2006
Analyst: JLS
Analyst: NA
Method: 8330
Instrument: HPLC4
Curve Workgroup: NA
Runlog ID: 12176
Analytical Workgroups: L0608643 DUE 9/8, L0609004 DUE 9/12 F3

Initial Calibration	X
Average RF	X
Linear Reg or Higher Order Curve	X
Second Source standard % Difference	X
Continuing Calibration /Check Standards	X
Project/Client Specific Requirements	X
Special Standards	NA
Blanks	X
TCL's	X
Surrogates	X
LCS (Laboratory Control Sample)	X
Recoveries	X
Surrogates	X
MS/MSD/Duplicates	X
Samples	X
TCL Hits	X
Confirmations	X
Surrogates	X
Calculations & Correct Factors	X
Dilutions Run	X
Reruns	X
Manual Integrations	X
Integrations digitally signed	X
Case Narrative	NA
KEMRON .pdf forms	X
Results Reporting/Data Qualifiers	X
KOBRA Workgroup Data	X
Check for Completeness	X
Primary Reviewer	JLS
Secondary Reviewer	MDC
Check for compliance with method and project specific requirements	X
Check the completeness of reported information	X
Check the information for the report narrative	NA
Check the resonableness of the results	X
Comments	

Primary Reviewer:
11-SEP-2006
Janice Schimmel

Secondary Reviewer:
11-SEP-2006

Generated: SEP-11-2006 13:00:21

Checklist ID: 9914

KEMRON Environmental Services
Data Checklist

Date: 11-SEP-2006
Analyst: JLS
Analyst: NA
Method: 8330
Instrument: HPLC4
Curve Workgroup: NA
Runlog ID: 12216
Analytical Workgroups: L0609004 DUE 9/12 F3

Initial Calibration	X
Average RF	X
Linear Reg or Higher Order Curve	X
Second Source standard % Difference	X
Continuing Calibration /Check Standards	X
Project/Client Specific Requirements	X
Special Standards	NA
Blanks	X
TCL's	X
Surrogates	X
LCS (Laboratory Control Sample)	X
Recoveries	X
Surrogates	X
MS/MSD/Duplicates	X
Samples	X
TCL Hits	X
Confirmations	X
Surrogates	X
Calculations & Correct Factors	X
Dilutions Run	NA
Reruns	NA
Manual Integrations	X
Integrations digitally signed	X
Case Narrative	NA
KEMRON .pdf forms	X
Results Reporting/Data Qualifiers	X
KOBRA Workgroup Data	X
Check for Completeness	X
Primary Reviewer	JLS
Secondary Reviewer	MDC
Check for compliance with method and project specific requirements	X
Check the completeness of reported information	X
Check the information for the report narrative	NA
Check the resonableness of the results	X
Comments	

Primary Reviewer:
12-SEP-2006
Janice Schimmel

Secondary Reviewer:
12-SEP-2006
Michael Cochran

Generated: SEP-12-2006 15:55:36

Run Log ID: **11718**

KEMRON Environmental Services

Instrument Run Log

00091751

Instrument: HPLC4
Dataset: 081006
Analyst1: JLS
Analyst2: NA
Method: 8330
SOP: HPLC02
Rev: 8

Maintenance Log ID: 15141

Column 1 ID: ULTRACARB 5 ODS
Column 2 ID: NA
Workgroups: WG219024, WG217741
Internal Standard: NA
Surrogate Standard: STD13480

Comments:

Seq.	File ID	Sample Information	Mat	Dil	Reference	Date/Time
1	4L008947.F	WG219506-01 STD6	1	1		08/10/06 16:24
2	4L008948.F	WG219506-02 STD5	1	1		08/10/06 17:01
3	4L008949.F	WG219506-03 STD4	1	1		08/10/06 17:38
4	4L008950.F	WG219506-04 STD3	1	1		08/10/06 18:16
5	4L008951.F	WG219506-05 STD2	1	1		08/10/06 18:53
6	4L008952.F	WG219506-06 STD1	1	1		08/10/06 19:30
7	4L008953.F	WG219506-07 ALT	1	1		08/10/06 20:07
8	4L008954.F	WG218108-01 BLK	1	1		08/10/06 20:44
22	4L008955.F	WG218108-02 LCS	1	1		08/10/06 21:22
23	4L008956.F	WG218108-03 LCS2	1	1		08/10/06 21:59
11	4L008957.F	L0607001-01	1	1		08/10/06 22:36
12	4L008958.F	L0607002-01	1	1		08/10/06 23:13
13	4L008959.F	L0607333-01	1	1		08/10/06 23:50
14	4L008960.F	L0607333-02	1	1		08/11/06 00:28
24	4L008961.F	WG216614-01 BLK	7	1		08/11/06 01:05
25	4L008962.F	WG216614-02 LCS	7	1		08/11/06 01:42
17	4L008963.F	WG216614-02 LCS	7	1		08/11/06 02:19
18	4L008964.F	WG219523-01 CCV	1	1		08/11/06 02:56
19	4L008965.F	L0607003-01	7	1		08/11/06 03:34
20	4L008966.F	L0607004-01	7	1		08/11/06 04:11
21	4L008967.F	WG219523-02 CCV	1	1		08/11/06 04:48

Comments

Seq.	Rerun	Dil.	Reason	Analytes
11	X			
	To confirm the blob at the end of the run.			

