LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS

ADMINISTRATIVE RECORD

Volume 6 of 13

2009

Bate Stamp Numbers

00075715 – 00076630

Prepared for

Department of the Army
Longhorn Army Ammunition Plant

1976 – 2009

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

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2009

A. Title: Report (continued) – Appendix F to Final Site Evaluation for LHAAP-49, Former Acid Storage Area, Longhorn Army Ammunition Plant, Karnack, Texas
Author(s): Shaw Environmental, Inc., Houston, Texas
Recipient: All Stakeholders
Date: June 16, 2009
Bate Stamp: 00075715 - 00076058

B. Title: Meeting Minutes – Longhorn AAP Restoration Advisory Board Meeting
Author(s): Shaw Environmental, Inc., Houston, Texas
Recipient: All Stakeholders
Date: June 16, 2009
Bate Stamp: 00076059 - 00076070

C. Title: Meeting Minutes – Monthly Manager's Meeting, Longhorn Army Ammunition Plant, Karnack, Texas
Author(s): Shaw Environmental, Inc., Houston, Texas
Recipient: All Stakeholders
Date: July 14, 2009
Bate Stamp: 00076071 - 00076080

D. Title: Report – Final Action Memorandum for Former Pistol Range and LHAAP-04, Former Pilot Wastewater Treatment Plant, Longhorn Army Ammunition Plant, Karnack, Texas
Author(s): Shaw Environmental, Inc., Houston, Texas
Recipient: All Stakeholders
Date: August 3, 2009
Bate Stamp: 00076081 - 00076101

E. Title: Report – Final Removal Action Work Plan for the Former Pistol Range and LHAAP-04, Former Pilot Wastewater Treatment Plant, Group 4, Longhorn Army Ammunition Plant, Karnack, Texas
Author(s): Shaw Environmental, Inc., Houston, Texas
Recipient: All Stakeholders
Date: August 3, 2009
Bate Stamp: 00076102 - 00076204

LONGHORN ARMY AMMUNITION PLANT
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2009

F. Title: Report – Final Site Investigation Report, LHAAP-03 (Waste Collection Pad Near Building 722-P, Paint Shop), Longhorn Army Ammunition Plant, Karnack, Texas
Author(s): Shaw Environmental, Inc., Houston, Texas
Recipient: All Stakeholders
Date: August 17, 2009
Bate Stamp: 00076205 - 00076348

G. Title: Meeting Minutes – Monthly Manager's Meeting, Longhorn Army Ammunition Plant, Karnack, Texas
Author(s): Shaw Environmental, Inc., Houston, Texas
Recipient: All Stakeholders
Date: August 18, 2009
Bate Stamp: 00076349 - 00076359

H. Title: Meeting Minutes – Monthly Manager's Meeting, Longhorn Army Ammunition Plant, Karnack, Texas
Author(s): Shaw Environmental, Inc., Houston, Texas
Recipient: All Stakeholders
Date: September 15, 2009
Bate Stamp: 00076360 - 00076369

I. Title: Meeting Minutes – Longhorn AAP Restoration Advisory Board Meeting
Author(s): Shaw Environmental, Inc., Houston, Texas
Recipient: All Stakeholders
Date: September 15, 2009
Bate Stamp: 00076370 - 00076392

J. Title: Meeting Minutes – Monthly Manager's Meeting, Longhorn Army Ammunition Plant, Karnack, Texas
Author(s): Shaw Environmental, Inc., Houston, Texas
Recipient: All Stakeholders
Date: October 20, 2009
Bate Stamp: 00076393 - 00076407

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

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2009

K. Title: Report – Final Feasibility Study, LHAAP-46, Plant 2 Area, Group 4, Longhorn Army Ammunition Plant, Karnack, Texas
Author(s): Shaw Environmental, Inc., Houston, Texas
Recipient: All Stakeholders
Date: October 28, 2009
Bate Stamp: 00076408 - 00076630

2.2.1.2 QC Summary Data

Example 6010 Calculations
Perkin Elmer Optima 4300 DV

1.0 Initial Calibration (ICAL) Parameters
The system performs linear regression from data consisting of a blank and three standards.

2.0 Calculating the concentration (C) of an element in water using data from prep log, run log, and quantitation report (note:the data system performs this calculation automatically when correction factors have been entered):

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

Where:	**Example:**
Cs = Concentration computed by the data system in ug/mL (ppm)	0.1
Vf = Final volume (mL)	50
Vi = Initial volume (mL)	50
D = Dilution factor as a multiplier (10X = 10)	1
Cx = Concentration of element in ug/mL (mg/L)	0.1

3.0 Calculating the concentration (C) of an element in soil using data from prep log, run log, and quantitation report (note: the data system performs this calculation automatically when correction factors have been entered):

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

Where:	**Example:**
Cs = Concentration computed by the data system (mg/L) (ppm)	0.1
Vf = Final volume (mL)	50
Vi = Initial weight (g)	1
D = Dilution factor as a multiplier (10X = 10)	1
Cx = Concentration of element in ug/g (mg/kg)	5

4.0 Adjusting the concentration to dry weight:

$$Cdry = \frac{Cx \times 100}{Px}$$

Where:	**Example:**
Cx = Concentration calculated as received (wet basis)	5
Px = Percent solids of sample (%wt)	80
$Cdry$ = Concentration calculated as dry weight (mg/kg)	6.25

Example 6010 Calculations
Thermo Scientific IRIS Advantage

1.0 Initial Calibration (ICAL) Parameters
The system performs linear regression from data consisting of a blank and three standards.

2.0 Calculating the concentration (C) of an element in water using data from prep log, run log, and quantitation report (note:the data system performs this calculation automatically when correction factors have been entered):

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

Where:	**Example:**
Cs = Concentration computed by the data system in ug/mL (ppm)	0.1
Vf = Final volume (mL)	50
Vi = Initial volume (mL)	50
D = Dilution factor as a multiplier (10X = 10)	1
Cx = Concentration of element in ug/mL (mg/L)	0.1

3.0 Calculating the concentration (C) of an element in soil using data from prep log, run log, and quantitation report (note: the data system performs this calculation automatically when correction factors have been entered):

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

Where:	**Example:**
Cs = Concentration computed by the data system (mg/L) (ppm)	0.1
Vf = Final volume (mL)	50
Vi = Initial weight (g)	1
D = Dilution factor as a multiplier (10X = 10)	1
Cx = Concentration of element in ug/g (mg/kg)	5

4.0 Adjusting the concentration to dry weight:

$$Cdry = \frac{Cx \times 100}{Px}$$

Where:	**Example:**
Cx = Concentration calculated as received (wet basis)	5
Px = Percent solids of sample (%wt)	80
$Cdry$ = Concentration calculated as dry weight (mg/kg)	6.25

Example 6010 Calculations
Thermo Scientific iCAP 6500

1.0 Initial Calibration (ICAL) Parameters
The system performs linear regression from data consisting of a blank and four standards.

2.0 Calculating the concentration (C) of an element in water using data from prep log, run log, and quantitation report (note:the data system performs this calculation automatically when correction factors have been entered):

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

Where:	**Example:**
Cs = Concentration computed by the data system in ug/mL (ppm)	0.1
Vf = Final volume (mL)	50
Vi = Initial volume (mL)	50
D = Dilution factor as a multiplier (10X = 10)	1
Cx = Concentration of element in ug/mL (mg/L)	0.1

3.0 Calculating the concentration (C) of an element in soil using data from prep log, run log, and quantitation report (note: the data system performs this calculation automatically when correction factors have been entered):

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

Where:	**Example:**
Cs = Concentration computed by the data system (mg/L) (ppm)	0.1
Vf = Final volume (mL)	50
Vi = Initial weight (g)	1
D = Dilution factor as a multiplier (10X = 10)	1
Cx = Concentration of element in ug/g (mg/kg)	5

4.0 Adjusting the concentration to dry weight:

$$Cdry = \frac{Cx \times 100}{Px}$$

Where:	**Example:**
Cx = Concentration calculated as received (wet basis)	5
Px = Percent solids of sample (%wt)	80
$Cdry$ = Concentration calculated as dry weight (mg/kg)	6.25

Microbac Laboratories Inc.
Metals Digest Log

Workgroup: WG299269
Analyst: REK
Spike Analyst: REK
Method: 3005A
Run Date: 04/08/2009 06:32
Hotblock Start Temp: 95 @ 05:30
Hotblock End Temp: 94.9 @ 09:30

SOP: ME401 Revison 13
Spike Solution: STD27613
Spike Witness: SDL
Digest tubes Lot #: COA13696
HCL Lot #: COA13765
HNO3 Lot #: COA13771

	SAMPLE #	Type	Matrix	Initial Amount	Final Volume	Spike Amount	Due Date
1	WG299269-02	BLANK	1	50 mL	50 mL		
2	WG299117-01	FBLK	18	50 mL	50 mL		
3	WG299269-03	LCS	1	50 mL	50 mL	5 mL	
4	L09040090-03	SAMP	18	50 mL	50 mL		04/10/09
5	L09040090-05	SAMP	18	50 mL	50 mL		04/10/09
6	L09040090-07	SAMP	18	50 mL	50 mL		04/10/09
7	L09040090-09	SAMP	18	50 mL	50 mL		04/10/09
8	L09040090-11	SAMP	18	50 mL	50 mL		04/10/09
9	L09040130-01	SAMP	1	50 mL	50 mL		04/14/09
10	L09040130-02	SAMP	1	50 mL	50 mL		04/14/09
11	L09040130-03	SAMP	1	50 mL	50 mL		04/14/09
12	L09040130-04	SAMP	1	50 mL	50 mL		04/14/09
13	L09040130-05	SAMP	1	50 mL	50 mL		04/14/09
14	L09040130-06	SAMP	1	50 mL	50 mL		04/14/09
15	L09040141-01	SAMP	1	50 mL	50 mL		04/14/09
16	WG299269-01	REF	1	50 mL	50 mL		
17	L09040142-07	SAMP	1	50 mL	50 mL		04/08/09
18	WG299269-04	MS	1	50 mL	50 mL	5 mL	
19	WG299269-05	MSD	1	50 mL	50 mL	5 mL	

Analyst: _____

Reviewer: _____

BLOCK_DIG - Modified 07/22/2008
PDF ID: 1360934
Report generated: 04/08/2009 09:31

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Instrument Run Log

Instrument: PE-ICP2 Dataset: 040809H.CSV
Analyst1: JYH Analyst2: PDM
Method: 6010B SOP: ME600E Rev: 9
Maintenance Log ID: 28274

Calibration Std: STD32077 ICV/CCV Std: STD32039 Post Spike: STD27612
ICSA: STD32053 ICSAB: STD32155

Workgroups: 299317,299344,299203

Comments:

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
1	P2.040809.094238	WG299351-01	Calibration Point		1		04/08/09 09:42
2	P2.040809.094850	WG299351-02	Calibration Point		1		04/08/09 09:48
3	P2.040809.095505	WG299351-03	Calibration Point		1		04/08/09 09:55
4	P2.040809.100122	WG299351-04	Calibration Point		1		04/08/09 10:01
5	P2.040809.100741	WG299351-05	Calibration Point		1		04/08/09 10:07
6	P2.040809.101418	WG299351-06	Initial Calibration Verification		1		04/08/09 10:14
7	P2.040809.102036	WG299351-07	Initial Calib Blank		1		04/08/09 10:20
8	P2.040809.102652	WG299351-08	Interference Check		1		04/08/09 10:26
9	P2.040809.103212	WG299351-09	Interference Check		1		04/08/09 10:32
10	P2.040809.103733	WG299351-10	CCV		1		04/08/09 10:37
11	P2.040809.104350	WG299351-11	CCB		1		04/08/09 10:43
12	P2.040809.105007	WG299269-02	Method/Prep Blank	50/50	1		04/08/09 10:50
13	P2.040809.105620	WG299269-03	Laboratory Control S	50/50	1		04/08/09 10:56
14	P2.040809.110241	WG299117-01	Fluid Blank		1		04/08/09 11:02
15	P2.040809.110853	WG299269-01	Reference Sample		1	L09040142-07	04/08/09 11:08
16	P2.040809.111516	WG299269-04	Matrix Spike	50/50	1	L09040142-07	04/08/09 11:15
17	P2.040809.112142	WG299269-05	Matrix Spike Duplica	50/50	1	L09040142-07	04/08/09 11:21
18	P2.040809.112801	WG299317-01	Post Digestion Spike		1	L09040142-07	04/08/09 11:28
19	P2.040809.113429	WG299317-02	Serial Dilution		5	L09040142-07	04/08/09 11:34
20	P2.040809.114054	WG299351-12	CCV		1		04/08/09 11:40
21	P2.040809.114712	WG299351-13	CCB		1		04/08/09 11:47
22	P2.040809.115330	L09040090-03	AV-NCB-PE-VIS-38-C1-0402	50/50	1		04/08/09 11:53
23	P2.040809.115948	L09040090-05	AV-NCB-AS-VIS-7-040209	50/50	1		04/08/09 11:59
24	P2.040809.120605	L09040090-07	AV-NCB-PE-UNK-38-C3-040	50/50	1		04/08/09 12:06
25	P2.040809.121226	L09040090-09	AV-NCB-PE-UNK-38-C3D-04	50/50	1		04/08/09 12:12
26	P2.040809.121848	L09040090-11	AV-NCB-AS-UNK-156-04020	50/50	1		04/08/09 12:18
27	P2.040809.122502	L09040130-01	13306-W0001	50/50	1		04/08/09 12:25
28	P2.040809.123124	L09040130-02	13306-W0002	50/50	1		04/08/09 12:31
29	P2.040809.123744	L09040130-03	13307-W0001	50/50	1		04/08/09 12:37
30	P2.040809.124357	L09040130-04	13310-W0001	50/50	1		04/08/09 12:43
31	P2.040809.125020	L09040130-05	13314-W0001	50/50	1		04/08/09 12:50
32	P2.040809.125640	WG299351-14	CCV		1		04/08/09 12:56
33	P2.040809.130258	WG299351-15	CCB		1		04/08/09 13:02
34	P2.040809.130916	L09040130-06	14153-W0001	50/50	1		04/08/09 13:09
35	P2.040809.131534	L09040141-01	SANITARY LEACHATE	50/50	1		04/08/09 13:15
36	P2.040809.132052	WG299351-16	CCV		1		04/08/09 13:20
37	P2.040809.132710	WG299351-17	CCB		1		04/08/09 13:27

Page: 1 Approved: April 09, 2009

Maren Berry

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Instrument Run Log

Instrument: PE-ICP2 Dataset: 040809H.CSV
Analyst1: JYH Analyst2: PDM
Method: 6010B SOP: ME600E Rev: 9
Maintenance Log ID: 28274

Calibration Std: STD32077 ICV/CCV Std: STD32039 Post Spike: STD27612
ICSA: STD32053 ICSAB: STD32155

Workgroups: 299317,299344,299203

Comments:

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
38	P2.040809.133443	WG299170-02	Method/Prep Blank	5/50	1		04/08/09 13:34
39	P2.040809.134057	WG299170-03	Laboratory Control S	5/50	1		04/08/09 13:40
40	P2.040809.134720	WG299170-01	Reference Sample		1	L09040106-01	04/08/09 13:47
41	P2.040809.135345	WG299170-04	Matrix Spike	5/50	1	L09040106-01	04/08/09 13:53
42	P2.040809.140004	WG299170-05	Matrix Spike Duplica	5/50	1	L09040106-01	04/08/09 14:00
43	P2.040809.140630	L09040087-01	GRIT	5/50	1		04/08/09 14:06
44	P2.040809.141254	L09040087-02	BAGHOUSE DUST	5/50	1		04/08/09 14:12
45	P2.040809.141912	L09040087-03	PAINT DUST	5/50	1		04/08/09 14:19
46	P2.040809.142537	WG299344-01	Post Digestion Spike		1	L09040087-03	04/08/09 14:25
47	P2.040809.143202	WG299344-02	Serial Dilution		5	L09040087-03	04/08/09 14:32
48	P2.040809.143827	WG299351-18	CCV		1		04/08/09 14:38
49	P2.040809.144444	WG299351-19	CCB		1		04/08/09 14:44
50	P2.040809.145102	WG299123-01	Fluid Blank		1		04/08/09 14:51
51	P2.040809.145516	L09040100-01	0904-036-1	50/50	1		04/08/09 14:55
52	P2.040809.150039	WG299203-03	Post Digestion Spike		1	L09040100-01	04/08/09 15:00
53	P2.040809.150610	WG299203-04	Serial Dilution		5	L09040100-01	04/08/09 15:06
54	P2.040809.151232	WG299351-20	CCV		1		04/08/09 15:12
55	P2.040809.151853	WG299351-21	CCB		1		04/08/09 15:18

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Instrument Run Log

Instrument: PE-ICP2 Dataset: 040809H2R.CSV
Analyst1: JYH Analyst2: PDM
Method: 6010B SOP: 600E Rev: 9
Maintenance Log ID: 28274

Calibration Std: STD32077 ICV/CCV Std: STD32039 Post Spike: STD27612
ICSA: STD32053 ICSAB: STD32155

Workgroups: 299317

Comments:

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
1	P2.040809.160620	WG299480-01	Calibration Point		1		04/08/09 16:06
2	P2.040809.161233	WG299480-02	Calibration Point		1		04/08/09 16:12
3	P2.040809.161845	WG299480-03	Calibration Point		1		04/08/09 16:18
4	P2.040809.162501	WG299480-04	Calibration Point		1		04/08/09 16:25
5	P2.040809.163121	WG299480-05	Calibration Point		1		04/08/09 16:31
6	P2.040809.163745	WG299480-06	Initial Calibration Verification		1		04/08/09 16:37
7	P2.040809.164406	WG299480-07	Initial Calib Blank		1		04/08/09 16:44
8	P2.040809.165025	WG299480-08	Interference Check		1		04/08/09 16:50
9	P2.040809.165545	WG299480-09	Interference Check		1		04/08/09 16:55
10	P2.040809.170107	WG299480-10	CCV		1		04/08/09 17:01
11	P2.040809.170727	WG299480-11	CCB		1		04/08/09 17:07
12	P2.040809.172000	WG299269-02	Method/Prep Blank	50/50	1		04/08/09 17:20
13	P2.040809.172616	WG299269-03	Laboratory Control S	50/50	1		04/08/09 17:26
14	P2.040809.173238	WG299117-01	Fluid Blank		1		04/08/09 17:32
15	P2.040809.173857	WG299269-01	Reference Sample		1	L09040142-07	04/08/09 17:38
16	P2.040809.174515	WG299269-04	Matrix Spike	50/50	1	L09040142-07	04/08/09 17:45
17	P2.040809.175140	WG299269-05	Matrix Spike Duplica	50/50	1	L09040142-07	04/08/09 17:51
18	P2.040809.175802	L09040090-03	AV-NCB-PE-VIS-38-C1-0402	50/50	1		04/08/09 17:58
19	P2.040809.180416	WG299317-03	Post Digestion Spike		1	L09040090-03	04/08/09 18:04
20	P2.040809.181037	WG299317-04	Serial Dilution		5	L09040090-03	04/08/09 18:10
21	P2.040809.181654	WG299480-12	CCV		1		04/08/09 18:16
22	P2.040809.182315	WG299480-13	CCB		1		04/08/09 18:23
23	P2.040809.182933	L09040090-05	AV-NCB-AS-VIS-7-040209	50/50	1		04/08/09 18:29
24	P2.040809.183556	L09040090-07	AV-NCB-PE-UNK-38-C3-040	50/50	1		04/08/09 18:35
25	P2.040809.184210	L09040090-09	AV-NCB-PE-UNK-38-C3D-04	50/50	1		04/08/09 18:42
26	P2.040809.184834	L09040090-11	AV-NCB-AS-UNK-156-04020	50/50	1		04/08/09 18:48
27	P2.040809.185455	WG299480-14	CCV		1		04/08/09 18:54
28	P2.040809.190113	WG299480-15	CCB		1		04/08/09 19:01

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Maren Berry

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Microbac Laboratories Inc.

Data Checklist

Date: 08-APR-2009
Analyst: JYH
Analyst: PDM
Method: 6010B
Instrument: PE-ICP 2
Curve Workgroup: 299351
Runlog ID: 27460
Analytical Workgroups: 299317,299344,299203

Calibration/Linearity	X
ICV/CCV	X
ICB/CCB	X
ICSA/ICSAB	X
CRI	
Blank/LCS	X
MS/MSD	X
Post Spike/Serial Dilution	X
Upload Results	X
Data Qualifiers	
Generate PDF Instrument Data	X
Sign/Annotate PDF Data	X
Upload Curve Data	X
Workgroup Forms	X
Case Narrative	0090,0130,0142,0106,0100,0113
Client Forms	X
Level X	
Level 3	0142
Level 4	0090,0130,0113
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	PDM
Secondary Reviewer	MMB
Comments	

Primary Reviewer: 09-APR-2009 Pierce Morris

Secondary Reviewer: 09-APR-2009 Maren Berry

CHECKLIST1 - Modified 03/05/2008
Generated: APR-09-2009 18:10:57

Microbac Laboratories Inc.

Data Checklist

Date: 08-APR-2009
Analyst: JYH
Analyst: PDM
Method: 6010B
Instrument: PE-ICP 2
Curve Workgroup: 299480
Runlog ID: 27493
Analytical Workgroups: 299317

Calibration/Linearity	X
ICV/CCV	X
ICB/CCB	X
ICSA/ICSAB	X
CRI	
Blank/LCS	X
MS/MSD	X
Post Spike/Serial Dilution	X
Upload Results	X
Data Qualifiers	
Generate PDF Instrument Data	X
Sign/Annotate PDF Data	X
Upload Curve Data	X
Workgroup Forms	X
Case Narrative	0090
Client Forms	X
Level X	
Level 3	
Level 4	0090
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	PDM
Secondary Reviewer	MMB
Comments	

Primary Reviewer:
10-APR-2009
Pierce Morris

Secondary Reviewer:
10-APR-2009
Maren Berry

CHECKLIST1 - Modified 03/05/2008
Generated: APR-10-2009 16:04:45

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Microbac Laboratories Inc.

00075725

HOLDING TIMES
EQUIVALENT TO AFCEE FORM 9

Analytical Method: 6010B

AAB#: WG299317

Login Number: L09040142

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
49WW06-040409	04/04/09	04/07/09	04/08/09	180	3.55	04/08/09	180	0.192	

* EXT = SEE PROJECT QAPP REQUIREMENTS
*ANAL = SEE PROJECT QAPP REQUIREMENTS

HOLD_TIMES - Modified 03/06/2008
PDF File ID: 1361662
Report generated 04/08/2009 13:57

Microbac®

METHOD BLANK SUMMARY

Login Number: L09040142
Blank File ID: P2.040809.105007
Prep Date: 04/08/09 06:32
Analyzed Date: 04/08/09 10:50
Analyst: JYH/PDM

Work Group: WG299317
Blank Sample ID: WG299269-02
Instrument ID: PE-ICP2
Method: 6010B

This Method Blank Applies To The Following Samples:

Client ID	Lab Sample ID	Lab File ID	Time Analyzed	TAG
LCS	WG299269-03	P2.040809.105620	04/08/09 10:56	01
49WW06-040409	L09040142-07	P2.040809.110853	04/08/09 11:08	01

Report Name: BLANK_SUMMARY
PDF File ID: 1361663
Report generated 04/08/2009 13:57

Microbac Laboratories Inc.

METHOD BLANK REPORT

Login Number: L09040142 Prep Date: 04/08/09 06:32 Sample ID: WG299269-02
Instrument ID: PE-ICP2 Run Date: 04/08/09 10:50 Prep Method: 3005A
File ID: P2.040809.105007 Analyst: JYH/PDM Method: 6010B
Workgroup (AAB#): WG299317 Matrix: Water Units: mg/L
Contract #: DACA56-94-D-0020 Cal ID: PE-ICP - 08-APR-09

Analytes	SDL	PQL	Concentration	Dilution	Qualifier
Aluminum, Total	0.0500	0.100	0.0500	1	U
Iron, Total	0.0250	0.100	0.0250	1	U

SDL Method Detection Limit
PQL Reporting/Practical Quantitation Limit
ND Analyte Not detected at or above reporting limit
* |Analyte concentration| > RL

Report Name: BLANK
PDF ID: 1361664
08-APR-2009 13:57

Microbac Laboratories Inc.
LABORATORY CONTROL SAMPLE (LCS)

Login Number: L09040142 Run Date: 04/08/2009 Sample ID: WG299269-03
Instrument ID: PE-ICP2 Run Time: 10:56 Prep Method: 3005A
File ID: P2.040809.105620 Analyst: JYH/PDM Method: 6010B
Workgroup (AAB#): WG299317 Matrix: Water Units: mg/L
QC Key: STD Lot#: STD27613 Cal ID: PE-ICP-08-APR-09

Analytes	Expected	Found	% Rec	LCS Limits	Q
Aluminum, Total	5.00	4.91	98.1	85 - 115	
Iron, Total	2.00	2.03	102	85 - 115	

LCS - Modified 03/06/2008
PDF File ID: 1361665
Report generated: 04/08/2009 13:57

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Microbac Laboratories Inc.
MATRIX SPIKE AND MATRIX SPIKE DUP (MS/MSD)

00075729

Loginnum: L09040142 Cal ID: PE-ICP2- Worknum: WG299317
Instrument ID: PE-ICP2 Contract #: DACA56-94-D-0020 Method: 6010B
Parent ID: WG299269-01 File ID: P2.040809.110853 Dil: 1 Matrix: WATER
Sample ID: WG299269-04 MS File ID: P2.040809.111516 Dil: 1 Units: mg/L
Sample ID: WG299269-05 MSD File ID: P2.040809.112142 Dil: 1

Analyte	Parent	MS Spiked	MS Found	MS %Rec	MSD Spiked	MSD Found	MSD %Rec	%RPD	%Rec Limits	RPD Limit	Q
Aluminum, Total	ND	5.00	4.80	96.1	5.00	5.02	100	4.39	80 - 120	20	
Iron, Total	0.0551	2.00	1.93	93.6	2.00	2.02	98.1	4.59	80 - 120	20	

* FAILS %REC LIMIT

FAILS RPD LIMIT

NOTE: This is an internal quality control sample.

WG_MS_MSD_DRYWT - Modified 03/07/2008
PDF File ID: 1361666
Report generated 04/08/2009 13:57

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Microbac Laboratories Inc.
Serial Dilution Report

Login: L09040142 **Worknum:** WG299317
Instrument: PE-ICP2 **Method:** 6010B
Serial Dil: WG299317-02 **File ID:** P2.040809.113429 **Dil:** 5 **Units:** mg/L
Sample: L09040142-07 **File ID:** P2.040809.110853 **Dil:** 1

Analyte	Sample	Qual	Serial Dil	Qual	% Diff	Q
Aluminum	ND	U	ND	U		
Iron	.0551	F	ND	U		

U = Result is below MDL.
F = Result is greater than or equal to MDL and less than the RL.
X = Result is greater than or equal to RL and less than 50 times the MDL.
E = %D exceeds control limit of 10% and initial sample result is greater than or equal to 50 times the MDL.

SERIAL_DIL - Modified 09/22/2008
PDF File ID: 1361660
04/08/2009 13:57

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Microbac Laboratories Inc.
POST SPIKE REPORT

Sample Login ID: L09040142 **Worknum:** WG299317
Instrument ID: PE-ICP2 **Method:** 6010B
Post Spike ID: WG299317-01 **File ID:** P2.040809.112801 **Dil:** 1 **Units:** mg/L
Sample ID: L09040142-07 **File ID:** P2.040809.110853 **Dil:** 1 **Matrix:** Water

Analyte	Post Spike Result	C	Sample Result	C	Spike Added(SA)	% R	Control Limit %R	Q
ALUMINUM	4.90		0	U	5	98.0	75 - 125	
IRON	1.98		0.0551	F	2	96.3	75 - 125	

N = % Recovery exceeds control limits
F = Result is between MDL and RL
U = Sample result is below MDL. A value of zero is used in the calculation

POST_SPIKE - Modified 03/06/2008
PDF File ID: 1361661
Report generated: 04/08/2009 13:57

Microbac Laboratories Inc.
Initial Calibration Summary

Login:	L09040142	Workgroup (AAB#):	WG299317
Analytical Method:	6010B	Instrument ID:	PE-ICP2
ICAL Worknum:	WG299351	Initial Calibration Date:	08-APR-2009 10:07

	WG299351-01		WG299351-02		WG299351-03		WG299351-04		WG299351-05			
	Conc	INT	Conc	INT	Conc	INT	Conc	INT	Conc	INT	R	Q
ALUMINUM	0	-124	.1	839	.2	1710	10	81800	20	164000	.999999	
IRON	0	1.05	.04	18.2	.08	39.3	4	1840	8	3700	.999995	

INT = Instrument intensity
R = Coefficient of correlation
Q = Data Qualifier
*** = Out of Compliance; R < 0.995**

INT_CAL_ICP - Modified 03/06/2008
PDF File ID: 1361669
Report generated: 09-APR-2009 13:12

Microbac Laboratories Inc.

INITIAL CALIBRATION BLANK (ICB)

Login Number: L09040142
Run Date: 04/08/2009
Sample ID: WG299351-07
Instrument ID: PE-ICP2
Run Time: 10:20
Method: 6010
File ID: P2.040809.102036
Analyst: JYH/PDM
Units: mg/L
Workgroup (AAB#): WG299317
Cal ID: PE-ICP2 - 08-APR-09
Matrix: WATER

Analytes	MDL	RDL	Concentration	Qualifier
ALUMINUM	.05	.1	.05	U
IRON	.025	.1	.025	U

ICB - Modified 03/06/2008
PDF File ID: 1361671
Report generated 04/08/2009 13:58

Microbac

Microbac Laboratories Inc.
CONTINUING CALIBRATION BLANK (CCB)

00075734

Login Number: L09040142
Run Date: 04/08/2009
Sample ID: WG299351-11
Instrument ID: PE-ICP2
Run Time: 10:43
Method: 6010B
File ID: P2.040809.104350
Analyst: JYH/PDM
Units: mg/L
Workgroup (AAB#): WG299317
Cal ID: PE-ICP - 08-APR-09
Matrix: WATER

Analytes	MDL	RDL	Concentration	Qualifier
Aluminum	0.0500	0.100	0.0500	U
Iron	0.0250	0.100	0.0250	U

U = Result is less than MDL.
F = Result is between MDL and RL.
* = Result is above RL.

CCB - Modified 03/05/2008
PDF File ID: 1361674
Report generated 04/08/2009 13:58

Microbac Laboratories Inc.
CONTINUING CALIBRATION BLANK (CCB)

00075735

Login Number: L09040142
Run Date: 04/08/2009
Sample ID: WG299351-13
Instrument ID: PE-ICP2
Run Time: 11:47
Method: 6010B
File ID: P2.040809.114712
Analyst: JYH/PDM
Units: mg/L
Workgroup (AAB#): WG299317
Cal ID: PE-ICP - 08-APR-09
Matrix: WATER

Analytes	MDL	RDL	Concentration	Qualifier
Aluminum	0.0500	0.100	0.0500	U
Iron	0.0250	0.100	0.0250	U

U = Result is less than MDL.
F = Result is between MDL and RL.
* = Result is above RL.

CCB - Modified 03/05/2008
PDF File ID: 1361674
Report generated 04/08/2009 13:58

Microbac Laboratories Inc.

INITIAL CALIBRATION VERIFICATION (ICV)

(Alternate Source)

00075736

Login Number: L09040142 Run Date: 04/08/2009 Sample ID: WG299351-06

Instrument ID: PE-ICP2 Run Time: 10:14 Method: 6010B

File ID: P2.040809.101418 Analyst: JYH/PDM Units: mg/L

Workgroup (AAB#): WG299317 Cal ID: PE-ICP - 08-APR-09

QC Key: STD

Analyte		Expected	Found	%REC	LIMITS	Q
Aluminum		10	10.1	101	90 - 110	
Iron		4	4.16	104	90 - 110	

* Exceeds LIMITS Limit

ICV - Modified 03/06/2008

PDF File ID: 1361670

Report generated 04/08/2009 13:57

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CONTINUING CALIBRATION VERIFICATION (CCV)

00075737

Login Number: L09040142
Run Date: 04/08/2009
Sample ID: WG299351-10
Instrument ID: PE-ICP2
Run Time: 10:37
Method: 6010B
File ID: P2.040809.103733
Analyst: JYH/PDM
QC Key: STD
Workgroup (AAB#): WG299317
Cal ID: PE-ICP - 08-APR-09
Matrix: WATER

Analyte		Expected	Found	UNITS	%REC	LIMITS		Q
Aluminum		10.0	9.93	mg/L	99.3	90 - 110		
Iron		4.00	4.12	mg/L	103	90 - 110		

* Exceeds LIMITS Criteria

CCV - Modified 03/05/2008
PDF File ID: 1361673
Report generated 04/08/2009 13:58

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CONTINUING CALIBRATION VERIFICATION (CCV)

00075738

Login Number: L09040142
Run Date: 04/08/2009
Sample ID: WG299351-12
Instrument ID: PE-ICP2
Run Time: 11:40
Method: 6010B
File ID: P2.040809.114054
Analyst: JYH/PDM
QC Key: STD
Workgroup (AAB#): WG299317
Cal ID: PE-ICP - 08-APR-09
Matrix: WATER

Analyte		Expected	Found	UNITS	%REC	LIMITS		Q
Aluminum		10.0	10.0	mg/L	100	90 - 110		
Iron		4.00	4.22	mg/L	106	90 - 110		

* Exceeds LIMITS Criteria

CCV - Modified 03/05/2008
PDF File ID: 1361673
Report generated 04/08/2009 13:58

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Microbac Laboratories Inc.
INTERFERENCE CHECK SAMPLES

Login number: L09040142
Instrument ID: PE-ICP2
Sol. A : WG299351-08 **File ID:** P2.040809.102652
Sol. AB : WG299351-09 **File ID:** P2.040809.103212

Workgroup (AAB#): WG299317
Method: 6010B
Units: mg/L
Matrix: Water

	Sol. A			Sol. AB			
ANALYTE	True	Found	%Recovery	True	Found	%Recovery	Q
Aluminum	250	250	100	250	245	98.0	
Iron	100	97.7	97.7	100	94.5	94.5	

NS = Not spiked
*** = Recovery of spiked element is outside acceptance limit of 80% - 120% of true value.**
 # = Result for unspiked element is outside the acceptance limits of (+/-) the project reporting limit (RL).

ICS - Modified 03/06/2008
PDF File ID: 1361672
Report generated 04/08/2009 13:58

Microbac Laboratories Inc.
INTERELEMENT CORRECTION FACTORS (ANNUALLY)

Login Number: L09040142 **Date:** 02/02/2009
Insturment ID: PE-ICP2 **Method:** 6010B

Analyte	Wave Length	AG	AL	AS	B	BA
ALUMINUM	396.15	0	0	0.206	0	0
ANTIMONY	206.84	0	0	-0.740	0	0
ARSENIC	188.98	0	-0.00216	0	0	0
BARIUM	233.53	0	0	0	0	0
BERYLLIUM	234.86	0	0	0	0	0
BORON	249.68	0	0	0	0	0
CADMIUM	228.80	0	0	0	0	0
CALCIUM	227.55	0	-0.370	0.0414	0	0
CHROMIUM	267.72	0	0	0	0	0
COBALT	228.62	0	0	0	0	-1.07
COPPER	327.39	0	0	0	0	0
IRON	239.56	0	0	0	0	0
LEAD	220.35	0	-0.107	0	0	0
LITHIUM	670.78	0	0	0	0	0
MAGNESIUM	279.08	0	0	0	0	0
MANGANESE	257.61	-0.185	0	-0.231	-0.0949	-0.230
MOLYBDENUM	202.03	0	0	0	0	0
NICKEL	231.60	0	0	0	0	0
POTASSIUM	766.49	0	0	0	0	0
SELENIUM	196.03	0	0.207	0	0	0
SILICON	251.61	0	0	0	0	0
SILVER	328.07	0	0	0	0	0
SODIUM	589.59	0	0	0	0	0
STRONTIUM	407.77	0	0	0	0	0
THALLIUM	190.80	0	0	0	0	0
TIN	189.93	0	0	0	0	0
TITANIUM	334.94	0	0	0	0	0
VANADIUM	290.88	0	0	0.200	0	0.0400
ZINC	206.20	0	0.0753	0	0	0

CORR_FACTORS - Modified 03/05/2008
PDF File ID: 1361668
Report generated: 04/08/2009 13:57

Microbac Laboratories Inc.
INTERELEMENT CORRECTION FACTORS (ANNUALLY)

Login Number: L09040142 **Date:** 02/02/2009
Insturment ID: PE-ICP2 **Method:** 6010B

Analyte	Wave Length	BE	CA	CD	CO	CR
ALUMINUM	396.15	0	0.274	0	0	0
ANTIMONY	206.84	0	0	0	0	19.8
ARSENIC	188.98	0	-0.00673	-0.0875	0	-2.91
BARIUM	233.53	0	0	0	0	0
BERYLLIUM	234.86	0	0	0	0	-0.0105
BORON	249.68	0	0	50.1	3.51	1.50
CADMIUM	228.80	0	0	0	-5.41	0
CALCIUM	227.55	0	0	0	126	-21.8
CHROMIUM	267.72	0	0	0	0	0
COBALT	228.62	0	0	0	0	0.156
COPPER	327.39	0	0	0	0.380	-0.0467
IRON	239.56	0	0.0227	0	1.91	0.331
LEAD	220.35	0	-0.0247	0	0.666	-0.0700
LITHIUM	670.78	0	0	0	0	0
MAGNESIUM	279.08	0	0.638	0	0	0
MANGANESE	257.61	-1.04	0.0280	-0.755	-0.0418	-0.110
MOLYBDENUM	202.03	0	0	0	0	0
NICKEL	231.60	0	0	0	0.623	0
POTASSIUM	766.49	0	0	0	0	0
SELENIUM	196.03	0	0.0190	0	-0.633	0
SILICON	251.61	0	0	0	0	0
SILVER	328.07	0	0	0	0	0
SODIUM	589.59	0	0	0	0	0
STRONTIUM	407.77	0	0	0	0	0
THALLIUM	190.80	0	-0.0100	0	0.953	0
TIN	189.93	0	0	0	0	0
TITANIUM	334.94	0	-0.0233	0	0	0.297
VANADIUM	290.88	0	-0.00100	0	0	0
ZINC	206.20	0	-0.0333	15.3	0	-7.08

CORR_FACTORS - Modified 03/05/2008
PDF File ID: 1361668
Report generated: 04/08/2009 13:57

Microbac Laboratories Inc.
INTERELEMENT CORRECTION FACTORS (ANNUALLY)

Login Number: L09040142 **Date:** 02/02/2009
Insturment ID: PE-ICP2 **Method:** 6010B

Analyte	Wave Length	CU	FE	K	LI	MG
ALUMINUM	396.15	0	0.108	0	0	0
ANTIMONY	206.84	0	0	0	0	0
ARSENIC	188.98	0	0.00251	0	0	0
BARIUM	233.53	0	0.0520	0	0	0
BERYLLIUM	234.86	0	0.152	0	0	0
BORON	249.68	0	-4.02	0	0	0
CADMIUM	228.80	0	-0.00274	0	0	0
CALCIUM	227.55	-2.44	-4.01	0	0	0.104
CHROMIUM	267.72	0	-0.0239	0	0	0
COBALT	228.62	0	0.00949	0	0	0
COPPER	327.39	0	-0.0851	0	0.154	0.0143
IRON	239.56	0	0	0	0	0.0276
LEAD	220.35	0.551	0.103	0	0	0
LITHIUM	670.78	0	0	0	0	0
MAGNESIUM	279.08	0	0.174	0	0	0
MANGANESE	257.61	-0.0457	-0.156	-0.0181	-0.794	0.0147
MOLYBDENUM	202.03	0	-0.0494	0	0	0
NICKEL	231.60	0	0	0	0	0
POTASSIUM	766.49	0	-0.0451	0	0	0
SELENIUM	196.03	0	-1.01	0	0	-0.0113
SILICON	251.61	0	0	0	0	0
SILVER	328.07	0.0717	-0.00209	0	0	0
SODIUM	589.59	0	0	0	0	0
STRONTIUM	407.77	0	0.138	0	0	0
THALLIUM	190.80	0	0	0	0	0
TIN	189.93	0	0	0	0	0
TITANIUM	334.94	0	0	0	0	0
VANADIUM	290.88	0	0.0715	0	0	-0.0400
ZINC	206.20	-0.200	-0.0563	0	0	0

CORR_FACTORS - Modified 03/05/2008
PDF File ID: 1361668
Report generated: 04/08/2009 13:57

Microbac Laboratories Inc.
INTERELEMENT CORRECTION FACTORS (ANNUALLY)

Login Number: L09040142 **Date:** 02/02/2009
Insturment ID: PE-ICP2 **Method:** 6010B

Analyte	Wave Length	MN	MO	NA	NI	PB
ALUMINUM	396.15	0	32.9	0	0	0
ANTIMONY	206.84	0	-17.4	0	0	0
ARSENIC	188.98	0	3.66	0	0	0
BARIUM	233.53	0	-0.548	0	0	0
BERYLLIUM	234.86	-0.131	-0.529	0	-0.00974	0
BORON	249.68	0	-2.08	0	0	0
CADMIUM	228.80	0	0.0112	0	-0.0299	0
CALCIUM	227.55	0	-18.6	0	-1090	0
CHROMIUM	267.72	0.434	-0.00100	0	0	0
COBALT	228.62	0	-0.835	0	0.129	0
COPPER	327.39	0.136	-0.0774	0	0.150	0.257
IRON	239.56	0.480	0	0	0	0.407
LEAD	220.35	0.0756	-2.50	0	-0.174	0
LITHIUM	670.78	0	0	0	0	0
MAGNESIUM	279.08	0	-5.58	0	0	0.0252
MANGANESE	257.61	0	-0.0482	-0.00916	-0.0340	-0.0413
MOLYBDENUM	202.03	-0.209	0	0	0.120	0
NICKEL	231.60	0	0	0	0	0
POTASSIUM	766.49	0	0	1.00	0	0
SELENIUM	196.03	0.451	0.199	0	0.0799	0
SILICON	251.61	0	12.9	0	0	0
SILVER	328.07	0.130	0.0781	0	0	0
SODIUM	589.59	0	0	0	0	0
STRONTIUM	407.77	0	0	0	0	0
THALLIUM	190.80	-0.00100	1.20	0	0	0
TIN	189.93	0	0	0	0	0
TITANIUM	334.94	0	0	0	0	0
VANADIUM	290.88	0	0.578	0	0	0
ZINC	206.20	0	0.180	0	-0.200	-0.100

CORR_FACTORS - Modified 03/05/2008
PDF File ID: 1361668
Report generated: 04/08/2009 13:57

Microbac Laboratories Inc.
INTERELEMENT CORRECTION FACTORS (ANNUALLY)

Login Number: L09040142 **Date:** 02/02/2009
Insturment ID: PE-ICP2 **Method:** 6010B

Analyte	Wave Length	SB	SE	SI	SN	SR
ALUMINUM	396.15	0	0	0	0	0
ANTIMONY	206.84	0	0	0	-10.6	0
ARSENIC	188.98	0	0	0	0	0
BARIUM	233.53	0	0	0	0	0
BERYLLIUM	234.86	0	0	0	0	0
BORON	249.68	0	0	0	0	0
CADMIUM	228.80	0	0	0	0	0
CALCIUM	227.55	0	0	2.79	0	0
CHROMIUM	267.72	0	0	0	0	0
COBALT	228.62	0	0	0	0	0
COPPER	327.39	0	0.148	0	0	0
IRON	239.56	0	0	0	0	0
LEAD	220.35	-0.0100	0	0	0	0
LITHIUM	670.78	0	0	0	0	0
MAGNESIUM	279.08	0	-0.0924	0	0	0
MANGANESE	257.61	-0.0505	-0.0281	-0.185	-0.0445	-0.625
MOLYBDENUM	202.03	0	0	0	0	0
NICKEL	231.60	-0.0500	-0.0100	0	0	0
POTASSIUM	766.49	0	0	0	0	0
SELENIUM	196.03	0	0	0	0	0
SILICON	251.61	0	0	0	0	0
SILVER	328.07	0	0	0	0	0.200
SODIUM	589.59	0	0	0	0	0
STRONTIUM	407.77	0	0	0	0	0
THALLIUM	190.80	0	0	0	0	0
TIN	189.93	0	0	0	0	0
TITANIUM	334.94	0	0	0	0	0
VANADIUM	290.88	0	0	0	0	0
ZINC	206.20	-0.300	0	0	0	0

CORR_FACTORS - Modified 03/05/2008
PDF File ID: 1361668
Report generated: 04/08/2009 13:57

Microbac Laboratories Inc.
INTERELEMENT CORRECTION FACTORS (ANNUALLY)

Login Number: L09040142 **Date:** 02/02/2009
Insturment ID: PE-ICP2 **Method:** 6010B

Analyte	Wave Length	TI	TL	V	ZN
ALUMINUM	396.15	0	0	0	0
ANTIMONY	206.84	0	0	-3.59	0
ARSENIC	188.98	0	0	0.0930	0
BARIUM	233.53	0	0	-1.83	0
BERYLLIUM	234.86	0	0	0	0
BORON	249.68	0	0	0	0
CADMIUM	228.80	0	0	0.0940	0
CALCIUM	227.55	0	0	19.1	0
CHROMIUM	267.72	0	0	-0.567	-0.0400
COBALT	228.62	2.21	0	0	0
COPPER	327.39	-1.05	0	-0.603	0
IRON	239.56	0	0	0	-0.0613
LEAD	220.35	-0.441	0	-0.150	0
LITHIUM	670.78	0	0	0	0
MAGNESIUM	279.08	0	0	-0.0280	0
MANGANESE	257.61	-0.00931	-0.0414	-0.0601	-0.0553
MOLYBDENUM	202.03	0	0	-0.288	0
NICKEL	231.60	0	0.617	0	0
POTASSIUM	766.49	0	0	0	0
SELENIUM	196.03	-0.220	0	0.823	0
SILICON	251.61	0	0	0	0
SILVER	328.07	0	0	-5.47	0
SODIUM	589.59	0	0	0	0
STRONTIUM	407.77	0	0	0	0
THALLIUM	190.80	-4.00	0	0	0
TIN	189.93	0	0	0	0
TITANIUM	334.94	0	0	0	0
VANADIUM	290.88	0	0	0	0
ZINC	206.20	0	0	-0.100	0

CORR_FACTORS - Modified 03/05/2008
PDF File ID: 1361668
Report generated: 04/08/2009 13:57

Microbac Laboratories Inc.
LINEAR RANGE (QUARTERLY)

Login Number: L09040142 **Date:** 03/25/2009
Insturment ID: PE-ICP2 **Method:** 6010B

Analyte	Integration Time (Sec.)	Concentration (mg/L)
Aluminum	10.00	450.0
Antimony	10.00	45.0
Arsenic	10.00	9.0
Barium	10.00	9.0
Beryllium	10.00	4.5
Boron	10.00	45.0
Cadmium	10.00	9.0
Calcium	10.00	450.0
Chromium	10.00	45.0
Cobalt	10.00	45.0
Copper	10.00	45.0
Iron	10.00	450.0
Lead	10.00	90.0
Lithium	10.00	1.8
Magnesium	10.00	450.0
Manganese	10.00	27.0
Molybdenum	10.00	45.0
Nickel	10.00	45.0
Potassium	10.00	90.0
Selenium	10.00	45.0
Silicon	10.00	36.0
Silver	10.00	9.0
Sodium	10.00	180.0
Strontium	10.00	4.5
Thallium	10.00	45.0
Tin	10.00	45.0
Titanium	10.00	45.0
Vanadium	10.00	45.0
Zinc	10.00	45.0

Comments:
All analytes passed acceptance criteria at the specified concentration.

LINEAR_RANGE - Modified 03/06/2008
PDF File ID: 1361667
Report generated: 04/08/2009 13:57

2.2.2 Metals ICP-MS Data

2.2.2.1 Summary Data

LABORATORY REPORT

L09040142

04/13/09 09:36

Submitted By

Microbac Laboratories Inc.
158 Starlite Drive
Marietta , OH 45750
(740) 373 - 4071

For

Account Name: Shaw E & I, Inc.
ABB Lummus Biulding
3010 Briarpark Drive Suite 4N
Houston, TX 77042
Attention: Jennifer Hoang

Project Number: 2773.025
Project: Longhorn AAP
Site: LONGHORN AAP KARNACK TX

P.O. Number: 389869/ 390836(GWTP)

Sample Analysis Summary

Client ID	Lab ID	Method	Dilution	Date Received
49WW06-040409	L09040142-07	6020	5	07-APR-09

Report Number: **L09040142**
Report Date : **April 13, 2009**

Sample Number: **L09040142-07**
Client ID: **49WW06-040409**
Matrix: **Water**
Workgroup Number: **WG299242**
Collect Date: **04/04/2009 17:15**
Sample Tag: **DL01**

PrePrep Method: **NONE**
Prep Method: **3015**
Analytical Method: **6020**
Analyst: **JYH**
Dilution: **5**
Units: **mg/L**

Instrument: **ELAN-ICP**
Prep Date: **04/07/2009 12:22**
Cal Date: **04/07/2009 13:59**
Run Date: **04/07/2009 16:30**
File ID: **EL.040709.163005**

Analyte	CAS. Number	Result	Qual	PQL	SDL
Arsenic, Total	7440-38-2	0.0139		0.00500	0.00125

2.2.2.2 QC Summary Data

Example 6020 Calculations
Perkin Elmer ELAN 6100

1.0 Initial Calibration (ICAL) Parameters
The system performs linear regression from data consisting of a blank and three standards.

2.0 Calculating the concentration (C) of an element in water using data from prep log, run log, and quantitation report (note:the data system performs this calculation automatically when correction factors have been entered):

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

Where:	**Example:**
Cs = Concentration computed by the data system (ug/L)	0.1
Vf = Final volume	100
Vi = Initial volume	40
D = Dilution factor as a multiplier (10X = 10)	1
Cx = Concentration of element in (ug/L)	0.25

3.0 Calculating the concentration (C) of an element in soil using data from prep log, run log, and quantitation report (note: the data system performs this calculation automatically when correction factors have been entered):

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

Where:	**Example:**
Cs = Concentration computed by the data system (ug/L)	0.1
Vf = Final volume	200
Vi = Initial volume	0.5
D = Dilution factor as a multiplier (10X = 10)	1
Cx = Concentration of element in (ug/kg)	40

4.0 Adjusting the concentration to dry weight:

$$Cdry = \frac{Cx \times 100}{Px}$$

Where:	**Example:**
Cx = Concentration calculated as received (wet basis)	40
Px = Percent solids of sample (%wt)	80
$Cdry$ = Concentration calculated as dry weight (ug/kg)	50

50 ug/kg = 0.050 mg/kg

Perkin Elmer ELAN ICP/MS

STANDARDS KEY

QC Std 1 - ICV
QC Std 2 - ICB
QC Std 3 - CRI - Soil
QC Std 4 - CRI - Water
QC Std 5 - ICSA
QC Std 6 - ICSAB
QC Std 7 - CCV
QC Std 8 - CCB

Calibration Solutions

Analyte	Stock Conc. (mg/L)	S1 (mg/L)	S2 (mg/L)	S3 (mg/L)	S4 (mg/L)
Al	10	0	0.0004	0.05	0.1
Sb	10	0	0.0004	0.05	0.1
As	10	0	0.0004	0.05	0.1
Ba	10	0	0.0004	0.05	0.1
Be	10	0	0.0004	0.05	0.1
Ca	1000	0	0.04	5	10
Cd	10	0	0.0004	0.05	0.1
Cr	10	0	0.0004	0.05	0.1
Co	10	0	0.0004	0.05	0.1
Cu	10	0	0.0004	0.05	0.1
Fe	1000	0	0.04	5	10
Pb	10	0	0.0004	0.05	0.1
Mg	1000	0	0.04	5	10
Mn	10	0	0.0004	0.05	0.1
Ni	10	0	0.0004	0.05	0.1
K	1000	0	0.04	5	10
Se	10	0	0.0004	0.05	0.1
Ag	10	0	0.0004	0.05	0.1
Na	1000	0	0.04	5	10
Tl	10	0	0.0004	0.05	0.1
V	10	0	0.0004	0.05	0.1
Zn	10	0	0.0004	0.05	0.1

Microbac Laboratories Inc.
Microwave Digestion Log

Workgroup: WG299169
Analyst: VC
Spike Analyst: VC
Run Date: 04/07/2009 10:10
Method: 3015

SOP: ME407 Revison 10
Spike Solution: STD30482
Spike Witness: SDL
HNO3 Lot #: COA13771
Digest tubes Lot #: COA13696

	SAMPLE #	Type	Matrix	Initial Amount	Final Volume	Initial Vessel Wt	Final Vessel Wt	Spike Amount	Due Date
1	WG299169-02	BLANK	1	40 mL	100 mL	205.758 g	205.756 g		
2	WG299117-01	FBLK	18	40 mL	100 mL	208.837 g	208.815 g		
3	WG299169-03	LCS	1	40 mL	100 mL	206.053 g	206.049 g	.25 mL	
4	L09040090-03	SAMP	18	40 mL	100 mL	205.709 g	205.672 g		04/10/09
5	L09040090-05	SAMP	18	40 mL	100 mL	205.402 g	205.387 g		04/10/09
6	L09040090-07	SAMP	18	40 mL	100 mL	205.974 g	205.96 g		04/10/09
7	L09040090-09	SAMP	18	40 mL	100 mL	206.221 g	206.215 g		04/10/09
8	L09040090-11	SAMP	18	40 mL	100 mL	206.487 g	206.477 g		04/10/09
9	L09040090-12	SAMP	1	40 mL	100 mL	206.437 g	206.43 g		04/10/09
10	L09040125-01	SAMP	1	40 mL	100 mL	205.552 g	205.553 g		04/14/09
11	L09040126-01	SAMP	1	40 mL	100 mL	205.873 g	205.879 g		04/14/09
12	L09040126-02	SAMP	1	40 mL	100 mL	204.812 g	204.806 g		04/14/09
13	L09040126-03	SAMP	1	40 mL	100 mL	206.864 g	206.856 g		04/14/09
14	WG299169-01	REF	2	40 mL	100 mL	205.802 g	205.791 g		
15	L09040128-01	SAMP	2	40 mL	100 mL	205.802 g	205.791 g		04/13/09
16	L09040142-07	SAMP	1	40 mL	100 mL	205.401 g	205.382 g		04/08/09
17	WG299169-06	DUP	1	40 mL	100 mL	206.49 g	206.478 g		
18	WG299169-04	MS	1	40 mL	100 mL	207.18 g	207.17 g	.25 mL	
19	WG299169-05	MSD	1	40 mL	100 mL	206.222 g	206.216 g	.25 mL	

Analyst: Vicki Collins

Reviewer: Shelly Lent

MW_DIG - Modified 07/02/2008
PDF ID: 1360228
Report generated: 04/07/2009 12:57

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Microbac Laboratories Inc.