Page: 1 of 1

Approved: 14-AGU-06

KEMRON Environmental Services

Instrument Run Log

Instrument:	HPLC4	Dataset:	090806		
Analyst1:	JLS	Analyst2:	NA		
Method:	8330	SOP:	HPLC02	Rev:	8

Maintenance Log ID: 15564

Column 1 ID: ULTRACARB 5 ODS

Column 2 ID: NA

Workgroups: WG221826/WG221609

Internal STD: NA

Surrogate STD: STD14513

Calibration STD

Comments:

Seq.	File ID	Sample Information	Mat	Dil	Reference	Date/Time
1	4L009134.F	WG221825-01 CCV	1	1		09/08/06 13:57
2	4L009135.F	L0608643-09 MS	7	1		09/08/06 14:43
3	4L009136.F	L0608643-10 MSD	7	1		09/08/06 15:20
4	4L009137.F	WG221825-02 CCV	1	1		09/08/06 15:57
5	4L009138.F	WG221670-01 BLK	7	1		09/08/06 16:34
6	4L009139.F	WG221670-02 LCS	7	1		09/08/06 17:11
14	4L009140.F	WG221670-03 LCS2	7	1		09/08/06 17:49
7	4L009141.F	L0609004-01	7	1		09/08/06 18:26
8	4L009142.F	L0609004-02	7	1		09/08/06 19:03
9	4L009143.F	L0609004-03	7	1		09/08/06 19:40
10	4L009144.F	L0609004-04	7	1		09/08/06 20:17
11	4L009145.F	L0609004-05	7	1		09/08/06 20:55
12	4L009146.F	L0609004-06	7	1		09/08/06 21:32
13	4L009147.F	WG221825-03 CCV	1	1		09/08/06 22:09

Comments

Seq.	Rerun	Dil.	Reason	Analytes
6	X			
7	X	10	Over Calibration Range	2,4,6-Trinitrotoluene
8	X	10	Over Calibration Range	4-amino-4,6-dinitrotoluene

Page: 1 of 1

Approved:

KEMRON Environmental Services

Instrument Run Log

Instrument:	HPLC4	Dataset:	091106		
Analyst1:	JLS	Analyst2:	NA		
Method:	8330	SOP:	HPLC02	Rev:	8

Maintenance Log ID: 15601

Column 1 ID: ULTRACARB 5 ODS

Column 2 ID: NA

Workgroups: WG221826

Internal STD: NA

Surrogate STD: STD14513

Calibration STD

Comments:

Seq.	File ID	Sample Information	Mat	Dil	Reference	Date/Time
1	4L009150.F	WG221972-01 CCV	1	1		09/11/06 15:40
2	4L009151.F	WG221670-02 LCS	7	1		09/11/06 16:20
3	4L009152.F	L0609004-01 10X	7	10		09/11/06 16:57
4	4L009153.F	L0609004-02 10X	7	10		09/11/06 17:34
5	4L009154.F	WG221972-02 CCV	1	1		09/11/06 18:11

Comments

Seq.	Rerun	Dil.	Reason	Analytes

Page: 1 of 1

Approved: 12-SEP-06

KEMRON
ENVIRONMENTAL SERVICES

Document Control No.: EE0006 Page: 32 of 50

Sample Extraction Log Sheet – Method 8330 / Explosives

R1108847

Analyst: CEB
Date: 09-7-06 @ 0800
SOP#: EXTNT2 REV 6
Spike Analyst: CEB Witness: Ed
Sample Matrix: SOIL
Ext Solvent: CH_3CN Lot#: CO4825
Ext Solvent: - Lot#: -
Ext Disk: - Lot#: -
Other: CaCl Lot#: EK0017-92

Extract Relinquished By: CEB
Extract Received By: HV
Date Extract Received: 9-8-06

Matrix Spike # / Conc: STD14512 @ 1.0 ppm
Surrogate Spike # / Conc: STD14513 @ 1.0 ppm

Extraction Work Group: WG221670
Analytical Work Group:

Sonic Bath On – Date: 09-07-06	
Time (1) 1300	Temp (1) Ctrl 3.5°C
	Bath 10°C
Time (2) 1500	Temp (2) Ctrol 3.5°C
	Bath 12°C
Sonic Bath Off – Date: 09-08-06	
Time (3) 0700	Temp (3) Ctrl 3.5°C
	Bath 12°C

	Project ID	Sample ID	Sample Wt (g) / Vol (mL)	Surrogate Amount (uL)	Matrix Spike Amount (uL)	Extract F. Volume (mL)	Comments
1		BLK	2.00 g	1000 ul		20.0 mL	WG221670-01
2		LCS			1000 ul		-02
3		LCS DUP					-03
4		09-004-01	2.01				
5		-02	2.04				
6		-03	2.09				
7		-04	2.03				
8		-05	2.01				
9		-06	2.07				
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							

CEB 09/07/06

All soil samples are air dried to a constant weight prior to extraction
*All extracts are filtered through a 0.45 um teflon **ACRODISC** prior to analysis*