Instrument Run Log

Instrument: ELAN-ICP Dataset: 040709B.REP
Analyst1: JYH Analyst2: N/A
Method: 6020 SOP: ME700 Rev:
Maintenance Log ID: 28254

Calibration Std: STD31921 ICV/CCV Std: STD32127 Post Spike: STD27580
ICSA: STD31706 ICSAB: STD31705

Workgroups: 299242

Comments:

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
1	EL.040709.133714	Blank	Blank		1		04/07/09 13:37
2	EL.040709.134254	WG299305-01	Calibration Point		1		04/07/09 13:42
3	EL.040709.134834	WG299305-02	Calibration Point		1		04/07/09 13:48
4	EL.040709.135416	WG299305-03	Calibration Point		1		04/07/09 13:54
5	EL.040709.135958	WG299305-04	Calibration Point		1		04/07/09 13:59
6	EL.040709.140540	WG299305-05	Initial Calibration Verification		1		04/07/09 14:05
7	EL.040709.141232	WG299305-06	Initial Calib Blank		1		04/07/09 14:12
8	EL.040709.141925	WG299305-07	CRQL Check Solid		1		04/07/09 14:19
9	EL.040709.142621	WG299305-08	CRQL Check Water		1		04/07/09 14:26
10	EL.040709.143316	WG299305-09	Interference Check		1		04/07/09 14:33
11	EL.040709.144009	WG299305-10	Interference Check		1		04/07/09 14:40
12	EL.040709.144703	WG299305-11	CCV		1		04/07/09 14:47
13	EL.040709.145354	WG299305-12	CCB		1		04/07/09 14:53
14	EL.040709.155350	WG299169-02	Method/Prep Blank	40/100	1		04/07/09 15:53
15	EL.040709.155952	WG299117-01	Fluid Blank		1		04/07/09 15:59
16	EL.040709.160554	WG299169-03	Laboratory Control S	40/100	1		04/07/09 16:05
17	EL.040709.161156	WG299169-01	Reference Sample		1	L09040128-01	04/07/09 16:11
18	EL.040709.161759	WG299169-04	Matrix Spike	40/100	1	L09040128-01	04/07/09 16:17
19	EL.040709.162402	WG299169-05	Matrix Spike Duplica	40/100	1	L09040128-01	04/07/09 16:24
20	EL.040709.163005	L09040142-07	49WW06-040409	40/100	5		04/07/09 16:30
21	EL.040709.163609	WG299242-01	Post Digestion Spike		5	L09040142-07	04/07/09 16:36
22	EL.040709.164213	WG299242-02	Serial Dilution		25	L09040142-07	04/07/09 16:42
23	EL.040709.164817	L09040090-03	AV-NCB-PE-VIS-38-C1-0402	40/100	1		04/07/09 16:48
24	EL.040709.165441	WG299305-13	CCV		1		04/07/09 16:54
25	EL.040709.170132	WG299305-14	CCB		1		04/07/09 17:01

Page: 1 Approved:

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Microbac Laboratories Inc.

Instrument Run Log

Instrument: ELAN-ICP Dataset: 040809B.REP
Analyst1: JYH Analyst2: N/A
Method: 6020 SOP: ME700 Rev:
Maintenance Log ID: 28254

Calibration Std: STD31921 ICV/CCV Std: STD32127 Post Spike: STD27580
ICSA: STD32228 ICSAB: STD32229

Workgroups: 299298,299242,299218,299219

Comments:

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
1	EL.040809.112358	Blank	Blank		1		04/08/09 11:23
2	EL.040809.112938	WG299428-01	Calibration Point		1		04/08/09 11:29
3	EL.040809.113518	WG299428-02	Calibration Point		1		04/08/09 11:35
4	EL.040809.114059	WG299428-03	Calibration Point		1		04/08/09 11:40
5	EL.040809.114641	WG299428-04	Calibration Point		1		04/08/09 11:46
6	EL.040809.115224	WG299428-05	Initial Calibration Verification		1		04/08/09 11:52
7	EL.040809.115915	WG299428-06	Initial Calib Blank		1		04/08/09 11:59
8	EL.040809.120608	WG299428-07	CRQL Check Solid		1		04/08/09 12:06
9	EL.040809.121304	WG299428-08	CRQL Check Water		1		04/08/09 12:13
10	EL.040809.121958	WG299428-09	Interference Check		1		04/08/09 12:19
11	EL.040809.122652	WG299428-10	Interference Check		1		04/08/09 12:26
12	EL.040809.123453	WG299428-11	Interference Check		1		04/08/09 12:34
13	EL.040809.124146	WG299428-12	CCV		1		04/08/09 12:41
14	EL.040809.124838	WG299428-13	CCB		1		04/08/09 12:48
15	EL.040809.125508	WG299268-02	Method/Prep Blank	.5/200	1		04/08/09 12:55
16	EL.040809.130108	WG299268-03	Laboratory Control S	.5/200	1		04/08/09 13:01
17	EL.040809.130709	WG299268-01	Reference Sample		1	L09040158-07	04/08/09 13:07
18	EL.040809.131310	WG299268-04	Matrix Spike	.506/200	1	L09040158-07	04/08/09 13:13
19	EL.040809.131911	WG299268-05	Matrix Spike Duplica	.506/200	1	L09040158-07	04/08/09 13:19
20	EL.040809.132512	L09040146-01	FTMD02-PM-BF01C	.519/200	1		04/08/09 13:25
21	EL.040809.133114	L09040146-02	FTMD02-PM-BF02C	.518/200	1		04/08/09 13:31
22	EL.040809.133716	L09040146-03	FTMD02-PM-BF03C	.515/200	1		04/08/09 13:37
23	EL.040809.134319	WG299298-01	Post Digestion Spike		1	L09040146-03	04/08/09 13:43
24	EL.040809.134921	WG299298-02	Serial Dilution		5	L09040146-03	04/08/09 13:49
25	EL.040809.135544	WG299428-14	CCV		1		04/08/09 13:55
26	EL.040809.140236	WG299428-15	CCB		1		04/08/09 14:02
27	EL.040809.140907	L09040158-01	A2BS1078D001	.539/200	1		04/08/09 14:09
28	EL.040809.141511	L09040158-02	A2BS1078S001	.531/200	1		04/08/09 14:15
29	EL.040809.142113	L09040158-03	A2BS1079S001	.509/200	1		04/08/09 14:21
30	EL.040809.142713	L09040158-04	A2BS1082S001	.516/200	1		04/08/09 14:27
31	EL.040809.143314	L09040158-05	A2BS1088S001	.506/200	1		04/08/09 14:33
32	EL.040809.143916	L09040158-06	A2BS1091S002		1		04/08/09 14:39
33	EL.040809.144517	WG299268-01	Reference Sample		10	L09040158-07	04/08/09 14:45
34	EL.040809.145118	WG299268-04	Matrix Spike	.506/200	10	L09040158-07	04/08/09 14:51
35	EL.040809.145719	WG299268-05	Matrix Spike Duplica	.506/200	10	L09040158-07	04/08/09 14:57
36	EL.040809.150321	L09040146-01	FTMD02-PM-BF01C	.519/200	50		04/08/09 15:03
37	EL.040809.150943	WG299428-16	CCV		1		04/08/09 15:09

Page: 1 Approved: April 09, 2009

Maren Berry

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Microbac Laboratories Inc.

Instrument Run Log

Instrument: ELAN-ICP Dataset: 040809B.REP
Analyst1: JYH Analyst2: N/A
Method: 6020 SOP: ME700 Rev:
Maintenance Log ID: 28254

Calibration Std: STD31921 ICV/CCV Std: STD32127 Post Spike: STD27580
ICSA: STD32228 ICSAB: STD32229

Workgroups: 299298,299242,299218,299219

Comments:

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
38	EL.040809.151634	WG299428-17	CCB		1		04/08/09 15:16
39	EL.040809.152305	L09040146-02	FTMD02-PM-BF02C	.518/200	50		04/08/09 15:23
40	EL.040809.152907	L09040146-03	FTMD02-PM-BF03C	.515/200	50		04/08/09 15:29
41	EL.040809.153510	WG299298-01	Post Digestion Spike		50	L09040146-03	04/08/09 15:35
42	EL.040809.154112	WG299298-02	Serial Dilution		250	L09040146-03	04/08/09 15:41
43	EL.040809.154735	WG299428-18	CCV		1		04/08/09 15:47
44	EL.040809.155427	WG299428-19	CCB		1		04/08/09 15:54
45	EL.040809.160155	L09040158-06	A2BS1091S002	.511/200	10		04/08/09 16:01
46	EL.040809.162748	L09040090-03	AV-NCB-PE-VIS-38-C1-0402		1		04/08/09 16:27
47	EL.040809.163412	WG299428-20	CCV		1		04/08/09 16:34
48	EL.040809.164103	WG299428-21	CCB		1		04/08/09 16:41
49	EL.040809.164736	L09040090-05	AV-NCB-AS-VIS-7-040209	40/100	1		04/08/09 16:47
50	EL.040809.165341	L09040090-07	AV-NCB-PE-UNK-38-C3-040	40/100	1		04/08/09 16:53
51	EL.040809.165944	L09040090-09	AV-NCB-PE-UNK-38-C3D-04	40/100	1		04/08/09 16:59
52	EL.040809.170547	L09040090-11	AV-NCB-AS-UNK-156-04020	40/100	1		04/08/09 17:05
53	EL.040809.171149	L09040090-12	AV-NCB-EB-1-040209	40/100	1		04/08/09 17:11
54	EL.040809.171752	L09040125-01	EBQW1838Q001	40/100	1		04/08/09 17:17
55	EL.040809.172355	L09040126-01	EBQW1840Q001	40/100	1		04/08/09 17:23
56	EL.040809.172959	L09040126-02	EBQW1841Q001	40/100	1		04/08/09 17:29
57	EL.040809.173603	L09040126-03	EBQW1842Q001	40/100	1		04/08/09 17:36
58	EL.040809.174207	WG299169-06	Duplicate	40/100	1	L09040128-01	04/08/09 17:42
59	EL.040809.174831	WG299428-22	CCV		1		04/08/09 17:48
60	EL.040809.175522	WG299428-23	CCB		1		04/08/09 17:55
61	EL.040809.180152	WG299146-02	Method/Prep Blank	.5/200	1		04/08/09 18:01
62	EL.040809.180752	WG299146-03	Laboratory Control S	.5/200	1		04/08/09 18:07
63	EL.040809.181352	WG299146-01	Reference Sample		1	L09040123-09	04/08/09 18:13
64	EL.040809.181953	WG299146-04	Matrix Spike	.515/200	1	L09040123-09	04/08/09 18:19
65	EL.040809.182554	WG299146-05	Matrix Spike Duplica	.515/200	1	L09040123-09	04/08/09 18:25
66	EL.040809.183156	L09040123-01	APBS1028D001	.502/200	5		04/08/09 18:31
67	EL.040809.183758	L09040123-02	APBS1028S001	.511/200	5		04/08/09 18:37
68	EL.040809.184400	L09040123-03	APBS1030S001	.515/200	5		04/08/09 18:44
69	EL.040809.185002	L09040123-04	APBS1030S002	.536/200	5		04/08/09 18:50
70	EL.040809.185605	L09040123-05	LXBS1033S001	.502/200	5		04/08/09 18:56
71	EL.040809.190228	WG299428-24	CCV		1		04/08/09 19:02
72	EL.040809.190920	WG299428-25	CCB		1		04/08/09 19:09
73	EL.040809.191551	L09040123-06	LXBS1034S001	.508/200	5		04/08/09 19:15
74	EL.040809.192155	L09040123-07	LXBS1044S001	.546/200	1		04/08/09 19:21

Page: 2 Approved: April 09, 2009

Maren Berry

Microbac®

Microbac Laboratories Inc.

Instrument Run Log

Instrument: ELAN-ICP Dataset: 040809B.REP
Analyst1: JYH Analyst2: N/A
Method: 6020 SOP: ME700 Rev:
Maintenance Log ID: 28254

Calibration Std: STD31921 ICV/CCV Std: STD32127 Post Spike: STD27580
ICSA: STD32228 ICSAB: STD32229

Workgroups: 299298,299242,299218,299219

Comments:

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
75	EL.040809.192757	WG299218-01	Post Digestion Spike		1	L09040123-07	04/08/09 19:27
76	EL.040809.193358	WG299218-02	Serial Dilution		5	L09040123-07	04/08/09 19:33
77	EL.040809.193959	L09040123-08	LXBS1038S001	.514/200	5		04/08/09 19:39
78	EL.040809.194601	L09040123-12	LXBS1045S001	.537/200	1		04/08/09 19:46
79	EL.040809.195203	L09040123-13	LXBS1046S001	.505/200	1		04/08/09 19:52
80	EL.040809.195805	L09040123-14	LXBS1037D001	.511/200	1		04/08/09 19:58
81	EL.040809.200408	L09040123-15	LXBS1037S001	.547/200	5		04/08/09 20:04
82	EL.040809.201011	L09040123-16	LXBS1047S001	.523/200	5		04/08/09 20:10
83	EL.040809.201634	WG299428-26	CCV		1		04/08/09 20:16
84	EL.040809.202326	WG299428-27	CCB		1		04/08/09 20:23
85	EL.040809.202957	L09040123-17	LXBS1048S001	.507/200	1		04/08/09 20:29
86	EL.040809.203601	L09040123-18	LXBS1039S001	.541/200	1		04/08/09 20:36
87	EL.040809.204205	L09040123-19	LXBS1035S001	.505/200	5		04/08/09 20:42
88	EL.040809.204809	WG299147-02	Method/Prep Blank	.5/200	1		04/08/09 20:48
89	EL.040809.205412	WG299147-03	Laboratory Control S	.5/200	1		04/08/09 20:54
90	EL.040809.210014	WG299147-01	Reference Sample		1	L09040123-27	04/08/09 21:00
91	EL.040809.210615	WG299147-04	Matrix Spike	.517/200	1	L09040123-27	04/08/09 21:06
92	EL.040809.211217	WG299147-05	Matrix Spike Duplica	.517/200	1	L09040123-27	04/08/09 21:12
93	EL.040809.211819	L09040123-20	LXBS1040S001	.55/200	1	WG299209-01	04/08/09 21:18
94	EL.040809.212422	L09040123-21	LXBS1049S001	.544/200	1		04/08/09 21:24
95	EL.040809.213045	WG299428-28	CCV		1		04/08/09 21:30
96	EL.040809.213737	WG299428-29	CCB		1		04/08/09 21:37
97	EL.040809.214408	L09040123-22	LXBS1049S002	.507/200	1		04/08/09 21:44
98	EL.040809.215011	WG299219-01	Post Digestion Spike		1	L09040123-22	04/08/09 21:50
99	EL.040809.215615	WG299219-02	Serial Dilution		5	L09040123-22	04/08/09 21:56
100	EL.040809.220219	L09040123-23	LXBS1050S001	.515/200	1		04/08/09 22:02
101	EL.040809.220823	L09040123-24	LXBS1042S001	.509/200	1		04/08/09 22:08
102	EL.040809.221428	L09040123-25	LXBS1041S001	.513/200	1		04/08/09 22:14
103	EL.040809.222031	L09040123-26	LXBS1051S001	.506/200	1		04/08/09 22:20
104	EL.040809.222633	L09040123-30	A2BS1090S001		1		04/08/09 22:26
105	EL.040809.223235	L09040123-31	A2BS1090S002	.55/200	1		04/08/09 22:32
106	EL.040809.223837	L09040123-32	A2BS1089S001	.522/200	1		04/08/09 22:38
107	EL.040809.224500	WG299428-30	CCV		1		04/08/09 22:45
108	EL.040809.225152	WG299428-31	CCB		1		04/08/09 22:51
109	EL.040809.225823	L09040123-33	A2BS1089S002		1		04/08/09 22:58
110	EL.040809.230426	L09040123-34	A2BS1092S001	.516/200	1		04/08/09 23:04
111	EL.040809.231030	L09040123-35	A2BS1092S002	.545/200	1		04/08/09 23:10

Page: 3 Approved: April 09, 2009

Maren Berry

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Instrument Run Log

Instrument: ELAN-ICP Dataset: 040809B.REP
Analyst1: JYH Analyst2: N/A
Method: 6020 SOP: ME700 Rev:
Maintenance Log ID: 28254

Calibration Std: STD31921 ICV/CCV Std: STD32127 Post Spike: STD27580
ICSA: STD32228 ICSAB: STD32229

Workgroups: 299298,299242,299218,299219

Comments:

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
112	EL.040809.231634	L09040124-01	APBS1029S001	.507/200	1		04/08/09 23:16
113	EL.040809.232238	L09040124-02	APBS1029D002	.55/200	1		04/08/09 23:22
114	EL.040809.232842	L09040124-03	APBS1029S002	.535/200	1	WG299209-02	04/08/09 23:28
115	EL.040809.233506	WG299428-32	CCV		1		04/08/09 23:35
116	EL.040809.234158	WG299428-33	CCB		1		04/08/09 23:41

Page: 4 Approved: April 09, 2009

Maren Berry

Microbac®

Microbac Laboratories Inc.

Data Checklist

Date: 07-APR-2009
Analyst: JYH
Analyst: NA
Method: 6020
Instrument: ELAN
Curve Workgroup: 299305
Runlog ID: 27444
Analytical Workgroups: 299242

Calibration/Linearity	X
ICV/CCV	X
ICB/CCB	X
ICSA/ICSAB	X
CRI	X
Blank/LCS	X
MS/MSD	X
Post Spike/Serial Dilution	X
Upload Results	X
Data Qualifiers	X
Generate PDF Instrument Data	X
Sign/Annotate PDF Data	X
Upload Curve Data	X
Workgroup Forms	
Case Narrative	090,128,142
Client Forms	X
Level X	
Level 3	142
Level 4	090
Check for compliance with method and project specific requirements	
Check the completeness of reported information	
Check the information for the report narrative	
Primary Reviewer	JYH
Secondary Reviewer	
Comments	

Primary Reviewer: Secondary Reviewer:

CHECKLIST1 - Modified 03/05/2008
Generated: APR-08-2009 09:56:14

Microbac Laboratories Inc.

Data Checklist

Date: 08-APR-2009
Analyst: JYH
Analyst: NA
Method: 6020
Instrument: ELAN
Curve Workgroup: 299428
Runlog ID: 27471
Analytical Workgroups: 299298,299242,299218,299219

Calibration/Linearity	X
ICV/CCV	X
ICB/CCB	X
ICSA/ICSAB	X
CRI	X
Blank/LCS	X
MS/MSD	X
Post Spike/Serial Dilution	X
Upload Results	X
Data Qualifiers	X
Generate PDF Instrument Data	X
Sign/Annotate PDF Data	X
Upload Curve Data	X
Workgroup Forms	
Case Narrative	146,158,090,125,126,123,124
Client Forms	X
Level X	
Level 3	
Level 4	146,158,090,125,126,123,124
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	JYH
Secondary Reviewer	MMB
Comments	

Primary Reviewer: Secondary Reviewer:
09-APR-2009

CHECKLIST1 - Modified 03/05/2008
Generated: APR-09-2009 19:20:44

Microbac Laboratories Inc.

00075762

HOLDING TIMES
EQUIVALENT TO AFCEE FORM 9

Analytical Method: 6020 AAB#: WG299242

Login Number: L09040142

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
49WW06-040409	04/04/09	04/07/09	04/07/09	180	2.80	04/07/09	180	0.172	

* EXT = SEE PROJECT QAPP REQUIREMENTS
*ANAL = SEE PROJECT QAPP REQUIREMENTS

HOLD_TIMES - Modified 03/06/2008
PDF File ID: 1360874
Report generated 04/08/2009 09:12

Microbac®

METHOD BLANK SUMMARY

Login Number: L09040142
Blank File ID: EL.040709.155350
Prep Date: 04/07/09 10:10
Analyzed Date: 04/07/09 15:53
Analyst: JYH

Work Group: WG299242
Blank Sample ID: WG299169-02
Instrument ID: ELAN-ICP
Method: 6020

This Method Blank Applies To The Following Samples:

Client ID	Lab Sample ID	Lab File ID	Time Analyzed	TAG
LCS	WG299169-03	EL.040709.160554	04/07/09 16:05	01
49WW06-040409	L09040142-07	EL.040709.163005	04/07/09 16:30	DL01

Report Name: BLANK_SUMMARY
PDF File ID: 1360875
Report generated 04/08/2009 09:12

Microbac Laboratories Inc.

METHOD BLANK REPORT

Login Number: L09040142 Prep Date: 04/07/09 10:10 Sample ID: WG299169-02
Instrument ID: ELAN-ICP Run Date: 04/07/09 15:53 Prep Method: 3015
File ID: EL.040709.155350 Analyst: JYH Method: 6020
Workgroup (AAB#): WG299242 Matrix: Water Units: mg/L
Contract #: DACA56-94-D-0020 Cal ID: ELAN-I-07-APR-09

Analytes	SDL	PQL	Concentration	Dilution	Qualifier
Arsenic, Total	0.000250	0.00100	0.000250	1	U

SDL Method Detection Limit
PQL Reporting/Practical Quantitation Limit
ND Analyte Not detected at or above reporting limit
* |Analyte concentration| > RL

Report Name: BLANK
PDF ID: 1360876
08-APR-2009 09:12

Microbac Laboratories Inc.
LABORATORY CONTROL SAMPLE (LCS)

Login Number: L09040142 Run Date: 04/07/2009 Sample ID: WG299169-03
Instrument ID: ELAN-ICP Run Time: 16:05 Prep Method: 3015
File ID: EL.040709.160554 Analyst: JYH Method: 6020
Workgroup (AAB#): WG299242 Matrix: Water Units: mg/L
QC Key: STD Lot#: STD30482 Cal ID: ELAN-I-07-APR-09

Analytes	Expected	Found	% Rec	LCS Limits	Q
Arsenic, Total	0.0625	0.0639	102	80 - 120	

LCS - Modified 03/06/2008
PDF File ID: 1360877
Report generated: 04/08/2009 09:12

Microbac®

Microbac Laboratories Inc.
MATRIX SPIKE AND MATRIX SPIKE DUP (MS/MSD)

00075766

Loginnum: L09040142 Cal ID: ELAN-ICP- Worknum: WG299242
Instrument ID: ELAN-ICP Contract #: DACA56-94-D-0020 Method: 6020
Parent ID: WG299169-01 File ID: EL.040709.161156 Dil: 1 Matrix: WATER
Sample ID: WG299169-04 MS File ID: EL.040709.161759 Dil: 1 Units: mg/L
Sample ID: WG299169-05 MSD File ID: EL.040709.162402 Dil: 1

Analyte	Parent	MS Spiked	MS Found	MS %Rec	MSD Spiked	MSD Found	MSD %Rec	%RPD	%Rec Limits	RPD Limit	Q
Arsenic	0.00124	0.0625	0.0611	95.8	0.0625	0.0615	96.4	0.642	75 - 125	20	

* FAILS %REC LIMIT

FAILS RPD LIMIT

NOTE: This is an internal quality control sample.

WG_MS_MSD_DRYWT - Modified 03/07/2008
PDF File ID: 1360878
Report generated 04/08/2009 09:12

Microbac®

Microbac Laboratories Inc.
Serial Dilution Report

Login: L09040142 **Worknum:** WG299242
Instrument: ELAN-ICP **Method:** 6020
Serial Dil: WG299242-02 **File ID:** EL.040709.164213 **Dil:** 25 **Units:** ug/L
Sample: L09040142-07 **File ID:** EL.040709.163005 **Dil:** 5

Analyte	Sample	Qual	Serial Dil	Qual	% Diff	Q
Arsenic	5.55	X	8.075	F	45.50	

U = Result is below MDL.
F = Result is greater than or equal to MDL and less than the RL.
X = Result is greater than or equal to RL and less than 100 times the MDL.
E = %D exceeds control limit of 10% and initial sample result is greater than or equal to 100 times the MDL.

SERIAL_DIL - Modified 09/22/2008
PDF File ID: 1360872
04/08/2009 09:12

Microbac®

Microbac Laboratories Inc.
POST SPIKE REPORT

Sample Login ID: L09040142 **Worknum:** WG299242
Instrument ID: ELAN-ICP **Method:** 6020
Post Spike ID: WG299242-01 **File ID:** EL.040709.163609 **Dil:** 5 **Units:** ug/L
Sample ID: L09040142-07 **File ID:** EL.040709.163005 **Dil:** 5 **Matrix:** Water

Analyte	Post Spike Result	C	Sample Result	C	Spike Added(SA)	% R	Control Limit %R	Q
ARSENIC	54.4		1.11		50	106.6	75 - 125	

N = % Recovery exceeds control limits
F = Result is between MDL and RL
U = Sample result is below MDL. A value of zero is used in the calculation

POST_SPIKE - Modified 03/06/2008
PDF File ID: 1360873
Report generated: 04/08/2009 09:12

Microbac Laboratories Inc.
Initial Calibration Summary

Login:	L09040142	Workgroup (AAB#):	WG299242
Analytical Method:	6020	Instrument ID:	ELAN-ICP
ICAL Worknum:	WG299305	Initial Calibration Date:	07-APR-2009 13:59

	WG299305-01		WG299305-02		WG299305-03		WG299305-04			
	Conc	INT	Conc	INT	Conc	INT	Conc	INT	R	Q
ARSENIC	0	-331	.4	393	50	84000	100	162000	.999933	

INT = Instrument intensity
R = Coefficient of correlation
Q = Data Qualifier
*** = Out of Compliance; R < 0.995**

INT_CAL_ICP - Modified 03/06/2008
PDF File ID: 1360882
Report generated: 08-APR-2009 09:11

Microbac Laboratories Inc.
INITIAL CALIBRATION BLANK (ICB)

Login Number: L09040142
Instrument ID: ELAN-ICP
File ID: EL.040709.141232
Workgroup (AAB#): WG299242
Matrix: WATER

Run Date: 04/07/2009
Run Time: 14:12
Analyst: JYH
Cal ID: ELAN-ICP - 07-APR-09

Sample ID: WG299305-06
Method: 6020
Units: ug/L

Analytes	MDL	RDL	Concentration	Qualifier
ARSENIC	.1	.4	.1	U

ICB - Modified 03/06/2008
PDF File ID: 1360884
Report generated 04/08/2009 09:11

Microbac

Microbac Laboratories Inc.
CONTINUING CALIBRATION BLANK (CCB)

00075771

Login Number: L09040142
Run Date: 04/07/2009
Sample ID: WG299305-12
Instrument ID: ELAN-ICP
Run Time: 14:53
Method: 6020
File ID: EL.040709.145354
Analyst: JYH
Units: ug/L
Workgroup (AAB#): WG299242
Cal ID: ELAN-I - 07-APR-09
Matrix: WATER

Analytes	MDL	RDL	Concentration	Qualifier
Arsenic	0.100	0.400	0.100	U

U = Result is less than MDL.
F = Result is between MDL and RL.
* = Result is above RL.

CCB - Modified 03/05/2008
PDF File ID: 1360887
Report generated 04/08/2009 09:11

Microbac®

Microbac Laboratories Inc.
CONTINUING CALIBRATION BLANK (CCB)

00075772

Login Number: L09040142
Run Date: 04/07/2009
Sample ID: WG299305-14
Instrument ID: ELAN-ICP
Run Time: 17:01
Method: 6020
File ID: EL.040709.170132
Analyst: JYH
Units: ug/L
Workgroup (AAB#): WG299242
Cal ID: ELAN-I - 07-APR-09
Matrix: WATER

Analytes	MDL	RDL	Concentration	Qualifier
Arsenic	0.100	0.400	0.100	U

U = Result is less than MDL.
F = Result is between MDL and RL.
* = Result is above RL.

CCB - Modified 03/05/2008
PDF File ID: 1360887
Report generated 04/08/2009 09:11

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Microbac Laboratories Inc.

INITIAL CALIBRATION VERIFICATION (ICV)

(Alternate Source)

00075773

Login Number: L09040142 Run Date: 04/07/2009 Sample ID: WG299305-05

Instrument ID: ELAN-ICP Run Time: 14:05 Method: 6020

File ID: EL.040709.140540 Analyst: JYH Units: ug/L

Workgroup (AAB#): WG299242 Cal ID: ELAN-I - 07-APR-09

QC Key: STD

Analyte		Expected	Found	%REC	LIMITS	Q
Arsenic		50	50.2	100	90 - 110	

* Exceeds LIMITS Limit

ICV - Modified 03/06/2008

PDF File ID: 1360883

Report generated 04/08/2009 09:11

Microbac®

Microbac Laboratories Inc.
CONTINUING CALIBRATION VERIFICATION (CCV)

00075774

Login Number: L09040142
Run Date: 04/07/2009
Sample ID: WG299305-11
Instrument ID: ELAN-ICP
Run Time: 14:47
Method: 6020
File ID: EL.040709.144703
Analyst: JYH
QC Key: STD
Workgroup (AAB#): WG299242
Cal ID: ELAN-I - 07-APR-09
Matrix: WATER

Analyte		Expected	Found	UNITS	%REC	LIMITS		Q
Arsenic		50.0	49.3	ug/L	98.6	90 - 110		

* Exceeds LIMITS Criteria

CCV - Modified 03/05/2008
PDF File ID: 1360886
Report generated 04/08/2009 09:11

Microbac®

Microbac Laboratories Inc.
CONTINUING CALIBRATION VERIFICATION (CCV)

00075775

Login Number: L09040142
Run Date: 04/07/2009
Sample ID: WG299305-13
Instrument ID: ELAN-ICP
Run Time: 16:54
Method: 6020
File ID: EL.040709.165441
Analyst: JYH
QC Key: STD
Workgroup (AAB#): WG299242
Cal ID: ELAN-I - 07-APR-09
Matrix: WATER

Analyte		Expected	Found	UNITS	%REC	LIMITS		Q
Arsenic		50.0	49.9	ug/L	99.9	90 - 110		

* Exceeds LIMITS Criteria

CCV - Modified 03/05/2008
PDF File ID: 1360886
Report generated 04/08/2009 09:11

Microbac®

Microbac Laboratories Inc.
INTERFERENCE CHECK SAMPLES

Login number: L09040142
Instrument ID: ELAN-ICP
Sol. A : WG299305-09 **File ID:** EL.040709.143316
Sol. AB : WG299305-10 **File ID:** EL.040709.144009

Workgroup (AAB#): WG299242
Method: 6020
Units: ug/L
Matrix: Water

	Sol. A			Sol. AB			
ANALYTE	True	Found	%Recovery	True	Found	%Recovery	Q
Arsenic	NS	-0.0290	NS	100	104	104	

NS = Not spiked
*** = Recovery of spiked element is outside acceptance limit of 80% - 120% of true value.**
 # = Result for unspiked element is outside the acceptance limits of (+/-) the project reporting limit (RL).

ICS - Modified 03/06/2008
PDF File ID: 1360885
Report generated 04/08/2009 09:11

Microbac Laboratories Inc.

INTERNAL STANDARD REPORT

Login: L09040142 **Analytical Method:** 6020
Analytical Workgroup: WG299242 **Matrix:** 1
Instrument: ELAN-ICP **Analyst:** JYH
ICAL Date: 07-APR-2009 13:42

			BISMUTH	GERMANIUM	INDIUM	TERBIUM
Sample	Type	Run Date	% Rec	% Rec	% Rec	% Rec
L09040142-07	SAMP	07-APR-2009 16:30	99.393	104.171	100.808	103.844
WG299117-01	FBLK	07-APR-2009 15:59	103.291	104.522	99.751	101.196
WG299169-01	REF	07-APR-2009 16:11	101.606	102.95	98.821	99.624
WG299169-02	BLANK	07-APR-2009 15:53	104.685	105.008	100.968	101.621
WG299169-03	LCS	07-APR-2009 16:05	103.661	105.634	99.498	101.117
WG299169-04	MS	07-APR-2009 16:17	101.427	104.114	99.832	102.479
WG299169-05	MSD	07-APR-2009 16:24	102.464	105.931	101.517	103.609
WG299242-01	PSPK	07-APR-2009 16:36	104.064	101.226	101.571	104.635
WG299242-02	SERIAL	07-APR-2009 16:42	106.243	102.526	104.251	105.891
WG299305-05	ICV	07-APR-2009 14:05	105.311	100.568	108.182	106.988
WG299305-06	ICB	07-APR-2009 14:12	105.532	102.063	105.084	104.366
WG299305-11	CCV	07-APR-2009 14:47	105.78	108.23	109.868	106.376
WG299305-12	CCB	07-APR-2009 14:53	103.12	104.366	101.68	102.498
WG299305-13	CCV	07-APR-2009 16:54	111.105	103.017	104.378	107.052
WG299305-14	CCB	07-APR-2009 17:01	110.903	103.347	102.848	108.469

Acceptance criteria: 30% - 120%
Underlined recoveries are out of range

INT_STD_ICPMS - Modified 03/05/2008
PDF File ID: 1360881
Report generated: 04/08/2009 09:12

Microbac Laboratories Inc.
LINEAR RANGE (QUARTERLY)

Login Number: L09040142 **Date:** 04/01/2009
Insturment ID: ELAN-ICP **Method:** 6020

Analyte	Integration Time (Sec.)	Concentration (ug/L)
Antimony	1.00	100.0
Arsenic	1.00	100.0
Barium	1.00	100.0
Cadmium	1.00	100.0
Chromium	1.00	100.0
Cobalt	1.00	100.0
Copper	1.00	100.0
Lead	1.00	100.0
Manganese	1.00	100.0
Nickel	1.00	100.0
Selenium	1.00	100.0
Silver	1.00	100.0
Thallium	1.00	100.0
Vanadium	1.00	100.0
Zinc	1.00	100.0

Comments:
All analytes passed acceptance criteria at the specified concentration.

LINEAR_RANGE - Modified 03/06/2008
PDF File ID: 1360879
Report generated: 04/08/2009 09:12

2.3 General Chemistry Data

2.3.1 Nitrate Data

2.3.1.1 Summary Data

LABORATORY REPORT

00075782

L09040142

04/13/09 09:36

Submitted By

Microbac Laboratories Inc.
158 Starlite Drive
Marietta , OH 45750
(740) 373 - 4071

For

Account Name: Shaw E & I, Inc.
ABB Lummus Biulding
3010 Briarpark Drive Suite 4N
Houston, TX 77042
Attention: Jennifer Hoang

Project Number: 2773.025
Project: Longhorn AAP
Site: LONGHORN AAP KARNACK TX

P.O. Number: 389869/ 390836(GWTP)

Sample Analysis Summary

Client ID	Lab ID	Method	Dilution	Date Received
49WW04-040409	L09040142-06	353.2	1	07-APR-09

Report Number: **L09040142**
Report Date : **April 13, 2009**

Sample Number: **L09040142-06**
Client ID: **49WW04-040409**
Matrix: **Water**
Workgroup Number: **WG299288**
Collect Date: **04/04/2009 14:05**

PrePrep Method: **NONE**
Prep Method: **353.2**
Analytical Method: **353.2**
Analyst: **JBK**
Dilution: **1**
Units: **mg/L**

Instrument: **SMARTCHEM**
Prep Date: **04/08/2009 09:00**
Cal Date: **04/07/2009 16:16**
Run Date: **04/08/2009 09:00**
File ID: **SC09040816082401**

Analyte	CAS. Number	Result	Qual	PQL	SDL
Nitrogen, Nitrate-Nitrite		0.141		0.0500	0.0250

2.3.1.2 QC Summary Data

Example Nitrate Calculations

(absorbance - intercept)/(slope * dilution) = mg/L

where:

absorbance = reading from the spectrophotometer
intercept = calculated from calibration standard absorbencies
slope = calculated from calibration standard absorbencies
dilution = dilution of the distillate in decimal form (ex. 1/5 dilution = 0.2)

Microbac Laboratories Inc.

Data Checklist

Date: 08-APR-2009
Analyst: JBK
Analyst: NA
Method: NO3
Instrument: SMARTCHEM
Curve Workgroup: NA
Runlog ID:
Analytical Workgroups: WG299288

Calibration/Linearity	04/08/2009
Second Source Check	X
ICV/CCV (std)	X
ICB/CCB	X
Blank	X
LCS/LCS Dup	X
MS/MSD	X
Duplicate	X
Upload Results	X
Client Forms	X
QC Violation Sheet	
Case Narratives	
Signed Raw Data	X
STD/LCS on benchsheet	X
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	JBK
Secondary Reviewer	DIH
Comments	

Primary Reviewer:
08-APR-2009

Secondary Reviewer:
08-APR-2009

CHECKLIST1 - Modified 03/05/2008
Generated: APR-08-2009 16:23:27

Microbac Laboratories Inc.

00075787

HOLDING TIMES
EQUIVALENT TO AFCEE FORM 9

Analytical Method: 353.2 AAB#: WG299288

Login Number: L09040142

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
49WW04-040409	04/04/09	04/07/09	04/08/09	28	3.79	04/08/09	28	3.79	

* EXT = SEE PROJECT QAPP REQUIREMENTS
*ANAL = SEE PROJECT QAPP REQUIREMENTS

HOLD_TIMES - Modified 03/06/2008
PDF File ID: 1361771
Report generated 04/08/2009 16:22

Microbac®

METHOD BLANK SUMMARY

Login Number: L09040142
Blank File ID: SC09040816071001
Prep Date: 04/08/09 09:00
Analyzed Date: 04/08/09 09:00
Analyst: JBK

Work Group: WG299288
Blank Sample ID: WG299288-01
Instrument ID: SMARTCHEM
Method: 353.2

This Method Blank Applies To The Following Samples:

Client ID	Lab Sample ID	Lab File ID	Time Analyzed	TAG
LCS2	WG299288-03	SC09040816072601	04/08/09 09:00	
49WW04-040409	L09040142-06	SC09040816082401	04/08/09 09:00	
DUP	WG299288-05	SC09040816074401	04/08/09 09:00	
LCS	WG299288-02	SC09040816072001	04/08/09 09:00	

Report Name: BLANK_SUMMARY
PDF File ID: 1361772
Report generated 04/08/2009 16:22

Microbac Laboratories Inc.

METHOD BLANK REPORT

Login Number: L09040142 Prep Date: 04/08/09 09:00 Sample ID: WG299288-01
Instrument ID: SMARTCHEM Run Date: 04/08/09 09:00 Prep Method: 353.2
File ID: SC09040816071001 Analyst: JBK Method: 353.2
Workgroup (AAB#): WG299288 Matrix: Water Units: mg/L
Contract #: DACA56-94-D-0020 Cal ID: SMARTC-07-APR-09

Analytes	SDL	PQL	Concentration	Dilution	Qualifier
Nitrogen, Nitrate-Nitrite	0.0250	0.0500	0.0250	1	U

SDL Method Detection Limit
PQL Reporting/Practical Quantitation Limit
ND Analyte Not detected at or above reporting limit
* |Analyte concentration| > RL

Report Name: BLANK
PDF ID: 1361773
08-APR-2009 16:22

Microbac Laboratories Inc.
LABORATORY CONTROL SAMPLE (LCS)

Login Number: L09040142 Analyst: JBK Prep Method: 353.2
Instrument ID: SMARTCHEM Matrix: Water Method: 353.2
Workgroup (AAB#): WG299288 Units: mg/L
QC Key: STD Lot #: STD32005

Sample ID: WG299288-02 LCS File ID: SC09040816072001 Run Date: 04/08/2009 09:00
Sample ID: WG299288-03 LCS2 File ID: SC09040816072601 Run Date: 04/08/2009 09:00

Analytes	LCS			LCS2			%RPD	%Rec Limits	RPD Lmt	Q
	Known	Found	% REC	Known	Found	% REC				
Nitrogen, Nitrate-Nitrite	1.00	0.965	96.5	1.00	0.989	98.9	2.46	90 - 110	15	

LCS_LCS2 - Modified 03/06/2008
PDF File ID: 1361774
Report generated: 04/08/2009 16:22

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2.3.1.3 Raw Data

WORKGROUP: WG299288

SMARTCHEM RUN LOG

Daily Check

- [x] Lamp On
- [x] Probe Rinse Full
- [x] DI Water > ½ Full
- [x] Wash Solution > ½ Full
- [x] NO3 Reagent bottle connected / purged
- [ ] NO3 pH adj to pH 5-9
- [x] WBL Run
- [x] Reagents Full
- [x] Dilution H_2O Full
- [x] Waste Container Check

1) **Workgroup** _____
   Plan # 20090408001
2) **Workgroup** _____
   Plan # _____
3) **Workgroup** _____
   Plan # _____

Analyte		1	2	3
User Prepared Curve				
SC Prepared Curve				
Position				
1-1	ICV 1.5			
1-2	Blank			
1-3	LCS 1			
1-4	LCS DUP			
1-5	NO2 1			
1-6	04-142-06			
1-7	04-128-01			
1-8	04-154-08	1/5		color
1-9	-09	1/50		
1-10	04-153-01			
1-11	DUP 128-01			
1-12	MS ↓			
1-13				
1-14				
1-15				
1-16				
1-17				
1-18				
1-19				
1-20				
1-21				
1-22				
2-1				
2-2				
2-3				

Analyte		1	2	3
Position				
2-4				
2-5				
2-6				
2-7				
2-8				
2-9				
2-10				
2-11				
2-12				
2-13				
2-14				
2-15				
2-16				
2-17				
2-18				
2-19				
2-20				
2-21				
2-22				
2-23				
2-24				
2-25				
2-26				
3-1				
3-2				

NOTES:
* Run NO2 std on NO3 runs
* LCS/LCS Dup all parameters
* MS/MSD (NO3, TKN, NH3)

DCN#78969

Donna Hesson

Approved: April 08, 2009

WORKGROUP: WG299288

SMARTCHEM RUN LOG

Analyte		1	2	3
Position				
3-3				
3-4				
3-5				
3-6				
3-7				
3-8				
3-9				
3-10				
3-11				
3-12				
3-13				
3-14				
3-15				

Analyte		1	2	3
Position				
3-16				
3-17				
3-18				
3-19				
3-20				
3-21				
3-22				
3-23				
3-24				
3-25				
3-26				
3-27				
3-28				

☐Chloride EPA 325.2/SM 4500-Cl⁻ E
☐Sulfate EPA 375.4
☐Alkalinity EPA 310.2
☑Nitrate-Nitrite EPA 353.2/SM 4500-NO3 F

☐Ammonia EPA 350.1/SM 4500-NH3 B
☐TKN EPA 351.2
☐Phos EPA 365.4

Analyte	NO3		
SOP & Revision	K 3532		
Curve Stock (SC made)	Std 32002		
Curve ID (user made)		NO2 Std 31928	
ICV	Std 32003		
CCV	Std ~~23004~~ 32004		
LCS	Std 32005		
MS	Std 30016		
	Dilution 0.1(25)/5=0.5		

Comments: _____

Analyst: [signature] Date: 04/08/09

DCN#78969

Approved: April 08, 2009

MICROBAC (OVD)

SMARTCHEM REPORT

UNITS: MG/L

Method : WNO3 -Unit [mg/L] - EPA 353.2 Nitrate-NitrIte

Smp#/[Dil Fact]	Sample ID	Conc	OD	%Recovery/RPD	Flag	Analysis Time
DIL-1	RBL	0.000	0.0134	0.00		9:00:04 AM
DIL-1	RBL	0.000	0.0104	0.00		9:01:16 AM
DIL-1	RBL	0.000	0.0104	0.00		9:02:28 AM
DIL-1	Std-1	0.000	-0.0024	0.00	INV	9:03:40 AM
SR5-1	Std-2	0.040	0.0090	0.00		9:04:52 AM
SR5-2	Std-3	0.100	0.0236	0.00		9:06:04 AM
SR5-3	Std-4	0.500	0.1268	0.00		9:07:16 AM
SR5-4	Std-5	1.000	0.2663	0.00		9:08:28 AM
ST-1	Std-6	2.000	0.5200	0.00		9:09:40 AM
1	ICV 1.5	1.502	0.3919	0.00		9:10:52 AM
2	WG299288-01 BLANK	0.004	-0.0007	0.00	INV	9:12:04 AM
3	WG299288-02 LCS1	0.965	0.2510	0.00		9:13:16 AM
4	WG299288-03 LCSDUP	0.989	0.2575	0.00		9:14:28 AM
5	NO2	1.014	0.2641	0.00		9:15:40 AM
6	L09040142-06	0.141	0.0351	0.00		9:16:53 AM
7	L09040128-01	0.388	0.0998	0.00	NO_2 = 0.010	9:18:04 AM
8	L09040154-08 (5)	0.075	0.0178	0.00	= 0.005	9:19:16 AM
9	L09040154-09 (50)	1.189	0.3099	0.00	= 0.263	9:20:28 AM
10	L09040153-01	4.702 X	1.2306	0.00	><,LH = 0.001 X	9:21:40 AM
ST-2	CCV (1 mg/L)	0.986	0.2567	98.62		9:22:52 AM
ST-3	CCB (0 mg/L)	-0.015	-0.0058	0.00	INV,><,LL	9:24:04 AM
11	DUP 128-01	0.278	0.0711	0.00	NO_2 = 0.010	9:25:16 AM
12	MS 128-01	0.825	0.2144	0.00	= 0.010	9:26:28 AM
13	ID 13	-0.008 X	-0.0040	0.00	INV,><,LL	9:27:40 AM
14	ID 14	-0.018 X	-0.0065	0.00	INV,><,LL	9:28:52 AM
15	ID 15	-0.016 X	-0.0060	0.00	INV,><,LL	9:30:05 AM
ST-2	CCV (1 mg/L)	0.947	0.2463	94.65		9:31:16 AM
ST-3	CCB (0 mg/L)	-0.018	-0.0065	0.00	INV,><,LL	9:32:28 AM
10-[1/4]	L09040153-01	4.754	0.3097	0.00	LH NO_2 = 0.001	9:41:28 AM
ST-2	CCV ~~(0 mg/L)~~ (1 mg/L)	0.981	0.2553	~~-0.00~~ 98.1		9:42:22 AM
ST-3	CCB (0 mg/L)	-0.003	-0.0027	0.00	INV,><,LL	9:43:35 AM

Report Date :04/08/2009 **Run Date :4/8/2009** **Operator : WESTCO** **Plan # :20090408001**

Plan Description : NO3-A-JBK/04/08/2009

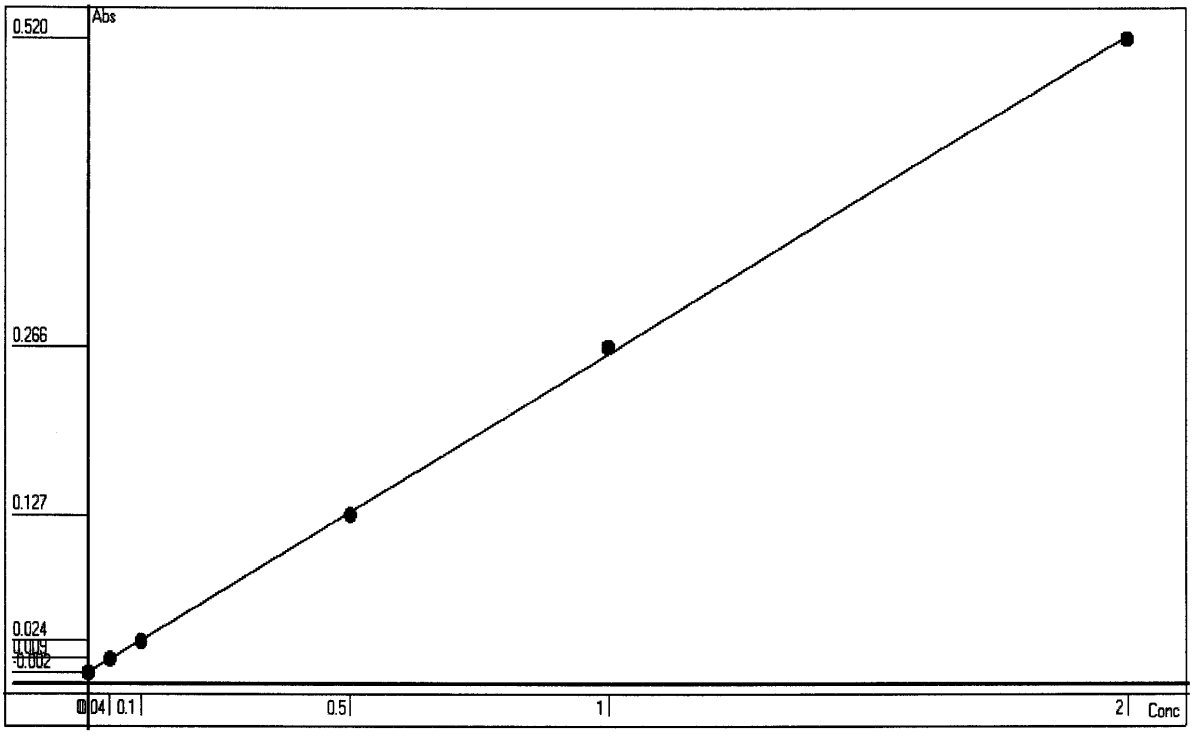
Donna Hesson

Approved: April 08, 2009

Calibrant Report - WNO3 -

Calib Lot #:010104 Exp Date:1/1/2010 User:Westco Scientific

Plan # : 20090408001 Description : [NO3-A-JBK/04/08/2009] Unit



Point	OD	Conc	Recalc Conc	% Error
1	-0.0024	0	-0.0023	-0.23
2	0.0090	0.04	0.0412	3.00
3	0.0236	0.1	0.0969	-3.10
4	0.1268	0.5	0.4907	-1.86
5	0.2663	1	1.0229	2.29
6	0.5200	2	1.9908	-0.46

Conc= +3.8151*Abso +0.0069 R^2=0.9998

RBL
0.0104
0

Report Date 4/8/2009 Run Date 4/8/2009

Approved: April 08, 2009

3.0 Attachments

Microbac Laboratories Inc.
Analyst Listing
April 13, 2009

ADC – ANTHONY D. CANTER
AJF – AMANDA J. FICKIESEN
ALB – ANNIE L. BROWN
AM – ALISON J. MILLER
AML – ANTHONY M. LONG
BRG – BRENDA R. GREGORY
CAA – CASSIE A. AUGENSTEIN
CAF – CHERYL A. FLOWERS
CAH – CHARLES A. HALL
CEB – CHAD E. BARNES
CLC – CHRYS L. CRAWFORD
CLW – CHARISSA L. WINTERS
CMS – CRYSTAL M. STEPHENS
CPD – CHAD P. DAVIS
CSH – CHRIS S. HILL
CTB – CHRIS T. BUCINA
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
ECL – ERIC C. LAWSON
EDA – ERIN D. AGEE
ERP – ERIN R. PORTER
FJB – FRANCES J. BOLDEN
HAV – HEMA VILASAGAR
HJR – HOLLY J. REED
JBK – JEREMY B. KINNEY
JDH – JUSTIN D. HESSON
JKP – JACQUELINE K. PARSONS
JKT – JANE K. THOMPSON
JWR – JOHN W. RICHARDS
JWS – JACK W. SHEAVES
JYH – JI Y. HU
KEB – KATHRYN E. BARNES
KHR – KIM H. RHODES
KRA – KATHY R. ALBERTSON
LHT – LANCE H. THOMPSON
LKN – LINDA K. NEDEFF
LSB – LESLIE S. BUCINA
MDA – MIKE D. ALBERTSON
MDC – MICHAEL D. COCHRAN
MES – MARY E. SCHILLING
MMB – MAREN M. BEERY
MRT – MICHELLE R. TAYLOR
MSW – MATT S. WILSON
NPM – NATHANIEL P. MILLER
PDM – PIERCE D. MORRIS
RAH – ROY A. HALSTEAD
RB – ROBERT BUCHANAN
REK – ROBERT E. KYER
RLK – ROBIN L. KLINGER
RWC – RODNEY W. CAMPBELL
SAV – SARAH A. VANDENBERG
SDH – SHANA D. HINYARD
SDL – SHELLY D. LENT
SLM – STEPHANIE L. MOSSBURG
SLP – SHERI L. PFALZGRAF
TDH – TRICIA D. HUCK
TIP – TAE I. PARRISH
TMB – TIFFANY M. BAILEY
TMM – TAMMY M. MORRIS
VC – VICKI COLLIER
WTD – WADE T. DELONG

Microbac Laboratories Inc.
List of Valid Qualifiers
April 13, 2009

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
B1	Target analyte detected in method blank at or above the method reporting limit
B3	Target analyte detected in calibration blank at or above the method reporting limit
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
F, S	Estimated result below quantitation limit; method of standard additions(MSA)
FL	Free Liquid
H1	Sample analysis performed past holding time.
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%
J,S	Estimated concentration; analyzed by method of standard addition (MSA)
L	Sample reporting limits elevated due to matrix interference
L1	The associated blank spike (LCS) recovery was above the laboratory acceptance limits.
L2	The associated blank spike (LCS) recovery was below the laboratory acceptance limits.
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 (RL).
ND, L	Not detected; sample reporting limit (RL) elevated due to interference
ND, S	Not detected; analyzed by method of standard addition (MSA)
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 (MSA)
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
X, S	Exceeds regulatory limit; method of standard additions (MSA)
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.

Microbac®

Shaw Environmental & Infrastructure, Inc.
3010 Briarpark Drive, Suite 400
Houston, TX 77042
(713) 996-4400

Laboratory Name: Microbac
Address : 158 Starlite Drive, Marietta OH 45750
Contact : Stephanie Mossburg
Phone: 1-800-373-4071

PM: Praveen Svrivastav (713.996.4588)
Project Contact: Jennifer Hoang
Project Name: LHAAP
Project #: 117591-0009A130

TAT: RUSH
Phone No: 713-996-4408
Site: 47/49/50
Location: Karnack, TX

RUSH 24-48 HOUR TAT

Sampler Print: ALLEN WILLMORE
Sampler Sign: M. Allen

Sample Number	Grab	Date	Time	Matrix	# of Containers	VOCs (8260)	NO3/NO2 as N (353.2)	METALS **(6010/6020)									Comments
47WW25 - 040309	X	4/3/09	16:55	Water	3	X	NA	NA									**6010/6020 (As,Al,Fe)
LHSMW56 - 0403-09	X	4/3/09	12:50	Water	3	X	NA	NA									
50WW02 - 040309	X	4/3/09	14:45	Water	3	X	NA	NA									
50WW05 - 040409	X	4/4/09	09:35	Water	3	X	NA	NA									
50WW07 - 040409	X	4/4/09	11:45	Water	3	X	NA	NA									
49WW04 - 040409	X	4/4/09	14:05	Water	1	NA	X	NA									
49WW06 - 040409	X	4/4/09	17:15	Water	1	NA	NA	X									
TB-0904	X	NR	NR	Water	3	X	NA	NA									

Relinquished By: M. Allen
Date/Time 4/6/09 17:45

Received By:
Date/Time

Special Instructions (24-hour TAT) ** As, Al, Fe Only !!

Relinquished By:
Date/Time

Received for Laboratory By:
Date/Time 4-7-09 0904

Remarks:

Microbac Laboratories, Inc.

SAMPLE RECEIPT FORM

00075800

158 Starlite Drive
Marietta, OH 45750
(740) 373-4071

Client:	Straw-
Workorder Number:	B
Date Received:	4-7-09
Delivered by:	( ) Fedx (✓) UPS ( ) Client ( ) Courier Time: 0924
Opened by:	RLK
IR Temp Gun:	( ) G (✓) H
Logged by:	RLK L 09040142

Cooler information

Cooler ID	Temp C	Airbill#	COC#	Other
556	4	1Z 401 663 22 1010 352	✓	water / 24 hr. TAT

Inspection Checklist	Y	N	NA	Discrepancy ID
Were shipping coolers sealed?	✓			
Were custody seals intact?	✓			
Were cooler temperatures in range of 0 - 6?	✓			
Was ice present?	✓			
Were COC's received/ information complete/signed and dated?	✓			
Were sample containers and labels intact and match COC?		✓		1
Were the correct containers and volumes received?	✓			
Were correct preservatives used? (water only) JKT	✓	✓		2
Were pH ranges acceptable? (voa's excluded)	✓			
Were VOA samples free of headspace (< 6mm)?	✓			
Were samples received within EPA hold times?	✓			

Discrepancy/Comments/Other Problems

1 Donley Rec'd 2 trips instead of 3

2 NO3NO2 PH 6 added 1 ml H2SO4 Lot# RGT 13641
PH < 2 now. JKT

Distribution

Name of Microbac representative:	
Client/Company:	
Person Contacted:	
Date contacted:	

Resolution/other comments:

Microbac Laboratories Inc.