Reviewed by:

KEMRON Environmental Services
HOLDING TIMES
EQUIVALENT TO AFCEE FORM 9

Analytical Method: 8330

AAB#: WG221826

Login Number: L0609004

Client ID	Date Collected	Date Received	Date Extracted	Max Hold Time Ext.	Time Held Ext.	Date Analyzed	Max Hold Time Anal	Time Held Anal.	Q
29-WL-12	08/31/06	09/01/06	09/07/06	14	6.85	09/08/06	40	1.43	
29-WL-12	08/31/06	09/01/06	09/07/06	14	6.85	09/11/06	40	4.37	
32-WL-05	08/31/06	09/01/06	09/07/06	14	6.88	09/08/06	40	1.46	
32-WL-05	08/31/06	09/01/06	09/07/06	14	6.88	09/11/06	40	4.40	
29-SD-48	08/31/06	09/01/06	09/07/06	14	6.95	09/08/06	40	1.49	
29-SD-49	08/31/06	09/01/06	09/07/06	14	6.94	09/08/06	40	1.51	
29-SD-47	08/31/06	09/01/06	09/07/06	14	6.96	09/08/06	40	1.54	
29-SD-49-QC	08/31/06	09/01/06	09/07/06	14	6.94	09/08/06	40	1.56	

* EXT = SEE PROJECT QAPP REQUIREMENTS

*ANAL = SEE PROJECT QAPP REQUIREMENTS

KEMRON FORMS - Modified 02/14/2006
Version 1.5 PDF File ID: 563838
Report generated 09/12/2006 16:15

SURROGATE STANDARDS

Login Number:	L0609004	Method:	8330
Instrument Id:	HPLC4	CAL ID:	HPLC4 - 10-AUG-06
Workgroup (AAB#):	WG221826	Matrix:	SOLID

Sample Number	Dilution	Tag	1
L0609004-01	1.00	01	93.6
L0609004-01	10.0	DL1	13.9
L0609004-02	1.00	01	97.3
L0609004-02	10.0	DL1	11.4
L0609004-03	1.00	01	105
L0609004-04	1.00	01	96.3
L0609004-05	1.00	01	97.8
L0609004-06	1.00	01	95.1
WG221670-01	1.00	01	96.0
WG221670-02	1.00	01	95.6
WG221670-03	1.00	01	94.6

Surrogates	Surrogate Limits
1 - 3,4-Dinitrotoluene	50 - 150

Underline = Result out of surrogate limits

DL = surrogate diluted out
ND = surrogate not detected

KEMRON FORMS - Modified 04/18/2006
Version 1.5 PDF File ID: 562029
Report generated 09/12/2006 16:16

METHOD BLANK SUMMARY

Login Number:	L0609004	Work Group:	WG221826
Blank File ID:	4L009138.F	Blank Sample ID:	WG221670-01
Date Analyzed:	09/08/06	Instrument ID:	HPLC4
Time Analyzed:	16:34	Method:	8330
Analyst:	JLS		

This Method Blank Applies To The Following Samples:

Client ID	Lab Sample ID	Lab File ID	Time Analyzed	TAG
LCS2	WG221670-03	4L009140.F	09/08/06 17:49	01
29-WL-12	L0609004-01	4L009141.F	09/08/06 18:26	01
32-WL-05	L0609004-02	4L009142.F	09/08/06 19:03	01
29-SD-48	L0609004-03	4L009143.F	09/08/06 19:40	01
29-SD-49	L0609004-04	4L009144.F	09/08/06 20:17	01
29-SD-47	L0609004-05	4L009145.F	09/08/06 20:55	01
29-SD-49-QC	L0609004-06	4L009146.F	09/08/06 21:32	01
LCS	WG221670-02	4L009151.F	09/11/06 16:20	01
29-WL-12	L0609004-01	4L009152.F	09/11/06 16:57	DL1
32-WL-05	L0609004-02	4L009153.F	09/11/06 17:34	DL1

KEMRON Environmental Services

METHOD BLANK REPORT

Login Number: L0609004
Run Date: 09/08/2006
Sample ID: WG221670-01
Instrument ID: HPLC4
Run Time: 16:34
Prep Method: METHOD
File ID: 4L009138.F
Analyst: JLS
Method: 8330
Workgroup (AAB#): WG221826
Matrix: Solid
Units: mg/kg
Contract #: DACA56-94-D-0020
Cal ID: HPLC4 - 10-AUG-06

Analytes	SQL	PQL	Concentration	Dilution	Qualifier
1,3,5-Trinitrobenzene	0.100	0.250	0.100	1	U
1,3-Dinitrobenzene	0.100	0.250	0.100	1	U
2,4,6-Trinitrotoluene	0.100	0.250	0.100	1	U
2,4-Dinitrotoluene	0.100	0.250	0.100	1	U
2,6-Dinitrotoluene	0.100	0.260	0.100	1	U
2-Amino-4,6-dinitrotoluene	0.100	0.260	0.100	1	U
2-Nitrotoluene	0.100	0.250	0.100	1	U
3-Nitrotoluene	0.100	0.250	0.100	1	U
4-Nitrotoluene	0.100	0.250	0.100	1	U
4-Amino-2,6-dinitrotoluene	0.100	0.260	0.100	1	U
HMX	0.100	2.20	0.100	1	U
Nitrobenzene	0.130	0.260	0.130	1	U
RDX	0.100	1.00	0.100	1	U
Tetryl	0.200	0.650	0.200	1	U