Internal Chain of Custody Report

Login: L09040142
Account: 2773
Project: 2773.025
Samples: 8
Due Date: 08-APR-2009

Samplenum	Container ID	Products
L09040142-07	569453	AL AS-MS FE

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN	COOLER	W1	07-APR-2009 11:17	ERE	
2	PREP	W1	DIG	07-APR-2009 11:31	REK	RLK
3	EXTRACT	DIG	METALS	07-APR-2009 12:18		VC
4	STORE	DIG	A1	08-APR-2009 10:06	RLK	REK

Samplenum	Container ID	Products
L09040142-06	569452	NO3NO2

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN	COOLER	W1	07-APR-2009 11:17	ERE	
2	ANALYZ	W1	WET	07-APR-2009 11:25	JDH	RLK

Samplenum	Container ID	Products
L09040142-03	569449	826-LOW

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN	COOLER	V1	07-APR-2009 11:17	ERE	
2	ANALYZ	V1	ORG4	07-APR-2009 11:29	MRT	RLK

Bottle: 2

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN	COOLER	V1	07-APR-2009 11:17	ERE	
2	ANALYZ	V1	ORG4	07-APR-2009 11:29	MRT	RLK

Bottle: 3

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN	COOLER	V1	07-APR-2009 11:17	ERE	
2	ANALYZ	V1	ORG4	07-APR-2009 11:29	MRT	RLK

A1 - Sample Archive (COLD)
A2 - Sample Archive (AMBIENT)
F1 - Volatiles Freezer in Login
V1 - Volatiles Refrigerator in Login
W1 - Walkin Cooler in Login

Microbac Laboratories Inc.

Internal Chain of Custody Report

Login: L09040142
Account: 2773
Project: 2773.025
Samples: 8
Due Date: 08-APR-2009

Samplenum	Container ID	Products
L09040142-05	569451	826-LOW

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN	COOLER	V1	07-APR-2009 11:17	ERE	
2	ANALYZ	V1	ORG4	07-APR-2009 11:29	MRT	RLK

Bottle: 2

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN	COOLER	V1	07-APR-2009 11:17	ERE	
2	ANALYZ	V1	ORG4	07-APR-2009 11:29	MRT	RLK

Bottle: 3

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN	COOLER	V1	07-APR-2009 11:17	ERE	
2	ANALYZ	V1	ORG4	07-APR-2009 11:29	MRT	RLK

Samplenum	Container ID	Products
L09040142-08	569454	826-LOW

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN	COOLER	V1	07-APR-2009 11:17	ERE	
2	ANALYZ	V1	ORG4	07-APR-2009 11:29	MRT	RLK

Bottle: 2

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN	COOLER	V1	07-APR-2009 11:17	ERE	
2	ANALYZ	V1	ORG4	07-APR-2009 11:29	MRT	RLK

Samplenum	Container ID	Products
L09040142-02	569448	826-LOW

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN	COOLER	V1	07-APR-2009 11:17	ERE	
2	ANALYZ	V1	ORG4	07-APR-2009 11:28	MRT	RLK

Bottle: 2

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN	COOLER	V1	07-APR-2009 11:17	ERE	
2	ANALYZ	V1	ORG4	07-APR-2009 11:28	MRT	RLK

Bottle: 3

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN	COOLER	V1	07-APR-2009 11:17	ERE	
2	ANALYZ	V1	ORG4	07-APR-2009 11:28	MRT	RLK

A1 - Sample Archive (COLD)
A2 - Sample Archive (AMBIENT)
F1 - Volatiles Freezer in Login
V1 - Volatiles Refrigerator in Login
W1 - Walkin Cooler in Login

Microbac Laboratories Inc.

Internal Chain of Custody Report

Login: L09040142
Account: 2773
Project: 2773.025
Samples: 8
Due Date: 08-APR-2009

Samplenum	Container ID	Products
L09040142-01	569447	826-LOW

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN	COOLER	V1	07-APR-2009 11:17	ERE	
2	ANALYZ	V1	ORG4	07-APR-2009 11:28	MRT	RLK

Bottle: 2

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN	COOLER	V1	07-APR-2009 11:17	ERE	
2	ANALYZ	V1	ORG4	07-APR-2009 11:28	MRT	RLK

Bottle: 3

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN	COOLER	V1	07-APR-2009 11:17	ERE	
2	ANALYZ	V1	ORG4	07-APR-2009 11:28	MRT	RLK

Samplenum	Container ID	Products
L09040142-04	569450	826-LOW

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN	COOLER	V1	07-APR-2009 11:17	ERE	
2	ANALYZ	V1	ORG4	07-APR-2009 11:29	MRT	RLK

Bottle: 2

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN	COOLER	V1	07-APR-2009 11:17	ERE	
2	ANALYZ	V1	ORG4	07-APR-2009 11:29	MRT	RLK

Bottle: 3

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN	COOLER	V1	07-APR-2009 11:17	ERE	
2	ANALYZ	V1	ORG4	07-APR-2009 11:29	MRT	RLK

A1 - Sample Archive (COLD)
A2 - Sample Archive (AMBIENT)
F1 - Volatiles Freezer in Login
V1 - Volatiles Refrigerator in Login
W1 - Walkin Cooler in Login

158 Starlite Drive, Marietta, OH 45750 • T:740-373-4071 • F:740-373-4835 • http://www.microbac.com

Laboratory Report Number: L09030085

Please find enclosed the analytical results for the samples you submitted to Microbac Laboratories.

Review and compilation of your report was completed by Microbac'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 below at 800-373-4071. Team member e-mail addresses also appear here for your convenience.

Kathy Albertson	*Team Chemist/Data Specialist*	kalbertson@microbac.com
Stephanie Mossburg	*Team Chemist/Data Specialist*	smossburg@microbac.com
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Annie Brown	*Client Services Specialist*	abrown@microbac.com
Jacqueline Parsons	*Team Assistant*	jparsons@microbac.com

This report was reviewed on March 09, 2009.

Stephanie Mossburg - Team Chemist/Data Specialist

I certify that all test results meet all of the requirements of the accrediting authority listed below. 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 Microbac Laboratories.

This report was certified on March 09, 2009.

David Vandenberg - Managing Director

State of origin: Texas
Accrediting authority: Texas Commission on Environmental Quality ID:T104704252-07-TX
QAPP: Microbac (OVD) LQAP
This report contains a total of 49 pages.

Look closer. Go further. Do more.

Microbac REPORT L09030085
PREPARED FOR Shaw E I, Inc.
WORK ID:

1.0 Introduction

Microbac Laboratories Inc.
REPORT NARRATIVE

Microbac Login No: L09030085

SHIPMENT CONDITIONS: The chain of custody forms were received sealed in a cooler. The cooler temperature was 2 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 Microbac Laboratories Inc., 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-MAR-09
Stephanie Mossburg

Laboratory Data Package Cover Page

00075808

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.

MAREN M. BEERY	Maren Beery	Metals Supervisor	March 9, 2009
Name (Printed)	Signature	Official Title (printed)	DATE

RG-366/TRRP-13 December 2002 A1

Microbac Laboratories Inc.
Laboratory Review Checklist

Laboratory Name:	Microbac Laboratories Inc.
Laboratory Log Number:	L09030085
Project Name:	798-LONGHORN
Method:	6020
Prep Batch Number(s):	WG296558
Reviewer Name:	MAREN M. BEERY
LRC Date:	March 09, 2009

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 <RL?	✓				
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 laboratory's 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?	✓				ER2
ICAL					
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?	✓				ER1
Was the absolute value of the analyte concentration in the inorganic CCB <RL?	✓				
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?	✓				

Microbac Laboratories Inc.
Laboratory Review Checklist

Laboratory Name:	Microbac Laboratories Inc.
Laboratory Log Number:	L09030085
Project Name:	798-LONGHORN
Method:	6020
Prep Batch Number(s):	WG296558
Reviewer Name:	MAREN M. BEERY
LRC Date:	March 09, 2009

EXCEPTIONS REPORT
ER# - The initial calibration verification analyzed initially on 06-Mar-2009 at 15:02 yielded a noncompliant result for selenium. The initial calibration verification was reanalyzed at 15:11prior to sample analysis and was compliant for all analytes of concern.
ER2 - Due to high levels of nontarget analytes, client sample 01 was analyzed at a dilution for all analytes
.
Footnotes:
(1) NA = Not applicable to method or project
(2) NR = Not reviewed
(3) ER# = Exception report number

2.1 Metals Data

2.1.1 Metals ICP-MS Data

2.1.1.1 Summary Data

LABORATORY REPORT

00075816

L09030085

03/09/09 15:19

Submitted By

Microbac Laboratories Inc.
158 Starlite Drive
Marietta , OH 45750
(740) 373 - 4071

For

Account Name: Shaw E & I, Inc.
ABB Lummus Biulding
3010 Briarpark Drive Suite 4N
Houston, TX 77042
Attention: Jennifer Hoang

Project Number: 2773.025
Project: Longhorn AAP
Site: LONGHORN AAP KARNACK TX

P.O. Number: 389869/ 390836(GWTP)

Sample Analysis Summary

Client ID	Lab ID	Method	Dilution	Date Received
49WW06-022409	L09030085-01	6020	5	05-MAR-09

Report Number: **L09030085**
Report Date : **March 9, 2009**

00075817

Sample Number: **L09030085-01**
Client ID: **49WW06-022409**
Matrix: **Water**
Workgroup Number: **WG296632**
Collect Date: **02/24/2009 15:00**
Sample Tag: **DL01**

PrePrep Method: **NONE**
Prep Method: **3015**
Analytical Method: **6020**
Analyst: **SLP**
Dilution: **5**
Units: **mg/L**

Instrument: **ELAN-ICP**
Prep Date: **03/05/2009 10:51**
Cal Date: **03/06/2009 14:56**
Run Date: **03/06/2009 17:22**
File ID: **EL.030609.172248**

Analyte	CAS. Number	Result	Qual	PQL	SDL
Arsenic, Total	7440-38-2	0.00862		0.00500	0.00125
Chromium, Total	7440-47-3	0.00428	J	0.0100	0.00250

J The analyte was positively identified, but the quantitation was below the RL

2.1.1.2 QC Summary Data

Example 6020 Calculations
Perkin Elmer ELAN 6100

1.0 Initial Calibration (ICAL) Parameters
The system performs linear regression from data consisting of a blank and three standards.

2.0 Calculating the concentration (C) of an element in water using data from prep log, run log, and quantitation report (note:the data system performs this calculation automatically when correction factors have been entered):

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

Where:	**Example:**
Cs = Concentration computed by the data system (ug/L)	0.1
Vf = Final volume	100
Vi = Initial volume	40
D = Dilution factor as a multiplier (10X = 10)	1
Cx = Concentration of element in (ug/L)	0.25

3.0 Calculating the concentration (C) of an element in soil using data from prep log, run log, and quantitation report (note: the data system performs this calculation automatically when correction factors have been entered):

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

Where:	**Example:**
Cs = Concentration computed by the data system (ug/L)	0.1
Vf = Final volume	200
Vi = Initial volume	0.5
D = Dilution factor as a multiplier (10X = 10)	1
Cx = Concentration of element in (ug/kg)	40

4.0 Adjusting the concentration to dry weight:

$$Cdry = \frac{Cx \times 100}{Px}$$

Where:	**Example:**
Cx = Concentration calculated as received (wet basis)	40
Px = Percent solids of sample (%wt)	80
$Cdry$ = Concentration calculated as dry weight (ug/kg)	50

50 ug/kg = 0.050 mg/kg

Perkin Elmer ELAN ICP/MS

STANDARDS KEY

QC Std 1 - ICV
QC Std 2 - ICB
QC Std 3 - CRI - Soil
QC Std 4 - CRI - Water
QC Std 5 - ICSA
QC Std 6 - ICSAB
QC Std 7 - CCV
QC Std 8 - CCB

Calibration Solutions

Analyte	Stock Conc. (mg/L)	S1 (mg/L)	S2 (mg/L)	S3 (mg/L)	S4 (mg/L)
Al	10	0	0.0004	0.05	0.1
Sb	10	0	0.0004	0.05	0.1
As	10	0	0.0004	0.05	0.1
Ba	10	0	0.0004	0.05	0.1
Be	10	0	0.0004	0.05	0.1
Ca	1000	0	0.04	5	10
Cd	10	0	0.0004	0.05	0.1
Cr	10	0	0.0004	0.05	0.1
Co	10	0	0.0004	0.05	0.1
Cu	10	0	0.0004	0.05	0.1
Fe	1000	0	0.04	5	10
Pb	10	0	0.0004	0.05	0.1
Mg	1000	0	0.04	5	10
Mn	10	0	0.0004	0.05	0.1
Ni	10	0	0.0004	0.05	0.1
K	1000	0	0.04	5	10
Se	10	0	0.0004	0.05	0.1
Ag	10	0	0.0004	0.05	0.1
Na	1000	0	0.04	5	10
Tl	10	0	0.0004	0.05	0.1
V	10	0	0.0004	0.05	0.1
Zn	10	0	0.0004	0.05	0.1

Microbac Laboratories Inc.
Microwave Digestion Log

Workgroup: WG296558
Analyst: VC
Spike Analyst: VC
Run Date: 03/05/2009 06:36
Method: 3015

SOP: ME407 Revison 10
Spike Solution: STD30482
Spike Witness: REK
HNO3 Lot #: COA13758
Digest tubes Lot #: COA13696

	SAMPLE #	Type	Matrix	Initial Amount	Final Volume	Initial Vessel Wt	Final Vessel Wt	Spike Amount	Due Date
1	WG296558-03	BLANK	2	40 mL	100 mL	209.167 g	209.153 g		
2	WG296558-04	LCS	2	40 mL	100 mL	205.884 g	205.87 g	.25 mL	
3	WG296558-01	REF	2	40 mL	100 mL	204.914 g	204.876 g		
4	L09030034-01	SAMP	2	40 mL	100 mL	204.914 g	204.876 g		03/10/09
5	WG296558-02	REF	2	40 mL	100 mL	206.373 g	206.348 g		
6	L09030035-03	SAMP	2	40 mL	100 mL	206.373 g	206.348 g		03/10/09
7	L09030035-05	SAMP	2	40 mL	100 mL	207.344 g	207.325 g		03/10/09
8	L09030071-01	SAMP	2	40 mL	100 mL	206.067 g	206.04 g		03/06/09
9	L09030085-01	SAMP	1	40 mL	100 mL	206.092 g	206.065 g		03/09/09
10	WG296558-05	MS	2	40 mL	100 mL	206.252 g	206.179 g	.25 mL	
11	WG296558-06	MSD	2	40 mL	100 mL	206.263 g	206.253 g	.25 mL	
12	WG296558-07	DUP	2	40 mL	100 mL	206.819 g	206.797 g		

Analyst: Vicki Collins

Reviewer:

MW_DIG - Modified 07/02/2008
PDF ID: 1335178
Report generated: 03/05/2009 11:12

Microbac®

Microbac Laboratories Inc.

Instrument Run Log

Instrument: ELAN-ICP Dataset: 030609A.REP
Analyst1: SLP Analyst2: N/A
Method: 6020 SOP: ME700 Rev: 4
Maintenance Log ID: 27898

Calibration Std: STD31440 ICV/CCV Std: STD31654 Post Spike: STD27580
ICSA: STD31158 ICSAB: STD31157

Workgroups: 296632,296633

Comments:

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
1	EL.030609.143357	Blank	Blank		1		03/06/09 14:33
2	EL.030609.143937	WG296844-01	Calibration Point		1		03/06/09 14:39
3	EL.030609.144518	WG296844-02	Calibration Point		1		03/06/09 14:45
4	EL.030609.145059	WG296844-03	Calibration Point		1		03/06/09 14:50
5	EL.030609.145641	WG296844-04	Calibration Point		1		03/06/09 14:56
6	EL.030609.150224	WG296844-05	Initial Calibration Verification		1		03/06/09 15:02
7	EL.030609.151118	WG296844-06	Initial Calibration Verification		1		03/06/09 15:11
8	EL.030609.151749	WG296844-07	Initial Calib Blank		1		03/06/09 15:17
9	EL.030609.152421	WG296844-08	CRQL Check Solid		1		03/06/09 15:24
10	EL.030609.153057	WG296844-09	CRQL Check Water		1		03/06/09 15:30
11	EL.030609.153732	WG296844-10	Interference Check		1		03/06/09 15:37
12	EL.030609.154406	WG296844-11	Interference Check		1		03/06/09 15:44
13	EL.030609.155039	WG296844-12	CCV		1		03/06/09 15:50
14	EL.030609.155711	WG296844-13	CCB		1		03/06/09 15:57
15	EL.030609.160321	WG296558-03	Method/Prep Blank	40/100	1		03/06/09 16:03
16	EL.030609.160921	WG296558-04	Laboratory Control S	40/100	1		03/06/09 16:09
17	EL.030609.161522	WG296558-01	Reference Sample		1	L09030034-01	03/06/09 16:15
18	EL.030609.162123	WG296558-05	Matrix Spike	40/100	1	L09030034-01	03/06/09 16:21
19	EL.030609.162725	WG296558-06	Matrix Spike Duplica	40/100	1	L09030034-01	03/06/09 16:27
20	EL.030609.163327	WG296558-02	Reference Sample		1	L09030035-03	03/06/09 16:33
21	EL.030609.163929	WG296632-02	Serial Dilution		5	L09030035-03	03/06/09 16:39
22	EL.030609.164531	WG296632-01	Post Digestion Spike		1	L09030035-03	03/06/09 16:45
23	EL.030609.165134	WG296558-07	Duplicate	40/100	1	L09030035-03	03/06/09 16:51
24	EL.030609.165738	L09030035-05	LTL-K-EQBLK-2-DIS	40/100	1		03/06/09 16:57
25	EL.030609.170401	WG296844-14	CCV		1		03/06/09 17:04
26	EL.030609.171033	WG296844-15	CCB		1		03/06/09 17:10
27	EL.030609.171644	L09030071-01	OUTFALL 002/COMP	40/100	2		03/06/09 17:16
28	EL.030609.172248	L09030085-01	49WW06-022409	40/100	5		03/06/09 17:22
29	EL.030609.172912	WG296844-16	CCV		1		03/06/09 17:29
30	EL.030609.173544	WG296844-17	CCB		1		03/06/09 17:35
31	EL.030609.174154	WG296562-02	Method/Prep Blank	.5/200	1		03/06/09 17:41
32	EL.030609.174755	WG296562-03	Laboratory Control S	.5/200	1		03/06/09 17:47
33	EL.030609.175356	WG296562-01	Reference Sample		1	L09020697-01	03/06/09 17:53
34	EL.030609.175958	WG296633-02	Serial Dilution		5	L09020697-01	03/06/09 17:59
35	EL.030609.180600	WG296633-01	Post Digestion Spike		1	L09020697-01	03/06/09 18:06
36	EL.030609.181202	WG296562-04	Matrix Spike	.525/200	1	L09020697-01	03/06/09 18:12
37	EL.030609.181805	WG296562-05	Matrix Spike Duplica	.527/200	1	L09020697-01	03/06/09 18:18

Page: 1 Approved:

Microbac®

Microbac Laboratories Inc.

Instrument Run Log

Instrument: ELAN-ICP Dataset: 030609A.REP
Analyst1: SLP Analyst2: N/A
Method: 6020 SOP: ME700 Rev: 4
Maintenance Log ID: 27898

Calibration Std: STD31440 ICV/CCV Std: STD31654 Post Spike: STD27580
ICSA: STD31158 ICSAB: STD31157

Workgroups: 296632,296633

Comments:

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
38	EL.030609.182428	WG296844-18	CCV		1		03/06/09 18:24
39	EL.030609.183100	WG296844-19	CCB		1		03/06/09 18:31

Page: 2 Approved:

Microbac Laboratories Inc.

Data Checklist

Date: 06-MAR-2009
Analyst: SLP
Analyst: NA
Method: 6020
Instrument: ELAN
Curve Workgroup: 296844
Runlog ID: 26922
Analytical Workgroups: 296632,296633

Calibration/Linearity	X
ICV/CCV	X
ICB/CCB	X
ICSA/ICSAB	X
CRI	X
Blank/LCS	X
MS/MSD	X
Post Spike/Serial Dilution	X
Upload Results	X
Data Qualifiers	X
Generate PDF Instrument Data	X
Sign/Annotate PDF Data	X
Upload Curve Data	X
Workgroup Forms	
Case Narrative	034,035,071,085,697
Client Forms	X
Level X	
Level 3	085
Level 4	
Check for compliance with method and project specific requirements	
Check the completeness of reported information	
Check the information for the report narrative	
Primary Reviewer	JYH
Secondary Reviewer	
Comments	

Primary Reviewer: Secondary Reviewer:

CHECKLIST1 - Modified 03/05/2008
Generated: MAR-09-2009 12:03:43

Microbac Laboratories Inc.

00075825

HOLDING TIMES
EQUIVALENT TO AFCEE FORM 9

Analytical Method: 6020 AAB#: WG296632

Login Number: L09030085

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
49WW06-022409	02/24/09	03/05/09	03/05/09	180	8.83	03/06/09	180	1.27	

* EXT = SEE PROJECT QAPP REQUIREMENTS
*ANAL = SEE PROJECT QAPP REQUIREMENTS

HOLD_TIMES - Modified 03/06/2008
PDF File ID: 1337805
Report generated 03/09/2009 11:52

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METHOD BLANK SUMMARY

Login Number: L09030085
Blank File ID: EL.030609.160321
Prep Date: 03/05/09 06:36
Analyzed Date: 03/06/09 16:03
Analyst: SLP

Work Group: WG296632
Blank Sample ID: WG296558-03
Instrument ID: ELAN-ICP
Method: 6020

This Method Blank Applies To The Following Samples:

Client ID	Lab Sample ID	Lab File ID	Time Analyzed	TAG
LCS	WG296558-04	EL.030609.160921	03/06/09 16:09	01
DUP	WG296558-07	EL.030609.165134	03/06/09 16:51	01
49WW06-022409	L09030085-01	EL.030609.172248	03/06/09 17:22	DL01

Report Name: BLANK_SUMMARY
PDF File ID: 1337806
Report generated 03/09/2009 11:52

Microbac Laboratories Inc.

METHOD BLANK REPORT

Login Number: L09030085 Prep Date: 03/05/09 06:36 Sample ID: WG296558-03
Instrument ID: ELAN-ICP Run Date: 03/06/09 16:03 Prep Method: 3015
File ID: EL.030609.160321 Analyst: SLP Method: 6020
Workgroup (AAB#): WG296632 Matrix: Water Units: mg/L
Contract #: DACA56-94-D-0020 Cal ID: ELAN-I-06-MAR-09

Analytes	SDL	PQL	Concentration	Dilution	Qualifier
Arsenic, Total	0.000250	0.00100	0.000250	1	U
Chromium, Total	0.000500	0.00200	0.00114	1	J

SDL Method Detection Limit
PQL Reporting/Practical Quantitation Limit
ND Analyte Not detected at or above reporting limit
* |Analyte concentration| > RL

Report Name: BLANK
PDF ID: 1337807
09-MAR-2009 11:52

Microbac Laboratories Inc.
LABORATORY CONTROL SAMPLE (LCS)

Login Number: L09030085 Run Date: 03/06/2009 Sample ID: WG296558-04
Instrument ID: ELAN-ICP Run Time: 16:09 Prep Method: 3015
File ID: EL.030609.160921 Analyst: SLP Method: 6020
Workgroup (AAB#): WG296632 Matrix: Water Units: mg/L
QC Key: STD Lot#: STD30482 Cal ID: ELAN-I-06-MAR-09

Analytes	Expected	Found	% Rec	LCS Limits	Q
Arsenic, Total	0.0625	0.0571	91.3	80 - 120	
Chromium, Total	0.0625	0.0679	109	80 - 120	

LCS - Modified 03/06/2008
PDF File ID: 1337808
Report generated: 03/09/2009 11:52

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Microbac Laboratories Inc.
MATRIX SPIKE AND MATRIX SPIKE DUP (MS/MSD)

00075829

Loginnum: L09030085 Cal ID: ELAN-ICP- Worknum: WG296632
Instrument ID: ELAN-ICP Contract #: DACA56-94-D-0020 Method: 6020
Parent ID: WG296558-01 File ID: EL.030609.161522 Dil: 1 Matrix: WATER
Sample ID: WG296558-05 MS File ID: EL.030609.162123 Dil: 1 Units: mg/L
Sample ID: WG296558-06 MSD File ID: EL.030609.162725 Dil: 1

Analyte	Parent	MS Spiked	MS Found	MS %Rec	MSD Spiked	MSD Found	MSD %Rec	%RPD	%Rec Limits	RPD Limit	Q
Arsenic	0.00117	0.0625	0.0583	91.4	0.0625	0.0593	93.0	1.66	75 - 125	20	
Chromium	0.00161	0.0625	0.0657	103	0.0625	0.0669	105	1.92	75 - 125	20	

* FAILS %REC LIMIT

FAILS RPD LIMIT

NOTE: This is an internal quality control sample.

WG_MS_MSD_DRYWT - Modified 03/07/2008
PDF File ID: 1337809
Report generated 03/09/2009 11:52

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Microbac Laboratories Inc.
Serial Dilution Report

Login: L09030085 **Worknum:** WG296632
Instrument: ELAN-ICP **Method:** 6020
Serial Dil: WG296632-02 **File ID:** EL.030609.163929 **Dil:** 5 **Units:** ug/L
Sample: L09030035-03 **File ID:** EL.030609.163327 **Dil:** 1

Analyte	Sample	Qual	Serial Dil	Qual	% Diff	Q
Arsenic	5.06	X	4.935	X	2.47	
Chromium	4.79	X	1.15	F	76.00	

U = Result is below MDL.
F = Result is greater than or equal to MDL and less than the RL.
X = Result is greater than or equal to RL and less than 100 times the MDL.
E = %D exceeds control limit of 10% and initial sample result is greater than or equal to 100 times the MDL.

SERIAL_DIL - Modified 09/22/2008
PDF File ID: 1337803
03/09/2009 11:52

Microbac Laboratories Inc.
POST SPIKE REPORT

Sample Login ID: L09030085 **Worknum:** WG296632
Instrument ID: ELAN-ICP **Method:** 6020
Post Spike ID: WG296632-01 **File ID:** EL.030609.164531 **Dil:** 1 **Units:** ug/L
Sample ID: L09030035-03 **File ID:** EL.030609.163327 **Dil:** 1 **Matrix:** Water

Analyte	Post Spike Result	C	Sample Result	C	Spike Added(SA)	% R	Control Limit %R	Q
ARSENIC	51.0		5.06		50	91.9	75 - 125	
CHROMIUM	53.2		4.79		50	96.9	75 - 125	

N = % Recovery exceeds control limits
F = Result is between MDL and RL
U = Sample result is below MDL. A value of zero is used in the calculation

POST_SPIKE - Modified 03/06/2008
PDF File ID: 1337804
Report generated: 03/09/2009 11:52

Microbac Laboratories Inc.
Initial Calibration Summary

Login:	L09030085	Workgroup (AAB#):	WG296632
Analytical Method:	6020	Instrument ID:	ELAN-ICP
ICAL Worknum:	WG296844	Initial Calibration Date:	06-MAR-2009 14:56

	WG296844-01		WG296844-02		WG296844-03		WG296844-04			
	Conc	INT	Conc	INT	Conc	INT	Conc	INT	R	Q
ARSENIC	0	-411	.4	661	50	126000	100	244000	1	
CHROMIUM	0	20000	.4	26300	50	758000	100	1450000	.999998	

INT = Instrument intensity
R = Coefficient of correlation
Q = Data Qualifier
*** = Out of Compliance; R < 0.995**

INT_CAL_ICP - Modified 03/06/2008
PDF File ID: 1337813
Report generated: 09-MAR-2009 11:52

Microbac Laboratories Inc.

INITIAL CALIBRATION BLANK (ICB)

Login Number: L09030085
Run Date: 03/06/2009
Sample ID: WG296844-07
Instrument ID: ELAN-ICP
Run Time: 15:17
Method: 6020
File ID: EL.030609.151749
Analyst: SLP
Units: ug/L
Workgroup (AAB#): WG296632
Cal ID: ELAN-ICP - 06-MAR-09
Matrix: WATER

Analytes	MDL	RDL	Concentration	Qualifier
ARSENIC	.1	.4	.1	U
CHROMIUM	.2	.8	.2	U

ICB - Modified 03/06/2008
PDF File ID: 1337815
Report generated 03/09/2009 11:52

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Microbac Laboratories Inc.
CONTINUING CALIBRATION BLANK (CCB)

00075834

Login Number: L09030085
Run Date: 03/06/2009
Sample ID: WG296844-13
Instrument ID: ELAN-ICP
Run Time: 15:57
Method: 6020
File ID: EL.030609.155711
Analyst: SLP
Units: ug/L
Workgroup (AAB#): WG296632
Cal ID: ELAN-I - 06-MAR-09
Matrix: WATER

Analytes	MDL	RDL	Concentration	Qualifier
Arsenic	0.100	0.400	0.100	U
Chromium	0.200	0.800	0.200	U

U = Result is less than MDL.
F = Result is between MDL and RL.
* = Result is above RL.

CCB - Modified 03/05/2008
PDF File ID: 1337818
Report generated 03/09/2009 11:52

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Microbac Laboratories Inc.
CONTINUING CALIBRATION BLANK (CCB)

00075835

Login Number: L09030085
Run Date: 03/06/2009
Sample ID: WG296844-15
Instrument ID: ELAN-ICP
Run Time: 17:10
Method: 6020
File ID: EL.030609.171033
Analyst: SLP
Units: ug/L
Workgroup (AAB#): WG296632
Cal ID: ELAN-I - 06-MAR-09
Matrix: WATER

Analytes	MDL	RDL	Concentration	Qualifier
Arsenic	0.100	0.400	0.100	U
Chromium	0.200	0.800	0.200	U

U = Result is less than MDL.
F = Result is between MDL and RL.
* = Result is above RL.

CCB - Modified 03/05/2008
PDF File ID: 1337818
Report generated 03/09/2009 11:52

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Microbac Laboratories Inc.
CONTINUING CALIBRATION BLANK (CCB)

00075836

Login Number: L09030085
Run Date: 03/06/2009
Sample ID: WG296844-17
Instrument ID: ELAN-ICP
Run Time: 17:35
Method: 6020
File ID: EL.030609.173544
Analyst: SLP
Units: ug/L
Workgroup (AAB#): WG296632
Cal ID: ELAN-I - 06-MAR-09
Matrix: WATER

Analytes	MDL	RDL	Concentration	Qualifier
Arsenic	0.100	0.400	0.100	U
Chromium	0.200	0.800	0.200	U

U = Result is less than MDL.
F = Result is between MDL and RL.
* = Result is above RL.

CCB - Modified 03/05/2008
PDF File ID: 1337818
Report generated 03/09/2009 11:52

Microbac Laboratories Inc.

INITIAL CALIBRATION VERIFICATION (ICV)
(Alternate Source)

Login Number: L09030085 Run Date: 03/06/2009 Sample ID: WG296844-06
Instrument ID: ELAN-ICP Run Time: 15:11 Method: 6020
File ID: EL.030609.151118 Analyst: SLP Units: ug/L
Workgroup (AAB#): WG296632 Cal ID: ELAN-I - 06-MAR-09
QC Key: STD

Analyte		Expected	Found	%REC	LIMITS	Q
Arsenic		50	48.8	97.6	90 - 110	
Chromium		50	49.1	98.2	90 - 110	

* Exceeds LIMITS Limit

ICV - Modified 03/06/2008
PDF File ID: 1337814
Report generated 03/09/2009 14:54

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Microbac Laboratories Inc.
CONTINUING CALIBRATION VERIFICATION (CCV)

00075838

Login Number: L09030085
Run Date: 03/06/2009
Sample ID: WG296844-12
Instrument ID: ELAN-ICP
Run Time: 15:50
Method: 6020
File ID: EL.030609.155039
Analyst: SLP
QC Key: STD
Workgroup (AAB#): WG296632
Cal ID: ELAN-I - 06-MAR-09
Matrix: WATER

Analyte		Expected	Found	UNITS	%REC	LIMITS		Q
Arsenic		50.0	49.2	ug/L	98.3	90 - 110		
Chromium		50.0	49.9	ug/L	99.8	90 - 110		

* Exceeds LIMITS Criteria

CCV - Modified 03/05/2008
PDF File ID: 1337817
Report generated 03/09/2009 11:52

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CONTINUING CALIBRATION VERIFICATION (CCV)

00075839

Login Number: L09030085
Run Date: 03/06/2009
Sample ID: WG296844-14
Instrument ID: ELAN-ICP
Run Time: 17:04
Method: 6020
File ID: EL.030609.170401
Analyst: SLP
QC Key: STD
Workgroup (AAB#): WG296632
Cal ID: ELAN-I - 06-MAR-09
Matrix: WATER

Analyte		Expected	Found	UNITS	%REC	LIMITS		Q
Arsenic		50.0	49.2	ug/L	98.4	90 - 110		
Chromium		50.0	47.8	ug/L	95.6	90 - 110		

* Exceeds LIMITS Criteria

CCV - Modified 03/05/2008
PDF File ID: 1337817
Report generated 03/09/2009 11:52

Microbac

Microbac Laboratories Inc.
CONTINUING CALIBRATION VERIFICATION (CCV)

00075840

Login Number: L09030085
Run Date: 03/06/2009
Sample ID: WG296844-16
Instrument ID: ELAN-ICP
Run Time: 17:29
Method: 6020
File ID: EL.030609.172912
Analyst: SLP
QC Key: STD
Workgroup (AAB#): WG296632
Cal ID: ELAN-I - 06-MAR-09
Matrix: WATER

Analyte		Expected	Found	UNITS	%REC	LIMITS		Q
Arsenic		50.0	49.5	ug/L	99.1	90 - 110		
Chromium		50.0	48.4	ug/L	96.8	90 - 110		

* Exceeds LIMITS Criteria

CCV - Modified 03/05/2008
PDF File ID: 1337817
Report generated 03/09/2009 11:52

Microbac

Microbac Laboratories Inc.
INTERFERENCE CHECK SAMPLES

Login number: L09030085
Instrument ID: ELAN-ICP
Sol. A : WG296844-10 **File ID:** EL.030609.153732
Sol. AB : WG296844-11 **File ID:** EL.030609.154406

Workgroup (AAB#): WG296632
Method: 6020
Units: ug/L
Matrix: Water

	Sol. A			Sol. AB			
ANALYTE	True	Found	%Recovery	True	Found	%Recovery	Q
Arsenic	NS	-0.0238	NS	100	97.8	97.8	
Chromium	NS	0.254	NS	100	96.3	96.3	

NS = Not spiked
*** = Recovery of spiked element is outside acceptance limit of 80% - 120% of true value.**
 # = Result for unspiked element is outside the acceptance limits of (+/-) the project reporting limit (RL).

ICS - Modified 03/06/2008
PDF File ID: 1337816
Report generated 03/09/2009 11:52

Microbac Laboratories Inc.

INTERNAL STANDARD REPORT

Login: L09030085 **Analytical Method:** 6020
Analytical Workgroup: WG296632 **Matrix:** 1
Instrument: ELAN-ICP **Analyst:** SLP
ICAL Date: 06-MAR-2009 14:39

			BISMUTH	GERMANIUM	INDIUM	TERBIUM
Sample	Type	Run Date	% Rec	% Rec	% Rec	% Rec
L09030085-01	SAMP	06-MAR-2009 17:22	89.35	87.617	88.438	91.819
WG296558-01	REF	06-MAR-2009 16:15	92.965	94.274	89.428	91.861
WG296558-02	REF	06-MAR-2009 16:33	65.711	72.537	72.147	77.582
WG296558-03	BLANK	06-MAR-2009 16:03	98.142	95.239	91.84	94.52
WG296558-04	LCS	06-MAR-2009 16:09	94.457	94.148	90.867	92.64
WG296558-05	MS	06-MAR-2009 16:21	92.47	94.191	88.73	91.322
WG296558-06	MSD	06-MAR-2009 16:27	93.016	94.012	88.005	91.346
WG296558-07	DUP	06-MAR-2009 16:51	67.795	74.05	74.06	79.927
WG296632-01	PSPK	06-MAR-2009 16:45	68.753	75.432	75.044	80.953
WG296632-02	SERIAL	06-MAR-2009 16:39	84.392	86.353	85.617	89.946
WG296844-05	ICV	06-MAR-2009 15:02	95.2	92.356	92.575	94.665
WG296844-06	ICV	06-MAR-2009 15:11	94.961	95.145	95.442	96.46
WG296844-07	ICB	06-MAR-2009 15:17	94.257	93.274	95.131	95.885
WG296844-12	CCV	06-MAR-2009 15:50	91.711	91.102	90.164	91.333
WG296844-13	CCB	06-MAR-2009 15:57	92.383	93.295	90.576	91.534
WG296844-14	CCV	06-MAR-2009 17:04	95.416	85.379	91.06	95.807
WG296844-15	CCB	06-MAR-2009 17:10	94.393	80.845	87.998	93.783
WG296844-16	CCV	06-MAR-2009 17:29	94.35	86.58	91.414	94.709
WG296844-17	CCB	06-MAR-2009 17:35	92.847	87.422	93.218	95.566

Acceptance criteria: 30% - 120%
Underlined recoveries are out of range

INT_STD_ICPMS - Modified 03/05/2008
PDF File ID: 1337812
Report generated: 03/09/2009 11:52

Microbac Laboratories Inc.

INTERNAL STANDARD REPORT

Login: L09030085 **Analytical Method:** 6020
Analytical Workgroup: WG296632 **Matrix:** 2
Instrument: ELAN-ICP **Analyst:** SLP
ICAL Date: 06-MAR-2009 14:39

			BISMUTH	GERMANIUM	INDIUM	TERBIUM
Sample	Type	Run Date	% Rec	% Rec	% Rec	% Rec
L09030035-03	SAMP	06-MAR-2009 16:33	65.711	72.537	72.147	77.582

Acceptance criteria: 30% - 120%
Underlined recoveries are out of range

INT_STD_ICPMS - Modified 03/05/2008
PDF File ID: 1337812
Report generated: 03/09/2009 11:52

Microbac Laboratories Inc.
LINEAR RANGE (QUARTERLY)

Login Number: L09030085 **Date:** 01/03/2009
Insturment ID: ELAN-ICP **Method:** 6020

Analyte	Integration Time (Sec.)	Concentration (ug/L)
Antimony	1.00	100.0
Arsenic	1.00	100.0
Barium	1.00	100.0
Cadmium	1.00	100.0
Chromium	1.00	100.0
Cobalt	1.00	100.0
Copper	1.00	100.0
Lead	1.00	100.0
Manganese	1.00	100.0
Nickel	1.00	100.0
Selenium	1.00	100.0
Silver	1.00	100.0
Thallium	1.00	100.0
Vanadium	1.00	100.0
Zinc	1.00	100.0

Comments:
All analytes passed acceptance criteria at the specified concentration.

LINEAR_RANGE - Modified 03/06/2008
PDF File ID: 1337810
Report generated: 03/09/2009 11:52

3.0 Attachments

Microbac Laboratories Inc.
Analyst Listing
March 9, 2009

ADC - ANTHONY D. CANTER
AJF - AMANDA J. FICKIESEN
ALB - ANNIE L. BROWN
AM - ALISON J. MILLER
AML - ANTHONY M. LONG
BRG - BRENDA R. GREGORY
CAA - CASSIE A. AUGENSTEIN
CAF - CHERYL A. FLOWERS
CAH - CHARLES A. HALL
CEB - CHAD E. BARNES
CLC - CHRYS L. CRAWFORD
CLW - CHARISSA L. WINTERS
CMS - CRYSTAL M. STEPHENS
CPD - CHAD P. DAVIS
CSH - CHRIS S. HILL
CTB - CHRIS T. BUCINA
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
ECL - ERIC C. LAWSON
EDA - ERIN D. AGEE
ERP - ERIN R. PORTER
FJB - FRANCES J. BOLDEN
HAV - HEMA VILASAGAR
HJR - HOLLY J. REED
JBK - JEREMY B. KINNEY
JDH - JUSTIN D. HESSON
JKP - JACQUELINE K. PARSONS
JKT - JANE K. THOMPSON
JWR - JOHN W. RICHARDS
JWS - JACK W. SHEAVES
JYH - JI Y. HU
KEB - KATHRYN E. BARNES
KHR - KIM H. RHODES
KRA - KATHY R. ALBERTSON
LHT - LANCE H. THOMPSON
LKN - LINDA K. NEDEFF
LSB - LESLIE S. BUCINA
MDA - MIKE D. ALBERTSON
MDC - MICHAEL D. COCHRAN
MES - MARY E. SCHILLING
MMB - MAREN M. BEERY
MRT - MICHELLE R. TAYLOR
MSW - MATT S. WILSON
NPM - NATHANIEL P. MILLER
PDM - PIERCE D. MORRIS
RAH - ROY A. HALSTEAD
RB - ROBERT BUCHANAN
REK - ROBERT E. KYER
RLK - ROBIN L. KLINGER
RWC - RODNEY W. CAMPBELL
SAV - SARAH A. VANDENBERG
SDH - SHANA D. HINYARD
SDL - SHELLY D. LENT
SLM - STEPHANIE L. MOSSBURG
SLP - SHERI L. PFALZGRAF
TDH - TRICIA D. HUCK
TIP - TAE I. PARRISH
TMB - TIFFANY M. BAILEY
TMM - TAMMY M. MORRIS
VC - VICKI COLLIER
WTD - WADE T. DELONG

Microbac Laboratories Inc.
List of Valid Qualifiers
March 09, 2009

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
B3	Target analyte detected in calibration blank at or above the method reporting limit
C	Confirmed by GC/MS
CG	Confluent growth
D1	Sample required dilution due to matrix.
D2	Sample required dilution due to high concenration of target analyte.
DL	Surrogate or spike compound was diluted out
E	Estimated concentration due to sample matrix interference
E1	Concentration estimated. Analyte exceeded calibration range. Insufficient sample for reanalysis.
E2	Concentration estimated. Analyte exceeded calibration range. Reanalysis not performed due to matrix.
E3	Concentration estimated. Analyte exceeded calibration range. Reanalysis not performed due to holding time requirements
EDL	Elevated sample reporting limits, presence of non-target analytes
EMPC	Estimated Maximum Possible Concentration
F, S	Estimated result below quantitation limit; method of standard additions(MSA)
FL	Free Liquid
H1	Sample analysis performed past holding time.
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%
J,S	Estimated concentration; analyzed by method of standard addition (MSA)
L	Sample reporting limits elevated due to matrix interference
L1	The associated blank spike (LCS) recovery was above the laboratory acceptance limits.
L2	The associated blank spike (LCS) recovery was below the laboratory acceptance limits.
M	Matrix effect; the concentration is an estimate due to matrix effect.
M1	Matrix spike recovery was high; the assocated blank spike recovery was acceptable.
M2	Matrix spike recovery was low; the assocated blank spike recovery was acceptable.
M3	The spike recovery value is unusable since the analyte concentration is disproportionate to the spike level.
N	Tentatively identified compound(TIC)
NA	Not applicable
ND	Not detected at or above the reporting limit
ND, L	Not detected; sample reporting limit (RL) elevated due to interference
ND, S	Not detected; analyzed by method of standard addition (MSA)
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.
Q1	Sample integraity was not maintained. See report narrative.
QNS	Quantity of sample not sufficient to perform analysis
R1	Duplicate RPD/RSD exceeded the method acceptance limit.
R2	Duplicate RPD/RSD exceeded the laboratory acceptance limit.
RA	Reanalysis confirms reported results
RE	Reanalysis confirms sample matrix interference
S	Analyzed by method of standard addition (MSA)
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.
V1	CCV recovery was above method acceptance limits. This target analyte was not detected in the sample.
V2	CCV recovery was above method acceptance limits. Insufficient volume for sample reanalysis.
W	Post-digestion spike for furnace AA out of control limits
X	Exceeds regulatory limit
X, S	Exceeds regulatory limit; method of standard additions (MSA)
Z	Cannot be resolved from isomer - see below

*****Special Notes for Organic Analytes**

Microbac Laboratories Inc.
List of Valid Qualifiers
March 09, 2009

Qualkey: STD

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.

B 3017

Shaw Environmental & Infrastructure, Inc.
3010 Briarpark Drive, Suite 400
Houston, TX 77042
(713) 996-4400

Laboratory Name: Microbac
Address : 158 Starlite Drive, Marietta OH 45750
Contact : Stephanie Mossburg
Phone: 1-800-373-4071

PM: Chris Long (713.996.4579) TAT: Standard/Rush
Project Contact: Jennifer Hoang Phone No: 713-996-4408
Project Name: Longhorn Site: Site 17
Location: Texas Project #:

Sampler Print: Allen Willmore
Sampler Sign:

Sulfided separate from other anions + has H2SO4 preservative
2 coolers
Trip Blank included w/ VOCs

Sample Number	Grab	Date	Time	Matrix	# of Containers	8260	Arsenic	Antimony	Chromium	Nickel	Thallium	RSK175	Anions (NO3, NO2, SO4), PO4, ALK, S	TOC		COMMENTS
MW-130-030409	✓	3/4/09	12:30	Water	10	x	x					x	x	x		
18WW14-030309	✓	3/3/09	11:35	Water	3	x										
18WW15-030309	✓	3/3/09	11:55	Water	3	x										
C-07-022509	✓	02/25/09	15:50	Water	3	x										
MW-18-030309	✓	3/3/09	15:50	Water	4	x					x					
~~MW-19~~	✓			~~Water~~												
17WW10-022609-FD	✓	2/26/09	11:45	Water	2	x										Field Duplicate
17WW10-022609-MS	✓	2/26/09	11:45	Water	2	x										MS-
17WW10-022609-MSD	✓	2/26/09	11:45	Water	2	x										MSD
18WW14-030309-MS	✓	3/3/09	11:35	Water	3	x										
18WW15-030309-FD	✓	3/3/09	11:55	Water	3	x										
18WW14-030309-MSD	✓	3/3/09	11:35	Water	3	x										
49WW06-022409	✓	2/24/09	15:00	Water	1	~~x~~	x		x							48-hr TAT Only As, Cr, No VOCs
				Water												
				Water												
				Water												
				Water												
				Water												

Prelim = 2
P1

Relinquished By: Date/Time 03:04:09 / 17:15
Received By: Date/Time
Special Instructions: * 48 hr TAT on 49WW06-022409 only
only As, Cr.

Relinquished By: Date/Time
Received for Laboratory By: Date/Time 3-5-09 0909
Remarks

00075850

Microbac Laboratories, Inc.

SAMPLE RECEIPT FORM

00075851

158 Starlite Drive
Marietta, OH 45750
(740) 373-4071

Client:	SHAW -
Workorder Number:	B
Date Received:	3/5/09
Delivered by:	( ) Fedx (✓) UPS ( ) Client ( ) Courier Time: 0909
Opened by:	JRT
IR Temp Gun:	( ) G (✓) H
Logged by:	EAP/JL-1 L09030085

Cooler information

Cooler ID	Temp C	Airbill#	COC#	Other
2031	2	1Z66V7250199861023		
292	1	1Z66V7250199688013	Chains (2)	48hr metals (JHL)

Inspection Checklist	**Y**	**N**	**NA**	**Discrepancy ID**
Were shipping coolers sealed?	✓			
Were custody seals intact?	✓			
Were cooler temperatures in range of 0 - 6?	✓			
Was ice present?	✓			
Were COC's received/ information complete/signed and dated?	✓			
Were sample containers and labels intact and match COC?	✓			
Were the correct containers and volumes received?	✓			
Were correct preservatives used? (water only)	✓			
Were pH ranges acceptable? (voa's excluded)	✓			
Were VOA samples free of headspace (< 6mm)?			✓	
Were samples received within EPA hold times?	✓			

Discrepancy/Comments/Other Problems

Distribution

Name of Microbac representative:	
Client/Company:	
Person Contacted:	
Date contacted:	

Resolution/other comments:

Microbac Laboratories Inc.

Internal Chain of Custody Report

Login: L09030085
Account: 2773
Project: 2773.025
Samples: 1
Due Date: 09-MAR-2009

Samplenum	Container ID	Products
L09030085-01	558830	AS-MS CR-MS

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN	COOLER	W1	05-MAR-2009 10:40	ERE	
2	PREP	W1	DIG	05-MAR-2009 10:44	REK	RLK
3	EXTRACT	DIG	METALS	05-MAR-2009 10:46		VC
4	STORE	DIG	A1	06-MAR-2009 14:00	REK	ERE

A1 - Sample Archive (COLD)
A2 - Sample Archive (AMBIENT)
F1 - Volatiles Freezer in Login
V1 - Volatiles Refrigerator in Login
W1 - Walkin Cooler in Login

158 Starlite Drive, Marietta, OH 45750 • T:740-373-4071 • F:740-373-4835 • http://www.microbac.com

Laboratory Report Number: L09050164

Please find enclosed the analytical results for the samples you submitted to Microbac Laboratories.

Review and compilation of your report was completed by Microbac'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 below at 800-373-4071. Team member e-mail addresses also appear here for your convenience.

Kathy Albertson	*Team Chemist/Data Specialist*	kalbertson@microbac.com
Stephanie Mossburg	*Team Chemist/Data Specialist*	smossburg@microbac.com
Tony Long	*Team Chemist/Data Specialist*	tlong@microbac.com
Amanda Fickiesen	*Client Services Specialist*	afickiesen@microbac.com
Annie Brown	*Client Services Specialist*	abrown@microbac.com

This report was reviewed on May 12, 2009.

Stephanie Mossburg

Stephanie Mossburg - Team Chemist/Data Specialist

I certify that all test results meet all of the requirements of the accrediting authority listed below. 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 Microbac Laboratories.

This report was certified on May 12, 2009.

David E. Vandenberg

David Vandenberg - Managing Director

State of origin: Texas
Accrediting authority: Texas Commission on Environmental Quality ID:T104704252-07-TX
QAPP: Microbac OVD
This report contains a total of 107 pages.

Look closer. Go further. Do more.

Microbac REPORT L09050164
PREPARED FOR Shaw E I, Inc.
WORK ID:

1.0 Introduction

Microbac Laboratories Inc.
REPORT NARRATIVE

Microbac Login No: L09050164

CHAIN OF CUSTODY: The chain of custody number was LHAAP-49

SHIPMENT CONDITIONS: The chain of custody forms were received sealed in a cooler. The cooler temperature was 0 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 Microbac Laboratories Inc., 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: 11-MAY-09
Stephanie Mossburg

Laboratory Data Package Cover Page

00075857

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	May 9, 2009
Name (Printed)	Signature	Official Title (printed)	DATE

RG-366/TRRP-13 December 2002 A1

Microbac Laboratories Inc.
Laboratory Review Checklist

Laboratory Name:	Microbac Laboratories Inc.
Laboratory Log Number:	L09050164
Project Name:	798-LONGHORN
Method:	NITRATE-NITRITE
Prep Batch Number(s):	WG301890
Reviewer Name:	DEANNA I. HESSON
LRC Date:	May 09, 2009

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?	✓				

Checklist ID: **38247**

Microbac Laboratories Inc.
Laboratory Review Checklist

Laboratory Name:	Microbac Laboratories Inc.
Laboratory Log Number:	L09050164
Project Name:	798-LONGHORN
Method:	NITRATE-NITRITE
Prep Batch Number(s):	WG301890
Reviewer Name:	DEANNA I. HESSON
LRC Date:	May 09, 2009

Description	Yes	No	NA(1)	NR(2)	ER(3)
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?			✓		

Checklist ID: **38247**

Microbac Laboratories Inc.
Laboratory Review Checklist

Laboratory Name:	Microbac Laboratories Inc.
Laboratory Log Number:	L09050164
Project Name:	798-LONGHORN
Method:	NITRATE-NITRITE
Prep Batch Number(s):	WG301890
Reviewer Name:	DEANNA I. HESSON
LRC Date:	May 09, 2009

Description	Yes	No	NA(1)	NR(2)	ER(3)
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?	✓				
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?	✓				

Microbac Laboratories Inc.
Laboratory Review Checklist

Laboratory Name:	Microbac Laboratories Inc.
Laboratory Log Number:	L09050164
Project Name:	798-LONGHORN
Method:	NITRATE-NITRITE
Prep Batch Number(s):	WG301890
Reviewer Name:	DEANNA I. HESSON
LRC Date:	May 09, 2009

EXCEPTIONS REPORT
ER# - Description
Footnotes:
(1) NA = Not applicable to method or project
(2) NR = Not reviewed
(3) ER# = Exception report number

Laboratory Data Package Cover Page

00075863

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.

MAREN M. BEERY	Maren Beery	Metals Supervisor	May 11, 2009
Name (Printed)	Signature	Official Title (printed)	DATE

RG-366/TRRP-13 December 2002 A1

Microbac Laboratories Inc.
Laboratory Review Checklist

Laboratory Name:	Microbac Laboratories Inc.
Laboratory Log Number:	L09050164
Project Name:	798-LONGHORN
Method:	6020
Prep Batch Number(s):	WG301900
Reviewer Name:	MAREN M. BEERY
LRC Date:	May 11, 2009

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 <RL?	✓				
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 laboratory's 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?	✓				
ICAL					
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 <RL?	✓				
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?	✓				

Microbac Laboratories Inc.
Laboratory Review Checklist

Laboratory Name:	Microbac Laboratories Inc.
Laboratory Log Number:	L09050164
Project Name:	798-LONGHORN
Method:	6020
Prep Batch Number(s):	WG301900
Reviewer Name:	MAREN M. BEERY
LRC Date:	May 11, 2009

EXCEPTIONS REPORT
ER# - Description
Footnotes:
(1) NA = Not applicable to method or project
(2) NR = Not reviewed
(3) ER# = Exception report number

Laboratory Data Package Cover Page

00075868

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.