Surrogates	% Recovery	Surrogate Limits	Qualifier
3,4-Dinitrotoluene	96.0	50 - 150	PASS

MDL Method Detection Limit
RL Reporting/quantitation Limit

* Analyte concentration > RL

KEMRON FORMS - Modified 07/21/2006
Version 1.5 PDF File ID: 562027
Report generated 09/12/2006 16:15

LABORATORY CONTROL SAMPLE (LCS)

Login Number: L0609004
Analvst: JLS
Prep Method: METHOD
Instrument ID: HPLC4
Matrix: Soil
Method: 8330
Workgroup (AAB#): WG221826
Units: mg/kg
Sample ID: WG221670-02 LCS File ID: 4L009151.F Run Date: 09/11/2006 16:20
Sample ID: WG221670-03 LCS2 File ID: 4L009140.F Run Date: 09/08/2006 17:49

Analytes	LCS			LCS2			%RPD	%Rec Limits	RPD Lmt	Q
	Known	Found	% REC	Known	Found	% REC				
1,3,5-Trinitrobenzene	0.500	0.500	100	0.500	0.499	99.8	0.155	75 - 125	40	
1,3-Dinitrobenzene	0.500	0.505	101	0.500	0.500	100	1.03	80 - 125	40	
2,4,6-Trinitrotoluene	0.500	0.407	81.3	0.500	0.410	82.0	0.849	55 - 140	40	
2,4-Dinitrotoluene	0.500	0.535	107	0.500	0.499	99.9	6.96	80 - 125	40	
2,6-Dinitrotoluene	0.500	0.527	105	0.500	0.554	111	5.08	80 - 120	40	
2-Amino-4,6-dinitrotoluene	0.500	0.554	111	0.500	0.669	134	18.9	80 - 125	40	*
2-Nitrotoluene	0.500	0.511	102	0.500	0.492	98.3	3.84	80 - 125	40	
3-Nitrotoluene	0.500	0.517	103	0.500	0.495	99.1	4.32	75 - 120	40	
4-Nitrotoluene	0.500	0.526	105	0.500	0.467	93.4	11.9	75 - 125	40	
4-Amino-2,6-dinitrotoluene	0.500	0.468	93.7	0.500	0.504	101	7.34	80 - 125	40	
HMX	0.500	0.475	94.9	0.500	0.440	88.1	7.45	75 - 125	40	
Nitrobenzene	0.500	0.499	99.8	0.500	0.491	98.2	1.57	75 - 125	40	
RDX	0.500	0.559	112	0.500	0.484	96.8	14.3	70 - 135	40	
Tetryl	0.500	0.428	85.6	0.500	0.418	83.7	2.35	20 - 130	40	

Surogates	LCS	LCS2	Surrogate Limits	Qualifier
	% Recovery	% Recovery		
3,4-Dinitrotoluene	95.6	94.6	50 - 150	PASS

* FAILS %REC LIMIT

FAILS RPD LIMIT

KEMRON FORMS - Modified 07/13/2006
Version 1.5 PDF File ID: 562028
Report generated 09/12/2006 16:15

KEMRON Environmental Services

INITIAL CALIBRATION SUMMARY

Login Number:L0609004
Analytical Method:8330
ICAL Workgroup:WG219506

Instrument ID:HPLC4
Initial Calibration Date:10-AUG-06 19:30
Column ID:F

Analyte		AVG RF	% RSD	LINEAR	QUAD
1,3,5-Trinitrobenzene		2.503	4.27		
1,3-Dinitrobenzene		1.853	3.46		
2,4,6-Trinitrotoluene		2.638	3.49		
2,4-Dinitrotoluene		2.418	22.8	0.818	
2,6-Dinitrotoluene		4.408	9.45		
2-Amino-4,6-Dinitrotoluene		3.515	9.00		
2-Nitrotoluene		5.169	5.73		
3-Nitrotoluene		4.530	3.94		
4-Amino-2,6-Dinitrotoluene		4.280	3.91		
4-Nitrotoluene		6.317	8.42		
HMX		6.155	6.57		
Nitrobenzene		2.891	4.22		
RDX		6.185	14.6		
Tetryl		3.472	4.15		