MAREN M. BEERY	Maren Beery	Metals Supervisor	May 11, 2009
Name (Printed)	Signature	Official Title (printed)	DATE

RG-366/TRRP-13 December 2002 A1

Microbac Laboratories Inc.
Laboratory Review Checklist

Laboratory Name:	Microbac Laboratories Inc.
Laboratory Log Number:	L09050164
Project Name:	798-LONGHORN
Method:	6010
Prep Batch Number(s):	WG301911
Reviewer Name:	MAREN M. BEERY
LRC Date:	May 11, 2009

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 <RL?	✓				
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 laboratory's 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?	✓				
ICAL					
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 <RL?	✓				
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?	✓				

Microbac Laboratories Inc.
Laboratory Review Checklist

Laboratory Name:	Microbac Laboratories Inc.
Laboratory Log Number:	L09050164
Project Name:	798-LONGHORN
Method:	6010
Prep Batch Number(s):	WG301911
Reviewer Name:	MAREN M. BEERY
LRC Date:	May 11, 2009

EXCEPTIONS REPORT
ER# - Description
Footnotes:
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(3) ER# = Exception report number

2.1 Metals Data

2.1.1 Metals I C P Data

2.1.1.1 Summary Data

LABORATORY REPORT

L09050164

05/12/09 14:14

Submitted By

Microbac Laboratories Inc.
158 Starlite Drive
Marietta , OH 45750
(740) 373 - 4071

For

Account Name: Shaw E & I, Inc.
ABB Lummus Biulding
3010 Briarpark Drive Suite 4N
Houston, TX 77042
Attention: Jennifer Hoang

Project Number: 2773.025
Project: Longhorn AAP
Site: LONGHORN AAP KARNACK TX

P.O. Number: 389869/ 390836(GWTP)

Sample Analysis Summary

Client ID	Lab ID	Method	Dilution	Date Received
49WW06-090507	L09050164-01	6010B	1	08-MAY-09

Report Number: **L09050164**
Report Date : **May 12, 2009**

00075877

Sample Number: **L09050164-01**
Client ID: **49WW06-090507**
Matrix: **Water**
Workgroup Number: **WG301969**
Collect Date: **05/07/2009 13:40**
Sample Tag: **01**

PrePrep Method: **NONE**
Prep Method: **3005A**
Analytical Method: **6010B**
Analyst: **EDA**
Dilution: **1**
Units: **mg/L**

Instrument: **ICP-THERMO2**
Prep Date: **05/08/2009 13:49**
Cal Date: **05/11/2009 11:02**
Run Date: **05/11/2009 12:08**
File ID: **T2.051109.120829**

Analyte	CAS. Number	Result	Qual	PQL	SDL
Aluminum, Total	**7429-90-5**	**0.149**		**0.100**	**0.0500**
Iron, Total	**7439-89-6**	**0.276**		**0.100**	**0.0250**

2.1.1.2 QC Summary Data

Example 6010 Calculations
Perkin Elmer Optima 4300 DV

1.0 Initial Calibration (ICAL) Parameters
The system performs linear regression from data consisting of a blank and three standards.

2.0 Calculating the concentration (C) of an element in water using data from prep log, run log, and quantitation report (note:the data system performs this calculation automatically when correction factors have been entered):

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

Where:	**Example:**
Cs = Concentration computed by the data system in ug/mL (ppm)	0.1
Vf = Final volume (mL)	50
Vi = Initial volume (mL)	50
D = Dilution factor as a multiplier (10X = 10)	1
Cx = Concentration of element in ug/mL (mg/L)	0.1

3.0 Calculating the concentration (C) of an element in soil using data from prep log, run log, and quantitation report (note: the data system performs this calculation automatically when correction factors have been entered):

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

Where:	**Example:**
Cs = Concentration computed by the data system (mg/L) (ppm)	0.1
Vf = Final volume (mL)	50
Vi = Initial weight (g)	1
D = Dilution factor as a multiplier (10X = 10)	1
Cx = Concentration of element in ug/g (mg/kg)	5

4.0 Adjusting the concentration to dry weight:

$$Cdry = \frac{Cx \times 100}{Px}$$

Where:	**Example:**
Cx = Concentration calculated as received (wet basis)	5
Px = Percent solids of sample (%wt)	80
$Cdry$ = Concentration calculated as dry weight (mg/kg)	6.25

Example 6010 Calculations
Thermo Scientific IRIS Advantage

1.0 Initial Calibration (ICAL) Parameters
The system performs linear regression from data consisting of a blank and three standards.

2.0 Calculating the concentration (C) of an element in water using data from prep log, run log, and quantitation report (note:the data system performs this calculation automatically when correction factors have been entered):

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

Where:	**Example:**
Cs = Concentration computed by the data system in ug/mL (ppm)	0.1
Vf = Final volume (mL)	50
Vi = Initial volume (mL)	50
D = Dilution factor as a multiplier (10X = 10)	1
Cx = Concentration of element in ug/mL (mg/L)	0.1

3.0 Calculating the concentration (C) of an element in soil using data from prep log, run log, and quantitation report (note: the data system performs this calculation automatically when correction factors have been entered):

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

Where:	**Example:**
Cs = Concentration computed by the data system (mg/L) (ppm)	0.1
Vf = Final volume (mL)	50
Vi = Initial weight (g)	1
D = Dilution factor as a multiplier (10X = 10)	1
Cx = Concentration of element in ug/g (mg/kg)	5

4.0 Adjusting the concentration to dry weight:

$$Cdry = \frac{Cx \times 100}{Px}$$

Where:	**Example:**
Cx = Concentration calculated as received (wet basis)	5
Px = Percent solids of sample (%wt)	80
$Cdry$ = Concentration calculated as dry weight (mg/kg)	6.25

Example 6010 Calculations
Thermo Scientific iCAP 6500

1.0 Initial Calibration (ICAL) Parameters
The system performs linear regression from data consisting of a blank and four standards.

2.0 Calculating the concentration (C) of an element in water using data from prep log, run log, and quantitation report (note:the data system performs this calculation automatically when correction factors have been entered):

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

Where:	**Example:**
Cs = Concentration computed by the data system in ug/mL (ppm)	0.1
Vf = Final volume (mL)	50
Vi = Initial volume (mL)	50
D = Dilution factor as a multiplier (10X = 10)	1
Cx = Concentration of element in ug/mL (mg/L)	0.1

3.0 Calculating the concentration (C) of an element in soil using data from prep log, run log, and quantitation report (note: the data system performs this calculation automatically when correction factors have been entered):

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

Where:	**Example:**
Cs = Concentration computed by the data system (mg/L) (ppm)	0.1
Vf = Final volume (mL)	50
Vi = Initial weight (g)	1
D = Dilution factor as a multiplier (10X = 10)	1
Cx = Concentration of element in ug/g (mg/kg)	5

4.0 Adjusting the concentration to dry weight:

$$Cdry = \frac{Cx \times 100}{Px}$$

Where:	**Example:**
Cx = Concentration calculated as received (wet basis)	5
Px = Percent solids of sample (%wt)	80
$Cdry$ = Concentration calculated as dry weight (mg/kg)	6.25

Microbac Laboratories Inc.
Metals Digest Log

Workgroup: WG301911
Analyst: REK
Spike Analyst: REK
Method: 3005A
Run Date: 05/08/2009 13:50
Hotblock Start Temp: 94.9 @ 13:40
Hotblock End Temp: 95.2 @ 17:40

SOP: ME401 Revison 13
Spike Solution: STD27613
Spike Witness: VC
HCL Lot #: COA13815
Digest tubes Lot #: COA13830
HNO3 Lot #: COA13859

	SAMPLE #	Type	Matrix	Initial Amount	Final Volume	Spike Amount	Due Date
1	WG301911-01	BLANK	1	50 mL	50 mL		
2	WG301911-02	LCS	1	50 mL	50 mL	5 mL	
3	L09050164-01	SAMP	1	50 mL	50 mL		05/11/09
4	WG301911-03	LCS2	1	50 mL	50 mL	5 mL	

Analyst: [signature]

Reviewer: [signature]

BLOCK_DIG - Modified 07/22/2008
PDF ID: 1387848
Report generated: 05/08/2009 17:46

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Microbac Laboratories Inc.

Instrument Run Log

Instrument: ICP-THERMO2 Dataset: 051109T2.1
Analyst1: EDA Analyst2: N/A
Method: 6010B SOP: ME600G Rev: 8
Maintenance Log ID: 28673

Calibration Std: STD32446 ICV/CCV Std: STD32680 Post Spike: STD27612
ICSA: STD32624 ICSAB: STD32155 Int. Std: STD32604

Workgroups: 301907, 301969, 301972, 302014

Comments:

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
1	T2.051109.103852	WG302018-01	Calibration Point		1		05/11/09 10:38
2	T2.051109.104457	WG302018-02	Calibration Point		1		05/11/09 10:44
3	T2.051109.105102	WG302018-03	Calibration Point		1		05/11/09 10:51
4	T2.051109.105709	WG302018-04	Calibration Point		1		05/11/09 10:57
5	T2.051109.110257	WG302018-05	Calibration Point		1		05/11/09 11:02
6	T2.051109.110848	WG302018-06	Initial Calibration Verification		1		05/11/09 11:08
7	T2.051109.111438	WG302018-07	Initial Calib Blank		1		05/11/09 11:14
8	T2.051109.112044	WG302018-08	Interference Check		1		05/11/09 11:20
9	T2.051109.112646	WG302018-09	Interference Check		1		05/11/09 11:26
10	T2.051109.113241	WG302018-10	CCV		1		05/11/09 11:32
11	T2.051109.113830	WG302018-11	CCB		1		05/11/09 11:38
12	T2.051109.114436	L09040699-01	WITCONATE 90	5/50	2		05/11/09 11:44
13	T2.051109.115038	WG301911-01	Method/Prep Blank	50/50	1		05/11/09 11:50
14	T2.051109.115643	WG301911-02	Laboratory Control S	50/50	1		05/11/09 11:56
15	T2.051109.120236	WG301911-03	Laboratory Control S	50/50	1		05/11/09 12:02
16	T2.051109.120829	L09050164-01	49WW06-090507	50/50	1		05/11/09 12:08
17	T2.051109.121441	WG301969-01	Post Digestion Spike		1	L09050164-01	05/11/09 12:14
18	T2.051109.122043	WG301969-02	Serial Dilution		5	L09050164-01	05/11/09 12:20
19	T2.051109.122648	WG302018-12	CCV		1		05/11/09 12:26
20	T2.051109.123237	WG302018-13	CCB		1		05/11/09 12:32
21	T2.051109.123844	WG301743-02	Method/Prep Blank	50/50	1		05/11/09 12:38
22	T2.051109.124451	WG301743-03	Laboratory Control S	50/50	1		05/11/09 12:44
23	T2.051109.125045	L09050108-02	MW\#1	50/50	1		05/11/09 12:50
24	T2.051109.125647	L09050108-04	MW\#2	50/50	1		05/11/09 12:56
25	T2.051109.130243	L09050108-06	MW\#3	50/50	1		05/11/09 13:02
26	T2.051109.130844	L09050108-08	MW\#4	50/50	1		05/11/09 13:08
27	T2.051109.131442	L09050108-10	MW\#5	50/50	1		05/11/09 13:14
28	T2.051109.132044	L09050108-12	MW\#6	50/50	1		05/11/09 13:20
29	T2.051109.132645	L09050108-14	MW\#7	50/50	1		05/11/09 13:26
30	T2.051109.133243	L09050108-16	MW\#8	50/50	1		05/11/09 13:32
31	T2.051109.133844	WG302018-14	CCV		1		05/11/09 13:38
32	T2.051109.134435	WG302018-15	CCB		1		05/11/09 13:44
33	T2.051109.135041	L09050108-18	FIELD BLANK	50/50	1		05/11/09 13:50
34	T2.051109.135647	L09050108-20	DUPLICATE	50/50	1		05/11/09 13:56
35	T2.051109.140246	L09050109-01	DRL-K-EQBLK-1	50/50	1		05/11/09 14:02
36	T2.051109.140853	L09050110-01	DRL-Z-OUTLET 006	50/50	1		05/11/09 14:08
37	T2.051109.141458	L09050111-01	DRL-Z-SS-1	50/50	1		05/11/09 14:14

Page: 1 Approved: May 12, 2009

Microbac

Microbac Laboratories Inc.

Instrument Run Log

Instrument: ICP-THERMO2 Dataset: 051109T2.1
Analyst1: EDA Analyst2: N/A
Method: 6010B SOP: ME600G Rev: 8
Maintenance Log ID: 28673

Calibration Std: STD32446 ICV/CCV Std: STD32680 Post Spike: STD27612
ICSA: STD32624 ICSAB: STD32155 Int. Std: STD32604

Workgroups: 301907, 301969, 301972, 302014

Comments:

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
38	T2.051109.142102	WG301972-01	Post Digestion Spike		1	L09050111-01	05/11/09 14:21
39	T2.051109.142654	WG301972-02	Serial Dilution		5	L09050111-01	05/11/09 14:26
40	T2.051109.143258	WG301743-01	Reference Sample		1	L09050111-02	05/11/09 14:32
41	T2.051109.143901	WG301743-04	Matrix Spike	50/50	1	L09050111-02	05/11/09 14:39
42	T2.051109.144453	WG301743-05	Matrix Spike Duplica	50/50	1	L09050111-02	05/11/09 14:44
43	T2.051109.145044	WG302018-16	CCV		1		05/11/09 14:50
44	T2.051109.145634	WG302018-17	CCB		1		05/11/09 14:56
45	T2.051109.150241	WG302014-03	Louisville Chem Requ		100		05/11/09 15:02
46	T2.051109.150833	WG301963-02	Method/Prep Blank		1		05/11/09 15:08
47	T2.051109.151438	WG301963-03	Laboratory Control S		1		05/11/09 15:14
48	T2.051109.152517	WG302014-03	Louisville Chem Requ		100		05/11/09 15:25
49	T2.051109.153937	WG302014-03	Louisville Chem Requ		100		05/11/09 15:39
50	T2.051109.154836	WG302018-18	CCV		1		05/11/09 15:48
51	T2.051109.155425	WG302018-19	CCB		1		05/11/09 15:54
52	T2.051109.160445	WG302014-03	Louisville Chem Requ		100		05/11/09 16:04
53	T2.051109.165524	WG301963-02	Method/Prep Blank	50/50	1		05/11/09 16:55
54	T2.051109.170129	WG301963-03	Laboratory Control S	50/50	1		05/11/09 17:01
55	T2.051109.170724	L09050136-02	0905SWMST019-F		1		05/11/09 17:07
56	T2.051109.171329	WG302014-01	Post Digestion Spike		1	L09050136-02	05/11/09 17:13
57	T2.051109.171922	WG302014-02	Serial Dilution		5	L09050136-02	05/11/09 17:19
58	T2.051109.172527	WG301963-01	Reference Sample		1	L09050136-06	05/11/09 17:25
59	T2.051109.173132	WG302018-20	CCV		1		05/11/09 17:31
60	T2.051109.173722	WG302018-21	CCB		1		05/11/09 17:37
61	T2.051109.174329	WG301963-04	Matrix Spike		1	L09050136-06	05/11/09 17:43
62	T2.051109.174923	WG301963-05	Matrix Spike Duplica		1	L09050136-06	05/11/09 17:49
63	T2.051109.175515	L09050199-01	TANK 2	50/50	1		05/11/09 17:55
64	T2.051109.180113	L09050161-11	IDW-01-01	50/50	1		05/11/09 18:01
65	T2.051109.180712	L09050165-03	PZ-05-050609	50/50	1		05/11/09 18:07
66	T2.051109.181324	L09050165-05	PZ-06-050609	50/50	1		05/11/09 18:13
67	T2.051109.181929	L09050165-07	MW-02-050609	50/50	1		05/11/09 18:19
68	T2.051109.182540	L09050165-09	MW-22-050609	50/50	1		05/11/09 18:25
69	T2.051109.183145	WG302018-22	CCV		1		05/11/09 18:31
70	T2.051109.183735	WG302018-23	CCB		1		05/11/09 18:37
71	T2.051109.184342	L09050165-10	EB-050609-GW	50/50	1		05/11/09 18:43
72	T2.051109.184948	L09050181-02	0905-077-1	50/50	1		05/11/09 18:49
73	T2.051109.185553	L09050181-04	0905-082-1	50/50	1		05/11/09 18:55
74	T2.051109.190202	L09050181-05	0905-083-1	50/50	1		05/11/09 19:02

Page: 2 Approved: May 12, 2009

Microbac

Microbac Laboratories Inc.

Instrument Run Log

Instrument: ICP-THERMO2 Dataset: 051109T2.1
Analyst1: EDA Analyst2: N/A
Method: 6010B SOP: ME600G Rev: 8
Maintenance Log ID: 28673

Calibration Std: STD32446 ICV/CCV Std: STD32680 Post Spike: STD27612
ICSA: STD32624 ICSAB: STD32155 Int. Std: STD32604

Workgroups: 301907, 301969, 301972, 302014

Comments:

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
75	T2.051109.190812	L09050182-01	905-9	50/50	1		05/11/09 19:08
76	T2.051109.191424	L09050183-02	905-040-1	50/50	1		05/11/09 19:14
77	T2.051109.192028	L09050183-03	905-090-1	50/50	1		05/11/09 19:20
78	T2.051109.192631	L09050183-04	905-091-1	50/50	1		05/11/09 19:26
79	T2.051109.193229	L09050196-05	AV-NCB-EB-1-050609	50/50	1		05/11/09 19:32
80	T2.051109.193836	WG302018-24	CCV		1		05/11/09 19:38
81	T2.051109.194426	WG302018-25	CCB		1		05/11/09 19:44

Page: 3 Approved: May 12, 2009

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Data Checklist

Date: 11-MAY-2009
Analyst: EDA
Analyst: NA
Method: 6010B
Instrument: ICP-THERM02
Curve Workgroup: 302018
Runlog ID: 28004
Analytical Workgroups: 301907, 301969, 301972, 302014

Calibration/Linearity	X
ICV/CCV	X
ICB/CCB	X
ICSA/ICSAB	X
CRI	
Blank/LCS	X
MS/MSD	X
Post Spike/Serial Dilution	X
Upload Results	X
Data Qualifiers	
Generate PDF Instrument Data	X
Sign/Annotate PDF Data	X
Upload Curve Data	X
Workgroup Forms	
Case Narrative	699, 164, 199, 161, 165, 181, 182
Case Narrative (Continued)	183, 196
Client Forms	
Level X	
Level 3	164, 165
Level 4	199, 161, 196
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	EDA
Secondary Reviewer	SLP
Comments	

Primary Reviewer:

Secondary Reviewer:
12-MAY-2009

CHECKLIST1 - Modified 03/05/2008
Generated: MAY-12-2009 13:51:22

Microbac Laboratories Inc.

HOLDING TIMES
EQUIVALENT TO AFCEE FORM 9

Analytical Method: 6010B

AAB#: WG301969

Login Number: L09050164

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
49WW06-090507	05/07/09	05/08/09	05/08/09	180	1.01	05/11/09	180	2.93	

* EXT = SEE PROJECT QAPP REQUIREMENTS
*ANAL = SEE PROJECT QAPP REQUIREMENTS

HOLD_TIMES - Modified 03/06/2008
PDF File ID: 1388688
Report generated 05/11/2009 13:19

METHOD BLANK SUMMARY

Login Number: L09050164
Blank File ID: T2.051109.115038
Prep Date: 05/08/09 13:50
Analyzed Date: 05/11/09 11:50
Analyst: EDA

Work Group: WG301969
Blank Sample ID: WG301911-01
Instrument ID: ICP-THERMO2
Method: 6010B

This Method Blank Applies To The Following Samples:

Client ID	Lab Sample ID	Lab File ID	Time Analyzed	TAG
LCS	WG301911-02	T2.051109.115643	05/11/09 11:56	01
LCS2	WG301911-03	T2.051109.120236	05/11/09 12:02	01
49WW06-090507	L09050164-01	T2.051109.120829	05/11/09 12:08	01

Report Name: BLANK_SUMMARY
PDF File ID: 1388689
Report generated 05/11/2009 13:19

Microbac Laboratories Inc.
METHOD BLANK REPORT

Login Number: L09050164 Prep Date: 05/08/09 13:50 Sample ID: WG301911-01
Instrument ID: ICP-THERMO2 Run Date: 05/11/09 11:50 Prep Method: 3005A
File ID: T2.051109.115038 Analyst: EDA Method: 6010B
Workgroup (AAB#): WG301969 Matrix: Water Units: mg/L
Contract #: DACA56-94-D-0020 Cal ID: ICP-TH-11-MAY-09

Analytes	SDL	PQL	Concentration	Dilution	Qualifier
Aluminum, Total	0.0500	0.100	0.0500	1	U
Iron, Total	0.0250	0.100	0.0250	1	U

SDL Method Detection Limit
PQL Reporting/Practical Quantitation Limit
ND Analyte Not detected at or above reporting limit
* |Analyte concentration| > RL

Report Name: BLANK
PDF ID: 1388690
11-MAY-2009 13:19

Microbac Laboratories Inc.
LABORATORY CONTROL SAMPLE (LCS)

Login Number: L09050164 Analyst: EDA Prep Method: 3005A
Instrument ID: ICP-THERMO2 Matrix: Water Method: 6010B
Workgroup (AAB#): WG301969 Units: mg/L
QC Key: STD Lot #: STD27613

Sample ID: WG301911-02 LCS File ID: T2.051109.115643 Run Date: 05/11/2009 11:56
Sample ID: WG301911-03 LCS2 File ID: T2.051109.120236 Run Date: 05/11/2009 12:02

Analytes	LCS			LCS2			%RPD	%Rec Limits	RPD Lmt	Q
	Known	Found	% REC	Known	Found	% REC				
Aluminum, Total	5.00	5.23	105	5.00	5.25	105	0.399	85 - 115	20	
Iron, Total	2.00	2.10	105	2.00	2.10	105	0.114	85 - 115	20	

LCS_LCS2 - Modified 03/06/2008
PDF File ID: 1388691
Report generated: 05/11/2009 13:19

Microbac®

Microbac Laboratories Inc.
Serial Dilution Report

Login: L09050164 **Worknum:** WG301969
Instrument: ICP-THERMO2 **Method:** 6010B
Serial Dil: WG301969-02 **File ID:** T2.051109.122043 **Dil:** 5 **Units:** mg/L
Sample: L09050164-01 **File ID:** T2.051109.120829 **Dil:** 1

Analyte	Sample	Qual	Serial Dil	Qual	% Diff	Q
Aluminum	.149	X	ND	U		
Iron	.276	X	.269	F	2.54	

U = Result is below MDL.
F = Result is greater than or equal to MDL and less than the RL.
X = Result is greater than or equal to RL and less than 50 times the MDL.
E = %D exceeds control limit of 10% and initial sample result is greater than or equal to 50 times the MDL.

SERIAL_DIL - Modified 09/22/2008
PDF File ID: 1388686
05/11/2009 13:19

Microbac®

Microbac Laboratories Inc.
POST SPIKE REPORT

Sample Login ID: L09050164 **Worknum:** WG301969
Instrument ID: ICP-THERMO2 **Method:** 6010B
Post Spike ID: WG301969-01 **File ID:** T2.051109.121441 **Dil:** 1 **Units:** mg/L
Sample ID: L09050164-01 **File ID:** T2.051109.120829 **Dil:** 1 **Matrix:** Water

Analyte	Post Spike Result	C	Sample Result	C	Spike Added(SA)	% R	Control Limit %R	Q
ALUMINUM	5.34		0.149		5	104.1	75 - 125	
IRON	2.30		0.276		2	102.5	75 - 125	

N = % Recovery exceeds control limits
F = Result is between MDL and RL
U = Sample result is below MDL. A value of zero is used in the calculation

POST_SPIKE - Modified 03/06/2008
PDF File ID: 1388687
Report generated: 05/11/2009 13:19

Microbac Laboratories Inc.
Initial Calibration Summary

Login:	L09050164	Workgroup (AAB#):	WG301969
Analytical Method:	6010B	Instrument ID:	ICP-THERMO2
ICAL Worknum:	WG302018	Initial Calibration Date:	11-MAY-2009 11:02

	WG302018-01		WG302018-02		WG302018-03		WG302018-04		WG302018-05			
	Conc	INT	Conc	INT	Conc	INT	Conc	INT	Conc	INT	R	Q
ALUMINUM	0	0.000650	.1	0.000860	.2	0.00105	5	0.0239	10	0.0471	.999683	
IRON	0	0.0000200	.04	0.000250	.08	0.000480	2	0.0257	4	0.0511	.999858	

INT = Instrument intensity
R = Coefficient of correlation
Q = Data Qualifier
*** = Out of Compliance; R < 0.995**

INT_CAL_ICP - Modified 03/06/2008
PDF File ID: 1388693
Report generated: 11-MAY-2009 13:19

Microbac Laboratories Inc.
INITIAL CALIBRATION BLANK (ICB)

Login Number: L09050164
Instrument ID: ICP-THERMO2
File ID: T2.051109.111438
Workgroup (AAB#): WG301969
Matrix: WATER

Run Date: 05/11/2009
Run Time: 11:14
Analyst: EDA
Cal ID: ICP-THERI - 11-MAY-09

Sample ID: WG302018-07
Method: 6010
Units: mg/L

Analytes	MDL	RDL	Concentration	Qualifier
ALUMINUM	.05	.1	.05	U
IRON	.025	.1	.025	U

ICB - Modified 03/06/2008
PDF File ID: 1388695
Report generated 05/11/2009 13:19

Microbac

Microbac Laboratories Inc.
CONTINUING CALIBRATION BLANK (CCB)

00075895

Login Number: L09050164
Run Date: 05/11/2009
Sample ID: WG302018-11
Instrument ID: ICP-THERMO2
Run Time: 11:38
Method: 6010B
File ID: T2.051109.113830
Analyst: EDA
Units: mg/L
Workgroup (AAB#): WG301969
Cal ID: ICP-TH - 11-MAY-09
Matrix: WATER

Analytes	MDL	RDL	Concentration	Qualifier
Aluminum	0.0500	0.100	0.0500	U
Iron	0.0250	0.100	0.0250	U

U = Result is less than MDL.
F = Result is between MDL and RL.
* = Result is above RL.

CCB - Modified 03/05/2008
PDF File ID: 1388698
Report generated 05/11/2009 13:19

Microbac®

Microbac Laboratories Inc.
CONTINUING CALIBRATION BLANK (CCB)

00075896

Login Number: L09050164
Run Date: 05/11/2009
Sample ID: WG302018-13
Instrument ID: ICP-THERMO2
Run Time: 12:32
Method: 6010B
File ID: T2.051109.123237
Analyst: EDA
Units: mg/L
Workgroup (AAB#): WG301969
Cal ID: ICP-TH - 11-MAY-09
Matrix: WATER

Analytes	MDL	RDL	Concentration	Qualifier
Aluminum	0.0500	0.100	0.0500	U
Iron	0.0250	0.100	0.0250	U

U = Result is less than MDL.
F = Result is between MDL and RL.
* = Result is above RL.

CCB - Modified 03/05/2008
PDF File ID: 1388698
Report generated 05/11/2009 13:19

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Microbac Laboratories Inc.

INITIAL CALIBRATION VERIFICATION (ICV)

(Alternate Source)

00075897

Login Number: L09050164 Run Date: 05/11/2009 Sample ID: WG302018-06

Instrument ID: ICP-THERMO2 Run Time: 11:08 Method: 6010B

File ID: T2.051109.110848 Analyst: EDA Units: mg/L

Workgroup (AAB#): WG301969 Cal ID: ICP-TH - 11-MAY-09

QC Key: STD

Analyte		Expected	Found	%REC	LIMITS	Q
Aluminum		10	10.0	100	90 - 110	
Iron		4	4.08	102	90 - 110	

* Exceeds LIMITS Limit

ICV - Modified 03/06/2008

PDF File ID: 1388694

Report generated 05/11/2009 13:19

Microbac®

Microbac Laboratories Inc.
CONTINUING CALIBRATION VERIFICATION (CCV)

00075898

Login Number: L09050164
Run Date: 05/11/2009
Sample ID: WG302018-10
Instrument ID: ICP-THERMO2
Run Time: 11:32
Method: 6010B
File ID: T2.051109.113241
Analyst: EDA
QC Key: STD
Workgroup (AAB#): WG301969
Cal ID: ICP-TH - 11-MAY-09
Matrix: WATER

Analyte		Expected	Found	UNITS	%REC	LIMITS		Q
Aluminum		10.0	10.0	mg/L	100	90 - 110		
Iron		4.00	4.11	mg/L	103	90 - 110		

* Exceeds LIMITS Criteria

CCV - Modified 03/05/2008
PDF File ID: 1388697
Report generated 05/11/2009 13:19

Microbac®

Microbac Laboratories Inc.
CONTINUING CALIBRATION VERIFICATION (CCV)

00075899

Login Number: L09050164
Run Date: 05/11/2009
Sample ID: WG302018-12
Instrument ID: ICP-THERMO2
Run Time: 12:26
Method: 6010B
File ID: T2.051109.122648
Analyst: EDA
QC Key: STD
Workgroup (AAB#): WG301969
Cal ID: ICP-TH - 11-MAY-09
Matrix: WATER

Analyte		Expected	Found	UNITS	%REC	LIMITS		Q
Aluminum		10.0	10.0	mg/L	100	90 - 110		
Iron		4.00	4.03	mg/L	101	90 - 110		

* Exceeds LIMITS Criteria

CCV - Modified 03/05/2008
PDF File ID: 1388697
Report generated 05/11/2009 13:19

Microbac®

Microbac Laboratories Inc.
INTERFERENCE CHECK SAMPLES

Login number: L09050164
Instrument ID: ICP-THERMO2
Sol. A : WG302018-08 **File ID:** T2.051109.112044
Sol. AB : WG302018-09 **File ID:** T2.051109.112646

Workgroup (AAB#): WG301969
Method: 6010B
Units: mg/L
Matrix: Water

	Sol. A			Sol. AB			
ANALYTE	True	Found	%Recovery	True	Found	%Recovery	Q
Aluminum	250	246	98.4	250	252	101	
Iron	100	97.2	97.2	100	100	100	

NS = Not spiked
*** = Recovery of spiked element is outside acceptance limit of 80% - 120% of true value.**
 # = Result for unspiked element is outside the acceptance limits of (+/-) the project reporting limit (RL).

ICS - Modified 03/06/2008
PDF File ID: 1388696
Report generated 05/11/2009 13:19

2.1.2 Metals ICP-MS Data

2.1.2.1 Summary Data

LABORATORY REPORT

L09050164

05/12/09 14:14

Submitted By

Microbac Laboratories Inc.
158 Starlite Drive
Marietta , OH 45750
(740) 373 - 4071

For

Account Name: Shaw E & I, Inc.
ABB Lummus Biulding
3010 Briarpark Drive Suite 4N
Houston, TX 77042
Attention: Jennifer Hoang

Project Number: 2773.025
Project: Longhorn AAP
Site: LONGHORN AAP KARNACK TX

P.O. Number: 389869/ 390836(GWTP)

Sample Analysis Summary

Client ID	Lab ID	Method	Dilution	Date Received
49WW06-090507	L09050164-01	6020	5	08-MAY-09

Report Number: **L09050164**
Report Date : **May 12, 2009**

Sample Number: **L09050164-01**
Client ID: **49WW06-090507**
Matrix: **Water**
Workgroup Number: **WG301917**
Collect Date: **05/07/2009 13:40**
Sample Tag: **DL01**

PrePrep Method: **NONE**
Prep Method: **3015**
Analytical Method: **6020**
Analyst: **JYH**
Dilution: **5**
Units: **mg/L**

Instrument: **ELAN-ICP**
Prep Date: **05/08/2009 11:46**
Cal Date: **05/08/2009 12:35**
Run Date: **05/08/2009 16:46**
File ID: **EL.050809.164631**

Analyte	CAS. Number	Result	Qual	PQL	SDL
Arsenic, Total	7440-38-2	0.0178		0.00500	0.00125

2.1.2.2 QC Summary Data

Example 6020 Calculations
Perkin Elmer ELAN 6100

1.0 Initial Calibration (ICAL) Parameters
The system performs linear regression from data consisting of a blank and three standards.

2.0 Calculating the concentration (C) of an element in water using data from prep log, run log, and quantitation report (note:the data system performs this calculation automatically when correction factors have been entered):

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

Where:	**Example:**
Cs = Concentration computed by the data system (ug/L)	0.1
Vf = Final volume	100
Vi = Initial volume	40
D = Dilution factor as a multiplier (10X = 10)	1
Cx = Concentration of element in (ug/L)	0.25

3.0 Calculating the concentration (C) of an element in soil using data from prep log, run log, and quantitation report (note: the data system performs this calculation automatically when correction factors have been entered):

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

Where:	**Example:**
Cs = Concentration computed by the data system (ug/L)	0.1
Vf = Final volume	200
Vi = Initial volume	0.5
D = Dilution factor as a multiplier (10X = 10)	1
Cx = Concentration of element in (ug/kg)	40

4.0 Adjusting the concentration to dry weight:

$$Cdry = \frac{Cx \times 100}{Px}$$

Where:	**Example:**
Cx = Concentration calculated as received (wet basis)	40
Px = Percent solids of sample (%wt)	80
$Cdry$ = Concentration calculated as dry weight (ug/kg)	50

50 ug/kg = 0.050 mg/kg

Perkin Elmer ELAN ICP/MS

STANDARDS KEY

QC Std 1 - ICV
QC Std 2 - ICB
QC Std 3 - CRI - Soil
QC Std 4 - CRI - Water
QC Std 5 - ICSA
QC Std 6 - ICSAB
QC Std 7 - CCV
QC Std 8 - CCB

Calibration Solutions

Analyte	Stock Conc. (mg/L)	S1 (mg/L)	S2 (mg/L)	S3 (mg/L)	S4 (mg/L)
Al	10	0	0.0004	0.05	0.1
Sb	10	0	0.0004	0.05	0.1
As	10	0	0.0004	0.05	0.1
Ba	10	0	0.0004	0.05	0.1
Be	10	0	0.0004	0.05	0.1
Ca	1000	0	0.04	5	10
Cd	10	0	0.0004	0.05	0.1
Cr	10	0	0.0004	0.05	0.1
Co	10	0	0.0004	0.05	0.1
Cu	10	0	0.0004	0.05	0.1
Fe	1000	0	0.04	5	10
Pb	10	0	0.0004	0.05	0.1
Mg	1000	0	0.04	5	10
Mn	10	0	0.0004	0.05	0.1
Ni	10	0	0.0004	0.05	0.1
K	1000	0	0.04	5	10
Se	10	0	0.0004	0.05	0.1
Ag	10	0	0.0004	0.05	0.1
Na	1000	0	0.04	5	10
Tl	10	0	0.0004	0.05	0.1
V	10	0	0.0004	0.05	0.1
Zn	10	0	0.0004	0.05	0.1

Microbac Laboratories Inc.
Microwave Digestion Log

Workgroup: WG301900
Analyst: VC
Spike Analyst: VC
Run Date: 05/08/2009 11:46
Method: 3015

SOP: ME407 Revison 10
Spike Solution: STD30482
Spike Witness: REK
HNO3 Lot #: COA13859
Digest tubes Lot #: COA13830

	SAMPLE #	Type	Matrix	Initial Amount	Final Volume	Initial Vessel Wt	Final Vessel Wt	Spike Amount	Due Date
1	WG301900-02	BLANK	1	40 mL	100 mL	205.23 g	205.231 g		
2	WG301900-03	LCS	1	40 mL	100 mL	206.164 g	206.153 g	.25 mL	
3	L09050151-01	SAMP	1	40 mL	100 mL	207.633 g	207.622 g		05/18/09
4	L09050151-02	SAMP	1	40 mL	100 mL	206.147 g	206.138 g		05/18/09
5	L09050151-03	SAMP	1	40 mL	100 mL	206.033 g	206.023 g		05/18/09
6	L09050151-04	SAMP	1	40 mL	100 mL	206.872 g	206.857 g		05/18/09
7	L09050151-05	SAMP	1	40 mL	100 mL	209.01 g	208.995 g		05/18/09
8	L09050151-06	SAMP	1	40 mL	100 mL	206.497 g	206.483 g		05/18/09
9	L09050151-09	SAMP	1	40 mL	100 mL	205.221 g	205.215 g		05/18/09
10	L09050151-10	SAMP	1	40 mL	100 mL	206.746 g	206.743 g		05/18/09
11	L09050151-11	SAMP	1	40 mL	100 mL	205.713 g	205.705 g		05/18/09
12	L09050151-12	SAMP	1	40 mL	100 mL	205.942 g	205.912 g		05/18/09
13	WG301900-01	REF	1	40 mL	100 mL	206.766 g	206.738 g		
14	L09050164-01	SAMP	1	40 mL	100 mL	206.766 g	206.738 g		05/11/09
15	WG301900-04	MS	1	40 mL	100 mL	206.638 g	206.61 g	.25 mL	
16	WG301900-05	MSD	1	40 mL	100 mL	206.288 g	206.254 g	.25 mL	

Analyst: Vicki Collins

Reviewer:

MW_DIG - Modified 07/02/2008
PDF ID: 1387341
Report generated: 05/08/2009 14:25

Microbac®

Microbac Laboratories Inc.

Instrument Run Log

Instrument: ELAN-ICP Dataset: 050809A.REP
Analyst1: JYH Analyst2: N/A
Method: 6020 SOP: ME700 Rev: 5
Maintenance Log ID: 28661

Calibration Std: STD32560 ICV/CCV Std: STD32562 Post Spike: STD27580
ICSA: STD32228 ICSAB: STD32229 Int. Std: STD32010

Workgroups: 301899,301908,301917

Comments:

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
1	EL.050809.121228	Blank	Blank		1		05/08/09 12:12
2	EL.050809.121811	WG301919-01	Calibration Point		1		05/08/09 12:18
3	EL.050809.122354	WG301919-02	Calibration Point		1		05/08/09 12:23
4	EL.050809.122938	WG301919-03	Calibration Point		1		05/08/09 12:29
5	EL.050809.123523	WG301919-04	Calibration Point		1		05/08/09 12:35
6	EL.050809.124108	WG301919-05	Initial Calibration Verification		1		05/08/09 12:41
7	EL.050809.124803	WG301919-06	Initial Calib Blank		1		05/08/09 12:48
8	EL.050809.125458	WG301919-07	CRQL Check Solid		1		05/08/09 12:54
9	EL.050809.130157	WG301919-08	CRQL Check Water		1		05/08/09 13:01
10	EL.050809.130855	WG301919-09	Interference Check		1		05/08/09 13:08
11	EL.050809.131552	WG301919-10	Interference Check		1		05/08/09 13:15
12	EL.050809.132248	WG301919-11	CCV		1		05/08/09 13:22
13	EL.050809.132942	WG301919-12	CCB		1		05/08/09 13:29
14	EL.050809.133615	WG301886-01	Method/Prep Blank	.5/200	1		05/08/09 13:36
15	EL.050809.134228	WG301886-02	Laboratory Control S	.5/200	1		05/08/09 13:42
16	EL.050809.134842	L09050019-08	MDL-1	.5/200	1		05/08/09 13:48
17	EL.050809.135455	L09050019-09	MDL-2	.5/200	1		05/08/09 13:54
18	EL.050809.140109	L09050019-10	MDL-3	.5/200	1		05/08/09 14:01
19	EL.050809.140724	L09050019-11	MDL-4	.5/200	1		05/08/09 14:07
20	EL.050809.141339	L09050019-12	MDL-5	.5/200	1		05/08/09 14:13
21	EL.050809.141954	L09050019-13	MDL-6	.5/200	1		05/08/09 14:19
22	EL.050809.142610	L09050019-14	MDL-7	.5/200	1		05/08/09 14:26
23	EL.050809.143245	WG301919-13	CCV		1		05/08/09 14:32
24	EL.050809.143940	WG301919-14	CCB		1		05/08/09 14:39
25	EL.050809.144614	WG301898-01	Method/Prep Blank	40/100	1		05/08/09 14:46
26	EL.050809.145230	L09050032-01	DOC-1	40/100	1		05/08/09 14:52
27	EL.050809.145847	L09050032-02	DOC-2	40/100	1		05/08/09 14:58
28	EL.050809.150502	L09050032-03	DOC-3	40/100	1		05/08/09 15:05
29	EL.050809.151116	L09050032-04	DOC-4	40/100	1		05/08/09 15:11
30	EL.050809.151750	WG301919-15	CCV		1		05/08/09 15:17
31	EL.050809.152445	WG301919-16	CCB		1		05/08/09 15:24
32	EL.050809.153400	IDL1	IDL1		1		05/08/09 15:34
33	EL.050809.154014	IDL2	IDL2		1		05/08/09 15:40
34	EL.050809.154628	IDL3	IDL3		1		05/08/09 15:46
35	EL.050809.155243	IDL4	IDL4		1		05/08/09 15:52
36	EL.050809.160120	IDL5	IDL5		1		05/08/09 16:01
37	EL.050809.160736	IDL6	IDL6		1		05/08/09 16:07

Page: 1 Approved: May 11, 2009

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Instrument Run Log

Instrument: ELAN-ICP Dataset: 050809A.REP
Analyst1: JYH Analyst2: N/A
Method: 6020 SOP: ME700 Rev: 5
Maintenance Log ID: 28661

Calibration Std: STD32560 ICV/CCV Std: STD32562 Post Spike: STD27580
ICSA: STD32228 ICSAB: STD32229 Int. Std: STD32010

Workgroups: 301899,301908,301917

Comments:

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
38	EL.050809.161352	IDL7	IDL7		1		05/08/09 16:13
39	EL.050809.162028	WG301919-17	QC Std 7		1		05/08/09 16:20
40	EL.050809.162723	WG301919-18	QC Std 8		1		05/08/09 16:27
41	EL.050809.163357	WG301900-02	Method/Prep Blank	40/100	1		05/08/09 16:33
42	EL.050809.164014	WG301900-03	Laboratory Control S	40/100	1		05/08/09 16:40
43	EL.050809.164631	WG301900-01	Reference Sample		5	L09050164-01	05/08/09 16:46
44	EL.050809.165246	WG301900-04	Matrix Spike	40/100	5	L09050164-01	05/08/09 16:52
45	EL.050809.165900	WG301900-05	Matrix Spike Duplica	40/100	5	L09050164-01	05/08/09 16:59
46	EL.050809.170515	L09050151-01	TW-15D	40/100	1		05/08/09 17:05
47	EL.050809.171129	WG301917-01	Post Digestion Spike		1	L09050151-01	05/08/09 17:11
48	EL.050809.171744	WG301917-02	Serial Dilution		5	L09050151-01	05/08/09 17:17
49	EL.050809.172420	WG301919-19	CCV		1		05/08/09 17:24
50	EL.050809.173115	WG301919-20	CCB		1		05/08/09 17:31
51	EL.050809.173749	L09050151-02	TW-15D	40/100	1		05/08/09 17:37
52	EL.050809.174405	L09050151-03	TW-15S	40/100	1		05/08/09 17:44
53	EL.050809.175021	L09050151-04	TW-15S	40/100	1		05/08/09 17:50
54	EL.050809.175638	L09050151-05	TW-58R	40/100	1		05/08/09 17:56
55	EL.050809.180255	L09050151-06	TW-58R	40/100	1		05/08/09 18:02
56	EL.050809.180912	L09050151-09	EQUIP RINSE	40/100	1		05/08/09 18:09
57	EL.050809.181530	L09050151-10	EQUIP RINSE	40/100	1		05/08/09 18:15
58	EL.050809.182146	L09050151-11	SL22	40/100	1		05/08/09 18:21
59	EL.050809.182801	L09050151-12	SL22	40/100	1		05/08/09 18:28
60	EL.050809.183436	WG301919-21	CCV		1		05/08/09 18:34
61	EL.050809.184131	WG301919-22	CCB		1		05/08/09 18:41

Page: 2 Approved: May 11, 2009

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Data Checklist

Date: 08-MAY-2009
Analyst: JYH
Analyst: NA
Method: 6020
Instrument: ELAN
Curve Workgroup: 301919
Runlog ID: 27989
Analytical Workgroups: 301899,301908,301917

Calibration/Linearity	X
ICV/CCV	X
ICB/CCB	X
ICSA/ICSAB	X
CRI	X
Blank/LCS	X
MS/MSD	X
Post Spike/Serial Dilution	X
Upload Results	X
Data Qualifiers	X
Generate PDF Instrument Data	X
Sign/Annotate PDF Data	X
Upload Curve Data	X
Workgroup Forms	
Case Narrative	019,032151,164
Client Forms	X
Level X	
Level 3	164
Level 4	151
Check for compliance with method and project specific requirements	
Check the completeness of reported information	
Check the information for the report narrative	
Primary Reviewer	JYH
Secondary Reviewer	
Comments	

Primary Reviewer: Secondary Reviewer:

CHECKLIST1 - Modified 03/05/2008
Generated: MAY-11-2009 10:46:34

Microbac Laboratories Inc.

00075912

HOLDING TIMES
EQUIVALENT TO AFCEE FORM 9

Analytical Method: 6020 AAB#: WG301917

Login Number: L09050164

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
49WW06-090507	05/07/09	05/08/09	05/08/09	180	0.921	05/08/09	180	0.208	

* EXT = SEE PROJECT QAPP REQUIREMENTS
*ANAL = SEE PROJECT QAPP REQUIREMENTS

HOLD_TIMES - Modified 03/06/2008
PDF File ID: 1387980
Report generated 05/11/2009 08:48

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METHOD BLANK SUMMARY

Login Number: L09050164
Blank File ID: EL.050809.163357
Prep Date: 05/08/09 11:46
Analyzed Date: 05/08/09 16:33
Analyst: JYH

Work Group: WG301917
Blank Sample ID: WG301900-02
Instrument ID: ELAN-ICP
Method: 6020

This Method Blank Applies To The Following Samples:

Client ID	Lab Sample ID	Lab File ID	Time Analyzed	TAG
LCS	WG301900-03	EL.050809.164014	05/08/09 16:40	01
49WW06-090507	L09050164-01	EL.050809.164631	05/08/09 16:46	DL01

Report Name: BLANK_SUMMARY
PDF File ID: 1387981
Report generated 05/11/2009 08:48

Microbac Laboratories Inc.

METHOD BLANK REPORT

Login Number: L09050164 Prep Date: 05/08/09 11:46 Sample ID: WG301900-02
Instrument ID: ELAN-ICP Run Date: 05/08/09 16:33 Prep Method: 3015
File ID: EL.050809.163357 Analyst: JYH Method: 6020
Workgroup (AAB#): WG301917 Matrix: Water Units: mg/L
Contract #: DACA56-94-D-0020 Cal ID: ELAN-I-08-MAY-09

Analytes	SDL	PQL	Concentration	Dilution	Qualifier
Arsenic, Total	0.000250	0.00100	0.000250	1	U

SDL Method Detection Limit
PQL Reporting/Practical Quantitation Limit
ND Analyte Not detected at or above reporting limit
* |Analyte concentration| > RL

Report Name: BLANK
PDF ID: 1387982
11-MAY-2009 08:48

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Microbac Laboratories Inc.
LABORATORY CONTROL SAMPLE (LCS)

Login Number: L09050164 Run Date: 05/08/2009 Sample ID: WG301900-03
Instrument ID: ELAN-ICP Run Time: 16:40 Prep Method: 3015
File ID: EL.050809.164014 Analyst: JYH Method: 6020
Workgroup (AAB#): WG301917 Matrix: Water Units: mg/L
QC Key: STD Lot#: STD30482 Cal ID: ELAN-I-08-MAY-09

Analytes	Expected	Found	% Rec	LCS Limits	Q
Arsenic, Total	0.0625	0.0616	98.5	80 - 120	

LCS - Modified 03/06/2008
PDF File ID: 1387983
Report generated: 05/11/2009 08:48

Microbac Laboratories Inc.

MATRIX SPIKE AND MATRIX SPIKE DUP (MS/MSD)

Loginnum: L09050164 Cal ID: ELAN-ICP- Worknum: WG301917

Instrument ID: ELAN-ICP Contract #: DACA56-94-D-0020 Method: 6020

Parent ID: WG301900-01 File ID: EL.050809.164631 Dil: 5 Matrix: WATER

Sample ID: WG301900-04 MS File ID: EL.050809.165246 Dil: 5 Units: mg/L

Sample ID: WG301900-05 MSD File ID: EL.050809.165900 Dil: 5

Analyte	Parent	MS Spiked	MS Found	MS %Rec	MSD Spiked	MSD Found	MSD %Rec	%RPD	%Rec Limits	RPD Limit	Q
Arsenic, Total	0.0178	0.0625	0.0774	95.3	0.0625	0.0802	99.9	3.63	75 - 125	20	

* FAILS %REC LIMIT

FAILS RPD LIMIT

NOTE: This is an internal quality control sample.

WG_MS_MSD_DRYWT - Modified 03/07/2008

PDF File ID: 1387984

Report generated 05/11/2009 08:48

Microbac Laboratories Inc.
Serial Dilution Report

Login: L09050164 **Worknum:** WG301917
Instrument: ELAN-ICP **Method:** 6020
Serial Dil: WG301917-02 **File ID:** EL.050809.171744 **Dil:** 5 **Units:** ug/L
Sample: L09050151-01 **File ID:** EL.050809.170515 **Dil:** 1

Analyte	Sample	Qual	Serial Dil	Qual	% Diff	Q
Arsenic	.729	X	1.16	F	59.10	

U = Result is below MDL.
F = Result is greater than or equal to MDL and less than the RL.
X = Result is greater than or equal to RL and less than 100 times the MDL.
E = %D exceeds control limit of 10% and initial sample result is greater than or equal to 100 times the MDL.

SERIAL_DIL - Modified 09/22/2008
PDF File ID: 1387978
05/11/2009 08:48

Microbac Laboratories Inc.
POST SPIKE REPORT

Sample Login ID: L09050164 **Worknum:** WG301917
Instrument ID: ELAN-ICP **Method:** 6020
Post Spike ID: WG301917-01 **File ID:** EL.050809.171129 **Dil:** 1 **Units:** ug/L
Sample ID: L09050151-01 **File ID:** EL.050809.170515 **Dil:** 1 **Matrix:** Water

Analyte	Post Spike Result	C	Sample Result	C	Spike Added(SA)	% R	Control Limit %R	Q
ARSENIC	47.6		0.729		50	93.7	75 - 125	

N = % Recovery exceeds control limits
F = Result is between MDL and RL
U = Sample result is below MDL. A value of zero is used in the calculation

POST_SPIKE - Modified 03/06/2008
PDF File ID: 1387979
Report generated: 05/11/2009 08:48

Microbac Laboratories Inc.
Initial Calibration Summary

Login:	L09050164	Workgroup (AAB#):	WG301917
Analytical Method:	6020	Instrument ID:	ELAN-ICP
ICAL Worknum:	WG301919	Initial Calibration Date:	08-MAY-2009 12:35

	WG301919-01		WG301919-02		WG301919-03		WG301919-04			
	Conc	INT	Conc	INT	Conc	INT	Conc	INT	R	Q
ARSENIC	0	-584	.4	483	50	133000	100	267000	1	

INT = Instrument intensity
R = Coefficient of correlation
Q = Data Qualifier
*** = Out of Compliance; R < 0.995**

INT_CAL_ICP - Modified 03/06/2008
PDF File ID: 1387988
Report generated: 11-MAY-2009 08:48

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INITIAL CALIBRATION BLANK (ICB)

Login Number: L09050164
Run Date: 05/08/2009
Sample ID: WG301919-06
Instrument ID: ELAN-ICP
Run Time: 12:48
Method: 6020
File ID: EL.050809.124803
Analyst: JYH
Units: ug/L
Workgroup (AAB#): WG301917
Cal ID: ELAN-ICP - 08-MAY-09
Matrix: WATER

Analytes	MDL	RDL	Concentration	Qualifier
ARSENIC	.1	.4	.1	U

ICB - Modified 03/06/2008
PDF File ID: 1387990
Report generated 05/11/2009 08:48

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Microbac Laboratories Inc.
CONTINUING CALIBRATION BLANK (CCB)

00075921

Login Number: L09050164
Run Date: 05/08/2009
Sample ID: WG301919-12
Instrument ID: ELAN-ICP
Run Time: 13:29
Method: 6020
File ID: EL.050809.132942
Analyst: JYH
Units: ug/L
Workgroup (AAB#): WG301917
Cal ID: ELAN-I - 08-MAY-09
Matrix: WATER

Analytes	MDL	RDL	Concentration	Qualifier
Arsenic	0.100	0.400	0.100	U

U = Result is less than MDL.
F = Result is between MDL and RL.
* = Result is above RL.

CCB - Modified 03/05/2008
PDF File ID: 1387993
Report generated 05/11/2009 08:48

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CONTINUING CALIBRATION BLANK (CCB)

00075922

Login Number: L09050164
Run Date: 05/08/2009
Sample ID: WG301919-16
Instrument ID: ELAN-ICP
Run Time: 15:24
Method: 6020
File ID: EL.050809.152445
Analyst: JYH
Units: ug/L
Workgroup (AAB#): WG301917
Cal ID: ELAN-I - 08-MAY-09
Matrix: WATER

Analytes	MDL	RDL	Concentration	Qualifier
Arsenic	0.100	0.400	0.100	U

U = Result is less than MDL.
F = Result is between MDL and RL.
* = Result is above RL.

CCB - Modified 03/05/2008
PDF File ID: 1387993
Report generated 05/11/2009 08:48

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CONTINUING CALIBRATION BLANK (CCB)

00075923

Login Number: L09050164
Run Date: 05/08/2009
Sample ID: WG301919-20
Instrument ID: ELAN-ICP
Run Time: 17:31
Method: 6020
File ID: EL.050809.173115
Analyst: JYH
Units: ug/L
Workgroup (AAB#): WG301917
Cal ID: ELAN-I - 08-MAY-09
Matrix: WATER

Analytes	MDL	RDL	Concentration	Qualifier
Arsenic	0.100	0.400	0.100	F

U = Result is less than MDL.
F = Result is between MDL and RL.
* = Result is above RL.

CCB - Modified 03/05/2008
PDF File ID: 1387993
Report generated 05/11/2009 08:48

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INITIAL CALIBRATION VERIFICATION (ICV)
(Alternate Source)

Login Number: L09050164
Run Date: 05/08/2009
Sample ID: WG301919-05
Instrument ID: ELAN-ICP
Run Time: 12:41
Method: 6020
File ID: EL.050809.124108
Analyst: JYH
Units: ug/L
Workgroup (AAB#): WG301917
Cal ID: ELAN-I - 08-MAY-09
QC Key: STD

Analyte		Expected	Found	%REC	LIMITS	Q
Arsenic		50	49.7	99.3	90 - 110	

* Exceeds LIMITS Limit

ICV - Modified 03/06/2008
PDF File ID: 1387989
Report generated 05/11/2009 08:48

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CONTINUING CALIBRATION VERIFICATION (CCV)

00075925

Login Number: L09050164
Run Date: 05/08/2009
Sample ID: WG301919-11
Instrument ID: ELAN-ICP
Run Time: 13:22
Method: 6020
File ID: EL.050809.132248
Analyst: JYH
QC Key: STD
Workgroup (AAB#): WG301917
Cal ID: ELAN-I - 08-MAY-09
Matrix: WATER

Analyte		Expected	Found	UNITS	%REC	LIMITS		Q
Arsenic		50.0	49.6	ug/L	99.3	90 - 110		

* Exceeds LIMITS Criteria

CCV - Modified 03/05/2008
PDF File ID: 1387992
Report generated 05/11/2009 08:48

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CONTINUING CALIBRATION VERIFICATION (CCV)

00075926

Login Number: L09050164
Run Date: 05/08/2009
Sample ID: WG301919-15
Instrument ID: ELAN-ICP
Run Time: 15:17
Method: 6020
File ID: EL.050809.151750
Analyst: JYH
QC Key: STD
Workgroup (AAB#): WG301917
Cal ID: ELAN-I - 08-MAY-09
Matrix: WATER

Analyte		Expected	Found	UNITS	%REC	LIMITS		Q
Arsenic		50.0	49.8	ug/L	99.6	90 - 110		

* Exceeds LIMITS Criteria

CCV - Modified 03/05/2008
PDF File ID: 1387992
Report generated 05/11/2009 08:48

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Microbac Laboratories Inc.
CONTINUING CALIBRATION VERIFICATION (CCV)

00075927

Login Number: L09050164
Run Date: 05/08/2009
Sample ID: WG301919-19
Instrument ID: ELAN-ICP
Run Time: 17:24
Method: 6020
File ID: EL.050809.172420
Analyst: JYH
QC Key: STD
Workgroup (AAB#): WG301917
Cal ID: ELAN-I - 08-MAY-09
Matrix: WATER

Analyte		Expected	Found	UNITS	%REC	LIMITS		Q
Arsenic		50.0	48.3	ug/L	96.7	90 - 110		

* Exceeds LIMITS Criteria

CCV - Modified 03/05/2008
PDF File ID: 1387992
Report generated 05/11/2009 08:48

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Microbac Laboratories Inc.
INTERFERENCE CHECK SAMPLES

Login number: L09050164
Instrument ID: ELAN-ICP
Sol. A : WG301919-09 **File ID:** EL.050809.130855
Sol. AB : WG301919-10 **File ID:** EL.050809.131552

Workgroup (AAB#): WG301917
Method: 6020
Units: ug/L
Matrix: Water

	Sol. A			Sol. AB			
ANALYTE	True	Found	%Recovery	True	Found	%Recovery	Q
Arsenic	NS	0.000100	NS	100	106	106	

NS = Not spiked
*** = Recovery of spiked element is outside acceptance limit of 80% - 120% of true value.**
 # = Result for unspiked element is outside the acceptance limits of (+/-) the project reporting limit (RL).

ICS - Modified 03/06/2008
PDF File ID: 1387991
Report generated 05/11/2009 08:48

Microbac Laboratories Inc.

INTERNAL STANDARD REPORT

Login: L09050164 **Analytical Method:** 6020
Analytical Workgroup: WG301917 **Matrix:** 1
Instrument: ELAN-ICP **Analyst:** JYH
ICAL Date: 08-MAY-2009 12:18

			BISMUTH	GERMANIUM	INDIUM	TERBIUM
Sample	Type	Run Date	% Rec	% Rec	% Rec	% Rec
L09050151-01	SAMP	08-MAY-2009 17:05	87.314	91.555	85.011	90.138
L09050164-01	SAMP	08-MAY-2009 16:46	93.747	97.385	93.217	95.981
WG301900-01	REF	08-MAY-2009 16:46	93.747	97.385	93.217	95.981
WG301900-02	BLANK	08-MAY-2009 16:33	101.89	99.886	95.885	96.912
WG301900-03	LCS	08-MAY-2009 16:40	98.096	99.348	96.375	96.929
WG301900-04	MS	08-MAY-2009 16:52	95.403	100.041	92.743	96.766
WG301900-05	MSD	08-MAY-2009 16:59	92.584	101.268	92.896	96.37
WG301917-01	PSPK	08-MAY-2009 17:11	87.669	89.688	84.921	91.241
WG301917-02	SERIAL	08-MAY-2009 17:17	101.746	100.97	92.994	97.642
WG301919-05	ICV	08-MAY-2009 12:41	101.533	100.822	100.069	100.949
WG301919-06	ICB	08-MAY-2009 12:48	99.169	99.081	99.503	100.183
WG301919-11	CCV	08-MAY-2009 13:22	100.889	99.508	98.085	98.489
WG301919-12	CCB	08-MAY-2009 13:29	99.14	97.723	97.21	98.363
WG301919-15	CCV	08-MAY-2009 15:17	98.249	101.937	99.258	98.783
WG301919-16	CCB	08-MAY-2009 15:24	101.527	102.625	99.816	100.871
WG301919-19	CCV	08-MAY-2009 17:24	100.779	99.552	92.361	96.129
WG301919-20	CCB	08-MAY-2009 17:31	102.777	101.814	96.22	98.259

Acceptance criteria: 30% - 120%
Underlined recoveries are out of range

INT_STD_ICPMS - Modified 03/05/2008
PDF File ID: 1387987
Report generated: 05/11/2009 08:48

Microbac Laboratories Inc.
LINEAR RANGE (QUARTERLY)

Login Number: L09050164 **Date:** 04/01/2009
Insturment ID: ELAN-ICP **Method:** 6020

Analyte	Integration Time (Sec.)	Concentration (ug/L)
Antimony	1.00	100.0
Arsenic	1.00	100.0
Barium	1.00	100.0
Cadmium	1.00	100.0
Chromium	1.00	100.0
Cobalt	1.00	100.0
Copper	1.00	100.0
Lead	1.00	100.0
Manganese	1.00	100.0
Nickel	1.00	100.0
Selenium	1.00	100.0
Silver	1.00	100.0
Thallium	1.00	100.0
Vanadium	1.00	100.0
Zinc	1.00	100.0

Comments:
All analytes passed acceptance criteria at the specified concentration.

LINEAR_RANGE - Modified 03/06/2008
PDF File ID: 1387985
Report generated: 05/11/2009 08:48

2.2 General Chemistry Data

2.2.1 Nitrate Data

2.2.1.1 Summary Data

LABORATORY REPORT

L09050164

05/12/09 14:14

Submitted By

Microbac Laboratories Inc.
158 Starlite Drive
Marietta , OH 45750
(740) 373 - 4071

For

Account Name: Shaw E & I, Inc.
ABB Lummus Biulding
3010 Briarpark Drive Suite 4N
Houston, TX 77042
Attention: Jennifer Hoang

Project Number: 2773.025
Project: Longhorn AAP
Site: LONGHORN AAP KARNACK TX

P.O. Number: 389869/ 390836(GWTP)

Sample Analysis Summary

Client ID	Lab ID	Method	Dilution	Date Received
49WW04-090507	L09050164-02	353.2	1	08-MAY-09

Report Number: **L09050164**
Report Date : **May 12, 2009**

00075936

Sample Number: **L09050164-02**
Client ID: **49WW04-090507**
Matrix: **Water**
Workgroup Number: **WG301890**
Collect Date: **05/07/2009 16:00**

PrePrep Method: **NONE**
Prep Method: **353.2**
Analytical Method: **353.2**
Analyst: **DIH**
Dilution: **1**
Units: **mg/L**

Instrument: **SMARTCHEM**
Prep Date: **05/08/2009 14:05**
Cal Date: **05/08/2009 13:15**
Run Date: **05/08/2009 14:05**
File ID: **SC09050816355401**

Analyte	CAS. Number	Result	Qual	PQL	SDL
Nitrogen, Nitrate-Nitrite		0.0970		0.0500	0.0250

2.2.1.2 QC Summary Data

Example Nitrate Calculations

(absorbance - intercept)/(slope * dilution) = mg/L

where:

absorbance = reading from the spectrophotometer
intercept = calculated from calibration standard absorbencies
slope = calculated from calibration standard absorbencies
dilution = dilution of the distillate in decimal form (ex. 1/5 dilution = 0.2)

Microbac Laboratories Inc.

Data Checklist

Date: 09-MAY-2009
Analyst: DIH
Analyst: NA
Method: NO3
Instrument: SC
Curve Workgroup: NA
Runlog ID:
Analytical Workgroups: WG301890 WG301891

Calibration/Linearity	5/8/2009
Second Source Check	X
ICV/CCV (std)	X
ICB/CCB	X
Blank	X
LCS/LCS Dup	X
MS/MSD	X
Duplicate	X
Upload Results	X
Client Forms	X
QC Violation Sheet	
Case Narratives	X
Signed Raw Data	X
STD/LCS on benchsheet	X
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	DIH
Secondary Reviewer	DR
Comments	

Primary Reviewer:
09-MAY-2009

Secondary Reviewer:
10-MAY-2009

CHECKLIST1 - Modified 03/05/2008
Generated: MAY-10-2009 18:10:50

Microbac Laboratories Inc.

00075940

HOLDING TIMES
EQUIVALENT TO AFCEE FORM 9

Analytical Method: 353.2 AAB#: WG301890

Login Number: L09050164

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
49WW04-090507	05/07/09	05/08/09	05/08/09	28	0.920	05/08/09	28	0.920	

* EXT = SEE PROJECT QAPP REQUIREMENTS
*ANAL = SEE PROJECT QAPP REQUIREMENTS

HOLD_TIMES - Modified 03/06/2008
PDF File ID: 1387832
Report generated 05/08/2009 16:46

Microbac®

METHOD BLANK SUMMARY

Login Number: L09050164
Blank File ID: SC09050816330801
Prep Date: 05/08/09 14:05
Analyzed Date: 05/08/09 14:05
Analyst: DIH

Work Group: WG301890
Blank Sample ID: WG301890-01
Instrument ID: SMARTCHEM
Method: 353.2

This Method Blank Applies To The Following Samples:

Client ID	Lab Sample ID	Lab File ID	Time Analyzed	TAG
LCS	WG301890-02	SC09050816331501	05/08/09 14:05	
49WW04-090507	L09050164-02	SC09050816355401	05/08/09 14:05	
DUP	WG301890-05	SC09050816333601	05/08/09 14:05	
LCS2	WG301890-03	SC09050816332101	05/08/09 14:05	

Report Name: BLANK_SUMMARY
PDF File ID: 1387833
Report generated 05/08/2009 16:46

Microbac Laboratories Inc.

METHOD BLANK REPORT

Login Number: L09050164 Prep Date: 05/08/09 14:05 Sample ID: WG301890-01
Instrument ID: SMARTCHEM Run Date: 05/08/09 14:05 Prep Method: 353.2
File ID: SC09050816330801 Analyst: DIH Method: 353.2
Workgroup (AAB#): WG301890 Matrix: Water Units: mg/L
Contract #: DACA56-94-D-0020 Cal ID: SMARTC-08-MAY-09

Analytes	SDL	PQL	Concentration	Dilution	Qualifier
Nitrogen, Nitrate-Nitrite	0.0250	0.0500	0.0250	1	U

SDL Method Detection Limit
PQL Reporting/Practical Quantitation Limit
ND Analyte Not detected at or above reporting limit
* |Analyte concentration| > RL

Report Name: BLANK
PDF ID: 1387834
08-MAY-2009 16:46

Microbac®

Microbac Laboratories Inc.
LABORATORY CONTROL SAMPLE (LCS)

Login Number: L09050164 Analyst: DIH Prep Method: 353.2
Instrument ID: SMARTCHEM Matrix: Water Method: 353.2
Workgroup (AAB#): WG301890 Units: mg/L
QC Key: STD Lot #: STD32552

Sample ID: WG301890-02 LCS File ID: SC09050816331501 Run Date: 05/08/2009 14:05
Sample ID: WG301890-03 LCS2 File ID: SC09050816332101 Run Date: 05/08/2009 14:05

Analytes	LCS			LCS2			%RPD	%Rec Limits	RPD Lmt	Q
	Known	Found	% REC	Known	Found	% REC				
Nitrogen, Nitrate-Nitrite	1.00	0.996	99.6	1.00	0.942	94.2	5.57	90 - 110	15	

LCS_LCS2 - Modified 03/06/2008
PDF File ID: 1387835
Report generated: 05/08/2009 16:46

2.2.1.3 Raw Data

WORKGROUP: WG301890

301891

SMARTCHEM RUN LOG

Daily Check

- [x] Lamp On
- [x] Probe Rinse Full
- [x] DI Water > ½ Full
- [x] Wash Solution > ½ Full
- [x] NO3 Reagent bottle connected / purged
- [x] NO3 pH adj to pH 5-9
- [x] WBL Run
- [x] Reagents Full
- [x] Dilution H_2O Full
- [x] Waste Container Check

Cd coil cleaned after Run 1

1) **Workgroup** 301890
Plan # 20090508004
2) **Workgroup** _____
Plan # _____
3) **Workgroup** 301891
Plan # 20090508005

Analyte		1	2	3
		NO3		
User Prepared Curve				
SC Prepared Curve				
Position				
1-1	ICV 1.5			
1-2	BLK			
1-3	LCS 1			
1-4	LCSDUP			
1-5	NO2 1			
1-6	05-164-02			
1-7	05-108-01			
1-8	03			
1-9	05			
1-10	07			
1-11	09			
1-12	11 ~~10~~			
1-13	13			
1-14	15			
1-15	~~05~~ 17			
1-16	19			
1-17	05-125-04			
1-18	06	1/4		color
1-19	08			
1-20	10	1/10		color
1-21	DUP			
1-22	MS			
2-1	MSD			
2-2	BLK			
2-3	LCS			

1-1 ICV Run 2

NOTES:
* Run NO2 std on NO3 runs
* LCS/LCS Dup all parameters
* MS/MSD (NO3, TKN, NH3)

Analyte		1	2	3	
Position					
2-4	LCSDUP				
2-5	~~05-125-12~~	~~1/4~~	~~dch~~	color	NO2
2-6	05-135-01	1/10	~~AUTO dil~~	~~1/4 dil~~	
2-7	03				
2-8	05				
2-9	07				
2-10	09				
2-11	11				
2-12	13				
2-13	15				
2-14	05-141-01	1/5		color	
2-15	02	↓		↓	
2-16	03				
2-17	05-152-01				
2-18	02				
2-19	DUP				
2-20	MS				
2-21	MSD				
2-22	04-170-02	1/15			
2-23 1	05-165-02	1/10	color		2-3
2-24 2	04	1/50	color		4
2-25 3	06	1/25	color		5
2-26 4	08	1/10	cntrfg		6
3-1 5	05-125-12	1/4	color		2-1
3-2 6	CC				2-2
					2-7
					2-8

DCN#79368

Kjeanna Roberts

Approved: May 10, 2009

WORKGROUP: WG301890

SMARTCHEM RUN LOG

Analyte		1	2	3
Position				
3-3				
3-4				
3-5				
3-6				
3-7				
3-8				
3-9				
3-10				
3-11				
3-12				
3-13				
3-14				
3-15				

Analyte		1	2	3
Position				
3-16				
3-17				
3-18				
3-19				
3-20				
3-21				
3-22				
3-23				
3-24				
3-25				
3-26				
3-27				
3-28				

☐Chloride EPA 325.2/SM 4500-Cl⁻ E
☐Sulfate EPA 375.4
☐Alkalinity EPA 310.2
☑Nitrate-Nitrite EPA 353.2/SM 4500-NO3 F

☐Ammonia EPA 350.1/SM 4500-NH3 B
☐TKN EPA 351.2
☐Phos EPA 365.4

Analyte	NO3		
SOP & Revision	K3532		
Curve Stock (SC made)	std 32554		
Curve ID (user made)			NO2
ICV	std 32551		std 32555
CCV	std 32553		
LCS	std 32552		
MS	std 30016 Dilution 0.1/5(25) = 0.5		

Comments:

Analyst: Deanna Hesson Date: 5/8/09

05-165's diluted due to color and interference. The samples "kill" the Cd coil.

DCN#79368

Deanna Roberts

Approved: May 10, 2009

MICROBAC (OVD)
SMARTCHEM REPORT
UNITS: MG/L

Method : WNO3 -Unit [mg/L] - EPA 353.2 Nitrate-NitrIte

Smp#/[Dil Fact]	Sample ID	Conc	OD	%Recovery/RPD	Flag		Analysis Time
DIL-1	RBL	0.000	0.0668	0.00			1:53:48 PM
DIL-1	RBL	0.000	0.0125	0.00			1:55:00 PM
DIL-1	RBL	0.000	0.0163	0.00			1:56:12 PM
DIL-1	Std-1	0.000	-0.0031	0.00	INV		1:57:24 PM
SR5-1	Std-2	0.040	0.0149	0.00			1:58:36 PM
SR5-2	Std-3	0.100	0.0305	0.00			1:59:48 PM
SR5-3	Std-4	0.500	0.1694	0.00			2:01:00 PM
SR5-4	Std-5	1.000	0.3457	0.00			2:02:12 PM
ST-1	Std-6	2.000	0.7112	0.00			2:03:24 PM
1	ICV 1.5	1.440	0.5081	0.00			2:04:36 PM
2	WG301890-01 BLANK	0.008	-0.0017	0.00	INV		2:05:48 PM
3	WG301890-02 LCS	0.996	0.3499	0.00			2:07:00 PM
4	WG301890-03 LCSDUP	0.942	0.3309	0.00			2:08:12 PM
5	NO2	0.925	0.3249	0.00			2:09:24 PM
6	L09050164-02	0.097	0.0300	0.00		NO2	2:10:36 PM
7	L09050108-01	0.136	0.0439	0.00		0	2:11:48 PM
8	L09050108-03	0.326	0.1115	0.00		0	2:13:00 PM
9	L09050108-05	0.472	0.1634	0.00		0	2:14:12 PM
10	L09050108-07	0.007	-0.0020	0.00	INV	0	2:15:24 PM
ST-2	CCV (1 mg/L)	1.025	0.3603	102.48			2:16:36 PM
ST-3	CCB (0 mg/L)	-0.003	-0.0056	0.00	INV,><,LL		2:17:49 PM
11	L09050108-09	0.020	0.0025	0.00		0	2:19:01 PM
12	L09050108-11	0.032	0.0068	0.00		0	2:20:13 PM
13	L09050108-13	0.291	0.0992	0.00		0	2:21:25 PM
14	L09050108-15	0.231	0.0776	0.00		0	2:22:37 PM
15	L09050108-17	0.015	0.0009	0.00		0	2:23:49 PM
16	L09050108-19	0.013	0.0002	0.00		0	2:25:01 PM
17	L09050125-04	0.011	-0.0007	0.00	INV		2:26:13 PM
18	L09050125-06 (4)	0.066	0.0189	0.00			2:27:25 PM
19	L09050125-08	0.408	0.1408	0.00			2:28:37 PM
20	L09050125-010 (10)	0.005	-0.0027	0.00	INV		2:29:49 PM
ST-2	CCV (1 mg/L)	0.913	0.3205	91.30			2:31:01 PM

Report Date :05/08/2009 **Run Date :5/8/2009** **Operator : WESTCO** **Plan # :20090508004**

Plan Description : NO3-A-DIH/5/8/2009

Kjeanna Roberts

Approved: May 10, 2009

MICROBAC (OVD)
SMARTCHEM REPORT
UNITS: MG/L

Method : WNO3 -Unit [mg/L] - EPA 353.2 Nitrate-Nitrite

Smp#/[Dil Fact]	Sample ID	Conc	OD	%Recovery/RPD	Flag	Analysis Time
ST-3	CCB (0 mg/L)	0.007	-0.0020	0.00	INV	2:32:13 PM
21	DUP 164-02	0.082	0.0246	0.00		2:33:25 PM
22	MS 164-02	0.518	0.1797	0.00		2:34:37 PM
23	MSD 164-02	0.494	0.1712	0.00		2:35:49 PM
24	WG301891-01 BLK	-0.001	-0.0049	0.00	INV,><,LL	2:37:01 PM
25	WG301891-02 LCS	0.877	0.3075	0.00		2:38:13 PM
26	WG301891-03 LCSDUP	0.866	0.3037	0.00		2:39:25 PM
27	L09050125-12 (4)	0.012	-0.0002	0.00	INV	2:40:37 PM
28	L09050135-01	9.384	3.3363	0.00	EPL,><,LH	2:41:49 PM
29	L09050135-03	0.044	0.0111	0.00		2:43:01 PM
30	L09050135-05	0.049	0.0129	0.00		2:44:13 PM
ST-2	CCV (1 mg/L)	0.917	0.3219	91.69		2:45:25 PM
ST-3	CCB (0 mg/L)	0.000	-0.0045	0.00	INV,><	2:46:37 PM
31	L09050135-07	0.050	0.0134	0.00		2:47:49 PM
32	L09050135-09	0.151	0.0492	0.00		2:49:01 PM
33	L09050135-11	0.119	0.0379	0.00		2:50:13 PM
34	L09050135-13	0.011	-0.0006	0.00	INV	2:51:25 PM
35	L09050135-15	0.014	0.0004	0.00		2:52:37 PM
36	L09050141-01 (5)	0.010	-0.0011	0.00	INV	2:53:49 PM
37	L09050141-02 (5)	0.027	0.0052	0.00		2:55:01 PM
38	L09050141-03 (5)	0.055	0.0150	0.00		2:56:13 PM
39	L09050152-01	0.579	0.2015	0.00		2:57:25 PM
40	L09050152-02	0.198	0.0658	0.00		2:58:37 PM
ST-2	CCV (1 mg/L)	0.934	0.3281	93.44		2:59:49 PM
ST-3	CCB (0 mg/L)	0.009	-0.0014	0.00	INV	3:01:01 PM
41	DUP 152-02	0.236	0.0795	0.00		3:02:13 PM
42	MS 152-02	0.604	0.2106	0.00		3:03:25 PM
43	MSD 152-02	0.620	0.2160	0.00		3:04:37 PM
44	L09050170-02 (15)	0.969	0.3403	0.00		3:05:49 PM
45	L09050165-02 (10)	-0.005	-0.0063	0.00	INV,><,LL	3:07:01 PM
46	L09050165-04 (50)	0.039	0.0093	0.00		3:08:13 PM
47	L09050165-06 (10)	0.000	-0.0045	0.00	INV,><	3:09:25 PM

Report Date :05/08/2009 **Run Date :5/8/2009** **Operator : WESTCO** **Plan # :20090508004**

Plan Description : NO3-A-DIH/5/8/2009

Kjeanna Roberts

Approved: May 10, 2009

MICROBAC (OVD)
SMARTCHEM REPORT
UNITS: MG/L

Method : WNO3 -Unit [mg/L] - EPA 353.2 Nitrate-Nitrite

Smp#/[Dil Fact]	Sample ID	Conc	OD	%Recovery/RPD	Flag	Analysis Time
48	L09050165-08	0.133	0.0426	0.00		3:10:37 PM
49	ID 49	0.624	0.2175	0.00		3:11:49 PM
50	ID 50	0.645	0.2250	0.00		3:13:01 PM
ST-2	CCV (1 mg/L)	0.720	0.2518	72.00		3:14:13 PM
ST-3	CCB (0 mg/L)	-0.002	-0.0054	0.00	INV,><,LL	3:15:26 PM
28-[1/4]	L09050135-01	1.788	0.1546	0.00		3:24:35 PM
ST-2	CCV (1 mg/L)	0.722	0.2525	72.20		3:25:30 PM
ST-3	CCB (0 mg/L)	0.008	-0.0019	0.00	INV	3:26:42 PM

Report Date :05/08/2009 **Run Date :5/8/2009** **Operator : WESTCO** **Plan # :20090508004**

Plan Description : NO3-A-DIH/5/8/2009

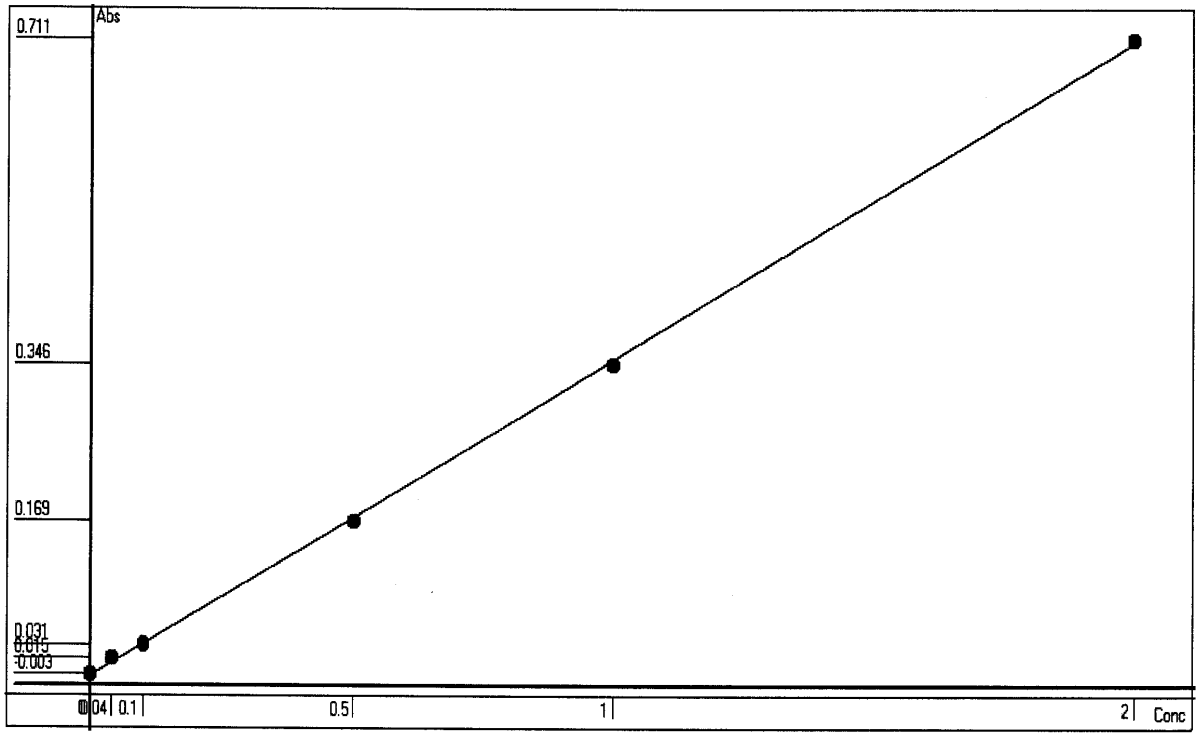
Kjeanna Roberts

Approved: May 10, 2009

Calibrant Report - WNO3 -

Calib Lot #:010104 Exp Date:1/1/2010 User:Westco Scientific

Plan # : 20090508004 Description : [NO3-A-DIH/5/8/2009] Unit



Point	OD	Conc	Recalc Conc	% Error
1	-0.0031	0	0.0041	0.41
2	0.0149	0.04	0.0546	36.50
3	0.0305	0.1	0.0985	-1.50
4	0.1694	0.5	0.4886	-2.28
5	0.3457	1	0.9838	-1.62
6	0.7112	2	2.0103	0.52

Conc= +2.8087*Abso +0.0128 R^2=0.9998

RBL
0.0144
0

Report Date 5/8/2009 Run Date 5/8/2009

Jeanna Roberts

Approved: May 10, 2009

MICROBAC (OVD)

SMARTCHEM REPORT

UNITS: MG/L

Method : WNO3 -Unit [mg/L] - EPA 353.2 Nitrate-NitrIte

Smp#/[Dil Fact]	Sample ID	Conc	OD	%Recovery/RPD	Flag		Analysis Time
DIL-1	RBL	0.000	0.0120	0.00			3:54:27 PM
DIL-1	RBL	0.000	0.0086	0.00			3:55:39 PM
DIL-1	RBL	0.000	0.0131	0.00			3:56:51 PM
DIL-1	Std-1	0.000	-0.0024	0.00	INV		3:58:03 PM
SR5-1	Std-2	0.040	0.0149	0.00			3:59:15 PM
SR5-2	Std-3	0.100	0.0351	0.00			4:00:27 PM
SR5-3	Std-4	0.500	0.1768	0.00			4:01:39 PM
SR5-4	Std-5	1.000	0.3647	0.00			4:02:51 PM
ST-1	Std-6	2.000	0.7332	0.00			4:04:03 PM
1	ICV 1.5	1.481	0.5414	0.00			4:05:15 PM
2	WG301891-01 BLK	0.006	-0.0005	0.00	INV		4:06:27 PM
3	WG301891-02 LCS	0.996	0.3634	0.00			4:07:39 PM
4	WG301891-03 LCSDUP	0.988	0.3603	0.00			4:08:51 PM
5	NO2	0.941	0.3433	0.00		NDL	4:10:03 PM
6	L09050135-01 (10)	1.057	0.3857	0.00		0	4:11:15 PM
7	L09050135-03	0.046	0.0145	0.00		0	4:12:27 PM
8	L09050135-05	0.055	0.0179	0.00		0	4:13:39 PM
9	L09050135-07	0.034	0.0101	0.00		0	4:14:51 PM
10	L09050135-09	0.182	0.0645	0.00		0	4:16:03 PM
ST-2	CCV (1 mg/L)	1.050	0.3833	105.02			4:17:15 PM
ST-3	CCB (0 mg/L)	-0.001	-0.0029	0.00	INV,><,LL		4:18:27 PM
11	L09050135-11	0.141	0.0493	0.00		0	4:19:39 PM
12	L09050135-13	0.010	0.0011	0.00		0	4:20:52 PM
13	L09050135-15	0.017	0.0037	0.00			4:22:03 PM
14	L09050141-01 (5)	0.022	0.0056	0.00			4:23:16 PM
15	L09050141-02 (5)	0.024	0.0064	0.00			4:24:28 PM
16	L09050141-03 (5)	0.059	0.0193	0.00			4:25:40 PM
17	L09050152-01	0.639	0.2322	0.00			4:26:52 PM
18	L09050152-02	0.224	0.0797	0.00			4:28:04 PM
19	DUP 152-02	0.257	0.0920	0.00			4:29:16 PM
20	MS 152-02	0.676	0.2458	0.00			4:30:28 PM
ST-2	CCV (1 mg/L)	1.023	0.3734	102.32			4:31:40 PM

Report Date :05/08/2009 **Run Date :5/8/2009** **Operator : WESTCO** **Plan # :20090508005**

Plan Description : NO3-B-DIH/5/8/2009

Kjeanna Roberts

Approved: May 10, 2009

MICROBAC (OVD)
SMARTCHEM REPORT
UNITS: MG/L

Method : WNO3 -Unit [mg/L] - EPA 353.2 Nitrate-Nitrite

Smp#/[Dil Fact]	Sample ID	Conc	OD	%Recovery/RPD	Flag	Analysis Time
ST-3	CCB (0 mg/L)	0.005	-0.0007	0.00	INV	4:32:52 PM
21	MSD 152-02	0.704	0.2563	0.00		4:34:04 PM
22	L09050170-02 (15)	1.095	0.3999	0.00	0.260	4:35:16 PM
23	L09050125-12 (4)	0.008	0.0006	0.00		4:36:28 PM
24	CCV	0.961	0.3505	0.00		4:37:40 PM
25	L09050165-02 (10)	0.005	-0.0006	0.00	INV	4:38:52 PM
26	L09050165-04 (50)	0.098	0.0336	0.00		4:40:04 PM
27	L09050165-06 (25)	0.015	0.0030	0.00		4:41:16 PM
28	L09050165-08 (10)	0.061	0.0198	0.00		4:42:28 PM
29	ID 29	0.006	-0.0004	0.00	INV	4:43:40 PM
30	ID 30	0.005	-0.0006	0.00	INV	4:44:52 PM
ST-2	CCV (1 mg/L)	1.043	0.3807	104.31		4:46:04 PM
ST-3	CCB (0 mg/L)	0.002	-0.0018	0.00	INV	4:47:16 PM

Report Date :05/08/2009 **Run Date :5/8/2009** **Operator : WESTCO** **Plan # :20090508005**

Plan Description : NO3-B-DIH/5/8/2009

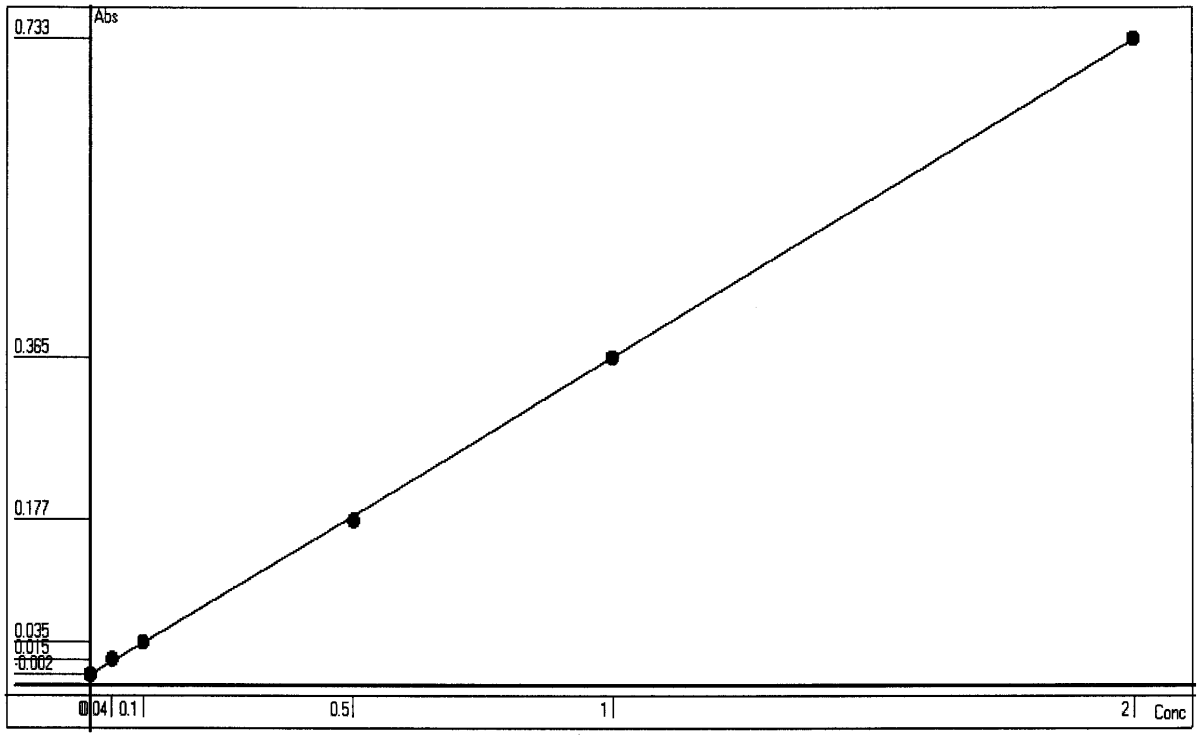
Kjeanna Roberts

Approved: May 10, 2009

Calibrant Report - WNO3 -

Calib Lot #:010104 Exp Date:1/1/2010 User:Westco Scientific

Plan # : 20090508005 Description : [NO3-B-DIH/5/8/2009] Unit



Point	OD	Conc	Recalc Conc	% Error
1	-0.0024	0	0.0002	0.02
2	0.0149	0.04	0.0473	18.25
3	0.0351	0.1	0.1023	2.30
4	0.1768	0.5	0.4881	-2.38
5	0.3647	1	0.9997	-0.03
6	0.7332	2	2.0030	0.15

Conc= +2.7227*Abso +0.0067 R^2=0.9999

RBL
0.0126
0

Report Date 5/8/2009 Run Date 5/8/2009

Kjeanna Roberts

Approved: May 10, 2009

3.0 Attachments

Microbac Laboratories Inc.
Analyst Listing
May 12, 2009

ADC - ANTHONY D. CANTER	AJF - AMANDA J. FICKIESEN	ALB - ANNIE L. BROWN
AM - ALISON J. MILLER	AML - ANTHONY M. LONG	BRG - BRENDA R. GREGORY
CAA - CASSIE A. AUGENSTEIN	CAF - CHERYL A. FLOWERS	CAH - CHARLES A. HALL
CEB - CHAD E. BARNES	CLC - CHRYS L. CRAWFORD	CLW - CHARISSA L. WINTERS
CPD - CHAD P. DAVIS	CSH - CHRIS S. HILL	CTB - CHRIS T. BUCINA
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
ECL - ERIC C. LAWSON	EDA - ERIN D. AGEE	ERP - ERIN R. PORTER
FJB - FRANCES J. BOLDEN	HAV - HEMA VILASAGAR	HJR - HOLLY J. REED
JBK - JEREMY B. KINNEY	JDH - JUSTIN D. HESSON	JKT - JANE K. THOMPSON
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	LSB - LESLIE S. BUCINA	MDA - MIKE D. ALBERTSON
MDC - MICHAEL D. COCHRAN	MES - MARY E. SCHILLING	MMB - MAREN M. BEERY
MRT - MICHELLE R. TAYLOR	MSW - MATT S. WILSON	NPM - NATHANIEL P. MILLER
PDM - PIERCE D. MORRIS	RAH - ROY A. HALSTEAD	RB - ROBERT BUCHANAN
REK - ROBERT E. KYER	RLK - ROBIN L. KLINGER	RWC - RODNEY W. CAMPBELL
SDH - SHANA D. HINYARD	SLM - STEPHANIE L. MOSSBURG	SLP - SHERI L. PFALZGRAF
TIP - TAE I. PARRISH	TMB - TIFFANY M. BAILEY	TMM - TAMMY M. MORRIS
VC - VICKI COLLIER	WTD - WADE T. DELONG	

Microbac Laboratories Inc.
List of Valid Qualifiers
May 12, 2009

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
B1	Target analyte detected in method blank at or above the method reporting limit
B3	Target analyte detected in calibration blank at or above the method reporting limit
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
F, S	Estimated result below quantitation limit; method of standard additions(MSA)
FL	Free Liquid
H1	Sample analysis performed past holding time.
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%
J,S	Estimated concentration; analyzed by method of standard addition (MSA)
L	Sample reporting limits elevated due to matrix interference
L1	The associated blank spike (LCS) recovery was above the laboratory acceptance limits.
L2	The associated blank spike (LCS) recovery was below the laboratory acceptance limits.
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 (RL).
ND, L	Not detected; sample reporting limit (RL) elevated due to interference
ND, S	Not detected; analyzed by method of standard addition (MSA)
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 (MSA)
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
X, S	Exceeds regulatory limit; method of standard additions (MSA)
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.

Microbac®

Shaw Environmental & Infrastructure, Inc.
3010 Briarpark Drive, Suite 400
Houston, TX 77042
(713) 996-4400

Laboratory Name: Microbac
Address : 158 Starlite Drive, Marietta OH 45750
Contact : Stephanie Mossburg
Phone: 1-800-373-4071

PM: Praveen Svrivastav (713.996.4588)
Project Contact: Jennifer Hoang
Project Name: LHAAP-49
Project #: 117591-

TAT: 24 hr RUSH
Phone No: 713-996-4408
Site: 49
Location: Karnack, TX

Sampler Print: ALLEN WILLMORE (713-247-9292)

Sampler Sign: M. Allen

Sample Number	Grab	Date	Time	Matrix	# of Containers	Al, As, Fe (6010/6020) w/ HNO3	NO3/NO2 as N (353.2)										Comments
49WW06 - 090507	X	5/7/09	13:40	Water	1	X	NA										
49WW04 - 090507	X	5/7/09	15:60	Water	1	NA	X										

Relinquished By: M. Allen
Date/Time 5/7/09 17:30

Received By:
Date/Time

Special Instructions
24- hour TAT

Relinquished By:
Date/Time

Received for Laboratory By: Ewu Pore
Date/Time 5-8-09 1000

Remarks:

Microbac Laboratories, Inc. **SAMPLE RECEIPT FORM** 00075958

158 Starlite Drive
Marietta, OH 45750
(740) 373-4071

Client: SHAW Longhorn	
Workorder Number: B	
Date Received: 5-8-09	
Delivered by: ( ) Fedx (✓) UPS ( ) Client ( ) Courier	**Time:** 1000
Opened by: SRM	
IR Temp Gun: (✓) G ( ) H	
Logged by: JEC	L 09050164

Cooler information

Cooler ID	Temp C	Airbill#	COC#	Other
1481	0	1Z401663221005 6080		24 hr TAT (SH)

Inspection Checklist	**Y**	**N**	**NA**	**Discrepancy ID**
Were shipping coolers sealed?	✓			
Were custody seals intact?	✓			
Were cooler temperatures in range of 0 - 6?	✓			
Was ice present?				
Were COC's received/ information complete/signed and dated?	✓			
Were sample containers and labels intact and match COC?	✓			
Were the correct containers and volumes received?	✓			
Were correct preservatives used? (water only)	✓			
Were pH ranges acceptable? (voa's excluded)	✓			
Were VOA samples free of headspace (< 6mm)?			✓	
Were samples received within EPA hold times?	✓			

Discrepancy/Comments/Other Problems

Distribution

Name of Microbac representative:
Client/Company:
Person Contacted:
Date contacted:

Resolution/other comments:

Microbac Laboratories Inc.

Internal Chain of Custody Report

Login: L09050164
Account: 2773
Project: 2773.025
Samples: 2
Due Date: 11-MAY-2009

Samplenum	Container ID	Products
L09050164-01	578589	AL AS-MS FE

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN	COOLER	W1	08-MAY-2009 11:07	ERE	
2	ANALYZ	W1	DIG	08-MAY-2009 11:14	VC	JKT
3	PREP	DIG	A1	11-MAY-2009 14:53	JKT	BRG

Samplenum	Container ID	Products
L09050164-02	578590	NO3NO2

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN	COOLER	W1	08-MAY-2009 11:07	ERE	
2	ANALYZ	W1	WET	08-MAY-2009 11:18	DIH	JKT
3	STORE	WET	A1	08-MAY-2009 17:00	JKT	DIH

A1 - Sample Archive (COLD)
A2 - Sample Archive (AMBIENT)
F1 - Volatiles Freezer in Login
V1 - Volatiles Refrigerator in Login
W1 - Walkin Cooler in Login

158 Starlite Drive, Marietta, OH 45750 • T:740-373-4071 • F:740-373-4835 • http://www.microbac.com

Laboratory Report Number: L09050313

Please find enclosed the analytical results for the samples you submitted to Microbac Laboratories.

Review and compilation of your report was completed by Microbac'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 below at 800-373-4071. Team member e-mail addresses also appear here for your convenience.

Kathy Albertson	*Team Chemist/Data Specialist*	kalbertson@microbac.com
Stephanie Mossburg	*Team Chemist/Data Specialist*	smossburg@microbac.com
Tony Long	*Team Chemist/Data Specialist*	tlong@microbac.com
Amanda Fickiesen	*Client Services Specialist*	afickiesen@microbac.com
Annie Brown	*Client Services Specialist*	abrown@microbac.com

This report was reviewed on May 21, 2009.

Stephanie Mossburg

Stephanie Mossburg - Team Chemist/Data Specialist

I certify that all test results meet all of the requirements of the accrediting authority listed below. 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 Microbac Laboratories.

This report was certified on May 21, 2009.

David E. Vandenberg

David Vandenberg - Managing Director

State of origin: Texas
Accrediting authority: Texas Commission on Environmental Quality ID:T104704252-07-TX
QAPP: Microbac OVD
This report contains a total of 99 pages.

Look closer. Go further. Do more.

Microbac REPORT L09050313
PREPARED FOR Shaw E I, Inc.
WORK ID:

1.0 Introduction

Microbac Laboratories Inc.
REPORT NARRATIVE

Microbac Login No: L09050313

CHAIN OF CUSTODY: The chain of custody number was 09434

SHIPMENT CONDITIONS: The chain of custody forms were received sealed in a cooler. The cooler temperature was 1 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 Microbac Laboratories Inc., 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: 14-MAY-09
Stephanie Mossburg

Laboratory Data Package Cover Page

00075964

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.

MAREN M. BEERY	Maren Beery	Metals Supervisor	May 15, 2009
Name (Printed)	Signature	Official Title (printed)	DATE

RG-366/TRRP-13 December 2002 A1

Microbac Laboratories Inc.
Laboratory Review Checklist

Laboratory Name:	Microbac Laboratories Inc.
Laboratory Log Number:	L09050313
Project Name:	798-LONGHORN
Method:	6020
Prep Batch Number(s):	WG302327
Reviewer Name:	MAREN M. BEERY
LRC Date:	May 15, 2009

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 <RL?	✓				
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 laboratory's 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?	✓				
ICAL					
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 <RL?	✓				
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?	✓				

Microbac Laboratories Inc.
Laboratory Review Checklist

Laboratory Name:	Microbac Laboratories Inc.
Laboratory Log Number:	L09050313
Project Name:	798-LONGHORN
Method:	6020
Prep Batch Number(s):	WG302327
Reviewer Name:	MAREN M. BEERY
LRC Date:	May 15, 2009

EXCEPTIONS REPORT
ER# - Description
Footnotes:
(1) NA = Not applicable to method or project
(2) NR = Not reviewed
(3) ER# = Exception report number

Laboratory Data Package Cover Page

00075969

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.

MAREN M. BEERY	Maren Beery	Metals Supervisor	May 15, 2009
Name (Printed)	Signature	Official Title (printed)	DATE

RG-366/TRRP-13 December 2002 A1

Microbac Laboratories Inc.
Laboratory Review Checklist

Laboratory Name:	Microbac Laboratories Inc.
Laboratory Log Number:	L09050313
Project Name:	798-LONGHORN
Method:	6010
Prep Batch Number(s):	WG302385
Reviewer Name:	MAREN M. BEERY
LRC Date:	May 15, 2009

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 <RL?	✓				
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 laboratory's 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?	✓				
ICAL					
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 <RL?	✓				
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?	✓				

Microbac Laboratories Inc.
Laboratory Review Checklist

Laboratory Name:	Microbac Laboratories Inc.
Laboratory Log Number:	L09050313
Project Name:	798-LONGHORN
Method:	6010
Prep Batch Number(s):	WG302385
Reviewer Name:	MAREN M. BEERY
LRC Date:	May 15, 2009

EXCEPTIONS REPORT
ER# - Description
Footnotes:
(1) NA = Not applicable to method or project
(2) NR = Not reviewed
(3) ER# = Exception report number

2.1 Metals Data

2.1.1 Metals I C P Data

2.1.1.1 Summary Data

LABORATORY REPORT

00075977

L09050313

05/21/09 08:11

Submitted By

Microbac Laboratories Inc.
158 Starlite Drive
Marietta , OH 45750
(740) 373 - 4071

For

Account Name: Shaw E & I, Inc.
ABB Lummus Biulding
3010 Briarpark Drive Suite 4N
Houston, TX 77042
Attention: Jennifer Hoang

Project Number: 2773.025
Project: Longhorn AAP
Site: LONGHORN AAP KARNACK TX

P.O. Number: 389869/ 390836(GWTP)

Sample Analysis Summary

Client ID	Lab ID	Method	Dilution	Date Received
49WW06-090513	L09050313-01	6010B	1	14-MAY-09

Report Number: **L09050313**
Report Date : **May 21, 2009**

00075978

Sample Number: **L09050313-01**
Client ID: **49WW06-090513**
Matrix: **Water**
Workgroup Number: **WG302423**
Collect Date: **05/13/2009 14:30**
Sample Tag: **01**

PrePrep Method: **NONE**
Prep Method: **3005A**
Analytical Method: **6010B**
Analyst: **JYH**
Dilution: **1**
Units: **mg/L**

Instrument: **PE-ICP2**
Prep Date: **05/15/2009 07:00**
Cal Date: **05/15/2009 10:46**
Run Date: **05/15/2009 12:16**
File ID: **P2.051509.121657**

Analyte	CAS. Number	Result	Qual	PQL	SDL
Aluminum, Total	7429-90-5		U	0.100	0.0500
Iron, Total	7439-89-6		U	0.100	0.0250

U Not detected at or above adjusted sample detection limit

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2.1.1.2 QC Summary Data

Example 6010 Calculations
Perkin Elmer Optima 4300 DV

1.0 Initial Calibration (ICAL) Parameters
The system performs linear regression from data consisting of a blank and three standards.

2.0 Calculating the concentration (C) of an element in water using data from prep log, run log, and quantitation report (note:the data system performs this calculation automatically when correction factors have been entered):

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

Where:	**Example:**
Cs = Concentration computed by the data system in ug/mL (ppm)	0.1
Vf = Final volume (mL)	50
Vi = Initial volume (mL)	50
D = Dilution factor as a multiplier (10X = 10)	1
Cx = Concentration of element in ug/mL (mg/L)	0.1

3.0 Calculating the concentration (C) of an element in soil using data from prep log, run log, and quantitation report (note: the data system performs this calculation automatically when correction factors have been entered):

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

Where:	**Example:**
Cs = Concentration computed by the data system (mg/L) (ppm)	0.1
Vf = Final volume (mL)	50
Vi = Initial weight (g)	1
D = Dilution factor as a multiplier (10X = 10)	1
Cx = Concentration of element in ug/g (mg/kg)	5

4.0 Adjusting the concentration to dry weight:

$$Cdry = \frac{Cx \times 100}{Px}$$

Where:	**Example:**
Cx = Concentration calculated as received (wet basis)	5
Px = Percent solids of sample (%wt)	80
$Cdry$ = Concentration calculated as dry weight (mg/kg)	6.25

Example 6010 Calculations
Thermo Scientific IRIS Advantage

1.0 Initial Calibration (ICAL) Parameters
The system performs linear regression from data consisting of a blank and three standards.

2.0 Calculating the concentration (C) of an element in water using data from prep log, run log, and quantitation report (note:the data system performs this calculation automatically when correction factors have been entered):

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

Where:	**Example:**
Cs = Concentration computed by the data system in ug/mL (ppm)	0.1
Vf = Final volume (mL)	50
Vi = Initial volume (mL)	50
D = Dilution factor as a multiplier (10X = 10)	1
Cx = Concentration of element in ug/mL (mg/L)	0.1

3.0 Calculating the concentration (C) of an element in soil using data from prep log, run log, and quantitation report (note: the data system performs this calculation automatically when correction factors have been entered):

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

Where:	**Example:**
Cs = Concentration computed by the data system (mg/L) (ppm)	0.1
Vf = Final volume (mL)	50
Vi = Initial weight (g)	1
D = Dilution factor as a multiplier (10X = 10)	1
Cx = Concentration of element in ug/g (mg/kg)	5

4.0 Adjusting the concentration to dry weight:

$$Cdry = \frac{Cx \times 100}{Px}$$

Where:	**Example:**
Cx = Concentration calculated as received (wet basis)	5
Px = Percent solids of sample (%wt)	80
$Cdry$ = Concentration calculated as dry weight (mg/kg)	6.25

Example 6010 Calculations
Thermo Scientific iCAP 6500

1.0 Initial Calibration (ICAL) Parameters
The system performs linear regression from data consisting of a blank and four standards.

2.0 Calculating the concentration (C) of an element in water using data from prep log, run log, and quantitation report (note:the data system performs this calculation automatically when correction factors have been entered):

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

Where:	**Example:**
Cs = Concentration computed by the data system in ug/mL (ppm)	0.1
Vf = Final volume (mL)	50
Vi = Initial volume (mL)	50
D = Dilution factor as a multiplier (10X = 10)	1
Cx = Concentration of element in ug/mL (mg/L)	0.1

3.0 Calculating the concentration (C) of an element in soil using data from prep log, run log, and quantitation report (note: the data system performs this calculation automatically when correction factors have been entered):

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

Where:	**Example:**
Cs = Concentration computed by the data system (mg/L) (ppm)	0.1
Vf = Final volume (mL)	50
Vi = Initial weight (g)	1
D = Dilution factor as a multiplier (10X = 10)	1
Cx = Concentration of element in ug/g (mg/kg)	5

4.0 Adjusting the concentration to dry weight:

$$Cdry = \frac{Cx \times 100}{Px}$$

Where:	**Example:**
Cx = Concentration calculated as received (wet basis)	5
Px = Percent solids of sample (%wt)	80
$Cdry$ = Concentration calculated as dry weight (mg/kg)	6.25

Microbac Laboratories Inc.
Metals Digest Log

Workgroup: WG302385
Analyst: REK
Spike Analyst: REK
Method: 3005A
Run Date: 05/15/2009 07:00
Hotblock Start Temp: 94.9 @ 05:40
Hotblock End Temp: 95.1 @ 09:40

SOP: ME401 Revison 13
Spike Solution: STD27613
Spike Witness: VC
HCL Lot #: COA13815
Digest tubes Lot #: COA13830
HNO3 Lot #: COA13859

	SAMPLE #	Type	Matrix	Initial Amount	Final Volume	Spike Amount	Due Date
1	WG302385-02	BLANK	1	50 mL	50 mL		
2	WG302385-03	LCS	1	50 mL	50 mL	5 mL	
3	L09050308-02	SAMP	1	50 mL	50 mL		05/22/09
4	L09050308-04	SAMP	1	50 mL	50 mL		05/22/09
5	L09050308-06	SAMP	1	50 mL	50 mL		05/22/09
6	L09050308-08	SAMP	1	50 mL	50 mL		05/22/09
7	L09050308-10	SAMP	1	50 mL	50 mL		05/22/09
8	WG302385-01	REF	1	50 mL	50 mL		
9	L09050313-01	SAMP	1	50 mL	50 mL		05/15/09
10	L09050316-11	SAMP	1	50 mL	50 mL		05/21/09
11	L09050320-01	SAMP	1	50 mL	50 mL		05/25/09
12	L09050320-02	SAMP	1	50 mL	50 mL		05/25/09
13	L09050320-03	SAMP	1	50 mL	50 mL		05/25/09
14	L09050320-04	SAMP	1	50 mL	50 mL		05/25/09
15	L09050320-05	SAMP	1	50 mL	50 mL		05/25/09
16	L09050320-06	SAMP	1	50 mL	50 mL		05/25/09
17	L09050320-07	SAMP	1	50 mL	50 mL		05/25/09
18	L09050320-08	SAMP	1	50 mL	50 mL		05/25/09
19	L09050320-09	SAMP	1	50 mL	50 mL		05/25/09
20	L09050320-10	SAMP	1	50 mL	50 mL		05/25/09
21	L09050320-11	SAMP	1	50 mL	50 mL		05/25/09
22	L09050340-14	SAMP	1	50 mL	50 mL		05/22/09
23	L09050340-15	SAMP	1	50 mL	50 mL		05/22/09
24	WG302385-04	MS	1	50 mL	50 mL	5 mL	
25	WG302385-05	MSD	1	50 mL	50 mL	5 mL	

Analyst: [signature]

Reviewer: Brenda Gregory

BLOCK_DIG - Modified 07/22/2008
PDF ID: 1393633
Report generated: 05/15/2009 09:43

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Microbac Laboratories Inc.

Instrument Run Log

Instrument: PE-ICP2 Dataset: 051509HR.CSV
Analyst1: JYH Analyst2: N/A
Method: 6010B SOP: ME660E Rev: 9
Maintenance Log ID: 28744

Calibration Std: STD32446 ICV/CCV Std: STD32864 Post Spike: STD27612
ICSA: STD32624 ICSAB: STD32450 Int. Std: STD32011

Workgroups: 302423,302228,302480,302341

Comments:

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
1	P2.051509.102031	WG302460-01	Calibration Point		1		05/15/09 10:20
2	P2.051509.102705	WG302460-02	Calibration Point		1		05/15/09 10:27
3	P2.051509.103336	WG302460-03	Calibration Point		1		05/15/09 10:33
4	P2.051509.104014	WG302460-04	Calibration Point		1		05/15/09 10:40
5	P2.051509.104656	WG302460-05	Calibration Point		1		05/15/09 10:46
6	P2.051509.105342	WG302460-06	Initial Calibration Verification		1		05/15/09 10:53
7	P2.051509.110024	WG302460-07	Initial Calib Blank		1		05/15/09 11:00
8	P2.051509.110700	WG302460-08	Interference Check		1		05/15/09 11:07
9	P2.051509.111242	WG302460-09	Interference Check		1		05/15/09 11:12
10	P2.051509.111822	WG302460-10	CCV		1		05/15/09 11:18
11	P2.051509.112503	WG302460-11	CCB		1		05/15/09 11:25
12	P2.051509.113516	WG302423-03	Louisville Chem Requ		1		05/15/09 11:35
13	P2.051509.114545	WG302423-04	QCMRL WG302423-04		1		05/15/09 11:45
14	P2.051509.115818	WG302423-05	QCMRL WG302423-05		1		05/15/09 11:58
15	P2.051509.120335	WG302385-02	Method/Prep Blank	50/50	1		05/15/09 12:03
16	P2.051509.121014	WG302385-03	Laboratory Control S	50/50	1		05/15/09 12:10
17	P2.051509.121657	WG302385-01	Reference Sample		1	L09050313-01	05/15/09 12:16
18	P2.051509.122346	WG302385-04	Matrix Spike	50/50	1	L09050313-01	05/15/09 12:23
19	P2.051509.122913	WG302385-05	Matrix Spike Duplica	50/50	1	L09050313-01	05/15/09 12:29
20	P2.051509.123556	WG302460-12	CCV		1		05/15/09 12:35
21	P2.051509.124242	WG302460-13	CCB		1		05/15/09 12:42
22	P2.051509.124927	L09050340-14	EBQW1300Q001	50/50	1		05/15/09 12:49
23	P2.051509.125559	L09050340-15	EBQW1301Q001	50/50	1		05/15/09 12:55
24	P2.051509.130234	WG302423-01	Post Digestion Spike		1	L09050340-15	05/15/09 13:02
25	P2.051509.130913	WG302423-02	Serial Dilution		5	L09050340-15	05/15/09 13:09
26	P2.051509.131553	WG302460-14	CCV		1		05/15/09 13:15
27	P2.051509.132234	WG302460-15	CCB		1		05/15/09 13:22
28	P2.051509.132910	L09050316-11	AV-NCB-EB-1-051309	50/50	1		05/15/09 13:29
29	P2.051509.133549	L09050320-01	12575-W0001	50/50	1		05/15/09 13:35
30	P2.051509.134228	L09050320-02	12591-W0001	50/50	1		05/15/09 13:42
31	P2.051509.134901	L09050320-03	12596-W0001	50/50	1		05/15/09 13:49
32	P2.051509.135540	L09050320-04	12678-W0001	50/50	1		05/15/09 13:55
33	P2.051509.140221	L09050320-05	13213-W0001	50/50	1		05/15/09 14:02
34	P2.051509.140855	L09050320-06	13230-W0001	50/50	1		05/15/09 14:08
35	P2.051509.141537	L09050320-07	13421-W0001	50/50	1		05/15/09 14:15
36	P2.051509.142217	L09050320-08	13582-W0001	50/50	1		05/15/09 14:22
37	P2.051509.142851	L09050320-09	13808-W0001	50/50	1		05/15/09 14:28

Page: 1 Approved: May 18, 2009

Marcu Berry

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Microbac Laboratories Inc.