KEMRON Environmental Services

INITIAL CALIBRATION DATA

Login Number: L0609004
Analytical Method: 8330

Instrument ID: HPLC4
Initial Calibration Date: 10-AUG-06 19:30
Column ID: F

Analyte	WG219506-01			WG219506-02			WG219506-03		
	CONC	RESP	RF	CONC	RESP	RF	CONC	RESP	RF
1,3,5-Trinitrobenzene	1000	410.116058	2.438	500	207.627075	2.408	100	42.0826988	2.376
1,3-Dinitrobenzene	1000	548.319336	1.824	500	277.595795	1.801	100	56.5400391	1.769
2,4,6-Trinitrotoluene	1000	386.420624	2.588	500	195.437485	2.558	100	39.5971184	2.525
2,4-Dinitrotoluene	1000	240.642197	4.156	500	251.197968	1.990	100	50.9184875	1.964
2,6-Dinitrotoluene	1000			500	121.976257	4.099	100	24.9163990	4.013
2-Amino-4,6-Dinitrotoluene	1000	238.729309	4.189	500	152.127487	3.287	100	30.7204628	3.255
2-Nitrotoluene	1000			500	101.645988	4.919	100	20.3516426	4.914
3-Nitrotoluene	1000			500	115.008423	4.348	100	22.9069786	4.365
4-Amino-2,6-Dinitrotoluene	1000			500	121.125664	4.128	100	24.4640102	4.088
4-Nitrotoluene	1000			500	84.9606018	5.885	100	17.0263252	5.873
HMX	1000	169.042252	5.916	500	90.1942596	5.544	100	16.3395462	6.120
Nitrobenzene	1000	354.979858	2.817	500	179.311600	2.788	100	36.4564056	2.743
RDX	1000	182.905731	5.467	500	92.5733414	5.401	100	18.2953339	5.466
Tetryl	1000	295.412659	3.385	500	149.222870	3.351	100	30.2906513	3.301

KEMRON FORMS - Modified 09/06/2006
Version 1.6 PDF File ID: 563840
Report generated 09/12/2006 16:15

KEMRON Environmental Services

INITIAL CALIBRATION DATA

Login Number: L0609004
Analytical Method: 8330
Instrument ID: HPLC4
Initial Calibration Date: 10-AUG-06 19:30
Column ID: F

Analyte	WG219506-04			WG219506-05			WG219506-06		
	CONC	RESP	RF	CONC	RESP	RF	CONC	RESP	RF
1,3,5-Trinitrobenzene	50.0	19.1474266	2.611	25.0	9.62814522	2.597	10.0	3.86683512	2.586
1,3-Dinitrobenzene	50.0	25.9892025	1.924	25.0	13.0911617	1.910	10.0	5.28941250	1.891
2,4,6-Trinitrotoluene	50.0	18.2330532	2.742	25.0	9.31017685	2.685	10.0	3.66835594	2.726
2,4-Dinitrotoluene	50.0	23.2483425	2.151	25.0	11.9094486	2.099	10.0	4.65987062	2.146
2,6-Dinitrotoluene	50.0	11.3105459	4.421	25.0	5.74631023	4.351	10.0	1.93934882	5.156
2-Amino-4,6-Dinitrotoluene	50.0	14.0588083	3.556	25.0	7.13465643	3.504	10.0	3.03034019	3.300
2-Nitrotoluene	50.0	9.48513603	5.271	25.0	4.91147327	5.090	10.0	1.76889133	5.653
3-Nitrotoluene	50.0	10.7789402	4.639	25.0	5.51862288	4.530	10.0	2.09677839	4.769
4-Amino-2,6-Dinitrotoluene	50.0	11.2209272	4.456	25.0	5.79186916	4.316	10.0	2.26526356	4.414
4-Nitrotoluene	50.0	7.76470518	6.439	25.0	4.07508135	6.135	10.0	1.37910843	7.251
HMX	50.0	7.68003368	6.510	25.0	3.77735090	6.618	10.0	1.60739887	6.221
Nitrobenzene	50.0	16.7608624	2.983	25.0	8.35599613	2.992	10.0	3.30798101	3.023
RDX	50.0	7.96912861	6.274	25.0	3.91651797	6.383	10.0	1.23154259	8.120
Tetryl	50.0	13.8570604	3.608	25.0	7.04509830	3.549	10.0	2.74744797	3.640

KEMRON FORMS - Modified 09/06/2006
Version 1.6 PDF File ID: 563840
Report generated 09/12/2006 16:15

KEMRON Environmental Services

ALTERNATE SOURCE CALIBRATION REPORT

Login Number: L0609004
Run Date: 08/10/2006
Sample ID: WG219506-07
Instrument ID: HPLC4
Run Time: 20:07
Method: 8330
File ID: 4L008953.F
Analvst: JLS
ICal Workgroup: WG219506
Cal ID: HPLC4 - 10-AUG-06

Analyte		Expected	Found	RF	%D	UNITS	Q
1,3,5-Trinitrobenzene		50	49.0	2.49	2.1	ug/L	
1,3-Dinitrobenzene		50	48.1	1.88	3.8	ug/L	
2,4,6-Trinitrotoluene		50	48.7	2.65	2.5	ug/L	
2,4-Dinitrotoluene		50	48.1	2.08	3.9	ug/L	
2,6-Dinitrotoluene		50	51.0	4.07	1.9	ug/L	
2-Amino-4,6-Dinitrotoluene		50	53.4	3.11	6.9	ug/L	
2-Nitrotoluene		50	51.2	4.86	2.4	ug/L	
3-Nitrotoluene		50	50.2	4.37	.4	ug/L	
4-Nitrotoluene		50	51.9	5.78	3.8	ug/L	
4-Amino-2,6-Dinitrotoluene		50	49.3	4.23	1.5	ug/L	
HMX		50	43.9	6.61	12.1	ug/L	
Nitrobenzene		50	48.7	2.89	2.5	ug/L	
RDX		50	49.2	5.86	1.6	ug/L	
Tetryl		50	48.1	3.53	3.9	ug/L	

* Exceeds %D Limit

KEMRON FORMS - Modified 07/26/2006
Version 1.5 PDF File ID: 563841
Report generated 09/12/2006 16:15

KEMRON Environmental Services

CONTINUING CALIBRATION VERIFICATION (CCV)

Login Number: L0609004
Run Date: 09/08/2006
Sample ID: WG221826-02
Instrument ID: HPLC4
Run Time: 15:57
Method: 8330
File ID: 4L009137.F
Analyst: JLS
Workgroup (AAB#): WG221826
Cal ID: HPLC4 - 10-AUG-06

Analyte		Expected	Found	RF	%D	UNITS	Q
Sym-Trinitrobenzene		50.0	47.8	2.55	4.30	ug/L	
1,3-Dinitrobenzene		50.0	48.0	1.88	3.90	ug/L	
2,4,6-Trinitrotoluene		50.0	47.4	2.72	5.10	ug/L	
2,4-Dinitrotoluene		50.0	47.6	2.10	4.80	ug/L	
2,6-Dinitrotoluene		50.0	49.0	4.24	2.00	ug/L	
2-Amino-4,6-Dinitrotoluene		50.0	48.5	3.43	3.00	ug/L	
2-Nitrotoluene		50.0	49.1	5.08	1.90	ug/L	
3-Nitrotoluene		50.0	48.5	4.52	3.00	ug/L	
4-Nitrotoluene		50.0	62.9	4.76	25.8	ug/L	*
4-Amino-2,6-Dinitrotoluene		50.0	48.9	4.26	2.20	ug/L	
HMX		50.0	43.1	6.74	13.8	ug/L	
Nitrobenzene		50.0	47.6	2.96	4.90	ug/L	
RDX		50.0	46.5	6.23	7.10	ug/L	
Tetryl		50.0	50.7	3.34	1.40	ug/L	

* Exceeds %D Criteria

KEMRON FORMS - Modified 09/06/2006
Version 1.3 PDF File ID: 563842
Report generated 09/12/2006 16:15

KEMRON Environmental Services

CONTINUING CALIBRATION VERIFICATION (CCV)

Login Number: L0609004
Run Date: 09/08/2006
Sample ID: WG221826-03
Instrument ID: HPLC4
Run Time: 22:09
Method: 8330
File ID: 4L009147.F
Analyst: JLS
Workgroup (AAB#): WG221826
Cal ID: HPLC4 - 10-AUG-06

Analyte		Expected	Found	RF	%D	UNITS	Q
Sym-Trinitrobenzene		50.0	47.6	2.57	4.90	ug/L	
1,3-Dinitrobenzene		50.0	47.9	1.89	4.20	ug/L	
2,4,6-Trinitrotoluene		50.0	47.2	2.73	5.60	ug/L	
2,4-Dinitrotoluene		50.0	48.2	2.08	3.50	ug/L	
2,6-Dinitrotoluene		50.0	50.7	4.10	1.40	ug/L	
2-Amino-4,6-Dinitrotoluene		50.0	49.5	3.36	1.10	ug/L	
2-Nitrotoluene		50.0	48.1	5.18	3.70	ug/L	
3-Nitrotoluene		50.0	48.0	4.58	4.10	ug/L	
4-Nitrotoluene		50.0	59.1	5.07	18.1	ug/L	*
4-Amino-2,6-Dinitrotoluene		50.0	48.5	4.29	2.90	ug/L	
HMX		50.0	42.7	6.81	14.7	ug/L	
Nitrobenzene		50.0	47.1	2.99	5.80	ug/L	
RDX		50.0	43.0	6.77	14.1	ug/L	
Tetryl		50.0	50.1	3.39	0.200	ug/L	

* Exceeds %D Criteria

KEMRON FORMS - Modified 09/06/2006
Version 1.3 PDF File ID: 563842
Report generated 09/12/2006 16:15

KEMRON Environmental Services

CONTINUING CALIBRATION VERIFICATION (CCV)

Login Number: L0609004
Run Date: 09/11/2006
Sample ID: WG221972-01
Instrument ID: HPLC4
Run Time: 15:40
Method: 8330
File ID: 4L009150.F
Analyst: JLS
Workgroup (AAB#): WG221826
Cal ID: HPLC4 - 10-AUG-06

Analyte		Expected	Found	RF	%D	UNITS	Q
Sym-Trinitrobenzene		50.0	49.3	2.48	1.30	ug/L	
1,3-Dinitrobenzene		50.0	49.1	1.84	1.80	ug/L	
2,4,6-Trinitrotoluene		50.0	48.3	2.67	3.50	ug/L	
2,4-Dinitrotoluene		50.0	47.3	2.12	5.40	ug/L	
2,6-Dinitrotoluene		50.0	48.7	4.27	2.70	ug/L	
2-Amino-4,6-Dinitrotoluene		50.0	48.7	3.41	2.60	ug/L	
2-Nitrotoluene		50.0	50.1	4.97	0.200	ug/L	
3-Nitrotoluene		50.0	52.0	4.22	4.00	ug/L	
4-Nitrotoluene		50.0	52.7	5.69	5.40	ug/L	
4-Amino-2,6-Dinitrotoluene		50.0	49.0	4.25	2.00	ug/L	
HMX		50.0	45.1	6.44	9.80	ug/L	
Nitrobenzene		50.0	48.9	2.88	2.20	ug/L	
RDX		50.0	46.6	6.20	6.70	ug/L	
Tetryl		50.0	51.5	3.29	3.00	ug/L	