Instrument Run Log

Instrument: PE-ICP2 Dataset: 051509HR.CSV
Analyst1: JYH Analyst2: N/A
Method: 6010B SOP: ME660E Rev: 9
Maintenance Log ID: 28744

Calibration Std: STD32446 ICV/CCV Std: STD32864 Post Spike: STD27612
ICSA: STD32624 ICSAB: STD32450 Int. Std: STD32011

Workgroups: 302423,302228,302480,302341

Comments:

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
38	P2.051509.143534	WG302460-16	CCV		1		05/15/09 14:35
39	P2.051509.144218	WG302460-17	CCB		1		05/15/09 14:42
40	P2.051509.144856	L09050320-10	13893-W0001	50/50	1		05/15/09 14:48
41	P2.051509.145535	L09050320-11	13907-W0001	50/50	1		05/15/09 14:55
42	P2.051509.150216	WG302460-18	CCV		1		05/15/09 15:02
43	P2.051509.150859	WG302460-19	CCB		1		05/15/09 15:08
44	P2.051509.151724	WG302228-05	Louisville Chem Requ		1		05/15/09 15:17
45	P2.051509.152635	WG302228-07	Louisville Chem Requ		1		05/15/09 15:26
46	P2.051509.153346	WG302228-07	Louisville Chem Requ		1		05/15/09 15:33
47	P2.051509.154020	WG302061-03	Method/Prep Blank	50/50	1		05/15/09 15:40
48	P2.051509.154433	WG302061-04	Laboratory Control S	50/50	1		05/15/09 15:44
49	P2.051509.155112	WG302061-02	Reference Sample		1	L09050200-01	05/15/09 15:51
50	P2.051509.155755	WG302061-07	Matrix Spike	50/50	1	L09050200-01	05/15/09 15:57
51	P2.051509.160436	L09050200-04	RVSMW15	50/50	1		05/15/09 16:04
52	P2.051509.161110	WG302460-20	CCV		1		05/15/09 16:11
53	P2.051509.161759	WG302460-21	CCB		1		05/15/09 16:17
54	P2.051509.162239	WG302228-03	Post Digestion Spike		1	L09050200-04	05/15/09 16:22
55	P2.051509.162916	WG302228-04	Serial Dilution		5	L09050200-04	05/15/09 16:29
56	P2.051509.163602	L09050200-05	RVSMW13	50/50	1		05/15/09 16:36
57	P2.051509.164243	L09050200-07	DUP-04	50/50	1		05/15/09 16:42
58	P2.051509.164917	L09050200-08	RVSMW01	50/50	1		05/15/09 16:49
59	P2.051509.165558	WG302228-06	Louisville Chem Requ		1		05/15/09 16:55
60	P2.051509.170238	MDL	MDL		1		05/15/09 17:02
61	P2.051509.170912	MDL 0.5	MDL 0.5		1		05/15/09 17:09
62	P2.051509.171553	MDL 0.25	MDL 0.25		1		05/15/09 17:15
63	P2.051509.172238	WG302460-22	CCV		1		05/15/09 17:22
64	P2.051509.173006	WG302460-23	CCB		1		05/15/09 17:30
65	P2.051509.173644	L09050190-01	MCL-MW02	50/50	1		05/15/09 17:36
66	P2.051509.174325	WG302061-01	Reference Sample		1	L09050190-02	05/15/09 17:43
67	P2.051509.174959	WG302061-05	Matrix Spike	50/50	1	L09050190-02	05/15/09 17:49
68	P2.051509.175646	WG302061-06	Matrix Spike Duplica	50/50	1	L09050190-02	05/15/09 17:56
69	P2.051509.180330	L09050190-03	MCL-MW03	50/50	1		05/15/09 18:03
70	P2.051509.181004	L09050190-04	MCL-MW12	50/50	1		05/15/09 18:10
71	P2.051509.181549	L09050190-05	MCL-MW08	50/50	1		05/15/09 18:15
72	P2.051509.182132	L09050190-06	MCL-MW07	50/50	1		05/15/09 18:21
73	P2.051509.182717	L09050190-07	MCL-MW06	50/50	1		05/15/09 18:27
74	P2.051509.183255	WG302460-24	CCV		1		05/15/09 18:32

Page: 2 Approved: May 18, 2009

Maren Berry

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Microbac Laboratories Inc.

Instrument Run Log

Instrument: PE-ICP2 Dataset: 051509HR.CSV
Analyst1: JYH Analyst2: N/A
Method: 6010B SOP: ME660E Rev: 9
Maintenance Log ID: 28744

Calibration Std: STD32446 ICV/CCV Std: STD32864 Post Spike: STD27612
ICSA: STD32624 ICSAB: STD32450 Int. Std: STD32011

Workgroups: 302423,302228,302480,302341

Comments:

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
75	P2.051509.183938	WG302460-25	CCB		1		05/15/09 18:39
76	P2.051509.184613	L09050216-01	SE-3037P	50/50	1		05/15/09 18:46
77	P2.051509.185205	L09050216-02	SE-3037F	50/50	1		05/15/09 18:52
78	P2.051509.185851	L09050219-01	T-1360	50/50	1		05/15/09 18:58
79	P2.051509.190526	L09050219-02	T-1362	50/50	1		05/15/09 19:05
80	P2.051509.191209	L09050220-01	PZ159GW03S001	50/50	1		05/15/09 19:12
81	P2.051509.191858	WG302460-26	CCV		1		05/15/09 19:18
82	P2.051509.192536	WG302460-27	CCB		1		05/15/09 19:25
83	P2.051509.193214	WG302418-02	Method/Prep Blank	5/50	1		05/15/09 19:32
84	P2.051509.193855	WG302370-01	Fluid Blank		1		05/15/09 19:38
85	P2.051509.194533	WG302418-03	Laboratory Control S	5/50	1		05/15/09 19:45
86	P2.051509.195211	WG302418-01	Reference Sample		1	L09050327-02	05/15/09 19:52
87	P2.051509.195856	WG302418-04	Matrix Spike	5/50	1	L09050327-02	05/15/09 19:58
88	P2.051509.200434	WG302418-05	Matrix Spike Duplica	5/50	1	L09050327-02	05/15/09 20:04
89	P2.051509.201117	L09050327-01	SURGE TANK SLUDGE	5/50	1		05/15/09 20:11
90	P2.051509.201801	WG302480-01	Post Digestion Spike		1	L09050327-01	05/15/09 20:18
91	P2.051509.202441	WG302480-02	Serial Dilution		5	L09050327-01	05/15/09 20:24
92	P2.051509.203126	WG302460-28	CCV		1		05/15/09 20:31
93	P2.051509.203802	WG302460-29	CCB		1		05/15/09 20:38
94	P2.051509.204435	WG302264-01	Reference Sample		1	L09050298-07	05/15/09 20:44
95	P2.051509.205114	WG302264-04	Matrix Spike	50/50	1	L09050298-07	05/15/09 20:51
96	P2.051509.205800	WG302264-05	Matrix Spike Duplica	50/50	1	L09050298-07	05/15/09 20:58
97	P2.051509.210439	L09050298-10	ANL3049	50/50	1		05/15/09 21:04
98	P2.051509.211124	WG302341-01	Post Digestion Spike		1	L09050298-10	05/15/09 21:11
99	P2.051509.211809	WG302341-02	Serial Dilution		5	L09050298-10	05/15/09 21:18
100	P2.051509.212448	WG302460-30	CCV		1		05/15/09 21:24
101	P2.051509.213136	WG302460-31	CCB		1		05/15/09 21:31

Page: 3 Approved: May 18, 2009

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Instrument Run Log

Instrument: PE-ICP2 Dataset: 051909H4R.CSV
Analyst1: PDM Analyst2: N/A
Method: 6010B SOP: ME660E Rev: 9
Maintenance Log ID: 28784

Calibration Std: STD32446 ICV/CCV Std: STD32864 Post Spike: STD27612
ICSA: STD32624 ICSAB: STD32450 Int. Std: STD32011

Workgroups: 302228,302563,302423,302567,302487

Comments: No results from sequence 12 through 30 were reported.

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
1	P2.051909.104924	WG302743-01	Calibration Point		1		05/19/09 10:49
2	P2.051909.105601	WG302743-02	Calibration Point		1		05/19/09 10:56
3	P2.051909.110232	WG302743-03	Calibration Point		1		05/19/09 11:02
4	P2.051909.110909	WG302743-04	Calibration Point		1		05/19/09 11:09
5	P2.051909.111551	WG302743-05	Calibration Point		1		05/19/09 11:15
6	P2.051909.112235	WG302743-06	Initial Calibration Verification		1		05/19/09 11:22
7	P2.051909.112915	WG302743-07	Initial Calib Blank		1		05/19/09 11:29
8	P2.051909.113551	WG302743-08	Interference Check		1		05/19/09 11:35
9	P2.051909.114133	WG302743-09	Interference Check		1		05/19/09 11:41
10	P2.051909.114712	WG302743-10	CCV		1		05/19/09 11:47
11	P2.051909.115351	WG302743-11	CCB		1		05/19/09 11:53
12	P2.051909.120603	WG302228-08	Louisville Chem Requ		1		05/19/09 12:06
13	P2.051909.121346	WG302743-12	CCV		1		05/19/09 12:13
14	P2.051909.122028	WG302743-13	CCB		1		05/19/09 12:20
15	P2.051909.122705	WG302228-08	Louisville Chem Requ		1		05/19/09 12:27
16	P2.051909.123343	WG302061-03	Method/Prep Blank		1		05/19/09 12:33
17	P2.051909.124016	WG302061-04	Laboratory Control S		1		05/19/09 12:40
18	P2.051909.124653	WG302061-01	Reference Sample		1	L09050190-02	05/19/09 12:46
19	P2.051909.125337	WG302061-07	Matrix Spike		1	L09050200-01	05/19/09 12:53
20	P2.051909.130015	WG302061-08	Duplicate		1	L09050200-01	05/19/09 13:00
21	P2.051909.130658	L09050200-04	RVSMW15		1		05/19/09 13:06
22	P2.051909.131340	L09050200-05	RVSMW13		1		05/19/09 13:13
23	P2.051909.132017	WG302228-10	Post Digestion Spike		1	L09050200-05	05/19/09 13:20
24	P2.051909.132704	WG302228-11	Serial Dilution		5	L09050200-05	05/19/09 13:27
25	P2.051909.133348	WG302743-14	CCV		1		05/19/09 13:33
26	P2.051909.134035	WG302743-15	CCB		1		05/19/09 13:40
27	P2.051909.134713	L09050200-07	DUP-04		1		05/19/09 13:47
28	P2.051909.135351	WG302228-09	Louisville Chem Requ		1		05/19/09 13:53
29	P2.051909.140032	MDL	MDL		1		05/19/09 14:00
30	P2.051909.140711	WG302743-16	CCV		1		05/19/09 14:07
31	P2.051909.141350	WG302743-17	CCB		1		05/19/09 14:13
32	P2.051909.142026	WG302529-02	Method/Prep Blank	50/50	1		05/19/09 14:20
33	P2.051909.142716	WG302529-03	Laboratory Control S	50/50	1		05/19/09 14:27
34	P2.051909.144405	WG302353-01	Fluid Blank		1		05/19/09 14:44
35	P2.051909.145124	L09050316-02	AV-NCB-PE-UNK-36-C1-051	50/50	1		05/19/09 14:51
36	P2.051909.145800	L09050316-04	AV-NCB-PE-UNK-36-C1-D-0	50/50	1		05/19/09 14:58
37	P2.051909.150438	WG302563-01	Post Digestion Spike		1	L09050316-04	05/19/09 15:04

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Instrument Run Log

Instrument: PE-ICP2 Dataset: 051909H4R.CSV
Analyst1: PDM Analyst2: N/A
Method: 6010B SOP: ME660E Rev: 9
Maintenance Log ID: 28784

Calibration Std: STD32446 ICV/CCV Std: STD32864 Post Spike: STD27612
ICSA: STD32624 ICSAB: STD32450 Int. Std: STD32011

Workgroups: 302228,302563,302423,302567,302487

Comments: No results from sequence 12 through 30 were reported.

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
38	P2.051909.151112	WG302563-02	Serial Dilution		5	L09050316-04	05/19/09 15:11
39	P2.051909.151752	WG302529-01	Reference Sample		1	L09050316-06	05/19/09 15:17
40	P2.051909.152431	WG302529-04	Matrix Spike	50/50	1	L09050316-06	05/19/09 15:24
41	P2.051909.153141	WG302529-05	Matrix Spike Duplica	50/50	1	L09050316-06	05/19/09 15:31
42	P2.051909.153822	WG302743-18	CCV		1		05/19/09 15:38
43	P2.051909.154505	WG302743-19	CCB		1		05/19/09 15:45
44	P2.051909.155140	L09050346-01	14429-W0001	50/50	1		05/19/09 15:51
45	P2.051909.155823	L09050348-01	14248-W0001	50/50	1		05/19/09 15:58
46	P2.051909.160506	L09050348-02	14274-W0001	50/50	1		05/19/09 16:05
47	P2.051909.161139	L09050348-03	14276-W0001	50/50	1		05/19/09 16:11
48	P2.051909.161816	L09050351-01	16251-W1921	50/50	1		05/19/09 16:18
49	P2.051909.162456	L09050351-02	16261-W0005	50/50	1		05/19/09 16:24
50	P2.051909.163129	L09050351-03	16261-W0006	50/50	1		05/19/09 16:31
51	P2.051909.163810	L09050364-01	13586-W0001	50/50	1		05/19/09 16:38
52	P2.051909.164449	L09050364-02	14502-W0001	50/50	1		05/19/09 16:44
53	P2.051909.165128	L09050364-03	14692-W0001	50/50	1		05/19/09 16:51
54	P2.051909.165801	WG302743-20	CCV		1		05/19/09 16:58
55	P2.051909.170443	WG302743-21	CCB		1		05/19/09 17:04
56	P2.051909.171120	L09050366-01	737-W0001	50/50	1		05/19/09 17:11
57	P2.051909.171803	L09050366-02	737-W0002	50/50	1		05/19/09 17:18
58	P2.051909.172443	L09050394-01	13383-W0001	50/50	1		05/19/09 17:24
59	P2.051909.173117	L09050394-02	16645-W0001	50/50	1		05/19/09 17:31
60	P2.051909.173824	L09050394-03	537-W0001	50/50	1		05/19/09 17:38
61	P2.051909.174503	WG302743-22	CCV		1		05/19/09 17:45
62	P2.051909.175146	WG302743-23	CCB		1		05/19/09 17:51
63	P2.051909.175822	WG302423-03	Louisville Chem Requ		1		05/19/09 17:58
64	P2.051909.180501	WG302385-02	Method/Prep Blank	50/50	1		05/19/09 18:05
65	P2.051909.181135	WG302385-03	Laboratory Control S	50/50	1		05/19/09 18:11
66	P2.051909.181818	L09050308-02	0905SWMST136-F	50/50	1		05/19/09 18:18
67	P2.051909.182458	WG302423-04	Post Digestion Spike		1	L09050308-02	05/19/09 18:24
68	P2.051909.183132	WG302423-05	Serial Dilution		5	L09050308-02	05/19/09 18:31
69	P2.051909.183813	WG302385-01	Reference Sample		1	L09050313-01	05/19/09 18:38
70	P2.051909.184457	WG302385-04	Matrix Spike	50/50	1	L09050313-01	05/19/09 18:44
71	P2.051909.185134	WG302385-05	Matrix Spike Duplica	50/50	1	L09050313-01	05/19/09 18:51
72	P2.051909.185819	WG302743-24	CCV		1		05/19/09 18:58
73	P2.051909.190501	WG302743-25	CCB		1		05/19/09 19:05
74	P2.051909.191137	L09050308-04	0905SWMST143-F	50/50	1		05/19/09 19:11

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Instrument Run Log

Instrument: PE-ICP2 Dataset: 051909H4R.CSV
Analyst1: PDM Analyst2: N/A
Method: 6010B SOP: ME660E Rev: 9
Maintenance Log ID: 28784

Calibration Std: STD32446 ICV/CCV Std: STD32864 Post Spike: STD27612
ICSA: STD32624 ICSAB: STD32450 Int. Std: STD32011

Workgroups: 302228,302563,302423,302567,302487

Comments: No results from sequence 12 through 30 were reported.

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
75	P2.051909.191821	L09050308-06	0905SWMST269-F	50/50	1		05/19/09 19:18
76	P2.051909.192500	L09050308-08	0905ER-SW-06-F	50/50	1		05/19/09 19:25
77	P2.051909.193134	L09050308-10	0905B-SW-06-F	50/50	1		05/19/09 19:31
78	P2.051909.193815	L09050316-11	AV-NCB-EB-1-051309	50/50	1		05/19/09 19:38
79	P2.051909.194455	WG302423-03	Louisville Chem Requ		1		05/19/09 19:44
80	P2.051909.195129	WG302743-26	CCV		1		05/19/09 19:51
81	P2.051909.195816	WG302743-27	CCB		1		05/19/09 19:58
82	P2.051909.200454	WG302531-02	Method/Prep Blank	50/50	1		05/19/09 20:04
83	P2.051909.201128	WG302531-03	Laboratory Control S	50/50	1		05/19/09 20:11
84	P2.051909.201811	L09050329-01	SE-3026P	50/50	1		05/19/09 20:18
85	P2.051909.202617	WG302567-01	Post Digestion Spike		1	L09050329-01	05/19/09 20:26
86	P2.051909.203251	WG302567-02	Serial Dilution		5	L09050329-01	05/19/09 20:32
87	P2.051909.203936	L09050329-02	SE-3026F	50/50	1		05/19/09 20:39
88	P2.051909.204617	L09050342-01	W-20	50/50	1		05/19/09 20:46
89	P2.051909.205256	WG302531-01	Reference Sample		1	L09050342-02	05/19/09 20:52
90	P2.051909.205940	WG302531-04	Matrix Spike	50/50	1	L09050342-02	05/19/09 20:59
91	P2.051909.210623	WG302531-05	Matrix Spike Duplica	50/50	1	L09050342-02	05/19/09 21:06
92	P2.051909.211308	WG302743-28	CCV		1		05/19/09 21:13
93	P2.051909.211944	WG302743-29	CCB		1		05/19/09 21:19
94	P2.051909.212620	L09050342-05	W-37 WT	50/50	1		05/19/09 21:26
95	P2.051909.213259	L09050342-07	W-1 A	50/50	1		05/19/09 21:32
96	P2.051909.213946	L09050342-09	W-31 WB	50/50	1		05/19/09 21:39
97	P2.051909.214627	L09050342-11	W-50	50/50	1		05/19/09 21:46
98	P2.051909.215304	L09050390-01	14456-W0001	50/50	1		05/19/09 21:53
99	P2.051909.215945	L09050390-02	14845-W0001	50/50	1		05/19/09 21:59
100	P2.051909.220626	L09050390-03	15907-W0001	50/50	1		05/19/09 22:06
101	P2.051909.221301	WG302743-30	CCV		1		05/19/09 22:13
102	P2.051909.221949	WG302743-31	CCB		1		05/19/09 22:19
103	P2.051909.222625	L09050390-04	16035-W0001	50/50	1		05/19/09 22:26
104	P2.051909.223259	L09050390-05	16072-W0001	50/50	1		05/19/09 22:32
105	P2.051909.223941	L09050390-06	17414-W0001	50/50	1		05/19/09 22:39
106	P2.051909.224622	L09050398-01	905-98	50/50	1		05/19/09 22:46
107	P2.051909.225302	L09050398-02	905-97	50/50	1		05/19/09 22:53
108	P2.051909.225948	L09050399-05	0905-141-1	50/50	1		05/19/09 22:59
109	P2.051909.230628	WG302743-32	CCV		1		05/19/09 23:06
110	P2.051909.231308	WG302743-33	CCB		1		05/19/09 23:13
111	P2.051909.231943	WG302487-03	Louisville Chem Requ		1		05/19/09 23:19

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Instrument Run Log

Instrument: PE-ICP2 Dataset: 051909H4R.CSV
Analyst1: PDM Analyst2: N/A
Method: 6010B SOP: ME660E Rev: 9
Maintenance Log ID: 28784

Calibration Std: STD32446 ICV/CCV Std: STD32864 Post Spike: STD27612
ICSA: STD32624 ICSAB: STD32450 Int. Std: STD32011

Workgroups: 302228,302563,302423,302567,302487

Comments: No results from sequence 12 through 30 were reported.

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
112	P2.051909.232623	WG302387-02	Method/Prep Blank	50/50	1		05/19/09 23:26
113	P2.051909.233258	WG302387-03	Laboratory Control S	50/50	1		05/19/09 23:32
114	P2.051909.233943	WG302387-01	Reference Sample		1	L09050337-02	05/19/09 23:39
115	P2.051909.234631	WG302387-04	Matrix Spike	50/50	1	L09050337-02	05/19/09 23:46
116	P2.051909.235315	WG302387-05	Matrix Spike Duplica	50/50	1	L09050337-02	05/19/09 23:53
117	P2.052009.000005	L09050337-04	LF5MW10-0905	50/50	1		05/20/09 00:00
118	P2.052009.000650	WG302487-01	Post Digestion Spike		1	L09050337-04	05/20/09 00:06
119	P2.052009.001331	WG302487-02	Serial Dilution		5	L09050337-04	05/20/09 00:13
120	P2.052009.002017	WG302743-34	CCV		1		05/20/09 00:20
121	P2.052009.002657	WG302743-35	CCB		1		05/20/09 00:26
122	P2.052009.003332	L09050335-01	EOD-MW02	50/50	1		05/20/09 00:33
123	P2.052009.004017	L09050335-02	EOD-MW02 RIN	50/50	1		05/20/09 00:40
124	P2.052009.004658	L09050335-03	EOD-MW03	50/50	1		05/20/09 00:46
125	P2.052009.005333	L09050335-04	EOD-MW04R	50/50	1		05/20/09 00:53
126	P2.052009.010018	WG302487-03	Louisville Chem Requ		1		05/20/09 01:00
127	P2.052009.010659	L09050337-01	LF5MW07-0905	50/50	1		05/20/09 01:06
128	P2.052009.011338	L09050337-03	LF5MW09-0905	50/50	1		05/20/09 01:13
129	P2.052009.012028	L09050337-05	LF5MW11-0905	50/50	1		05/20/09 01:20
130	P2.052009.012713	L09050337-06	LF5MW01-0905	50/50	1		05/20/09 01:27
131	P2.052009.013403	WG302743-36	CCV		1		05/20/09 01:34
132	P2.052009.014045	WG302743-37	CCB		1		05/20/09 01:40
133	P2.052009.014720	L09050337-07	LF5MW12-0905	50/50	1		05/20/09 01:47
134	P2.052009.015400	L09050337-08	LF5MW13-0905	50/50	1		05/20/09 01:54
135	P2.052009.020048	L09050337-09	LF5MW14-0905	50/50	1		05/20/09 02:00
136	P2.052009.020737	L09050337-10	LF5MW08-0905-DUP	50/50	1		05/20/09 02:07
137	P2.052009.021456	L09050339-01	ANL 3048	50/50	1		05/20/09 02:14
138	P2.052009.022139	L09050339-02	ANL 3050	50/50	1		05/20/09 02:21
139	P2.052009.022820	L09050339-03	ANL 3051	50/50	1		05/20/09 02:28
140	P2.052009.023456	L09050339-04	ANL 3052	50/50	1		05/20/09 02:34
141	P2.052009.024138	L09050339-05	ANL 3053	50/50	1		05/20/09 02:41
142	P2.052009.024819	L09050339-06	ANL 3054	50/50	1		05/20/09 02:48
143	P2.052009.025501	WG302743-38	CCV		1		05/20/09 02:55
144	P2.052009.030141	WG302743-39	CCB		1		05/20/09 03:01

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Data Checklist

Date: 15-MAY-2009
Analyst: JYH
Analyst: NA
Method: 6010
Instrument: PE-ICP2
Curve Workgroup: 302460
Runlog ID: 28109
Analytical Workgroups: 302423,302228,302480,302341

Additional WG: 302248, 302341, 302261	
Calibration/Linearity	X
ICV/CCV	X
ICB/CCB	X
ICSA/ICSAB	X
CRI	
Blank/LCS	X
MS/MSD	X
Post Spike/Serial Dilution	X
Upload Results	X
Data Qualifiers	
Generate PDF Instrument Data	X
Sign/Annotate PDF Data	X
Upload Curve Data	X
Workgroup Forms	X
Case Narrative	313,316,320,340,190,200,216,219
	220,327,298
Client Forms	X
Level X	
Level 3	313,190
Level 4	316,320,340,200,220,290
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	JYH
Secondary Reviewer	MMB
Comments	

Primary Reviewer:
18-MAY-2009

Secondary Reviewer:
18-MAY-2009

CHECKLIST1 - Modified 03/05/2008
Generated: MAY-18-2009 17:01:28

Microbac Laboratories Inc.

Data Checklist

Date: 19-MAY-2009
Analyst: PDM
Analyst: NA
Method: 6010B
Instrument: PE-ICP2
Curve Workgroup: 302743
Runlog ID: 28158
Analytical Workgroups: 302228,302563,302423,302567,302487

Calibration/Linearity	X
ICV/CCV	X
ICB/CCB	X
ICSA/ICSAB	X
CRI	
Blank/LCS	X
MS/MSD	X
Post Spike/Serial Dilution	X
Upload Results	X
Data Qualifiers	
Generate PDF Instrument Data	X
Sign/Annotate PDF Data	X
Upload Curve Data	X
Workgroup Forms	X
Case Narrative	0316,0346,0348,3051,0364,0366,0394
	0308,0398,0342,0329,0390,0399,0337
	0335,0339
Client Forms	X
Level X	
Level 3	0335
Level 4	0316,0346,0348,3051,0364,0366,0394
	0308,0390,0337,0339
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	PDM
Secondary Reviewer	MMB
Comments	

Primary Reviewer: 20-MAY-2009 Pierce Morris

Secondary Reviewer: 20-MAY-2009 Maren Berry

CHECKLIST1 - Modified 03/05/2008
Generated: MAY-20-2009 15:08:44

Microbac Laboratories Inc.

HOLDING TIMES
EQUIVALENT TO AFCEE FORM 9

Analytical Method: 6010B

AAB#: WG302423

Login Number: L09050313

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
49WW06-090513	05/13/09	05/14/09	05/15/09	180	1.69	05/15/09	180	0.220	

* EXT = SEE PROJECT QAPP REQUIREMENTS
*ANAL = SEE PROJECT QAPP REQUIREMENTS

HOLD_TIMES - Modified 03/06/2008
PDF File ID: 1394263
Report generated 05/15/2009 14:04

METHOD BLANK SUMMARY

Login Number: L09050313
Blank File ID: P2.051509.120335
Prep Date: 05/15/09 07:00
Analyzed Date: 05/15/09 12:03
Analyst: JYH

Work Group: WG302423
Blank Sample ID: WG302385-02
Instrument ID: PE-ICP2
Method: 6010B

This Method Blank Applies To The Following Samples:

Client ID	Lab Sample ID	Lab File ID	Time Analyzed	TAG
LCS	WG302385-03	P2.051509.121014	05/15/09 12:10	01
49WW06-090513	L09050313-01	P2.051509.121657	05/15/09 12:16	01

Report Name: BLANK_SUMMARY
PDF File ID: 1394264
Report generated 05/15/2009 14:04

Microbac Laboratories Inc.

METHOD BLANK REPORT

Login Number: L09050313 Prep Date: 05/15/09 07:00 Sample ID: WG302385-02
Instrument ID: PE-ICP2 Run Date: 05/15/09 12:03 Prep Method: 3005A
File ID: P2.051509.120335 Analyst: JYH Method: 6010B
Workgroup (AAB#): WG302423 Matrix: Water Units: mg/L
Contract #: DACA56-94-D-0020 Cal ID: PE-ICP - 15-MAY-09

Analytes	SDL	PQL	Concentration	Dilution	Qualifier
Aluminum, Total	0.0500	0.100	0.0500	1	U
Iron, Total	0.0250	0.100	0.0250	1	U

SDL Method Detection Limit
PQL Reporting/Practical Quantitation Limit
ND Analyte Not detected at or above reporting limit
* |Analyte concentration| > RL

Report Name: BLANK
PDF ID: 1394265
15-MAY-2009 14:04

Microbac Laboratories Inc.
LABORATORY CONTROL SAMPLE (LCS)

Login Number: L09050313 Run Date: 05/15/2009 Sample ID: WG302385-03
Instrument ID: PE-ICP2 Run Time: 12:10 Prep Method: 3005A
File ID: P2.051509.121014 Analyst: JYH Method: 6010B
Workgroup (AAB#): WG302423 Matrix: Water Units: mg/L
QC Key: STD Lot#: STD27613 Cal ID: PE-ICP-15-MAY-09

Analytes	Expected	Found	% Rec	LCS Limits	Q
Aluminum, Total	5.00	5.36	107	85 - 115	
Iron, Total	2.00	2.13	106	85 - 115	

LCS - Modified 03/06/2008
PDF File ID: 1394266
Report generated: 05/15/2009 14:04

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Microbac Laboratories Inc.
MATRIX SPIKE AND MATRIX SPIKE DUP (MS/MSD)

Loginnum: L09050313 Cal ID: PE-ICP2- Worknum: WG302423
Instrument ID: PE-ICP2 Contract #: DACA56-94-D-0020 Method: 6010B
Parent ID: WG302385-01 File ID: P2.051509.121657 Dil: 1 Matrix: WATER
Sample ID: WG302385-04 MS File ID: P2.051509.122346 Dil: 1 Units: mg/L
Sample ID: WG302385-05 MSD File ID: P2.051509.122913 Dil: 1

Analyte	Parent	MS Spiked	MS Found	MS %Rec	MSD Spiked	MSD Found	MSD %Rec	%RPD	%Rec Limits	RPD Limit	Q
Aluminum, Total	ND	5.00	5.11	102	5.00	5.15	103	0.879	80 - 120	20	
Iron, Total	ND	2.00	1.97	98.7	2.00	2.01	101	1.89	80 - 120	20	

* FAILS %REC LIMIT

FAILS RPD LIMIT

NOTE: This is an internal quality control sample.

WG_MS_MSD_DRYWT - Modified 03/07/2008
PDF File ID: 1394267
Report generated 05/15/2009 14:04

Microbac Laboratories Inc.
Serial Dilution Report

Login: L09050313 **Worknum:** WG302423
Instrument: PE-ICP2 **Method:** 6010B
Serial Dil: WG302423-02 **File ID:** P2.051509.130913 **Dil:** 5 **Units:** mg/L
Sample: L09050340-15 **File ID:** P2.051509.125559 **Dil:** 1

Analyte	Sample	Qual	Serial Dil	Qual	% Diff	Q
Aluminum	ND	U	ND	U		
Iron	ND	U	ND	U		

U = Result is below MDL.
F = Result is greater than or equal to MDL and less than the RL.
X = Result is greater than or equal to RL and less than 50 times the MDL.
E = %D exceeds control limit of 10% and initial sample result is greater than or equal to 50 times the MDL.

SERIAL_DIL - Modified 09/22/2008
PDF File ID: 1394261
05/15/2009 14:04

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Microbac Laboratories Inc.
POST SPIKE REPORT

Sample Login ID: L09050313 **Worknum:** WG302423
Instrument ID: PE-ICP2 **Method:** 6010B
Post Spike ID: WG302423-01 **File ID:** P2.051509.130234 **Dil:** 1 **Units:** mg/L
Sample ID: L09050340-15 **File ID:** P2.051509.125559 **Dil:** 1 **Matrix:** Water

Analyte	Post Spike Result	C	Sample Result	C	Spike Added(SA)	% R	Control Limit %R	Q
ALUMINUM	5.03		0	U	5	100.5	75 - 125	
IRON	2.05		0	U	2	102.5	75 - 125	

N = % Recovery exceeds control limits
F = Result is between MDL and RL
U = Sample result is below MDL. A value of zero is used in the calculation

POST_SPIKE - Modified 03/06/2008
PDF File ID: 1394262
Report generated: 05/15/2009 14:04

Microbac Laboratories Inc.
Initial Calibration Summary

Login:	L09050313	Workgroup (AAB#):	WG302423
Analytical Method:	6010B	Instrument ID:	PE-ICP2
ICAL Worknum:	WG302460	Initial Calibration Date:	15-MAY-2009 10:46

	WG302460-01		WG302460-02		WG302460-03		WG302460-04		WG302460-05			
	Conc	INT	Conc	INT	Conc	INT	Conc	INT	Conc	INT	R	Q
ALUMINUM	0	-47.4	.1	770	.2	1530	10	72000	20	147000	.999949	
IRON	0	-0.461	.04	12.2	.08	28.9	4	1270	8	2590	.999962	

INT = Instrument intensity
R = Coefficient of correlation
Q = Data Qualifier
*** = Out of Compliance; R < 0.995**

INT_CAL_ICP - Modified 03/06/2008
PDF File ID: 1394270
Report generated: 15-MAY-2009 14:04

Microbac Laboratories Inc.
INITIAL CALIBRATION BLANK (ICB)

Login Number: L09050313
Run Date: 05/15/2009
Sample ID: WG302460-07
Instrument ID: PE-ICP2
Run Time: 11:00
Method: 6010
File ID: P2.051509.110024
Analyst: JYH
Units: mg/L
Workgroup (AAB#): WG302423
Cal ID: PE-ICP2 - 15-MAY-09
Matrix: WATER

Analytes	MDL	RDL	Concentration	Qualifier
ALUMINUM	.05	.1	.05	U
IRON	.025	.1	.025	U

ICB - Modified 03/06/2008
PDF File ID: 1394272
Report generated 05/15/2009 14:04

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Microbac Laboratories Inc.
CONTINUING CALIBRATION BLANK (CCB)

00076002

Login Number: L09050313
Run Date: 05/15/2009
Sample ID: WG302460-11
Instrument ID: PE-ICP2
Run Time: 11:25
Method: 6010B
File ID: P2.051509.112503
Analyst: JYH
Units: mg/L
Workgroup (AAB#): WG302423
Cal ID: PE-ICP - 15-MAY-09
Matrix: WATER

Analytes	MDL	RDL	Concentration	Qualifier
Aluminum	0.0500	0.100	0.0500	U
Iron	0.0250	0.100	0.0250	U

U = Result is less than MDL.
F = Result is between MDL and RL.
* = Result is above RL.

CCB - Modified 03/05/2008
PDF File ID: 1394275
Report generated 05/15/2009 14:04

Microbac Laboratories Inc.

CONTINUING CALIBRATION BLANK (CCB)

Login Number: L09050313
Run Date: 05/15/2009
Sample ID: WG302460-13
Instrument ID: PE-ICP2
Run Time: 12:42
Method: 6010B
File ID: P2.051509.124242
Analyst: JYH
Units: mg/L
Workgroup (AAB#): WG302423
Cal ID: PE-ICP - 15-MAY-09
Matrix: WATER

Analytes	MDL	RDL	Concentration	Qualifier
Aluminum	0.0500	0.100	0.0500	U
Iron	0.0250	0.100	0.0250	U

U = Result is less than MDL.
F = Result is between MDL and RL.
* = Result is above RL.

CCB - Modified 03/05/2008
PDF File ID: 1394275
Report generated 05/15/2009 14:04

Microbac Laboratories Inc.
CONTINUING CALIBRATION BLANK (CCB)

00076004

Login Number: L09050313
Run Date: 05/15/2009
Sample ID: WG302460-15
Instrument ID: PE-ICP2
Run Time: 13:22
Method: 6010B
File ID: P2.051509.132234
Analyst: JYH
Units: mg/L
Workgroup (AAB#): WG302423
Cal ID: PE-ICP - 15-MAY-09
Matrix: WATER

Analytes	MDL	RDL	Concentration	Qualifier
Aluminum	0.0500	0.100	0.0500	U
Iron	0.0250	0.100	0.0250	U

U = Result is less than MDL.
F = Result is between MDL and RL.
* = Result is above RL.

CCB - Modified 03/05/2008
PDF File ID: 1394275
Report generated 05/15/2009 14:04

Microbac Laboratories Inc.

INITIAL CALIBRATION VERIFICATION (ICV)
(Alternate Source)

Login Number: L09050313 Run Date: 05/15/2009 Sample ID: WG302460-06
Instrument ID: PE-ICP2 Run Time: 10:53 Method: 6010B
File ID: P2.051509.105342 Analyst: JYH Units: mg/L
Workgroup (AAB#): WG302423 Cal ID: PE-ICP - 15-MAY-09
QC Key: STD

Analyte		Expected	Found	%REC	LIMITS	Q
Aluminum		10	9.93	99.3	90 - 110	
Iron		4	4.00	100	90 - 110	

* Exceeds LIMITS Limit

ICV - Modified 03/06/2008
PDF File ID: 1394271
Report generated 05/15/2009 14:04

Microbac Laboratories Inc.
CONTINUING CALIBRATION VERIFICATION (CCV)

00076006

Login Number: L09050313
Run Date: 05/15/2009
Sample ID: WG302460-10
Instrument ID: PE-ICP2
Run Time: 11:18
Method: 6010B
File ID: P2.051509.111822
Analyst: JYH
QC Key: STD
Workgroup (AAB#): WG302423
Cal ID: PE-ICP - 15-MAY-09
Matrix: WATER

Analyte		Expected	Found	UNITS	%REC	LIMITS		Q
Aluminum		10.0	10.0	mg/L	100	90 - 110		
Iron		4.00	4.00	mg/L	100	90 - 110		

* Exceeds LIMITS Criteria

CCV - Modified 03/05/2008
PDF File ID: 1394274
Report generated 05/15/2009 14:04

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CONTINUING CALIBRATION VERIFICATION (CCV)

00076007

Login Number: L09050313
Run Date: 05/15/2009
Sample ID: WG302460-12
Instrument ID: PE-ICP2
Run Time: 12:35
Method: 6010B
File ID: P2.051509.123556
Analyst: JYH
QC Key: STD
Workgroup (AAB#): WG302423
Cal ID: PE-ICP - 15-MAY-09
Matrix: WATER

Analyte		Expected	Found	UNITS	%REC	LIMITS		Q
Aluminum		10.0	9.87	mg/L	98.7	90 - 110		
Iron		4.00	4.01	mg/L	100	90 - 110		

* Exceeds LIMITS Criteria

CCV - Modified 03/05/2008
PDF File ID: 1394274
Report generated 05/15/2009 14:04

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CONTINUING CALIBRATION VERIFICATION (CCV)

Login Number: L09050313
Run Date: 05/15/2009
Sample ID: WG302460-14
Instrument ID: PE-ICP2
Run Time: 13:15
Method: 6010B
File ID: P2.051509.131553
Analyst: JYH
QC Key: STD
Workgroup (AAB#): WG302423
Cal ID: PE-ICP - 15-MAY-09
Matrix: WATER

Analyte		Expected	Found	UNITS	%REC	LIMITS		Q
Aluminum		10.0	10.0	mg/L	100	90 - 110		
Iron		4.00	4.08	mg/L	102	90 - 110		

* Exceeds LIMITS Criteria

CCV - Modified 03/05/2008
PDF File ID: 1394274
Report generated 05/15/2009 14:04

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Microbac Laboratories Inc.
INTERFERENCE CHECK SAMPLES

Login number: L09050313
Instrument ID: PE-ICP2
Sol. A : WG302460-08 **File ID:** P2.051509.110700
Sol. AB : WG302460-09 **File ID:** P2.051509.111242

Workgroup (AAB#): WG302423
Method: 6010B
Units: mg/L
Matrix: Water

	Sol. A			Sol. AB			
ANALYTE	True	Found	%Recovery	True	Found	%Recovery	Q
Aluminum	250	247	98.8	250	243	97.2	
Iron	100	94.8	94.8	100	95.5	95.5	

NS = Not spiked
*** = Recovery of spiked element is outside acceptance limit of 80% - 120% of true value.**
 # = Result for unspiked element is outside the acceptance limits of (+/-) the project reporting limit (RL).

ICS - Modified 03/06/2008
PDF File ID: 1394273
Report generated 05/15/2009 14:04

Microbac Laboratories Inc.
INTERELEMENT CORRECTION FACTORS (ANNUALLY)

Login Number: L09050313 **Date:** 02/02/2009
Insturment ID: PE-ICP2 **Method:** 6010B

Analyte	Wave Length	AG	AL	AS	B	BA
ALUMINUM	396.15	0	0	0.206	0	0
ANTIMONY	206.84	0	0	-0.740	0	0
ARSENIC	188.98	0	-0.00216	0	0	0
BARIUM	233.53	0	0	0	0	0
BERYLLIUM	234.86	0	0	0	0	0
BORON	249.68	0	0	0	0	0
CADMIUM	228.80	0	0	0	0	0
CALCIUM	227.55	0	-0.370	0.0414	0	0
CHROMIUM	267.72	0	0	0	0	0
COBALT	228.62	0	0	0	0	-1.07
COPPER	327.39	0	0	0	0	0
IRON	239.56	0	0	0	0	0
LEAD	220.35	0	-0.107	0	0	0
LITHIUM	670.78	0	0	0	0	0
MAGNESIUM	279.08	0	0	0	0	0
MANGANESE	257.61	-0.185	0	-0.231	-0.0949	-0.230
MOLYBDENUM	202.03	0	0	0	0	0
NICKEL	231.60	0	0	0	0	0
POTASSIUM	766.49	0	0	0	0	0
SELENIUM	196.03	0	0.207	0	0	0
SILICON	251.61	0	0	0	0	0
SILVER	328.07	0	0	0	0	0
SODIUM	589.59	0	0	0	0	0
STRONTIUM	407.77	0	0	0	0	0
THALLIUM	190.80	0	0	0	0	0
TIN	189.93	0	0	0	0	0
TITANIUM	334.94	0	0	0	0	0
VANADIUM	290.88	0	0	0.200	0	0.0400
ZINC	206.20	0	0.0753	0	0	0

CORR_FACTORS - Modified 03/05/2008
PDF File ID: 1394269
Report generated: 05/15/2009 14:04

Microbac Laboratories Inc.
INTERELEMENT CORRECTION FACTORS (ANNUALLY)

Login Number: L09050313 **Date:** 02/02/2009
Insturment ID: PE-ICP2 **Method:** 6010B

Analyte	Wave Length	BE	CA	CD	CO	CR
ALUMINUM	396.15	0	0.274	0	0	0
ANTIMONY	206.84	0	0	0	0	19.8
ARSENIC	188.98	0	-0.00673	-0.0875	0	-2.91
BARIUM	233.53	0	0	0	0	0
BERYLLIUM	234.86	0	0	0	0	-0.0105
BORON	249.68	0	0	50.1	3.51	1.50
CADMIUM	228.80	0	0	0	-5.41	0
CALCIUM	227.55	0	0	0	126	-21.8
CHROMIUM	267.72	0	0	0	0	0
COBALT	228.62	0	0	0	0	0.156
COPPER	327.39	0	0	0	0.380	-0.0467
IRON	239.56	0	0.0227	0	1.91	0.331
LEAD	220.35	0	-0.0247	0	0.666	-0.0700
LITHIUM	670.78	0	0	0	0	0
MAGNESIUM	279.08	0	0.638	0	0	0
MANGANESE	257.61	-1.04	0.0280	-0.755	-0.0418	-0.110
MOLYBDENUM	202.03	0	0	0	0	0
NICKEL	231.60	0	0	0	0.623	0
POTASSIUM	766.49	0	0	0	0	0
SELENIUM	196.03	0	0.0190	0	-0.633	0
SILICON	251.61	0	0	0	0	0
SILVER	328.07	0	0	0	0	0
SODIUM	589.59	0	0	0	0	0
STRONTIUM	407.77	0	0	0	0	0
THALLIUM	190.80	0	-0.0100	0	0.953	0
TIN	189.93	0	0	0	0	0
TITANIUM	334.94	0	-0.0233	0	0	0.297
VANADIUM	290.88	0	-0.00100	0	0	0
ZINC	206.20	0	-0.0333	15.3	0	-7.08

CORR_FACTORS - Modified 03/05/2008
PDF File ID: 1394269
Report generated: 05/15/2009 14:04

Microbac Laboratories Inc.
INTERELEMENT CORRECTION FACTORS (ANNUALLY)

Login Number: L09050313 **Date:** 02/02/2009
Insturment ID: PE-ICP2 **Method:** 6010B

Analyte	Wave Length	CU	FE	K	LI	MG
ALUMINUM	396.15	0	0.108	0	0	0
ANTIMONY	206.84	0	0	0	0	0
ARSENIC	188.98	0	0.00251	0	0	0
BARIUM	233.53	0	0.0520	0	0	0
BERYLLIUM	234.86	0	0.152	0	0	0
BORON	249.68	0	-4.02	0	0	0
CADMIUM	228.80	0	-0.00274	0	0	0
CALCIUM	227.55	-2.44	-4.01	0	0	0.104
CHROMIUM	267.72	0	-0.0239	0	0	0
COBALT	228.62	0	0.00949	0	0	0
COPPER	327.39	0	-0.0851	0	0.154	0.0143
IRON	239.56	0	0	0	0	0.0276
LEAD	220.35	0.551	0.103	0	0	0
LITHIUM	670.78	0	0	0	0	0
MAGNESIUM	279.08	0	0.174	0	0	0
MANGANESE	257.61	-0.0457	-0.156	-0.0181	-0.794	0.0147
MOLYBDENUM	202.03	0	-0.0494	0	0	0
NICKEL	231.60	0	0	0	0	0
POTASSIUM	766.49	0	-0.0451	0	0	0
SELENIUM	196.03	0	-1.01	0	0	-0.0113
SILICON	251.61	0	0	0	0	0
SILVER	328.07	0.0717	-0.00209	0	0	0
SODIUM	589.59	0	0	0	0	0
STRONTIUM	407.77	0	0.138	0	0	0
THALLIUM	190.80	0	0	0	0	0
TIN	189.93	0	0	0	0	0
TITANIUM	334.94	0	0	0	0	0
VANADIUM	290.88	0	0.0715	0	0	-0.0400
ZINC	206.20	-0.200	-0.0563	0	0	0

CORR_FACTORS - Modified 03/05/2008
PDF File ID: 1394269
Report generated: 05/15/2009 14:04

Microbac Laboratories Inc.
INTERELEMENT CORRECTION FACTORS (ANNUALLY)

Login Number: L09050313 **Date:** 02/02/2009
Insturment ID: PE-ICP2 **Method:** 6010B

Analyte	Wave Length	MN	MO	NA	NI	PB
ALUMINUM	396.15	0	32.9	0	0	0
ANTIMONY	206.84	0	-17.4	0	0	0
ARSENIC	188.98	0	3.66	0	0	0
BARIUM	233.53	0	-0.548	0	0	0
BERYLLIUM	234.86	-0.131	-0.529	0	-0.00974	0
BORON	249.68	0	-2.08	0	0	0
CADMIUM	228.80	0	0.0112	0	-0.0299	0
CALCIUM	227.55	0	-18.6	0	-1090	0
CHROMIUM	267.72	0.434	-0.00100	0	0	0
COBALT	228.62	0	-0.835	0	0.129	0
COPPER	327.39	0.136	-0.0774	0	0.150	0.257
IRON	239.56	0.480	0	0	0	0.407
LEAD	220.35	0.0756	-2.50	0	-0.174	0
LITHIUM	670.78	0	0	0	0	0
MAGNESIUM	279.08	0	-5.58	0	0	0.0252
MANGANESE	257.61	0	-0.0482	-0.00916	-0.0340	-0.0413
MOLYBDENUM	202.03	-0.209	0	0	0.120	0
NICKEL	231.60	0	0	0	0	0
POTASSIUM	766.49	0	0	1.00	0	0
SELENIUM	196.03	0.451	0.199	0	0.0799	0
SILICON	251.61	0	12.9	0	0	0
SILVER	328.07	0.130	0.0781	0	0	0
SODIUM	589.59	0	0	0	0	0
STRONTIUM	407.77	0	0	0	0	0
THALLIUM	190.80	-0.00100	1.20	0	0	0
TIN	189.93	0	0	0	0	0
TITANIUM	334.94	0	0	0	0	0
VANADIUM	290.88	0	0.578	0	0	0
ZINC	206.20	0	0.180	0	-0.200	-0.100

CORR_FACTORS - Modified 03/05/2008
PDF File ID: 1394269
Report generated: 05/15/2009 14:04

Microbac Laboratories Inc.
INTERELEMENT CORRECTION FACTORS (ANNUALLY)

Login Number: L09050313 **Date:** 02/02/2009
Insturment ID: PE-ICP2 **Method:** 6010B

Analyte	Wave Length	SB	SE	SI	SN	SR
ALUMINUM	396.15	0	0	0	0	0
ANTIMONY	206.84	0	0	0	-10.6	0
ARSENIC	188.98	0	0	0	0	0
BARIUM	233.53	0	0	0	0	0
BERYLLIUM	234.86	0	0	0	0	0
BORON	249.68	0	0	0	0	0
CADMIUM	228.80	0	0	0	0	0
CALCIUM	227.55	0	0	2.79	0	0
CHROMIUM	267.72	0	0	0	0	0
COBALT	228.62	0	0	0	0	0
COPPER	327.39	0	0.148	0	0	0
IRON	239.56	0	0	0	0	0
LEAD	220.35	-0.0100	0	0	0	0
LITHIUM	670.78	0	0	0	0	0
MAGNESIUM	279.08	0	-0.0924	0	0	0
MANGANESE	257.61	-0.0505	-0.0281	-0.185	-0.0445	-0.625
MOLYBDENUM	202.03	0	0	0	0	0
NICKEL	231.60	-0.0500	-0.0100	0	0	0
POTASSIUM	766.49	0	0	0	0	0
SELENIUM	196.03	0	0	0	0	0
SILICON	251.61	0	0	0	0	0
SILVER	328.07	0	0	0	0	0.200
SODIUM	589.59	0	0	0	0	0
STRONTIUM	407.77	0	0	0	0	0
THALLIUM	190.80	0	0	0	0	0
TIN	189.93	0	0	0	0	0
TITANIUM	334.94	0	0	0	0	0
VANADIUM	290.88	0	0	0	0	0
ZINC	206.20	-0.300	0	0	0	0

CORR_FACTORS - Modified 03/05/2008
PDF File ID: 1394269
Report generated: 05/15/2009 14:04

Microbac Laboratories Inc.
INTERELEMENT CORRECTION FACTORS (ANNUALLY)

Login Number: L09050313 **Date:** 02/02/2009
Insturment ID: PE-ICP2 **Method:** 6010B

Analyte	Wave Length	TI	TL	V	ZN
ALUMINUM	396.15	0	0	0	0
ANTIMONY	206.84	0	0	-3.59	0
ARSENIC	188.98	0	0	0.0930	0
BARIUM	233.53	0	0	-1.83	0
BERYLLIUM	234.86	0	0	0	0
BORON	249.68	0	0	0	0
CADMIUM	228.80	0	0	0.0940	0
CALCIUM	227.55	0	0	19.1	0
CHROMIUM	267.72	0	0	-0.567	-0.0400
COBALT	228.62	2.21	0	0	0
COPPER	327.39	-1.05	0	-0.603	0
IRON	239.56	0	0	0	-0.0613
LEAD	220.35	-0.441	0	-0.150	0
LITHIUM	670.78	0	0	0	0
MAGNESIUM	279.08	0	0	-0.0280	0
MANGANESE	257.61	-0.00931	-0.0414	-0.0601	-0.0553
MOLYBDENUM	202.03	0	0	-0.288	0
NICKEL	231.60	0	0.617	0	0
POTASSIUM	766.49	0	0	0	0
SELENIUM	196.03	-0.220	0	0.823	0
SILICON	251.61	0	0	0	0
SILVER	328.07	0	0	-5.47	0
SODIUM	589.59	0	0	0	0
STRONTIUM	407.77	0	0	0	0
THALLIUM	190.80	-4.00	0	0	0
TIN	189.93	0	0	0	0
TITANIUM	334.94	0	0	0	0
VANADIUM	290.88	0	0	0	0
ZINC	206.20	0	0	-0.100	0

CORR_FACTORS - Modified 03/05/2008
PDF File ID: 1394269
Report generated: 05/15/2009 14:04

Microbac Laboratories Inc.
LINEAR RANGE (QUARTERLY)

Login Number: L09050313 **Date:** 03/25/2009
Insturment ID: PE-ICP2 **Method:** 6010B

Analyte	Integration Time (Sec.)	Concentration (mg/L)
Aluminum	10.00	450.0
Antimony	10.00	45.0
Arsenic	10.00	9.0
Barium	10.00	9.0
Beryllium	10.00	4.5
Boron	10.00	45.0
Cadmium	10.00	9.0
Calcium	10.00	450.0
Chromium	10.00	45.0
Cobalt	10.00	45.0
Copper	10.00	45.0
Iron	10.00	450.0
Lead	10.00	90.0
Lithium	10.00	1.8
Magnesium	10.00	450.0
Manganese	10.00	27.0
Molybdenum	10.00	45.0
Nickel	10.00	45.0
Potassium	10.00	90.0
Selenium	10.00	45.0
Silicon	10.00	36.0
Silver	10.00	9.0
Sodium	10.00	180.0
Strontium	10.00	4.5
Thallium	10.00	45.0
Tin	10.00	45.0
Titanium	10.00	45.0
Vanadium	10.00	45.0
Zinc	10.00	45.0

Comments:
All analytes passed acceptance criteria at the specified concentration.

LINEAR_RANGE - Modified 03/06/2008
PDF File ID: 1394268
Report generated: 05/15/2009 14:04

2.1.2 Metals ICP-MS Data

2.1.2.1 Summary Data

LABORATORY REPORT

L09050313

05/21/09 08:11

Submitted By

Microbac Laboratories Inc.
158 Starlite Drive
Marietta , OH 45750
(740) 373 - 4071

For

Account Name: Shaw E & I, Inc.
ABB Lummus Biulding
3010 Briarpark Drive Suite 4N
Houston, TX 77042
Attention: Jennifer Hoang

Project Number: 2773.025
Project: Longhorn AAP
Site: LONGHORN AAP KARNACK TX

P.O. Number: 389869/ 390836(GWTP)

Sample Analysis Summary

Client ID	Lab ID	Method	Dilution	Date Received
49WW06-090513	L09050313-01	6020	1	14-MAY-09

Report Number: **L09050313**
Report Date : **May 21, 2009**

Sample Number: **L09050313-01**
Client ID: **49WW06-090513**
Matrix: **Water**
Workgroup Number: **WG302348**
Collect Date: **05/13/2009 14:30**
Sample Tag: **01**

PrePrep Method: **NONE**
Prep Method: **3015**
Analytical Method: **6020**
Analyst: **JYH**
Dilution: **1**
Units: **mg/L**

Instrument: **ELAN-ICP**
Prep Date: **05/14/2009 12:32**
Cal Date: **05/14/2009 14:17**
Run Date: **05/14/2009 17:44**
File ID: **EL.051409.174423**

Analyte	CAS. Number	Result	Qual	PQL	SDL
Arsenic, Total	7440-38-2	0.0128		0.00100	0.000250

2.1.2.2 QC Summary Data

Example 6020 Calculations
Perkin Elmer ELAN 6100

1.0 Initial Calibration (ICAL) Parameters
The system performs linear regression from data consisting of a blank and three standards.

2.0 Calculating the concentration (C) of an element in water using data from prep log, run log, and quantitation report (note:the data system performs this calculation automatically when correction factors have been entered):

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

Where:	**Example:**
Cs = Concentration computed by the data system (ug/L)	0.1
Vf = Final volume	100
Vi = Initial volume	40
D = Dilution factor as a multiplier (10X = 10)	1
Cx = Concentration of element in (ug/L)	0.25

3.0 Calculating the concentration (C) of an element in soil using data from prep log, run log, and quantitation report (note: the data system performs this calculation automatically when correction factors have been entered):

$$Cx = Cs \times \frac{Vf}{Vi} \times D$$

Where:	**Example:**
Cs = Concentration computed by the data system (ug/L)	0.1
Vf = Final volume	200
Vi = Initial volume	0.5
D = Dilution factor as a multiplier (10X = 10)	1
Cx = Concentration of element in (ug/kg)	40

4.0 Adjusting the concentration to dry weight:

$$Cdry = \frac{Cx \times 100}{Px}$$

Where:	**Example:**
Cx = Concentration calculated as received (wet basis)	40
Px = Percent solids of sample (%wt)	80
$Cdry$ = Concentration calculated as dry weight (ug/kg)	50

50 ug/kg = 0.050 mg/kg

Perkin Elmer ELAN ICP/MS

STANDARDS KEY

QC Std 1 - ICV
QC Std 2 - ICB
QC Std 3 - CRI - Soil
QC Std 4 - CRI - Water
QC Std 5 - ICSA
QC Std 6 - ICSAB
QC Std 7 - CCV
QC Std 8 - CCB

Calibration Solutions

Analyte	Stock Conc. (mg/L)	S1 (mg/L)	S2 (mg/L)	S3 (mg/L)	S4 (mg/L)
Al	10	0	0.0004	0.05	0.1
Sb	10	0	0.0004	0.05	0.1
As	10	0	0.0004	0.05	0.1
Ba	10	0	0.0004	0.05	0.1
Be	10	0	0.0004	0.05	0.1
Ca	1000	0	0.04	5	10
Cd	10	0	0.0004	0.05	0.1
Cr	10	0	0.0004	0.05	0.1
Co	10	0	0.0004	0.05	0.1
Cu	10	0	0.0004	0.05	0.1
Fe	1000	0	0.04	5	10
Pb	10	0	0.0004	0.05	0.1
Mg	1000	0	0.04	5	10
Mn	10	0	0.0004	0.05	0.1
Ni	10	0	0.0004	0.05	0.1
K	1000	0	0.04	5	10
Se	10	0	0.0004	0.05	0.1
Ag	10	0	0.0004	0.05	0.1
Na	1000	0	0.04	5	10
Tl	10	0	0.0004	0.05	0.1
V	10	0	0.0004	0.05	0.1
Zn	10	0	0.0004	0.05	0.1

Microbac Laboratories Inc.
Microwave Digestion Log

Workgroup: WG302327
Analyst: REK
Spike Analyst: REK
Run Date: 05/14/2009 12:32
Method: 3015

SOP: ME407 Revison 10
Spike Solution: STD30482
Spike Witness: BRG
Digest tubes Lot #: COA13830
HNO3 Lot #: COA13859

	SAMPLE #	Type	Matrix	Initial Amount	Final Volume	Initial Vessel Wt	Final Vessel Wt	Spike Amount	Due Date
1	WG302327-03	BLANK	1	40 mL	100 mL	204.781 g	204.771 g		
2	WG302327-04	LCS	1	40 mL	100 mL	205.791 g	205.78 g	.25 mL	
3	WG302327-01	REF	2	40 mL	100 mL	204.906 g	204.885 g		
4	L09050288-01	SAMP	2	40 mL	100 mL	204.906 g	204.885 g		05/20/09
5	L09050308-01	SAMP	1	40 mL	100 mL	205.887 g	205.869 g		05/22/09
6	L09050308-02	SAMP	1	40 mL	100 mL	205.089 g	205.07 g		05/22/09
7	L09050308-03	SAMP	1	40 mL	100 mL	205.416 g	205.399 g		05/22/09
8	L09050308-04	SAMP	1	40 mL	100 mL	206.177 g	206.158 g		05/22/09
9	L09050308-05	SAMP	1	40 mL	100 mL	205.079 g	205.063 g		05/22/09
10	L09050308-06	SAMP	1	40 mL	100 mL	205.704 g	205.682 g		05/22/09
11	L09050308-07	SAMP	1	40 mL	100 mL	205.538 g	205.51 g		05/22/09
12	L09050308-08	SAMP	1	40 mL	100 mL	206.084 g	206.072 g		05/22/09
13	L09050308-09	SAMP	1	40 mL	100 mL	205.638 g	205.625 g		05/22/09
14	L09050308-10	SAMP	1	40 mL	100 mL	205.538 g	205.526 g		05/22/09
15	WG302327-02	REF	1	40 mL	100 mL	205.607 g	205.6 g		
16	L09050313-01	SAMP	1	40 mL	100 mL	205.607 g	205.6 g		05/15/09
17	WG302327-05	DUP	1	40 mL	100 mL	206.152 g	206.144 g		
18	WG302327-06	MS	1	40 mL	100 mL	205.808 g	205.798 g	.25 mL	
19	WG302327-07	MSD	1	40 mL	100 mL	206.445 g	206.439 g	.25 mL	

Analyst: [signature]

Reviewer: [signature]

MW_DIG - Modified 07/02/2008
PDF ID: 1392701
Report generated: 05/14/2009 13:37

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Instrument Run Log

Instrument: ELAN-ICP Dataset: 051409B.REP
Analyst1: JYH Analyst2: N/A
Method: 6020 SOP: ME700 Rev: 5
Maintenance Log ID:

Calibration Std: STD32560 ICV/CCV Std: STD32562 Post Spike: STD27580
ICSA: STD32774 ICSAB: STD32775 Int. Std: STD32845

Workgroups: 302189,302348,302357,302258

Comments:

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
1	EL.051409.135418	Blank	Blank		1		05/14/09 13:54
2	EL.051409.140001	WG302378-01	Calibration Point		1		05/14/09 14:00
3	EL.051409.140544	WG302378-02	Calibration Point		1		05/14/09 14:05
4	EL.051409.141128	WG302378-03	Calibration Point		1		05/14/09 14:11
5	EL.051409.141713	WG302378-04	Calibration Point		1		05/14/09 14:17
6	EL.051409.142258	WG302378-05	Initial Calibration Verification		1		05/14/09 14:22
7	EL.051409.142953	WG302378-06	Initial Calib Blank		1		05/14/09 14:29
8	EL.051409.143648	WG302378-07	CRQL Check Solid		1		05/14/09 14:36
9	EL.051409.144347	WG302378-08	CRQL Check Water		1		05/14/09 14:43
10	EL.051409.145045	WG302378-09	Interference Check		1		05/14/09 14:50
11	EL.051409.145742	WG302378-10	Interference Check		1		05/14/09 14:57
12	EL.051409.150438	WG302378-11	CCV		1		05/14/09 15:04
13	EL.051409.151132	WG302378-12	CCB		1		05/14/09 15:11
14	EL.051409.151805	WG302099-03	Method/Prep Blank	.5/200	1		05/14/09 15:18
15	EL.051409.152418	WG302099-04	Laboratory Control S	.5/200	1		05/14/09 15:24
16	EL.051409.153031	WG302099-01	Reference Sample		1	L09050161-02	05/14/09 15:30
17	EL.051409.153645	WG302099-05	Matrix Spike	.526/200	1	L09050161-02	05/14/09 15:36
18	EL.051409.154259	WG302099-06	Matrix Spike Duplica	.526/200	1	L09050161-02	05/14/09 15:42
19	EL.051409.154914	L09050161-01	BKG-01-01	.502/200	1		05/14/09 15:49
20	EL.051409.155528	WG302189-01	Post Digestion Spike		1	L09050161-01	05/14/09 15:55
21	EL.051409.160143	WG302189-02	Serial Dilution		5	L09050161-01	05/14/09 16:01
22	EL.051409.160819	WG302378-13	CCV		1		05/14/09 16:08
23	EL.051409.161513	WG302378-14	CCB		1		05/14/09 16:15
24	EL.051409.162148	L09050161-05	BKG-01-03	.5/200	1		05/14/09 16:21
25	EL.051409.162804	L09050161-06	ENV-01-01	.504/200	1		05/14/09 16:28
26	EL.051409.163420	L09050161-07	ENV-01-02	.533/200	1		05/14/09 16:34
27	EL.051409.164036	WG302099-02	Reference Sample		1	L09050161-08	05/14/09 16:40
28	EL.051409.164651	WG302099-07	Matrix Spike	.512/200	1	L09050161-08	05/14/09 16:46
29	EL.051409.165305	WG302099-08	Matrix Spike Duplica	.512/200	1	L09050161-08	05/14/09 16:53
30	EL.051409.165919	WG302099-01	Reference Sample		10	L09050161-02	05/14/09 16:59
31	EL.051409.170533	WG302099-05	Matrix Spike	.526/200	10	L09050161-02	05/14/09 17:05
32	EL.051409.171148	WG302099-06	Matrix Spike Duplica	.526/200	10	L09050161-02	05/14/09 17:11
33	EL.051409.171823	WG302378-15	CCV		1		05/14/09 17:18
34	EL.051409.172518	WG302378-16	CCB		1		05/14/09 17:25
35	EL.051409.173151	WG302327-03	Method/Prep Blank	40/100	1		05/14/09 17:31
36	EL.051409.173807	WG302327-04	Laboratory Control S	40/100	1		05/14/09 17:38
37	EL.051409.174423	WG302327-02	Reference Sample		1	L09050313-01	05/14/09 17:44

Page: 1 Approved: May 15, 2009

Maren Berry

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Instrument Run Log

Instrument: ELAN-ICP Dataset: 051409B.REP
Analyst1: JYH Analyst2: N/A
Method: 6020 SOP: ME700 Rev: 5
Maintenance Log ID:

Calibration Std: STD32560 ICV/CCV Std: STD32562 Post Spike: STD27580
ICSA: STD32774 ICSAB: STD32775 Int. Std: STD32845

Workgroups: 302189,302348,302357,302258

Comments:

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
38	EL.051409.175039	WG302327-06	Matrix Spike	40/100	1	L09050313-01	05/14/09 17:50
39	EL.051409.175655	WG302327-07	Matrix Spike Duplica	40/100	1	L09050313-01	05/14/09 17:56
40	EL.051409.180312	L09050288-01	OUTFALL 110	40/100	1		05/14/09 18:03
41	EL.051409.180929	WG302327-05	Duplicate	40/100	1	L09050288-01	05/14/09 18:09
42	EL.051409.181544	L09050308-01	0905SWMST136-U		1		05/14/09 18:15
43	EL.051409.182158	WG302348-01	Post Digestion Spike		1	L09050308-01	05/14/09 18:21
44	EL.051409.182813	WG302348-02	Serial Dilution		5	L09050308-01	05/14/09 18:28
45	EL.051409.183449	WG302378-17	CCV		1		05/14/09 18:34
46	EL.051409.184143	WG302378-18	CCB		1		05/14/09 18:41
47	EL.051409.184817	L09050308-02	0905SWMST136-F	40/100	1		05/14/09 18:48
48	EL.051409.185432	L09050308-03	0905SWMST143-U		1		05/14/09 18:54
49	EL.051409.190048	L09050308-04	0905SWMST143-F	40/100	1		05/14/09 19:00
50	EL.051409.190704	L09050308-05	0905SWMST269-U		1		05/14/09 19:07
51	EL.051409.191320	L09050308-06	0905SWMST269-F	40/100	1		05/14/09 19:13
52	EL.051409.191937	L09050308-07	0905ER-SW-06-U		1		05/14/09 19:19
53	EL.051409.192554	L09050308-08	0905ER-SW-06-F	40/100	1		05/14/09 19:25
54	EL.051409.193211	L09050308-09	0905B-SW-06-U		1		05/14/09 19:32
55	EL.051409.193829	L09050308-10	0905B-SW-06-F	40/100	1		05/14/09 19:38
56	EL.051409.194506	WG302378-19	CCV		1		05/14/09 19:45
57	EL.051409.195201	WG302378-20	CCB		1		05/14/09 19:52
58	EL.051409.195835	WG302357-03	Louisville Chem Requ		1		05/14/09 19:58
59	EL.051409.200449	WG302059-03	Method/Prep Blank	40/100	1		05/14/09 20:04
60	EL.051409.201104	WG302059-04	Laboratory Control S	40/100	1		05/14/09 20:11
61	EL.051409.201720	WG302059-01	Reference Sample		1	L09050200-01	05/14/09 20:17
62	EL.051409.202335	WG302059-05	Matrix Spike	40/100	1	L09050200-01	05/14/09 20:23
63	EL.051409.202951	L09050200-04	RVSMW15	40/100	1		05/14/09 20:29
64	EL.051409.203608	WG302357-01	Post Digestion Spike		1	L09050200-04	05/14/09 20:36
65	EL.051409.204224	WG302357-02	Serial Dilution		5	L09050200-04	05/14/09 20:42
66	EL.051409.204901	WG302378-21	CCV		1		05/14/09 20:49
67	EL.051409.205556	WG302378-22	CCB		1		05/14/09 20:55
68	EL.051409.210231	L09050200-05	RVSMW13	40/100	1		05/14/09 21:02
69	EL.051409.210848	L09050200-07	DUP-04	40/100	1		05/14/09 21:08
70	EL.051409.211506	WG302059-06	Duplicate	40/100	1	L09050200-01	05/14/09 21:15
71	EL.051409.212124	QCMRL302357-04	QCMRL302357-04		1		05/14/09 21:21
72	EL.051409.212741	MDL	MDL		1		05/14/09 21:27
73	EL.051409.213356	MDL	MDL		1		05/14/09 21:33
74	EL.051409.214031	WG302378-23	CCV		1		05/14/09 21:40

Page: 2 Approved: May 15, 2009

Maren Berry

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Microbac Laboratories Inc.

Instrument Run Log

Instrument: ELAN-ICP Dataset: 051409B.REP
Analyst1: JYH Analyst2: N/A
Method: 6020 SOP: ME700 Rev: 5
Maintenance Log ID:

Calibration Std: STD32560 ICV/CCV Std: STD32562 Post Spike: STD27580
ICSA: STD32774 ICSAB: STD32775 Int. Std: STD32845

Workgroups: 302189,302348,302357,302258

Comments:

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
75	EL.051409.214726	WG302378-24	CCB		1		05/14/09 21:47
76	EL.051409.215400	L09050220-01	PZ159GW03S001	40/100	1		05/14/09 21:54
77	EL.051409.220016	L09050221-01	PZ139GW02S001	40/100	1		05/14/09 22:00
78	EL.051409.220632	WG302059-02	Reference Sample		1	L09050221-03	05/14/09 22:06
79	EL.051409.221248	WG302059-07	Matrix Spike	20/100	1	L09050221-03	05/14/09 22:12
80	EL.051409.221905	WG302059-08	Matrix Spike Duplica	20/100	1	L09050221-03	05/14/09 22:19
81	EL.051409.222522	L09050221-06	PZ141GW02S001	40/100	1		05/14/09 22:25
82	EL.051409.223139	L09050226-03	IDW	40/100	1		05/14/09 22:31
83	EL.051409.223757	L09050230-02	EB050709-GW	40/100	1		05/14/09 22:37
84	EL.051409.224415	L09050230-04	MW-15-050809	40/100	1		05/14/09 22:44
85	EL.051409.225034	L09050230-06	MW-12-050809	40/100	1		05/14/09 22:50
86	EL.051409.225711	WG302378-25	CCV		1		05/14/09 22:57
87	EL.051409.230406	WG302378-26	CCB		1		05/14/09 23:04
88	EL.051409.231040	L09050230-08	PZ-04-050809	40/100	1		05/14/09 23:10
89	EL.051409.231656	L09050221-02	PZ140GW02D001	40/100	1		05/14/09 23:16
90	EL.051409.232312	L09050125-07	MW-11S-050509	40/100	50		05/14/09 23:23
91	EL.051409.232928	WG302258-01	Post Digestion Spike		50	L09050125-07	05/14/09 23:29
92	EL.051409.233545	WG302258-02	Serial Dilution		250	L09050125-07	05/14/09 23:35
93	EL.051409.234221	WG302378-27	CCV		1		05/14/09 23:42
94	EL.051409.234916	WG302378-28	CCB		1		05/14/09 23:49

Page: 3 Approved: May 15, 2009

Maren Berry

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Instrument Run Log

Instrument: ELAN-ICP Dataset: 051909A.REP
Analyst1: JYH Analyst2: N/A
Method: 6020 SOP: ME700 Rev: 5
Maintenance Log ID: 28781

Calibration Std: STD32560 ICV/CCV Std: STD32562 Post Spike: STD27580
ICSA: STD32774 ICSAB: STD32775 Int. Std: STD32845

Workgroups: 302606,302536,302348,302576,302684

Comments:

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
1	EL.051909.101425	Blank	Blank		1		05/19/09 10:14
2	EL.051909.102008	WG302751-01	Calibration Point		1		05/19/09 10:20
3	EL.051909.102551	WG302751-02	Calibration Point		1		05/19/09 10:25
4	EL.051909.103135	WG302751-03	Calibration Point		1		05/19/09 10:31
5	EL.051909.103720	WG302751-04	Calibration Point		1		05/19/09 10:37
6	EL.051909.104306	WG302751-05	Initial Calibration Verification		1		05/19/09 10:43
7	EL.051909.105000	WG302751-06	Initial Calib Blank		1		05/19/09 10:50
8	EL.051909.105656	WG302751-07	CRQL Check Solid		1		05/19/09 10:56
9	EL.051909.110355	WG302751-08	CRQL Check Water		1		05/19/09 11:03
10	EL.051909.111052	WG302751-09	Interference Check		1		05/19/09 11:10
11	EL.051909.111749	WG302751-10	Interference Check		1		05/19/09 11:17
12	EL.051909.112446	WG302751-11	CCV		1		05/19/09 11:24
13	EL.051909.113140	WG302751-12	CCB		1		05/19/09 11:31
14	EL.051909.113814	WG302379-03	Method/Prep Blank	40/100	1		05/19/09 11:38
15	EL.051909.114430	WG302379-04	Laboratory Control S	40/100	1		05/19/09 11:44
16	EL.051909.115047	WG302379-01	Reference Sample		5	L09050315-06	05/19/09 11:50
17	EL.051909.115703	WG302379-05	Matrix Spike	40/100	5	L09050315-06	05/19/09 11:57
18	EL.051909.120320	WG302379-06	Matrix Spike Duplica	40/100	5	L09050315-06	05/19/09 12:03
19	EL.051909.120936	L09050340-14	EBQW1300Q001	40/100	1		05/19/09 12:09
20	EL.051909.121550	L09050340-15	EBQW1301Q001	40/100	1		05/19/09 12:15
21	EL.051909.122204	L09050315-14	TF-SB24-GW	40/100	5		05/19/09 12:22
22	EL.051909.122818	WG302606-01	Post Digestion Spike		5	L09050315-14	05/19/09 12:28
23	EL.051909.123433	WG302606-02	Serial Dilution		25	L09050315-14	05/19/09 12:34
24	EL.051909.124109	WG302751-13	CCV		1		05/19/09 12:41
25	EL.051909.124803	WG302751-14	CCB		1		05/19/09 12:48
26	EL.051909.125437	WG302379-02	Reference Sample		5	L09050315-07	05/19/09 12:54
27	EL.051909.130053	WG302379-07	Matrix Spike		5	L09050315-07	05/19/09 13:00
28	EL.051909.130708	WG302379-08	Matrix Spike Duplica		5	L09050315-07	05/19/09 13:07
29	EL.051909.131325	L09050315-15	TF-SB24-GW		5		05/19/09 13:13
30	EL.051909.131941	L09050315-16	EQ-1-AQ		5		05/19/09 13:19
31	EL.051909.132558	L09050315-17	EQ-2-AQ		5		05/19/09 13:25
32	EL.051909.133216	L09050315-19	TF-SB13-GW	40/100	5		05/19/09 13:32
33	EL.051909.133832	L09050315-20	TF-SB13-GW		5		05/19/09 13:38
34	EL.051909.134446	L09050315-21	TF-FB1-GW	40/100	5		05/19/09 13:44
35	EL.051909.135100	L09050315-22	TF-FB1-GW		5		05/19/09 13:51
36	EL.051909.135736	WG302751-15	CCV		1		05/19/09 13:57
37	EL.051909.140430	WG302751-16	CCB		1		05/19/09 14:04

Page: 1 Approved:

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Instrument Run Log

Instrument: ELAN-ICP Dataset: 051909A.REP
Analyst1: JYH Analyst2: N/A
Method: 6020 SOP: ME700 Rev: 5
Maintenance Log ID: 28781

Calibration Std: STD32560 ICV/CCV Std: STD32562 Post Spike: STD27580
ICSA: STD32774 ICSAB: STD32775 Int. Std: STD32845

Workgroups: 302606,302536,302348,302576,302684

Comments:

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
38	EL.051909.141104	L09050315-24	TF-SB12-GW		5		05/19/09 14:11
39	EL.051909.141720	L09050315-25	TF-SB12-GW		5		05/19/09 14:17
40	EL.051909.142335	L09050316-11	AV-NCB-EB-1-051309	40/100	1		05/19/09 14:23
41	EL.051909.143007	L09050315-14	TF-SB24-GW	40/100	50		05/19/09 14:30
42	EL.051909.143622	WG302606-01	Post Digestion Spike		50	L09050315-14	05/19/09 14:36
43	EL.051909.144237	WG302606-02	Serial Dilution		250	L09050315-14	05/19/09 14:42
44	EL.051909.145119	WG302379-01	Reference Sample		50	L09050315-06	05/19/09 14:51
45	EL.051909.145736	WG302379-05	Matrix Spike		50	L09050315-06	05/19/09 14:57
46	EL.051909.150353	WG302379-06	Matrix Spike Duplica		50	L09050315-06	05/19/09 15:03
47	EL.051909.151030	WG302751-17	CCV		1		05/19/09 15:10
48	EL.051909.151724	WG302751-18	CCB		1		05/19/09 15:17
49	EL.051909.152359	WG302379-02	Reference Sample		1	L09050315-07	05/19/09 15:23
50	EL.051909.153014	WG302379-07	Matrix Spike	40/100	1	L09050315-07	05/19/09 15:30
51	EL.051909.153630	WG302379-08	Matrix Spike Duplica	40/100	1	L09050315-07	05/19/09 15:36
52	EL.051909.154419	L09050315-15	TF-SB24-GW	40/100	1		05/19/09 15:44
53	EL.051909.155036	L09050315-16	EQ-1-AQ	40/100	1		05/19/09 15:50
54	EL.051909.155653	L09050315-17	EQ-2-AQ	40/100	1		05/19/09 15:56
55	EL.051909.160309	L09050315-20	TF-SB13-GW	40/100	1		05/19/09 16:03
56	EL.051909.160923	L09050315-22	TF-FB1-GW	40/100	1		05/19/09 16:09
57	EL.051909.161538	L09050315-24	TF-SB12-GW	40/100	100		05/19/09 16:15
58	EL.051909.162214	WG302751-19	CCV		1		05/19/09 16:22
59	EL.051909.162908	WG302751-20	CCB		1		05/19/09 16:29
60	EL.051909.163543	WG301836-02	Method/Prep Blank	40/100	1		05/19/09 16:35
61	EL.051909.164159	WG301836-02	Method/Prep Blank	40/100	1		05/19/09 16:41
62	EL.051909.164816	WG301836-01	Reference Sample		20	L09050136-08	05/19/09 16:48
63	EL.051909.165433	WG301836-04	Matrix Spike	40/100	20	L09050136-08	05/19/09 16:54
64	EL.051909.170050	WG301836-05	Matrix Spike Duplica	40/100	20	L09050136-08	05/19/09 17:00
65	EL.051909.170708	L09050134-01	0905SWMST069-U	40/100	20		05/19/09 17:07
66	EL.051909.171324	L09050134-03	0905SWMST066-U	40/100	1		05/19/09 17:13
67	EL.051909.171939	WG302536-01	Post Digestion Spike		1	L09050134-03	05/19/09 17:19
68	EL.051909.172554	WG302536-02	Serial Dilution		5	L09050134-03	05/19/09 17:25
69	EL.051909.173230	WG302751-21	CCV		1		05/19/09 17:32
70	EL.051909.173924	WG302751-22	CCB		1		05/19/09 17:39
71	EL.051909.174559	L09050134-05	0905ER-SW-01-U	40/100	1		05/19/09 17:45
72	EL.051909.175215	L09050134-07	0905B-SW-01-U	40/100	1		05/19/09 17:52
73	EL.051909.175832	L09050136-01	0905SWMST019-U	40/100	1		05/19/09 17:58
74	EL.051909.180450	L09050136-03	0905SWMST020-U	40/100	1		05/19/09 18:04

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Instrument Run Log

Instrument: ELAN-ICP Dataset: 051909A.REP
Analyst1: JYH Analyst2: N/A
Method: 6020 SOP: ME700 Rev: 5
Maintenance Log ID: 28781

Calibration Std: STD32560 ICV/CCV Std: STD32562 Post Spike: STD27580
ICSA: STD32774 ICSAB: STD32775 Int. Std: STD32845

Workgroups: 302606,302536,302348,302576,302684

Comments:

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
75	EL.051909.181107	L09050136-05	0905SWMST050-U	40/100	1		05/19/09 18:11
76	EL.051909.181723	L09050136-07	0905SWMST067-U	40/100	50		05/19/09 18:17
77	EL.051909.182359	WG302751-23	CCV		1		05/19/09 18:23
78	EL.051909.183053	WG302751-24	CCB		1		05/19/09 18:30
79	EL.051909.183728	WG302327-03	Method/Prep Blank	40/100	1		05/19/09 18:37
80	EL.051909.184345	WG302327-04	Laboratory Control S	40/100	1		05/19/09 18:43
81	EL.051909.185003	WG302327-02	Reference Sample		1	L09050313-01	05/19/09 18:50
82	EL.051909.185621	WG302327-06	Matrix Spike	40/100	1	L09050313-01	05/19/09 18:56
83	EL.051909.190239	WG302327-07	Matrix Spike Duplica	40/100	1	L09050313-01	05/19/09 19:02
84	EL.051909.190858	L09050308-01	0905SWMST136-U	40/100	1		05/19/09 19:08
85	EL.051909.191515	WG302348-01	Post Digestion Spike		1	L09050308-01	05/19/09 19:15
86	EL.051909.192131	WG302348-02	Serial Dilution		5	L09050308-01	05/19/09 19:21
87	EL.051909.192806	WG302751-25	CCV		1		05/19/09 19:28
88	EL.051909.193501	WG302751-26	CCB		1		05/19/09 19:35
89	EL.051909.194135	L09050308-02	0905SWMST136-F		1		05/19/09 19:41
90	EL.051909.194751	L09050308-03	0905SWMST143-U	40/100	1		05/19/09 19:47
91	EL.051909.195408	L09050308-04	0905SWMST143-F		1		05/19/09 19:54
92	EL.051909.200025	L09050308-05	0905SWMST269-U	40/100	1		05/19/09 20:00
93	EL.051909.200642	L09050308-06	0905SWMST269-F		1		05/19/09 20:06
94	EL.051909.201259	L09050308-07	0905ER-SW-06-U	40/100	1		05/19/09 20:12
95	EL.051909.201917	L09050308-08	0905ER-SW-06-F		1		05/19/09 20:19
96	EL.051909.202536	L09050308-09	0905B-SW-06-U	40/100	1		05/19/09 20:25
97	EL.051909.203154	L09050308-10	0905B-SW-06-F		1		05/19/09 20:31
98	EL.051909.203813	L09050340-01	CDBS1023S001	.533/200	10		05/19/09 20:38
99	EL.051909.204451	WG302751-27	CCV		1		05/19/09 20:44
100	EL.051909.205145	WG302751-28	CCB		1		05/19/09 20:51
101	EL.051909.205819	WG302576-01	Post Digestion Spike		10	L09050340-01	05/19/09 20:58
102	EL.051909.210435	WG302576-02	Serial Dilution		50	L09050340-01	05/19/09 21:04
103	EL.051909.211049	L09050340-02	CDBS1023S002	.529/200	10		05/19/09 21:10
104	EL.051909.211702	L09050340-03	CDBS1025S001	.539/200	10		05/19/09 21:17
105	EL.051909.212317	L09050340-04	CDBS1031S001	.52/200	10		05/19/09 21:23
106	EL.051909.212934	L09050340-05	CDBS1025S002	.51/200	10		05/19/09 21:29
107	EL.051909.213551	L09050340-06	CDBS1019S001	.516/200	10		05/19/09 21:35
108	EL.051909.214208	L09050340-07	CDBS1027S001	.531/200	10		05/19/09 21:42
109	EL.051909.214826	L09050340-08	CDBS1027S002	.505/200	10		05/19/09 21:48
110	EL.051909.215503	WG302751-29	CCV		1		05/19/09 21:55
111	EL.051909.220158	WG302751-30	CCB		1		05/19/09 22:01

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Instrument Run Log

Instrument: ELAN-ICP Dataset: 051909A.REP
Analyst1: JYH Analyst2: N/A
Method: 6020 SOP: ME700 Rev: 5
Maintenance Log ID: 28781

Calibration Std: STD32560 ICV/CCV Std: STD32562 Post Spike: STD27580
ICSA: STD32774 ICSAB: STD32775 Int. Std: STD32845

Workgroups: 302606,302536,302348,302576,302684

Comments:

Seq.	File ID	Sample	ID	Prep	Dil	Reference	Date/Time
112	EL.051909.220833	L09050340-09	CDBS1008S001	.543/200	10		05/19/09 22:08
113	EL.051909.221452	L09050340-10	CDBS1008S002	.503/200	10		05/19/09 22:14
114	EL.051909.222111	WG302537-01	Reference Sample		10	L09050340-11	05/19/09 22:21
115	EL.051909.222730	WG302537-04	Matrix Spike	.513/200	10	L09050340-11	05/19/09 22:27
116	EL.051909.223350	WG302537-05	Matrix Spike Duplica	.513/200	10	L09050340-11	05/19/09 22:33
117	EL.051909.224028	WG302751-31	CCV		1		05/19/09 22:40
118	EL.051909.224722	WG302751-32	CCB		1		05/19/09 22:47
119	EL.051909.225357	WG302425-03	Method/Prep Blank	40/100	1		05/19/09 22:53
120	EL.051909.230013	WG302353-01	Fluid Blank		1		05/19/09 23:00
121	EL.051909.230630	WG302425-04	Laboratory Control S	40/100	1		05/19/09 23:06
122	EL.051909.231247	WG302425-01	Reference Sample		1	L09050316-06	05/19/09 23:12
123	EL.051909.231905	WG302425-05	Matrix Spike	40/100	1	L09050316-06	05/19/09 23:19
124	EL.051909.232523	WG302425-06	Matrix Spike Duplica	40/100	1	L09050316-06	05/19/09 23:25
125	EL.051909.233141	L09050316-02	AV-NCB-PE-UNK-36-C1-051	40/100	1		05/19/09 23:31
126	EL.051909.233800	L09050316-04	AV-NCB-PE-UNK-36-C1-D-0	40/100	1		05/19/09 23:38
127	EL.051909.234418	WG302684-01	Post Digestion Spike		1	L09050316-04	05/19/09 23:44
128	EL.051909.235038	WG302684-02	Serial Dilution		5	L09050316-04	05/19/09 23:50
129	EL.051909.235716	WG302751-33	CCV		1		05/19/09 23:57
130	EL.052009.000410	WG302751-34	CCB		1		05/20/09 00:04
131	EL.052009.001047	L09050342-01	W-20	40/100	1		05/20/09 00:10
132	EL.052009.001707	WG302425-02	Reference Sample		1	L09050342-02	05/20/09 00:17
133	EL.052009.002325	WG302425-07	Matrix Spike	40/100	1	L09050342-02	05/20/09 00:23
134	EL.052009.002942	WG302425-08	Matrix Spike Duplica	40/100	1	L09050342-02	05/20/09 00:29
135	EL.052009.003559	L09050342-05	W-37 WT	40/100	1		05/20/09 00:35
136	EL.052009.004217	L09050342-07	W-1 A	40/100	1		05/20/09 00:42
137	EL.052009.004834	L09050342-09	W-31 WB	40/100	1		05/20/09 00:48
138	EL.052009.005453	L09050342-11	W-50	40/100	1		05/20/09 00:54
139	EL.052009.010130	WG302751-35	CCV		1		05/20/09 01:01
140	EL.052009.010825	WG302751-36	CCB		1		05/20/09 01:08

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Data Checklist

Date: 14-MAY-2009
Analyst: JYH
Analyst: NA
Method: 6020
Instrument: ELAN
Curve Workgroup: 302378
Runlog ID: 28091
Analytical Workgroups: 302189,302348,302357,302258

Calibration/Linearity	X
ICV/CCV	X
ICB/CCB	X
ICSA/ICSAB	X
CRI	X
Blank/LCS	X
MS/MSD	X
Post Spike/Serial Dilution	X
Upload Results	X
Data Qualifiers	X
Generate PDF Instrument Data	X
Sign/Annotate PDF Data	X
Upload Curve Data	X
Workgroup Forms	
Case Narrative	161,288,308,313,200,230,221,226,220
Client Forms	X
Level X	
Level 3	313,230
Level 4	161,308,221,226,220
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	JYH
Secondary Reviewer	MMB
Comments	

Primary Reviewer: Secondary Reviewer:
15-MAY-2009

CHECKLIST1 - Modified 03/05/2008
Generated: MAY-18-2009 10:31:49

Microbac Laboratories Inc.

Data Checklist

Date: 19-MAY-2009
Analyst: JYH
Analyst: NA
Method: 6020
Instrument: ELAN
Curve Workgroup: 302751
Runlog ID: 28152
Analytical Workgroups: 302606,302536,302348,302576,302684

Calibration/Linearity	X
ICV/CCV	X
ICB/CCB	X
ICSA/ICSAB	X
CRI	X
Blank/LCS	X
MS/MSD	X
Post Spike/Serial Dilution	X
Upload Results	X
Data Qualifiers	X
Generate PDF Instrument Data	X
Sign/Annotate PDF Data	X
Upload Curve Data	X
Workgroup Forms	
Case Narrative	315,316,340,134,136,308,342
Client Forms	X
Level X	
Level 3	
Level 4	315,316,340,134,136,308,
Check for compliance with method and project specific requirements	
Check the completeness of reported information	
Check the information for the report narrative	
Primary Reviewer	JYH
Secondary Reviewer	
Comments	

Primary Reviewer: Secondary Reviewer:

CHECKLIST1 - Modified 03/05/2008
Generated: MAY-20-2009 15:25:44

Microbac Laboratories Inc.

HOLDING TIMES
EQUIVALENT TO AFCEE FORM 9

Analytical Method: 6020 AAB#: WG302348

Login Number: L09050313

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
49WW06-090513	05/13/09	05/14/09	05/14/09	180	0.919	05/14/09	180	0.216	

* EXT = SEE PROJECT QAPP REQUIREMENTS
*ANAL = SEE PROJECT QAPP REQUIREMENTS

HOLD_TIMES - Modified 03/06/2008
PDF File ID: 1393178
Report generated 05/15/2009 08:54

Microbac®

METHOD BLANK SUMMARY

Login Number: L09050313
Blank File ID: EL.051409.173151
Prep Date: 05/14/09 12:32
Analyzed Date: 05/14/09 17:31
Analyst: JYH

Work Group: WG302348
Blank Sample ID: WG302327-03
Instrument ID: ELAN-ICP
Method: 6020

This Method Blank Applies To The Following Samples:

Client ID	Lab Sample ID	Lab File ID	Time Analyzed	TAG
LCS	WG302327-04	EL.051409.173807	05/14/09 17:38	01
49WW06-090513	L09050313-01	EL.051409.174423	05/14/09 17:44	01
DUP	WG302327-05	EL.051409.180929	05/14/09 18:09	01

Report Name: BLANK_SUMMARY
PDF File ID: 1393179
Report generated 05/15/2009 08:54

Microbac Laboratories Inc.

METHOD BLANK REPORT

Login Number: L09050313 Prep Date: 05/14/09 12:32 Sample ID: WG302327-03
Instrument ID: ELAN-ICP Run Date: 05/14/09 17:31 Prep Method: 3015
File ID: EL.051409.173151 Analyst: JYH Method: 6020
Workgroup (AAB#): WG302348 Matrix: Water Units: mg/L
Contract #: DACA56-94-D-0020 Cal ID: ELAN-I-14-MAY-09

Analytes	SDL	PQL	Concentration	Dilution	Qualifier
Arsenic, Total	0.000250	0.00100	0.000250	1	U

SDL Method Detection Limit
PQL Reporting/Practical Quantitation Limit
ND Analyte Not detected at or above reporting limit
* |Analyte concentration| > RL

Report Name: BLANK
PDF ID: 1393180
15-MAY-2009 08:54

Microbac Laboratories Inc.
LABORATORY CONTROL SAMPLE (LCS)

Login Number: L09050313 Run Date: 05/14/2009 Sample ID: WG302327-04
Instrument ID: ELAN-ICP Run Time: 17:38 Prep Method: 3015
File ID: EL.051409.173807 Analyst: JYH Method: 6020
Workgroup (AAB#): WG302348 Matrix: Water Units: mg/L
QC Key: STD Lot#: STD30482 Cal ID: ELAN-I-14-MAY-09

Analytes	Expected	Found	% Rec	LCS Limits	Q
Arsenic, Total	0.0625	0.0616	98.5	80 - 120	

LCS - Modified 03/06/2008
PDF File ID: 1393181
Report generated: 05/15/2009 08:54

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Microbac Laboratories Inc.

MATRIX SPIKE AND MATRIX SPIKE DUP (MS/MSD)

Loginnum: L09050313 Cal ID: ELAN-ICP- Worknum: WG302348

Instrument ID: ELAN-ICP Contract #: DACA56-94-D-0020 Method: 6020

Parent ID: WG302327-02 File ID: EL.051409.174423 Dil: 1 Matrix: WATER

Sample ID: WG302327-06 MS File ID: EL.051409.175039 Dil: 1 Units: mg/L

Sample ID: WG302327-07 MSD File ID: EL.051409.175655 Dil: 1

Analyte	Parent	MS Spiked	MS Found	MS %Rec	MSD Spiked	MSD Found	MSD %Rec	%RPD	%Rec Limits	RPD Limit	Q
Arsenic, Total	0.0128	0.0625	0.0722	95.1	0.0625	0.0730	96.3	1.03	75 - 125	20	

* FAILS %REC LIMIT

FAILS RPD LIMIT

NOTE: This is an internal quality control sample.

WG_MS_MSD_DRYWT - Modified 03/07/2008

PDF File ID: 1393182

Report generated 05/15/2009 08:54

Microbac Laboratories Inc.
Serial Dilution Report

Login: L09050313 **Worknum:** WG302348
Instrument: ELAN-ICP **Method:** 6020
Serial Dil: WG302348-02 **File ID:** EL.051409.182813 **Dil:** 5 **Units:** ug/L
Sample: L09050308-01 **File ID:** EL.051409.181544 **Dil:** 1

Analyte	Sample	Qual	Serial Dil	Qual	% Diff	Q
Arsenic	.566	X	1.34	F	137.00	

U = Result is below MDL.
F = Result is greater than or equal to MDL and less than the RL.
X = Result is greater than or equal to RL and less than 100 times the MDL.
E = %D exceeds control limit of 10% and initial sample result is greater than or equal to 100 times the MDL.

SERIAL_DIL - Modified 09/22/2008
PDF File ID: 1393176
05/15/2009 08:54

Microbac Laboratories Inc.
POST SPIKE REPORT

Sample Login ID: L09050313 **Worknum:** WG302348
Instrument ID: ELAN-ICP **Method:** 6020
Post Spike ID: WG302348-01 **File ID:** EL.051409.182158 **Dil:** 1 **Units:** ug/L
Sample ID: L09050308-01 **File ID:** EL.051409.181544 **Dil:** 1 **Matrix:** Water

Analyte	Post Spike Result	C	Sample Result	C	Spike Added(SA)	% R	Control Limit %R	Q
ARSENIC	46.0		0.566		50	91.0	75 - 125	

N = % Recovery exceeds control limits
F = Result is between MDL and RL
U = Sample result is below MDL. A value of zero is used in the calculation

POST_SPIKE - Modified 03/06/2008
PDF File ID: 1393177
Report generated: 05/15/2009 08:54

Microbac Laboratories Inc.
Initial Calibration Summary

Login:	L09050313	Workgroup (AAB#):	WG302348
Analytical Method:	6020	Instrument ID:	ELAN-ICP
ICAL Worknum:	WG302378	Initial Calibration Date:	14-MAY-2009 14:17

	WG302378-01		WG302378-02		WG302378-03		WG302378-04			
	Conc	INT	Conc	INT	Conc	INT	Conc	INT	R	Q
ARSENIC	0	-554	.4	467	50	126000	100	250000	.999991	

INT = Instrument intensity
R = Coefficient of correlation
Q = Data Qualifier
*** = Out of Compliance; R < 0.995**

INT_CAL_ICP - Modified 03/06/2008
PDF File ID: 1393186
Report generated: 15-MAY-2009 08:54

Microbac Laboratories Inc.

INITIAL CALIBRATION BLANK (ICB)

Login Number: L09050313
Run Date: 05/14/2009
Sample ID: WG302378-06
Instrument ID: ELAN-ICP
Run Time: 14:29
Method: 6020
File ID: EL.051409.142953
Analyst: JYH
Units: ug/L
Workgroup (AAB#): WG302348
Cal ID: ELAN-ICP - 14-MAY-09
Matrix: WATER

Analytes	MDL	RDL	Concentration	Qualifier
ARSENIC	.1	.4	.1	U

ICB - Modified 03/06/2008
PDF File ID: 1393188
Report generated 05/15/2009 08:54

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Microbac Laboratories Inc.
CONTINUING CALIBRATION BLANK (CCB)

00076043

Login Number: L09050313
Run Date: 05/14/2009
Sample ID: WG302378-12
Instrument ID: ELAN-ICP
Run Time: 15:11
Method: 6020
File ID: EL.051409.151132
Analyst: JYH
Units: ug/L
Workgroup (AAB#): WG302348
Cal ID: ELAN-I - 14-MAY-09
Matrix: WATER

Analytes	MDL	RDL	Concentration	Qualifier
Arsenic	0.100	0.400	0.100	U

U = Result is less than MDL.
F = Result is between MDL and RL.
* = Result is above RL.

CCB - Modified 03/05/2008
PDF File ID: 1393191
Report generated 05/15/2009 08:54

Microbac®

Microbac Laboratories Inc.
CONTINUING CALIBRATION BLANK (CCB)

00076044

Login Number: L09050313
Run Date: 05/14/2009
Sample ID: WG302378-16
Instrument ID: ELAN-ICP
Run Time: 17:25
Method: 6020
File ID: EL.051409.172518
Analyst: JYH
Units: ug/L
Workgroup (AAB#): WG302348
Cal ID: ELAN-I - 14-MAY-09
Matrix: WATER

Analytes	MDL	RDL	Concentration	Qualifier
Arsenic	0.100	0.400	0.100	U

U = Result is less than MDL.
F = Result is between MDL and RL.
* = Result is above RL.

CCB - Modified 03/05/2008
PDF File ID: 1393191
Report generated 05/15/2009 08:54

Microbac®

Microbac Laboratories Inc.

CONTINUING CALIBRATION BLANK (CCB)

Login Number: L09050313
Run Date: 05/14/2009
Sample ID: WG302378-18
Instrument ID: ELAN-ICP
Run Time: 18:41
Method: 6020
File ID: EL.051409.184143
Analyst: JYH
Units: ug/L
Workgroup (AAB#): WG302348
Cal ID: ELAN-I - 14-MAY-09
Matrix: WATER

Analytes	MDL	RDL	Concentration	Qualifier
Arsenic	0.100	0.400	0.140	F

U = Result is less than MDL.
F = Result is between MDL and RL.
* = Result is above RL.

CCB - Modified 03/05/2008
PDF File ID: 1393191
Report generated 05/15/2009 08:54

Microbac Laboratories Inc.

INITIAL CALIBRATION VERIFICATION (ICV)
(Alternate Source)

Login Number: L09050313 Run Date: 05/14/2009 Sample ID: WG302378-05
Instrument ID: ELAN-ICP Run Time: 14:22 Method: 6020
File ID: EL.051409.142258 Analyst: JYH Units: ug/L
Workgroup (AAB#): WG302348 Cal ID: ELAN-I - 14-MAY-09
QC Key: STD

Analyte		Expected	Found	%REC	LIMITS	Q
Arsenic		50	49.6	99.1	90 - 110	

* Exceeds LIMITS Limit

ICV - Modified 03/06/2008
PDF File ID: 1393187
Report generated 05/15/2009 08:54

Microbac®

Microbac Laboratories Inc.
CONTINUING CALIBRATION VERIFICATION (CCV)

00076047

Login Number: L09050313
Run Date: 05/14/2009
Sample ID: WG302378-11
Instrument ID: ELAN-ICP
Run Time: 15:04
Method: 6020
File ID: EL.051409.150438
Analyst: JYH
QC Key: STD
Workgroup (AAB#): WG302348
Cal ID: ELAN-I - 14-MAY-09
Matrix: WATER

Analyte		Expected	Found	UNITS	%REC	LIMITS		Q
Arsenic		50.0	48.7	ug/L	97.3	90 - 110		

* Exceeds LIMITS Criteria

CCV - Modified 03/05/2008
PDF File ID: 1393190
Report generated 05/15/2009 08:54

Microbac®

Microbac Laboratories Inc.
CONTINUING CALIBRATION VERIFICATION (CCV)

00076048

Login Number: L09050313
Run Date: 05/14/2009
Sample ID: WG302378-15
Instrument ID: ELAN-ICP
Run Time: 17:18
Method: 6020
File ID: EL.051409.171823
Analyst: JYH
QC Key: STD
Workgroup (AAB#): WG302348
Cal ID: ELAN-I - 14-MAY-09
Matrix: WATER

Analyte		Expected	Found	UNITS	%REC	LIMITS		Q
Arsenic		50.0	48.7	ug/L	97.4	90 - 110		

* Exceeds LIMITS Criteria

CCV - Modified 03/05/2008
PDF File ID: 1393190
Report generated 05/15/2009 08:54

Microbac®

Microbac Laboratories Inc.
CONTINUING CALIBRATION VERIFICATION (CCV)

00076049

Login Number: L09050313
Run Date: 05/14/2009
Sample ID: WG302378-17
Instrument ID: ELAN-ICP
Run Time: 18:34
Method: 6020
File ID: EL.051409.183449
Analyst: JYH
QC Key: STD
Workgroup (AAB#): WG302348
Cal ID: ELAN-I - 14-MAY-09
Matrix: WATER

Analyte		Expected	Found	UNITS	%REC	LIMITS		Q
Arsenic		50.0	47.2	ug/L	94.3	90 - 110		

* Exceeds LIMITS Criteria

CCV - Modified 03/05/2008
PDF File ID: 1393190
Report generated 05/15/2009 08:54

Microbac®

Microbac Laboratories Inc.
INTERFERENCE CHECK SAMPLES

Login number: L09050313
Instrument ID: ELAN-ICP
Sol. A : WG302378-09 **File ID:** EL.051409.145045
Sol. AB : WG302378-10 **File ID:** EL.051409.145742

Workgroup (AAB#): WG302348
Method: 6020
Units: ug/L
Matrix: Water

	Sol. A			Sol. AB			
ANALYTE	True	Found	%Recovery	True	Found	%Recovery	Q
Arsenic	NS	-0.00670	NS	100	101	101	

NS = Not spiked
*** = Recovery of spiked element is outside acceptance limit of 80% - 120% of true value.**
 # = Result for unspiked element is outside the acceptance limits of (+/-) the project reporting limit (RL).

ICS - Modified 03/06/2008
PDF File ID: 1393189
Report generated 05/15/2009 08:54

Microbac Laboratories Inc.

INTERNAL STANDARD REPORT

Login: L09050313 **Analytical Method:** 6020
Analytical Workgroup: WG302348 **Matrix:** 1
Instrument: ELAN-ICP **Analyst:** JYH
ICAL Date: 14-MAY-2009 14:00

			BISMUTH	GERMANIUM	INDIUM	TERBIUM
Sample	Type	Run Date	% Rec	% Rec	% Rec	% Rec
L09050308-01	SAMP	14-MAY-2009 18:15	89.07	89.669	81.376	84.471
L09050313-01	SAMP	14-MAY-2009 17:44	75.394	83.458	79.124	82.571
WG302327-01	REF	14-MAY-2009 18:03	86.731	93.521	82.948	87.109
WG302327-02	REF	14-MAY-2009 17:44	75.394	83.458	79.124	82.571
WG302327-03	BLANK	14-MAY-2009 17:31	92.222	92.443	93.106	92.151
WG302327-04	LCS	14-MAY-2009 17:38	92.697	92.575	91.57	90.594
WG302327-05	DUP	14-MAY-2009 18:09	86.771	89.484	81.609	85.306
WG302327-06	MS	14-MAY-2009 17:50	74.746	84.048	81.197	84.441
WG302327-07	MSD	14-MAY-2009 17:56	77.085	86.025	83.519	86.291
WG302348-01	PSPK	14-MAY-2009 18:21	89.368	89.945	81.726	85.337
WG302348-02	SERIAL	14-MAY-2009 18:28	91.063	90.868	83.978	85.85
WG302378-05	ICV	14-MAY-2009 14:22	94.647	97.079	95.728	96.75
WG302378-06	ICB	14-MAY-2009 14:29	93.979	95.188	96.894	95.891
WG302378-11	CCV	14-MAY-2009 15:04	94.61	94.417	91.932	93.561
WG302378-12	CCB	14-MAY-2009 15:11	96.886	96.666	94.75	96.565
WG302378-15	CCV	14-MAY-2009 17:18	90.828	92.116	90.348	90.306
WG302378-16	CCB	14-MAY-2009 17:25	91.676	93.211	90.732	90.128
WG302378-17	CCV	14-MAY-2009 18:34	89.979	89.552	83.206	84.297
WG302378-18	CCB	14-MAY-2009 18:41	90.397	90.485	84.236	86.778

Acceptance criteria: 30% - 120%
Underlined recoveries are out of range

INT_STD_ICPMS - Modified 03/05/2008
PDF File ID: 1393185
Report generated: 05/15/2009 08:54

Microbac Laboratories Inc.
LINEAR RANGE (QUARTERLY)

Login Number: L09050313 **Date:** 04/01/2009
Insturment ID: ELAN-ICP **Method:** 6020

Analyte	Integration Time (Sec.)	Concentration (ug/L)
Antimony	1.00	100.0
Arsenic	1.00	100.0
Barium	1.00	100.0
Cadmium	1.00	100.0
Chromium	1.00	100.0
Cobalt	1.00	100.0
Copper	1.00	100.0
Lead	1.00	100.0
Manganese	1.00	100.0
Nickel	1.00	100.0
Selenium	1.00	100.0
Silver	1.00	100.0
Thallium	1.00	100.0
Vanadium	1.00	100.0
Zinc	1.00	100.0

LINEAR_RANGE - Modified 03/06/2008
PDF File ID: 1393183
Report generated: 05/15/2009 08:54

3.0 Attachments

Microbac Laboratories Inc.
Analyst Listing
May 21, 2009

ADC - ANTHONY D. CANTER	AJF - AMANDA J. FICKIESEN	ALB - ANNIE L. BROWN
AM - ALISON J. MILLER	AML - ANTHONY M. LONG	BRG - BRENDA R. GREGORY
CAA - CASSIE A. AUGENSTEIN	CAF - CHERYL A. FLOWERS	CAH - CHARLES A. HALL
CEB - CHAD E. BARNES	CLC - CHRYS L. CRAWFORD	CLW - CHARISSA L. WINTERS
CPD - CHAD P. DAVIS	CSH - CHRIS S. HILL	CTB - CHRIS T. BUCINA
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
ECL - ERIC C. LAWSON	EDA - ERIN D. AGEE	ERP - ERIN R. PORTER
FJB - FRANCES J. BOLDEN	HAV - HEMA VILASAGAR	HJR - HOLLY J. REED
JBK - JEREMY B. KINNEY	JDH - JUSTIN D. HESSON	JKT - JANE K. THOMPSON
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	LSB - LESLIE S. BUCINA	MDA - MIKE D. ALBERTSON
MDC - MICHAEL D. COCHRAN	MES - MARY E. SCHILLING	MMB - MAREN M. BEERY
MRT - MICHELLE R. TAYLOR	MSW - MATT S. WILSON	NPM - NATHANIEL P. MILLER
PDM - PIERCE D. MORRIS	RAH - ROY A. HALSTEAD	RB - ROBERT BUCHANAN
REK - ROBERT E. KYER	RLK - ROBIN L. KLINGER	RWC - RODNEY W. CAMPBELL
SDH - SHANA D. HINYARD	SLM - STEPHANIE L. MOSSBURG	SLP - SHERI L. PFALZGRAF
TIP - TAE I. PARRISH	TMB - TIFFANY M. BAILEY	TMM - TAMMY M. MORRIS
VC - VICKI COLLIER	WTD - WADE T. DELONG	

Microbac Laboratories Inc.
List of Valid Qualifiers
May 21, 2009

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
B1	Target analyte detected in method blank at or above the method reporting limit
B3	Target analyte detected in calibration blank at or above the method reporting limit
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
F, S	Estimated result below quantitation limit; method of standard additions(MSA)
FL	Free Liquid
H1	Sample analysis performed past holding time.
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%
J,S	Estimated concentration; analyzed by method of standard addition (MSA)
L	Sample reporting limits elevated due to matrix interference
L1	The associated blank spike (LCS) recovery was above the laboratory acceptance limits.
L2	The associated blank spike (LCS) recovery was below the laboratory acceptance limits.
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 (RL).
ND, L	Not detected; sample reporting limit (RL) elevated due to interference
ND, S	Not detected; analyzed by method of standard addition (MSA)
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 (MSA)
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
X, S	Exceeds regulatory limit; method of standard additions (MSA)
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.