* Exceeds %D Criteria

KEMRON FORMS - Modified 09/06/2006
Version 1.3 PDF File ID: 563842
Report generated 09/12/2006 16:15

KEMRON Environmental Services

CONTINUING CALIBRATION VERIFICATION (CCV)

Login Number: L0609004
Run Date: 09/11/2006
Sample ID: WG221972-02
Instrument ID: HPLC4
Run Time: 18:11
Method: 8330
File ID: 4L009154.F
Analyst: JLS
Workgroup (AAB#): WG221826
Cal ID: HPLC4 - 10-AUG-06

Analyte		Expected	Found	RF	%D	UNITS	Q
Sym-Trinitrobenzene		50.0	48.9	2.50	2.20	ug/L	
1,3-Dinitrobenzene		50.0	52.6	1.72	5.20	ug/L	
2,4,6-Trinitrotoluene		50.0	47.0	2.74	5.90	ug/L	
2,4-Dinitrotoluene		50.0	49.7	2.02	0.700	ug/L	
2,6-Dinitrotoluene		50.0	52.0	4.00	3.90	ug/L	
2-Amino-4,6-Dinitrotoluene		50.0	49.8	3.33	0.400	ug/L	
2-Nitrotoluene		50.0	52.1	4.78	4.20	ug/L	
3-Nitrotoluene		50.0	51.3	4.28	2.50	ug/L	
4-Nitrotoluene		50.0	54.7	5.48	9.40	ug/L	
4-Amino-2,6-Dinitrotoluene		50.0	48.0	4.33	3.90	ug/L	
HMX		50.0	44.1	6.59	11.8	ug/L	
Nitrobenzene		50.0	47.8	2.95	4.30	ug/L	
RDX		50.0	47.6	6.06	4.70	ug/L	
Tetryl		50.0	54.0	3.14	8.00	ug/L	

* Exceeds %D Criteria

KEMRON FORMS - Modified 09/06/2006
Version 1.3 PDF File ID: 563842
Report generated 09/12/2006 16:15

KEMRON Environmental Services
Data Checklist

00091768

Date: 08-SEP-2006
Analyst: TMM
Analyst: NA
Method: PCT-S
Instrument: OVEN
Curve Workgroup: NA
Runlog ID:
Analytical Workgroups: WG221779

Calibration/Linearity	09/08/06
Second Source Check	
ICV/CCV (std)	
ICB/CCB	
Blank	
LCS/LCS Dup	
MS/MSD	
Duplicate	X
Upload Results	X
Client Forms	X
QC Violation Sheet	
Case Narratives	
Signed Raw Data	X
STD/LCS on benchsheet	
Check for compliance with method and project specific requirements	X
Check the completeness of reported information	X
Check the information for the report narrative	X
Primary Reviewer	TMM
Secondary Reviewer	DIH
Comments	

Primary Reviewer:	Secondary Reviewer:
11-SEP-2006	13-SEP-2006
Tammy Morris	Donna Hesson

Generated: SEP-13-2006 07:55:53

B2852

Shaw® Shaw Environmental, Inc.

3010 Briarpark Drive, Suite 4N
Houston, TX 77042 (713) 996-4400

CHAIN-OF-CUSTODY Transite line & Ditch

No. 10407

Laboratory Name: Kemron
Address: Marietta, Oh
Contact:

Project Name LHAAP
Project Location Transit line/Karnack, TX
Project No.
Project Contact
Project Telephone No.
Point of contact:
Telephone No.
Project Manager/Supervisor:

Analysis and Method Desired (Indicate separate containers)

Item No.	Sample Number	Date	Time	Comp	Grab	Matrix	Sample Description, Location	Number of Containers	Explosives						Remarks
1	29-WL-12	8/31	1130		X	S		1	X						
2	32-WL-05		1050		X	S		1	X						*Please make very good mix!
3	29-SD-48		915		X	S		1	X						
4	29-SD-49		930		X	S		1	X						
5	29-SD-47		900		X	S		1	X						
6	29-SD-49-QC		930		X	S		1	X						
7															
8															
9															
10															

Transfers Relinquished By (Signature)	Date/Time	Transfers Accepted By (Signature)	Date/Time
	8/31/06 1700	UPS	
		Laboratory Ben McGregory	9/1/06 0930

Special Instructions UPS

C/c sealed & intact
Cooler Temp 3

~~FedEx Airbill~~ No.: 1Z 4016 6322 1005 4751 bg

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

SAMPLE RECEIPT FORM

156 STARLITE DRIVE
MARIETTA, OH
45750
(740) 373-4071

Date: 9-01-06 Client: Shaw

Shipped By: ( ) Fed-Ex [✓ UPS] ( )DHL ( ) KEMRON ( ) Client ( ) Other 9:30

Opened By:

Logged By: Login # L06 09004

IR Temp Gun: ( ) D [✓ G]

COOLER INFORMATION

Number	Cooler ID	Temp °C	Airbill#	COC#	Other
1	1462	3	1240116032210054751		
2					
3					
4					
5					
6					

Were all coolers sealed?	[✓ Y]	N	N/A
Were custody seals used on all coolers?	[✓ Y]	N	N/A
Were custody seals intact?	[✓ Y]	N	N/A
Was visible ice present?	[✓ Y]	N	N/A
Were all coolers in the temperature range of 2-6C? (>6C*)	[✓ Y]	N	N/A
Were the samples frozen?*	Y	[✓ N]	N/A
Were COC papers provided?	[✓ Y]	N	N/A
Were all sample containers intact?*	[✓ Y]	N	N/A
Were all sample labels intact?	[✓ Y]	N	N/A
Were all sample labels legible?*	[✓ Y]	N	N/A
Did all sample labels match the COC?*	[✓ Y]	N	N/A
Was the label information complete?*	[✓ Y]	N	N/A
Were the correct containers used?*	[✓ Y]	N	N/A
Were the correct preservatives added to water samples?*	Y	N	[✓ N/A]
Was the pH tested on preserved water samples?	Y	N	[✓ N/A]
Were pH ranges acceptable?*	Y	N	[✓ N/A]
Was sufficient amount of sample provided?*	[✓ Y]	N	N/A
Were bubbles present in VOA samples?*	Y	N	[✓ N/A]
Were COC's signed and dated?	[✓ Y]	N	N/A
Did samples arrive before hold time expired?*	[✓ Y]	N	N/A
Are discrepancy forms attached?	Y	N	[✓ N/A]

**Requires a discrepancy form*

CRF #1
Revised 8/22/03

Comments:

KEMRON Environmental Services
Internal Chain of Custody Report

Login: L0609004
Account: 2773
Project: 2773.025
Samples: 6
Due Date: 12-SEP-2006

Samplenum	**Container ID**	**Products**
L0609004-01	270773	PCT-S 8330

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN			01-SEP-2006 10:23	BRG	
2	PREP	W1	EXT	05-SEP-2006 13:56	CEB	BRG
3	PREP	W1	EXT	05-SEP-2006 14:05	BRG	CEB
4	ANALYZ	W1	WET	07-SEP-2006 08:03	FJB	JKT
5	STORE	WET	A1	09-SEP-2006 10:27	BRG	TMM

Samplenum	**Container ID**	**Products**
L0609004-02	270774	8330 PCT-S

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN			01-SEP-2006 10:23	BRG	
2	PREP	W1	EXT	05-SEP-2006 13:57	CEB	BRG
3	PREP	W1	EXT	05-SEP-2006 14:05	BRG	CEB
4	ANALYZ	W1	WET	07-SEP-2006 08:03	FJB	JKT
5	STORE	WET	A1	09-SEP-2006 10:27	BRG	TMM

Samplenum	**Container ID**	**Products**
L0609004-03	270775	8330 PCT-S

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN			01-SEP-2006 10:23	BRG	
2	PREP	W1	EXT	05-SEP-2006 13:57	CEB	BRG
3	PREP	W1	EXT	05-SEP-2006 14:05	BRG	CEB
4	ANALYZ	W1	WET	07-SEP-2006 08:03	FJB	JKT
5	STORE	WET	A1	09-SEP-2006 10:27	BRG	TMM

Samplenum	**Container ID**	**Products**
L0609004-04	270776	8330 PCT-S

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN			01-SEP-2006 10:23	BRG	
2	PREP	W1	EXT	05-SEP-2006 13:57	CEB	BRG
3	PREP	W1	EXT	05-SEP-2006 14:05	BRG	CEB
4	ANALYZ	W1	WET	07-SEP-2006 08:03	FJB	JKT
5	STORE	WET	A1	09-SEP-2006 10:27	BRG	TMM

KEMRON Environmental Services

Internal Chain of Custody Report

Login: L0609004
Account: 2773
Project: 2773.025
Samples: 6
Due Date: 12-SEP-2006

Samplenum	Container ID	Products
L0609004-05	270777	8330 PCT-S

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN			01-SEP-2006 10:23	BRG	
2	PREP	W1	EXT	05-SEP-2006 13:57	CEB	BRG
3	PREP	W1	EXT	05-SEP-2006 14:05	BRG	CEB
4	ANALYZ	W1	WET	07-SEP-2006 08:03	FJB	JKT
5	STORE	WET	A1	09-SEP-2006 10:27	BRG	TMM

Samplenum	Container ID	Products
L0609004-06	270778	8330 PCT-S

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN			01-SEP-2006 10:23	BRG	
2	PREP	W1	EXT	05-SEP-2006 13:57	CEB	BRG
3	PREP	W1	EXT	05-SEP-2006 14:05	BRG	CEB
4	ANALYZ	W1	WET	07-SEP-2006 08:03	FJB	JKT
5	STORE	WET	A1	09-SEP-2006 10:27	BRG	TMM