Microbac®

00076056

COC No. A 09434

158 Starlite Drive
Marietta, OH 45750

Microbac

CHAIN-OF-CUSTODY RECORD

Phone: 740-373-4071
Fax: 740-373-4835

Company Name: Shaw E&I

Project Contact: Jennifer Hoang

Contact Phone #: (713)-996-4408

Turn Around Requirements: 24-hour

Location: Karnack, Texas

Project ID: 117591.0006C100

Sampler (print): Allen Willmore

Signature: [signature]

Program: ☐ CWA ☐ RCRA ☐ DOD ☐ AFCEE ☐ Other _____

Sample I.D. No.	Comp	Grab	Date	Time	Matrix*	NUMBER OF CONTAINERS	Hold	Arsenic 6010/6020	TOTAL # (LAB USE)	ADDITIONAL REQUIREMENTS
49WW06-090513		✓	5/13/09	14:30	Water	1		X		24-hour TAT

Relinquished by: (Signature)	Date	Time	Received by: (Signature)	Relinquished by: (Signature)	Date	Time	Received by: (Signature)
[signature]	5/13/2009	1530					

Relinquished by: (Signature)	Date	Time	Received for Laboratory by: (Signature)	Date	Time	Remarks:
			[signature]	5-14-09	930	

*Water (W), Soil (S), Solid Waste (SD), Unknown (X)

Page 1 of 1

Microbac Laboratories, Inc.

SAMPLE RECEIPT FORM

00076057

158 Starlite Drive
Marietta, OH 45750
(740) 373-4071

Client: SHAW	
Workorder Number: B	
Date Received: 5-14-09	
Delivered by:	( ) Fedx (✓) UPS ( ) Client ( ) Courier **Time:** 0930
Opened by: ERP	
IR Temp Gun:	(✓) G ( ) H
Logged by: JRT	L 09050313

Cooler information

Cooler ID	Temp C	Airbill#	COC#	Other
3672	1	1Z401663221009066 8		24 hr

Inspection Checklist	**Y**	**N**	**NA**	**Discrepancy ID**
Were shipping coolers sealed?	✓			
Were custody seals intact?	✓			
Were cooler temperatures in range of 0 - 6?	✓			
Was ice present?	✓			
Were COC's received/ information complete/signed and dated?	✓			
Were sample containers and labels intact and match COC?	✓			
Were the correct containers and volumes received?	✓			
Were correct preservatives used? (water only)	✓			
Were pH ranges acceptable? (voa's excluded)	✓			
Were VOA samples free of headspace (< 6mm)?			✓	
Were samples received within EPA hold times?	✓			

Discrepancy/Comments/Other Problems

Distribution

Name of Microbac representative:
Client/Company:
Person Contacted:
Date contacted:

Resolution/other comments:

Microbac Laboratories Inc.

Internal Chain of Custody Report

Login: L09050313
Account: 2773
Project: 2773.025
Samples: 1
Due Date: 15-MAY-2009

Samplenum	Container ID	Products
L09050313-01	580188	AS-MS

Bottle: 1

Seq.	Purpose	From	To	Date/Time	Accept	Relinquish
1	LOGIN	COOLER	W1	14-MAY-2009 11:53	ERE	
2	PREP	W1	DIG	14-MAY-2009 12:03	REK	JKT
3	STORE	DIG	A1	14-MAY-2009 14:17	JKT	REK
4	PREP	A1	DIG	15-MAY-2009 05:21	REK	JKT
5	STORE	DIG	A1	15-MAY-2009 07:35	JKT	BRG

A1 - Sample Archive (COLD)
A2 - Sample Archive (AMBIENT)
F1 - Volatiles Freezer in Login
V1 - Volatiles Refrigerator in Login
W1 - Walkin Cooler in Login

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

June 1, 2009

Distribution (one copy each)

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Jefferson, Texas 75657

Ken Shaw
1517 Dorough Road
Karnack, Texas 75661

Nigel R. Shivers
Post Office Box 558
Karnack, Texas 75661

Dear LHAAP RAB Member,

The next Restoration Advisory Board (RAB) meeting will be held on Tuesday, June 16, 2009, from 6:30 to 7:30 p.m. at the Karnack Community Center, Highway 134 and Spur 449, Karnack, Texas 75661. Tom Lederle, Industrial Branch Chief with BRAC Division, will be joining us. We hope that you can attend this meeting. If you have any questions, please do not hesitate to contact me.

Shaw Environmental, Inc. (Shaw) is the contractor supporting the U.S. Army environmental restoration activities at the Longhorn Army Ammunition Plant (LHAAP), and will be coordinating the RAB meeting. A tentative agenda is attached.

Regards,

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

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

AGENDA

DATE:	Tuesday, June 16, 2009
TIME:	6:30 – 7:30 PM
PLACE:	Karnack Community Center, Karnack, Texas

06:30 Welcome {RMZ & PF}

06:35 Open items {RMZ}

06:40 Programmatic Issues
- Site Status Summary
- Other

06:50 Defense Environmental Restoration Program (DERP) Performance Based Contract (PBC) Update {Shaw}
- Groundwater Treatment Plant (GWTP) Update
- Documents Status/ Environmental Sites
- Perimeter Well Monitoring
- Surface Water Monitoring

07:05 DERP Total Environmental Restoration Contract Update {RMZ}
- ROD for LHAAP-37 and-67

07:10 Military Munitions Response Program (MMRP) Update {USACE}

07:15 Other Environmental Restoration Issues/Concerns {RMZ)
- Construction Debris Landfill
- 2010 IAP

07:20 Transfer Update
- Powerhouse Demolition {USACE}
- Transfer status of Site 12
- ECOP VI

07:30 Adjourn {RMZ}

Shaw Environmental, Inc.

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

Location of Meeting: Karnack Community Center, Karnack, Texas

Date of Meeting: **June 16, 2009, 6:30 – 07:30 PM**

Meeting Participants:

LHAAP/BRAC	Rose M. Zeiler, Tom Lederle
USAEC	Matthew Mechenes
USACE-Tulsa:	John Lambert, Aaron Williams, Scottie Fiehler
USFWS:	Mark Williams, Jeannie Wagner-Greven
Shaw Environmental:	Greg Jones, Kay Everett, Van Vangala
TCEQ:	Fay Duke
USEPA Region 6:	Raji Josiam, Terry Burton
RAB:	Paul Fortune, Tony Novak, Judith Johnson
Community:	Brad Bailey, Katherine Carlson

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

Welcome – Rose Zeiler and Paul Fortune
Paul Fortune called the meeting to order and introduced Tom Lederle from BRAC HQ. New participants were also recognized. Paul acknowledged appreciation to the Army and their contractors for efforts in remediating Longhorn with the goal of public use through the FWS.

Open Items – Rose Zeiler
There were no open items discussed.

Programmatic Issues
Site Status Summary
Rose indicated that the site status summary was not ready to distribute. Some of the sites have only minor environmental issues, and there has been an effort to separate the NPL sites from

the non-NPL sites. This will help tighten the schedule and makes it easier to review the status of each site. Aaron stepped through the active sites that are currently being worked on. John Lambert talked about other active sites that included LHAAP-16, -17, -18/24, and -29. Tony Novak asked when the sites would be transferred, and John explained that the transfer determination needs to be done after the Records of Decision (RODs) have been issued. RODs are needed for those sites that need to reach a RIP goal. Rose Zeiler indicated that schedule dates will change over time and that FWS would need to agree once "Operating Properly and Successfully" was achieved in order to make the transfer.

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

Document Status/Environmental Sites

Greg Jones distributed copies of the document status table and discussed each site on the table.

- Greg indicated that LHAAP-02 was being evaluated on how to address soil-to-groundwater COCs without having to include monitoring within another site.
- He indicated that RTCs for the Site Investigation (SI) Report for LHAAP-03 are with the state for comments. He mentioned LHAAP-03 and LHAAP-49 would go to a no further action proposed plan.
- Comments were received from the Army on the draft Action Memorandum for LHAAP-04 and the Pistol Range. The final Engineering Evaluation/Cost Analysis (EE/CA) report for LHAAP-04 was submitted in early March. No regulatory review or signatures from regulators are required.
- Surveying is the next step for the NFA sites LHAAP-06, -07, -51, -55, -64, -66, and -68 and LHAAP-60.
- RTCs for the DF Feasibility Study (FS) for LHAAP-16 are in progress and additional field data has been collected.
- The draft final FS for LHAAP-17 was submitted in April and comments are being resolved.
- Army comments were received for the draft FS for LHAAP-18/24 and resolution is in progress.
- DF FS for LHAAP-29 is in progress as new data is being incorporated.
- The RTCs for the draft FS for LHAAP-47 are in preparation as additional groundwater sampling is incorporated.
- The Final Site Evaluation Report for LHAAP-49 will be issued this week after incorporating final field data.
- Revised RTCs for the DF FS for LHAAP-46, -50, and -58 are in Army review.
- Surveying and county notification are the next activities planned for LHAAP-60.
- The Final EE/CA for the Pistol Range was submitted in February and an Action Memorandum is being prepared.
- The final Addendum to the Final Data Evaluation Report for LHAAP-35/36 was submitted; a draft decision document has been submitted to the Army and comments have been received. Responses are being prepared.

Paul Fortune asked about the excavation being planned at the Pistol Range. Greg indicated that the area was located at a natural embankment. This is the area of highest contamination

from small arms firing as shooters fired into the embankment. Paul said that the cost of removal seemed high for what seemed to him to be little risk. John Lambert explained briefly about what is meant by risk and the derivation of risk-based values from regulatory standards. Paul asked about the costs associated with the upcoming soil removal at LHAAP-04 and the Pistol Range. The alternatives and the costs for each were presented in the Engineering Evaluation/Cost Analysis (EE/CA) reports (copies of which were sent to the Marshall library) and made available at the Public Meeting that took place before the last RAB meeting on March 24, 2009 at the Karnack Civic Center. Paul requested more information about the breakdown of these costs.

Groundwater Treatment Plant (GWTP) Update
The plant is functioning normally. Water is being treated from LHAAP-18/24 and LHAAP-16. Water is being discharged at LHAAP-18/24. The main compressor has been replaced since the last meeting.

Perimeter Well Monitoring/Surface Water Monitoring
The latest results from surface water sampling at Goose Prairie Creek and Harrison Bayou were provided along with the perimeter well groundwater sampling results.

DERP Total Environmental Restoration Contract (TERC) Update – Rose Zeiler

Status of Draft Final ROD for Sites LHAAP-37 and -67
Rose indicated that the ROD has been held up due to a groundwater restoration issue. She expects the issue to be resolved within this fiscal year.

Military Munitions Response Program (MMRP) Update – USACE

John Lambert said that two draft final reports were in preparation under the MMRP program--the MEC Removal Action Report which addresses the explosive ordnance from sites LHAAP-27 and LHAAP-54 and the MC Data Summary Report. These reports are currently at the comment resolution stage.

Other Environmental Restoration Issues/Concerns – USACE

Construction Debris Landfill
John said that the work plan for closure of the landfill is under preparation. Components of the closure include earthwork, a closure assessment regarding any borings and wells around the landfill and the administrative survey and deed recordation. Fieldwork may begin this summer.

2009 IAP Status
The 2009 IAP details the phases of each site. When finalized, it will be put in the Marshall library.

Transfer Update

Powerhouse Demolition Progress
Scottie Fiehler indicated that the demolition is proceeding and is expected to be completed within a few weeks. However, the contractors have found some unexpected material that had to be handled differently. Scottie also noted that the contractor uses a full-time representative for site monitoring.

Transfer Status of Site 12/ECOP VI
ECOP V had LHAAP-12 listed, and Army is working out issues regarding LHAAP-12. ECOP VI consists of about 100 acres that the Army hopes to transfer by the end of the year. Also part of ECOP VI, LHAAP-53 is a candidate for the National Historic Places registry where activities associated with the nuclear disarmament between the Soviet Union and the U.S. took place.

A question was asked how many acres are left to transfer. Rose indicated it was about 1,462 acres left. LHAAP-12 consists of 55 acres and there is about 100 acres of small areas scattered throughout the installation. Most of the larger areas have already been transferred.

Rose introduced Matthew Mechenes (AEC) who is taking over Jeff Armstrong's duties.

Tom Lederle thanked the community for their perseverance in sticking with the process.

The next RAB meeting is September 15, 2009 at 6:30 PM.

Adjourn

June Meeting Attachments and Handouts:

- *March 2009 RAB Meeting Minutes*
- *March 2009 Attendees Signup Sheet*
- *Status of Technical Documents MARC PBC*
- *Meeting Agenda*
- *Creek and Perimeter Sampling Results*

Shaw Environmental, Inc.

Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
16 June 2009

No.	Document in Progress	Submittal Date	Army	Regulator	Next Submittal	Expected Date	Army	Regulator	Comment Resolution	Status	Remarks
1	Draft Decision Document, LHAAP-02	4/06/09	x		Draft Final DD	06/30/09	x	x		Evaluating how to address soil-to-groundwater COCs within LHAAP-02, without having to include monitoring within LHAAP-58	
2	Draft Final SI Report for LHAAP-03, Rev 01	12/30/07		x	Final	07/02/09	x	x		RTCs submitted to Army for review on 05/29/09	Final SI report to be submitted after RTCs are resolved.
3	Final EE/CA, LHAAP-04	3/05/09	x	x					NA	Final EE/CA submitted on 3/5/09. Public comment period 3/15/09 – 4/15/09	
4	Draft Action Memorandum, LHAAP-04/Pistol Range	3/13/09	x		Final Action Memo	6/30/09	x		In progress	Revised Draft Action Memo submitted to Army on 4/14/09. Comments reeived from Army on 06/15/09.	No regulatory review or signatures required
5	Draft Final Removal Action Work Plan, LHAAP-04/Pistol Range	5/21/09	x	x	Final	06/25/09	x	x	In progress	TCEQ comments received.	
6	Final Decision Document, LHAAP-06, 07, 51, 55, 64, 66, 68	12/18/08	x		NA				NA	Final copies were distributed on 12/18/08.	Scheduling survey, followed by County notification.
7	Draft Final Feasibility Study Addendum, Rev 01, LHAAP-16	7/3/08		x	RTC	06/30/09	x		In progress	EPA and TCEQ comments rec'd. RTCs reviewed by Army. RTC revision in progress	
8	Draft Final Feasibility Study, LHAAP-17	4/14/09	x	x	Final	06/30/09	x	x	In progress	Revised RTCs submitted to Army on 5/29/09. RTCs include revised text for alternatives and trigger for turning off extraction.	

Shaw Environmental, Inc.

Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
16 June 2009

No.	Document in Progress	Submittal Date	Army	Regulator	Next Submittal	Expected Date	Army	Regulator	Comment Resolution	Status	Remarks
9	Draft Feasibility Study, LHAAP-18/24	3/3/09	x		Draft Final	07/02/09	x	x	In progress	Army comments received. Resolution in progress	
10	Draft Final Feasibility Study, LHAAP-29	03/11/09	x	x	Final	07/09/09	x	x	In progress	TCEQ comments received. EPA comments pending. New well installed and sampled week of 06/08/09 in groundwater below the intermediate zone.	
11	Draft Final Focused Feasibility Study, LHAAP-46	1/30/09	x	x	Final	06/30/09	x	x	In progress	Responses for TCEQ and EPA comments submitted to Army for review on 05/13/09.	
12	Draft Focused Feasibility Study, LHAAP-47	12/23/08	x		Draft Final	07/02/09	x	x	In progress	Army comments received. Conducted a new round of groundwater sampling. RTC in prep.	
13	Draft Final Site Evaluation Report for LHAAP-49	3/3/08	x	x	Final	6/16/09	x	x	Completed.	Collected a new round of samples from wells. Results reported. Proceeding with Final Report.	
14	Draft Final Feasibility Study, LHAAP-50	11/20/08	x	x	Final	06/30/09	x	x	In progress	Regulatory comments received. Revised responses submitted to Army for review on 05/13/09.	
15	Draft Final Feasibility Study, LHAAP-58	9/20/07	x	x	Final	06/30/09	x	x	In progress	MNA evaluation submitted to regulators. Revised RTCs submitted to Army for review on 05/12/09.	
16	Final Decision Document, LHAAP-60	12/18/08	x						NA	Final copies were distributed on 12/18/08.	Scheduling survey, followed by County notification.
17	Final EE/CA, Pistol Range	2/25/09	x	x					NA	Final EE/CA submitted on 2/25/09.	See LHAAP-04 regarding Action Memorandum and Work Plan

Shaw Environmental, Inc.

Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
16 June 2009

No.	Document in Progress	Submittal Date	Army	Regulator	Next Submittal	Expected Date	Army	Regulator	Comment Resolution	Status	Remarks
18	Final Addendum, LHAAP-35/36	4/22/09	x	x					NA	Final document submitted.	
19	Draft Decision Document, LHAAP-35/36	5/22/09	x		Draft Final	06/25/09	x	x	In progress	Draft Decision Document submitted to Army on 05/21/09; Army comments received on 06/09/09.	

Perchlorate Results for Creek Sampling

Longhorn Army Ammunition Plant, Karnack, Texas

Creek Sample ID	Feb 2003	Jun 2003	Aug 2003	Jul 2004	Dec 2006	May 2007	Aug 2007	Dec 2007	Mar 2008	Jun 2008	Sep 2008	Dec 2008	May 2009
GPW-1	18.6	59.9		2.25		1U	0.5U	10.7	27	0.5U	0.5U	0.22U	16
GPW-3	12.6	14.7		2.2		1U	0.5U	7.48	21.9	9.42	1.1	0.22U	8.9
HBW-1		4U	99.3	0.2U	1U	1U	122	0.5U	0.5U	0.5U	0.5U	0.22U	0.55U
HBW-7		4U	4U	0.2U	1U	1U	1.02	0.5U	0.5U	0.5U	0.5U	0.22U	0.55U
HBW-10		4U		0.2U	1U	1U	0.5U	0.5U	0.5U	0.5U	0.5U	0.22U	0.55U

NOTES:
all units in micrograms/liter (µg/L)
U undetected
GP is Goose Prairie Creek
HB is Harrison Bayou
W is surface water

Note: All creeks had strong flow at each sample location.

Perchlorate Results for Perimeter Well Sampling
Longhorn Army Ammunition Plant, Karnack, Texas

Well ID	Sep 2004	Dec 2004	Jun 2005	Sep 2005	Sep 2006	May 2007	Aug 2007	Dec 2007	Mar 2008	Sep 2008	May 2009
LHPMW108					10 U		0.5U			2.5 U	
LHPMW110					10 U		10U			5.0 U	
LHPMW111					4 U		0.5U			0.5 U	
LHPMW112					5 U		3U			2.0 U	
LHPMW133	0.542 JL	0.528	0.541	0.597	1.08	1 U	1.09	0.5 U	0.5 U	0.5 U	0.47 J
LHPMW134	0.809 JL	0.821	0.811	0.725	0.708 J	1 U	0.949 J	0.5 U	0.5 U	0.829 J	0.40 J

NOTES:
all units in µg/L

µg/L migrograms/liter
U undetected
J Present below normal reporting limit but greater than or equal to the MDL and the concentration is an approximate value.
L Result biased low.
MDL method detection limit

Shaw Environmental, Inc.

Longhorn Army Ammunition Plant
Restoration Advisory Board Meeting

Location	Karnack Community Center, Karnack, Texas
Date	16-Jun-2009 6:30 PM **page 1 of 1**

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

ATTENDEES

Name (printed)	Signature	Organization	Phone	E-mail
RAB Members				
Paul Fortune	✓			plfortune@hotmail.com
Robert Speight, Jr.				r.speightjr@att.net
Larry McCathran				MMCattle@yahoo.com
Nigel R. Shivers				nigelshivers@yahoo.com
Tom Walker				twalkercaddolake@gmail.com
Tony Novak				paldog_1@windstring.net
Judith Johnson		RAB		judithjohnson@webtv.net
Ken Shaw				kens@shreve.net
Longhorn Team Members and Community				
Rose M. Zeiler		Longhorn AAP	(479) 635-0110	rose.zeiler@us.army.mil
Matthew Mechenes		USAEC	(410) 436-1505	matthew.mechenes@us.army.mil
Aaron Williams		USACE, Tulsa	(918) 669-4915	aaron.k.williams@usace.army.mil
John Lambert		USACE, Tulsa	(918) 669-4992	john.r.lambert@SWT03.usace.army.mil
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Raji Josiam		USEPA, Dallas	(214) 665-8529	josiam.raji@epa.gov
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Barry Forsythe		USFSW	(214) 665-8467	forsythe.barry@epa.gov
Mark Williams		USFSW	(903) 679-9144	mark_williams@fws.gov
Greg Jones		SHAW	(713) 996-4472	greg[redacted]n.jones@shawgrp.com
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SUBRAMANYAM VANG		"	x4459	vam.vangala@shaw grp.com
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KATHERINE CARLSON		GUEST	903-665-7110	KATHERINEMCV@HUGHES.NET

LONGHORN ARMY AMMUNITION PLANT,

Karnack, Texas

MONTHLY MANAGERS' MEETING

AGENDA

DATE:	Tuesday, 14 July 2009
TIME:	9:00 a.m.
PLACE:	Teleconference Call-In Number 866-797-9304, Passcode 4155734

Welcome **RMZ**

Action Items:

Army

- Provide MMRP LUC notification language to Fay for review.

Programmatic Issues

- Technical Approach on FS Remedies
- Restoration **RMZ/ST**

Defense Environmental Restoration Program (DERP) PBC Update **PS/GJ**

- Document Status/Environmental Sites (Table)
- Path forward for LHAAP-04 and Pistol Range
- Groundwater Treatment Plant Update

DERP Total Environmental Restoration Contract Update **RMZ**

BRAC-Funded Environmental Restoration

- LHAAP-19 – Demolition Landfill Progress **JRL/AW**

MMRP **JRL/AW**

- Status of regulatory review
  - DF MEC Removal Action Report
  - DF MC Data Summary Report

Transfer Update **RMZ**

- ECOP VI
- LUCs
- Site 49
- Refuge Opening

Other Issues

- 2009 IAP Status
- Powerhouse Demolition Status
- LHAAP-18/24 ESD

Adjourn

Shaw Environmental, Inc.

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

Location of Meeting: **Teleconference**

Date of Meeting: **July 14, 2009; 9:00 AM – 10:30 AM**

Meeting Participants:

BRAC:	Rose M. Zeiler
USAEC:	Matthew Mechenes
USACE-Tulsa:	Aaron Williams, John Lambert
Shaw:	Praveen Srivastav, Greg Jones, Kay Everett, Susan Watson, John Elliott
USEPA Region 6:	Steve Tzhone
TCEQ:	Fay Duke
TCEQ – Tyler:	Dale Vodak
USFWS:	Paul Bruckwicki

Rose Zeiler indicated an error in last month's meeting minutes in that Paul Bruckwicki's name was inadvertently omitted from the meeting attendees list. The error will be corrected.

Previous Action Items

Army

- Provide MMRP LUC notification language to Fay for review.

Programmatic Issues **Rose Zeiler**

Technical approach on FS Remedies

John Lambert indicated that the Army is looking at a path forward in letting the contractor know what is acceptable in terms of remedies. He said that there has been some back and forth discussion between Shaw and the Army. The issue is not yet resolved, but is being worked on. John said that he wanted to emphasize that the issue has high priority. A question regarding non-

groundwater RODs was raised. Rose indicated that there are no issues on Pistol Range and LHAAP-04 and; therefore, these sites are proceeding as planned.

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

Document Status/Environmental Sites (Table)
Praveen Srivastav went over the document status/environmental sites table. Shaw collected 5 soil samples from LHAAP-02 for total and SPLP metals analysis. The Draft Decision Document for LHAAP-02 is on hold pending the latest sampling results. The Final SI Report for LHAAP-03 will be issued after regulatory review and concurrence with responses. A Draft Action Memorandum for the Pistol Range and LHAAP-04 has been submitted to the Army for review. Responses to Army comments were submitted near the end of June 2009. The responses to TCEQ comments for the Removal Action Work Plan for LHAAP-04 and the Pistol Range are being prepared and will be sent for Army's review later in the week. The site survey for the sites LHAAP-06, -07, -51, -55, -64, -66, -68, and -60 is being scheduled. County notification will follow. RTC revision is in preparation for the Draft Final FS Addendum LHAAP-16. Additional comments are currently being resolved for the Draft Final FS LHAAP-17. Resolution is in progress for the Draft FS for LHAAP-18/24. A new well was installed at LHAAP-29. RTC for the Draft Final FS for LHAAP-29 is in preparation. Resolution is in progress on comments received for the Draft Final Focused FS for LHAAP-46. Comments on the Draft Focused FS for LHAAP-47 are in preparation. The final SE Report for LHAAP-49 was submitted and the draft PP for LHAAP-49 is in Army review. The Draft Final FSs for LHAAP-50 and -58 are in comment resolution. Site survey is being scheduled for LHAAP-60 to be followed by county notification to close this site. The final addendum to LHAAP-35/36 has been submitted and comments have been received on the draft decision document for LHAAP-35/36 just prior to this meeting. The draft final version is in progress.

Rose Zeiler indicated that site surveys for the TERC sites have been completed and after the rest of the NFA site surveys are completed, she would like Shaw to coordinate with BRAC to schedule the visit to the county office to file the deed notification requirements for the TERC and PBC sites at the same time.

Path Forward for LHAAP-04 and Pistol Range
Shaw collected and analyzed samples beneath the slab at LHAAP-04. Some contamination was found beneath the slab and will require removal. Shaw also collected samples near the power poles and no contamination was found, therefore, the poles may be left in place. The schedule for Excavation at LHAAP-04 and the Pistol Range will be discussed later in the meeting in regards to the Powerhouse Demolition.

Groundwater Treatment Plant Update
A technical update has been sent on issues regarding the filter sand. No groundwater was extracted from LHAAP-18/24 during the month of June. Fay Duke asked how the well shut down could have happened. Praveen and Greg pointed out that the extraction wells at LHAAP-18/24 were shut down automatically because the influent tank was staying near capacity due to water coming in from the backwashing of the filter sand. Shaw didn't realize this was happening until

the end of June when totalizers on the ICP pumps were read. Shaw has taken steps to reduce the backwash water, check on the totalizers on a weekly basis, and has also scheduled a replacement of the sand media in the first week of August. At the present time, several wells and nearby creek will be sampled to document whether or not a release to the creek occurred during this time. Well heads have cumulative counting flow meters, and the sand was last replaced and cleaned in 2004. It is expected to take 2-3 days to replace the sand media. Rose asked if the sampling is taking place this week. That was confirmed.

DERP Total Environmental Restoration Contract (TERC) Update **Rose Zeiler**

Rose indicated that there was nothing new to report.

BRAC-Funded Environmental Restoration **John Lambert/Aaron Williams**

LHAAP-19-Demolition Landfill Progress
Aaron indicated that the work plan for Landfill 19 has been submitted. He'll have a copy to Fay soon and hopes that the state can get it back to them quickly as they need to initiate the work shortly. Dale requested that he be provided a copy of the work plan also.

Paul Bruckwicki asked about a special use permit (SUP) regarding Haystack Road and the deterioration of the roads that can be caused by ECC hauling fill dirt, water, and other heavy cargo. He would like to get something established for the maintenance and repair of the roads after ECC has completed its work. Rose indicated they can have a call with the Army and USFWS to discuss tomorrow.

Paul Bruckwicki indicated that work is going on at the landfill now. John said that ECC may have started preparatory work because ECC is aware that an approved work plan must be in place before beginning any work. He would contact ECC and confirm the status.

MMRP **John Lambert**

Status of Regulatory Review
John indicated that the MEC Removal Action Report is being completed and he expects to see the RTC this week. The MC Data Summary Report is being looked at in regards to how best to move forward. The Army expects something from the contractor in the next 2 to 3 weeks.

Transfer Update **Rose Zeiler**

ECOP VI
This ECOP includes LHAAP-08, -32, -48, and -53.

LUCs
The discussion on LUCs between the FWS and Army is ongoing. How LUCs will be handled, funded, and implemented needs to be resolved soon. Rose mentioned that USFWS is not accepting LHAAP-49 and asked if Paul would elaborate. Paul Bruckwicki stated that, in USFWS' opinion, vertical extent of contamination was not determined at the site.

Other
Rose noted that an outcome of the meeting between BRAC and USFWS in June was a need to begin preparing for the September opening of the Refuge. A discussion about what gates need to be locked to prevent the public from wandering into a site was discussed. Praveen said that he and Greg would be on base Thursday and asked for a meeting with Paul Bruckwicki and Mark Williams, the Refuge Manager, to discuss it in more detail. Paul said he and Mark would be available to meet.

Rose asked if Shaw would begin sending weekly notices about upcoming activities at the base, with a two week look-ahead. This would help ensure a smooth transition with USFWS after the Refuge has opened to the public. It would also allow early planning for coordinating activities between USFWS and Shaw especially in ensuring that certain areas are gated and locked to limit public access.

Refuge Opening
The Refuge is scheduled to open to the public on September 26, 2009.

<u>Other Issues</u> **Rose Zeiler**

2010 IAP Status
Outstanding issues have been wrapped up and once the IAP has been refreshed, it will be produced and made available for public review. Fay asked about the resolution of a couple sites in regards to LHAAP-35/36. Aaron indicated the sites in question were LHAAP-56 and -65. He said that these are being addressed by the Army.

Powerhouse Demolition Status
The schedule of the Powerhouse demolition was discussed briefly. The demolition is currently in progress and the contractor expects to be completed as scheduled. The superstructure has recently been removed and disposed. There have been 1.6 million pounds of steel removed and recycled, 27 roll offs of debris. The four brick boilers are currently being dismantled. This week, the Army expects all boilers to be removed. After the boilers are removed, ECC will begin the cleanup. Army expects all tasks to be completed by the end of next week.

Praveen mentioned that Shaw may start at the Pistol Range first then move to LHAAP-04 after ECC has withdrawn from the Power House area. Paul Bruckwicki said there is a cover over the switchbox and there are additional poles. He asked if the contractor could remove the unused poles and Army agreed. Paul also asked that the poles not be put in debris piles for burning. TCEQ agreed that the poles should not be burned.

Fay Duke mentioned she would be on vacation during the last week of July and would look at the LHAAP-04 and Pistol Range work plan RTCs if she gets it before then. Praveen indicated that Shaw would have it to the Army this week and hopefully to Fay by the middle of next week so that she may review before her vacation.

LHAAP-18/24 ESD
Rose asked Steve how EPA will handle this document, and would EPA like to review it. Steve thinks it is handled like a ROD but he would check. Steve indicated it may need to be signed or concurred. Fay said the state will review and concur.

The next monthly manager's meeting will be held via teleconference on August 18, 2009 at 2 PM.

Meeting Adjourned

Action Items:
Army

- Pass along the outcome of the restoration meeting.
- Inform Steve when the Army legal plans to discuss the restoration groundwater memo so that EPA legal would have a chance to participate if they wish, on the installation level or HQ level.
- RMZ to forward MMRP LUC notification language to Fay Duke.
- Follow up with AEC on the progress of the Action Memo concurrence and get back to Shaw as soon as possible.
- Army and ECC will discuss road conditions, truck routes and handling (Haystack Road) and coordinate with USFWS in regards to the need for a SUP (special use permit).
- Aaron will provide a copy of the work plan to Dale Vodak on landfill demolition.

EPA
- Steve will find out what EPA's role is on the ESD.

Shaw
- Shaw will meet with USFWS this week regarding site access (restricting gate access) during environmental work.
- Shaw will begin providing a two-week look-ahead schedule on a weekly basis.

Shaw Environmental, Inc.

Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
14 July 2009

No.	Document in Progress	Submittal Date	Army	Regulator	Next Submittal	Expected Date	Army	Regulator	Comment Resolution	Status	Remarks
1	Draft Decision Document, LHAAP-02	4/06/09	x		Draft Final DD	07/31/09	x	x		Evaluating how to address soil-to-groundwater COCs within LHAAP-02, without having to include monitoring within LHAAP-58.	Shaw collected 5 soil samples from LHAAP-02 for total and SPLP metals analysis
2	Draft Final SI Report for LHAAP-03, Rev 01	12/30/07		x	Final	07/31/09	x	x		RTCs submitted to TCEQ for review on 05/29/09	Final SI report to be submitted after RTCs are resolved.
3	Draft Action Memorandum, LHAAP-04/Pistol Range	3/13/09	x		Final Action Memo	7/31/09	x		In progress	Revised Draft Action Memo submitted to Army on 4/14/09. Comments received from Army on 06/15/09. Submitted responses 6/26/09	No regulatory review or signatures required
4	Draft Final Removal Action Work Plan, LHAAP-04/Pistol Range	5/21/09	x	x	Final	06/25/09	x	x	In progress	TCEQ comments received.	
5	Final Decision Document, LHAAP-06, 07, 51, 55, 64, 66, 68	12/18/08	x		NA				NA	Final copies were distributed on 12/18/08.	Scheduling survey, followed by County notification.
6	Draft Final Feasibility Study Addendum, Rev 01, LHAAP-16	7/3/08		x	RTC	07/31/09	x		In progress	EPA and TCEQ comments rec'd. RTCs reviewed by Army. RTC revision in progress	
7	Draft Final Feasibility Study, LHAAP-17	4/14/09	x	x	Final	07/31/09	x	x	In progress	Revised RTCs submitted to Army on 5/29/09. Resolving additional Army comments	
8	Draft Feasibility Study, LHAAP-18/24	3/3/09	x		Draft Final	07/31/09	x	x	In progress	Army comments received. Resolution in progress	

Shaw Environmental, Inc.

Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
14 July 2009

No.	Document in Progress	Submittal Date	Army	Regulator	Next Submittal	Expected Date	Army	Regulator	Comment Resolution	Status	Remarks
9	Draft Final Feasibility Study, LHAAP-29	03/11/09	x	x	Final	07/22/09	x	x	In progress	TCEQ and EPA comments received. EPA comments pending. New well installed and sampled week of 06/08/09 in groundwater below the intermediate zone. RTC prep in progress.	
10	Draft Final Focused Feasibility Study, LHAAP-46	1/30/09	x	x	Final	07/31/09	x	x	In progress	Responses for TCEQ and EPA comments submitted to Army for review on 05/13/09. Additional Army comments received. Resolution in progress.	
11	Draft Focused Feasibility Study, LHAAP-47	12/23/08	x		Draft Final	07/31/09	x	x	In progress	Army comments received. Conducted a new round of groundwater sampling. RTC in prep.	
12	Draft Final Site Evaluation Report for LHAAP-49	3/3/08	x	x	Final	6/16/09	x	x		Final report submitted.	
13	Draft Proposed Plan, LHAAP-49	7/2/09	x		Draft Final	7/31/09	x	x		In Army review	
14	Draft Final Feasibility Study, LHAAP-50	11/20/08	x	x	Final	06/30/09	X	x	In progress	Regulatory comments received. Revised responses submitted to Army for review on 05/13/09. Additional comments received. Resolution in progress.	
15	Draft Final Feasibility Study, LHAAP-58	9/20/07	x	x	Final	06/30/09	x	x	In progress	MNA evaluation submitted to regulators. Revised RTCs submitted to Army for review on 05/12/09. Resolution in progress.	
16	Final Decision Document, LHAAP-60	12/18/08	x						NA	Final copies were distributed on 12/18/08.	Scheduling survey, followed by County notification.

Shaw Environmental, Inc.

Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
14 July 2009

No.	Document in Progress	Submittal Date	Army	Regulator	Next Submittal	Expected Date	Army	Regulator	Comment Resolution	Status	Remarks
17	Final Addendum, LHAAP-35/36	4/22/09	x	x					NA	Final document submitted.	
18	Draft Decision Document, LHAAP-35/36	5/22/09	x		Draft Final	07/17/09	x	x		Draft Decision Document submitted to Army on 05/21/09; Army comments received on 06/09/09. RTCs submitted and resolved. DF in progress.	

Shaw

LONGHORN ARMY AMMUNITION PLANT
MONTHLY MANAGERS' MEETING

Location	Longhorn Army Ammunition Plant, Karnack, Texas		
Date	14-Jul-2009	**Time**	9:00 AM

ATTENDEES

Name (printed)	Signature	Organization	Phone	E-mail
Longhorn Team Members				
Rose M. Zeiler	✓	BRAC	(479) 635-0110	rose.zeiler@us.army.mil
Matthew Mechenes	✓	USAEC	(410) 436-1505	matthew.mechenes@us.army.mil
Aaron Williams	✓	USACE, Tulsa	(918) 669-4915	aaron.k.williams@usace.army.mil
John Lambert	✓	USACE, Tulsa	(918) 669-4992	john.r.lambert@SWT03.usace.army.mil
Scottie Fiehler		USACE, Tulsa	(918) 669-7232	scottie.fiehler@us.army.mil
Stephen Tzhone	✓	USEPA, Dallas	(214) 665-8409	tzhone.stephen@epa.gov
Raji Josiam		USEPA, Dallas	(214) 665-8529	josiam.raji@epa.gov
Fay Duke	✓	TCEQ, Austin	(512) 239-2443	fduke@tceq.state.tx.us
Dale Vodak	✓	TCEQ, Tyler	(903) 535-5142	dvodak@tceq.state.tx.us
Barry Forsythe		USFSW, Dallas	(214) 665-8467	forsythe.barry@epa.gov
Paul Bruckwicki	✓	USFSW, Karnack	(903) 679-4536	paul_bruckwicki@fws.gov
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Susan Watson	[illegible]	Shaw		
JOHN ELLIOTT	[illegible]	Shaw		
Praveen Srivastav	[illegible]	Shaw, Houston		

Shaw® Shaw Environmental, Inc.

Date: ***August 3, 2009***

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 Action Memorandum for Former Pistol Range and LHAAP-04, Former Pilot Wastewater Treatment Plant
Longhorn Army Ammunition Plant, Karnack, Texas, July 2009

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	July 2009	**Final Action Memorandum for Former Pistol Range and LHAAP-04, Former Pilot Wastewater Treatment Plant, Group 4** Longhorn Army Ammunition Plant, Karnack, Texas

Aaron – Enclosed please find two copies of Shaw's final version of the above-named document.

The document has been distributed according to the list below. Please call there are if any questions or comments.

Sincerely:

Praveen Srivastav
Project Manager

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

3010 Briarpark Drive, Suite 400, Houston, Texas 77042 ***Phone: (713) 996-4522/Fax: (713) 996-4436***

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

August 3, 2009

DAIM-ODB-LO

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

Re: Final Action Memorandum for Former Pistol Range and LHAAP-04, Former Pilot Wastewater Treatment Plant, Group 4
Longhorn Army Ammunition Plant, Karnack, Texas, July 2009

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, 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/S. Fiehler, USACE, Tulsa District, OK
A. Williams, USACE, Tulsa District, OK
M. Mechenes, USAEC, MD
P. Srivastav, Shaw – Houston, TX (for project files)

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

August 3, 2009

DAIM-ODB-LO

Ms. Fay Duke
Texas Commission on Environmental Quality
TCEQ Environmental Cleanup Section I, Team 2, MC-136
12100 Park 35 Circle, Bldg D
Austin, TX 78753

Re: Final Action Memorandum for Former Pistol Range and LHAAP-04, Former Pilot Wastewater Treatment Plant, Group 4
Longhorn Army Ammunition Plant, Karnack, Texas, July 2009
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, 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/S. Fiehler, USACE, Tulsa District, OK
M. Mechenes, USAEC, MD
A. Williams, USACE, Tulsa District, OK
P. Srivastav, Shaw, Houston, TX (for project files)

FINAL

ACTION MEMORANDUM FOR FORMER PISTOL RANGE AND LHAAP-04, FORMER PILOT WASTEWATER TREATMENT PLANT LONGHORN ARMY AMMUNITION PLANT KARNACK, TEXAS

Prepared for

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

Prepared by

Shaw Environmental, Inc.
3010 Briarpark, Suite 400
Houston, Texas 77042

MARC No. W912QR-04-D-0027, Shaw Project No. 117591
Task Order No. DS02

July 2009

Table of Contents

Acronyms and Abbreviations

ACE	Anderson Columbia Environmental
ARAR	applicable or relevant and appropriate requirements
BRAC	Base Realignment and Closure
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
DoD	Department of Defense
EE/CA	Engineering Evaluation/Cost Analysis
GW-Ind	groundwater MSC for industrial use
GWP-Ind	soil MSC for industrial use based on groundwater protection
Jacobs	Jacobs Engineering Corporation
LHAAP	Longhorn Army Ammunition Plant
LUC	land use controls
MARC	Multiple Award Remediation Contract
mg/kg	milligrams per kilogram
MSC	medium-specific concentration
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
PBC	performance based contract
RAB	Restoration Advisory Board
RAOs	removal action objectives
RCRA	Resource Conservation and Recovery Act
SAI-Ind	soil MSC for industrial use based on inhalation, ingestion, and dermal contact
Shaw	Shaw Environmental, Inc.
STEP	Solutions to Environmental Problems
TCEQ	Texas Commission on Environmental Quality
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service

1.0 Purpose

1.1 Introduction and Purpose

The U.S. Army Corps of Engineers (USACE) contracted Shaw Environmental, Inc. (Shaw), under the Multiple Award Remediation Contract (MARC) Number W912QR-04-D-0027, Task Order No. DS02, to perform remediation activities associated with Site Closure of Multiple Sites at the former Longhorn Army Ammunition Plant (LHAAP) in Karnack, Texas, a Federally-owned facility managed by the U.S. Army under the U.S. Department of Defense (DoD). As part of the activities associated with that task order, Shaw has prepared Engineering Evaluations/Cost Analyses (EE/CAs) for the former Pistol Range at LHAAP (Shaw, 2009a) and for the LHAAP-04, Former Pilot Wastewater Treatment Plant (Shaw, 2009b). This Action Memorandum documents selection of the non-time-critical removal actions recommended in the EE/CAs for the former Pistol Range and LHAAP-04 sites at LHAAP, Karnack, Harrison County, Texas.

1.2 Statement of Basis

The U.S. Army Environmental Command provides funding and oversight for the environmental response activities at LHAAP. The U.S. Army Base Realignment and Closure (BRAC) Division is the lead DoD organization for execution of environmental response at the LHAAP.

The removal action alternatives that will be implemented at the former Pistol Range and LHAAP-04 were developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986, and the National Oil and Hazardous Substances Contingency Plan (NCP) (40 Code of Federal Regulations [CFR] Part 300).

<u>Former Pistol Range</u>

The removal action objective (RAO) for the former Pistol Range can be described as follows:

- Minimize the potential for human contact with soil containing lead at concentrations that could adversely affect future maintenance workers.

This objective was used as the basis for formulating and evaluating removal alternatives and selecting a removal action. The selected action is supported by documents contained in the Administrative Record for LHAAP, which is available at the Marshall Public Library. The U.S. Army will implement the following response at the former Pistol Range:

- Excavate surface and near surface soil contaminated with lead exceeding industrial use levels and dispose of that soil off site at a permitted landfill that is approved to accept the contaminated soil.

LHAAP-04, Former Pilot Wastewater Treatment Plant

The RAOs for LHAAP-04 are as follows:

- Protection of human health and the environment by eliminating the threat for potential releases of perchlorate from contaminated soil to groundwater.
- Protection of human health and the environment by eliminating the threat for potential releases of perchlorate and mercury from contaminated soil to surface water.
- Protection of human health by eliminating the potential for exposure to mercury contaminated surface soils for a future maintenance worker.

These objectives were used as the basis for formulating and evaluating removal alternatives and selecting a removal action. The selected action is supported by documents contained in the Administrative Record for LHAAP, which is available at the Marshall Public Library. The U.S. Army will implement the following at LHAAP-04:

- Excavate soil contaminated with perchlorate exceeding the medium-specific soil concentration for industrial use based on groundwater protection levels with the potential to contaminate groundwater and dispose excavated soil off site at a permitted landfill that is approved to accept the contaminated soil.
- Excavate soil contaminated with mercury exceeding industrial use levels and dispose of that soil off site at a permitted landfill that is approved to accept the contaminated soil.

These removal actions are consistent with the intended future use of the LHAAP as a wildlife refuge and are intended to be final actions for the two sites. The U.S. Army, U.S. Environmental Protection Agency (USEPA), and Texas Commission on Environmental Quality (TCEQ) concur with the selected alternatives.

2.0 Site Conditions and Background

2.1 Site Description

LHAAP is located in central-east Texas in the northeastern corner of Harrison County, approximately 14 miles northeast of Marshall, Texas. The facility occupies approximately 8,416 acres between State Highway 43 in Karnack, Texas, and the western shore of Caddo Lake. Caddo Lake is a large freshwater lake that bounds LHAAP to the north and east. The eastern fence of LHAAP is 3.5 miles from the Texas-Louisiana state border.

The primary tasks performed as part of the EE/CAs included additional investigations to delineate contaminated areas and the preparation of the EE/CA reports (Shaw, 2009a and 2009b). The information gathered during the investigations was used to evaluate risk associated with each site, develop alternatives, and recommend a removal action. Site descriptions and summaries of the investigation activities are presented below for the former Pistol Range and LHAAP-04.

Former Pistol Range

The former Pistol Range is located in the southeastern portion of LHAAP, approximately 280 feet south of Avenue Q at the end of Robert Avenue. The site is the eastern portion of a rectangular field and is approximately 110 feet north to south by 150 feet east to west (approximately 0.4 acres). The target area was a wooded slope at the eastern side of the site. The area was used as a small arms firing range by base security personnel as early as the 1950s and intermittently through 2004 for small arms qualification and recertification. Preliminary field investigations were conducted at the Pistol Range in 1995, with subsequent site investigations in 2006 (soil sampling for site characterization) and 2007 (groundwater sampling and vertical delineation of soil contamination). The investigations showed that there had been no impact to groundwater, but identified areas where the soil was contaminated at levels that exceed the TCEQ soil medium-specific concentration (MSC) for industrial use based on inhalation, ingestion, and dermal contact (SAI-Ind)(TCEQ, 2006).

LHAAP-04, Former Pilot Wastewater Treatment Plant

LHAAP-04, Former Pilot Wastewater Treatment Plant, is approximately 0.5 acres and is located in the central portion of LHAAP at the northwest corner of 6th and 60th Streets near the former fire station. Wastewater treatment operations began at LHAAP-04 in 1984. The demolition of the Former Pilot Wastewater Treatment Facility and disposal of the associated wastes were completed in the Summer of 1997 as part of the Resource Conservation and Recovery Act (RCRA) closure of the plant.

Various sampling events were conducted at LHAAP-04 from 1993 through 2008 to assess the contamination from the operations at LHAAP-04 (Shaw, 2009b) and its impact to the soil and/or groundwater. Following RCRA closure of LHAAP-04, soil sampling was conducted (Anderson Columbia Environmental [ACE], 1997), and LHAAP-04 was approved for closure according to 30 Texas Administrative Code 335 Subchapter S, the Risk Reduction Rule Standard 2 in 1998 with the stipulation that the remaining soil contamination be addressed under CERCLA (Shaw, 2009b). The soil sampling results after 1998 delineated the perchlorate contamination in the soil at concentrations that are above the TCEQ soil MSC for industrial use based on groundwater protection (GWP-Ind) (TCEQ, 2006). Within the perchlorate contaminated soil area is an isolated area of mercury contamination that is above the SAI-Ind (TCEQ, 2006). Currently

available data do not indicate an impact to the groundwater above the groundwater MSC for industrial use (GW-Ind) for perchlorate. Additional evaluation of the groundwater will be performed after the soil removal action to determine the need for any future action for groundwater.

2.2 Current and Future Land Use

LHAAP is located near the unincorporated community of Karnack, Texas. Karnack is a rural community with a population of 775 people. The incorporated community of Uncertain, Texas, population 205, is a local resort area located to the northeast of LHAAP on the edge of Caddo Lake and is an access point to Caddo Lake. Industries in the surrounding area consist of agriculture, timber, oil and natural gas production, and recreation. The LHAAP acreage that was previously transferred to U.S. Fish and Wildlife Service (USFWS) is part of the Caddo Lake National Wildlife Refuge. The U.S. Army holds the remaining land while environmental restoration takes place in preparation for transfer to the USFWS.

At the present time, the general public does not have unrestricted access to the refuge. The Refuge Manager currently allows limited access to portions of the refuge. Approved access for hunters is very limited. Access to environmental sites is not granted to the general public by the U.S. Army. Physical controls consist of gated access roads with restricted access warning signs at the gates. The former LHAAP's perimeter fence remains in place around the refuge and represents the refuge boundary. The boundary along Caddo Lake is unfenced; however, current conditions discourage public access to areas within LHAAP. Despite the controls in place, trespassing is possible.

The reasonably anticipated future use of the entire facility, including the former Pistol Range and LHAAP-04, is as a wildlife refuge. The applicable receptor scenario for future use as a wildlife refuge is the hypothetical future maintenance worker. Once the former Pistol Range and LHAAP-04 are transferred, their use will be consistent with the rest of the refuge. That includes the following activities: hunting, fishing, wildlife observation, wildlife photography, wildlife education, and wildlife interpretation.

2.3 Previous Actions

There have been no previous removal actions at the former Pistol Range.

There have been no removal actions undertaken at LHAAP-04; however, a pilot study was conducted in 2000 and 2001. During the study, three different carbon sources were mixed into the top 12 inches of soil. The applications resulted in reductions in perchlorate concentrations in surface soil but results varied in deeper soil.

2.4 Federal, State, and Local Authorities' Roles (Coordination Summary)

This project was coordinated with several Federal, State, and local agencies, including the U.S. Army, USACE, USFWS, USEPA, and TCEQ (state and local offices), as well as with the Restoration Advisory Board (RAB) before and during the EE/CA process. All stakeholders were encouraged to participate in the EE/CA process, and copies of the EE/CA reports were made available for review and comment.

3.0 Threats to Public Health or Welfare or the Environment, and Statutory and Regulatory Authorities

Former Pistol Range

Firing of small arms is the only activity known to have occurred at the former Pistol Range, and there is no visual evidence of other activities. Therefore, the potential chemicals of concern at the former Pistol Range are limited to metals associated with small arms use. The results of the Site Investigation indicated that spent small arms ammunition, fragments, and shell casings were present at and near the surface at the former Pistol Range. Though the public does not have unrestricted access to the former Pistol Range, current physical controls do not prevent unauthorized access by trespassers. Workers and refuge visitors may access the site in the future for purposes associated with the wildlife refuge. A removal action is appropriate at the former Pistol Range based on the concentrations of lead in the surface and near-surface soil. The lead concentrations are sufficiently high to constitute a threat to public health and a removal action has been determined to be appropriate to address factor §300.415(b)(2)(i) of the NCP. §300.415(b)(2)(i) refers to "Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants."

LHAAP-04, Former Pilot Wastewater Treatment Plant

No unacceptable risks to human health or the environment were determined to be associated with LHAAP-04 by the human health risk assessment (Jacobs Engineering Corporation [Jacobs], 2003) or the Baseline Ecological Risk Assessment (Shaw, 2007). However, high perchlorate concentrations in soil indicate the potential for contamination of groundwater in the future (Solutions to Environmental Problems [STEP], 2005) and high mercury concentrations in soil detected during closure activities were above the SAI-Ind levels (TCEQ, 2006). In addition, other sites at LHAAP that have similarly high levels of perchlorate in the soil have had underlying groundwater contamination or contaminated surface water runoff (Jacobs, 2002). Therefore, the soil may present a hazard to human health and to the surrounding surface water/groundwater. It was determined that addressing the perchlorate contamination in soil will prevent potential for future impact to groundwater and surface water resources near LHAAP-04 and that doing so would also address the isolated area of mercury contamination. The site

conditions are such that it has been determined to be appropriate to implement a removal action to address the following two factors of the NCP:

- §300.415(b)(2)(i): "Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants."
- §300.415(b)(2)(iv): "High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface that may migrate."

4.0 Endangerment Determination

Actual or threatened releases of pollutants and contaminants from the former Pistol Range, if not addressed by implementing the response actions selected in this Action Memorandum, may present a potential for an imminent and substantial endangerment to public health, or welfare, or the environment.

5.0 Proposed Actions and Estimated Costs

The EE/CAs identify and screen removal action technologies that might be appropriate for satisfying the RAOs at the individual sites. After screening, remedial alternatives were developed from the various technologies. The alternatives were evaluated for effectiveness, implementability, and cost. The sections below present the alternatives that were evaluated for each site.

5.1 Former Pistol Range

5.1.1 Alternative 1 – No Action

The no action alternative is provided to serve as a baseline for comparison with the other alternatives. This alternative would leave the contaminated soil in place with no controls to prevent human exposure. No activities would be undertaken as part of this alternative to contain, remove, or treat the contaminated soil at the former Pistol Range.

5.1.2 Alternative 2 – Land Use Controls

This alternative involves the implementation of land use controls (LUCs) at the former Pistol Range to prevent exposure of the future maintenance worker to contaminated soil above permissible levels, but would not provide containment, removal, or treatment of the contaminated soil. LUCs would be maintained to prevent human exposure to soil in those areas where lead remains at concentrations exceeding the SAI-Ind value of 1,000 milligrams per kilogram (mg/kg) through access controls (i.e., legal restrictions, administrative controls, and physical mechanisms such as fencing or warning signs). LUCs would limit subsurface activities

such as drilling and excavation in the designated area. The county would also be notified that areas less than the SAI-Ind level at the former Pistol Range would be suitable for nonresidential use since soil contamination above residential cleanup levels would remain at the site.

Long-term operational requirements under this alternative would be minimal, and would involve surveillance activities and maintenance of the LUCs. Effectiveness of the controls would be evaluated and documented in 5-year reviews. A period of 30 years has been assumed for surveillance and maintenance for cost estimation purposes.

5.1.3 Alternative 3 – Excavation and Off-site Disposal

This alternative involves the removal of soil at the former Pistol Range containing lead concentrations exceeding the SAI-Ind value of 1,000 mg/kg from affected areas, and the subsequent transport of these soils to an appropriately licensed off-site facility for disposal. Once confirmation sampling results meet the cleanup level, the excavation area would be backfilled with clean soil and reseeded. No fencing or signs would be installed under this alternative since soil with lead concentrations exceeding the SAI-Ind value would be permanently removed from the site.

This alternative requires five year reviews because the soil removal is only to industrial levels and soil contamination above unrestricted use would remain at the site.

5.2 LHAAP-04, Former Pilot Wastewater Treatment Plant

5.2.1 Alternative 1 – No Action

The no action alternative is provided to serve as a baseline for comparison with the other alternatives. This alternative involves no actions to prevent impacts to groundwater or surface water resources, or to prevent human exposure.

5.2.2 Alternative 2 – Excavation and Off-site Disposal

This alternative involves the excavation and disposal of contaminated soil from LHAAP-04 that exceeds the following cleanup levels:

Chemical	Cleanup Level (mg/kg)	Basis
Perchlorate	7.2	GWP-Ind
Mercury	0.15	SAI-Ind

Notes and Abbreviations:

mg/kg *milligrams per kilogram*
GWP-Ind *soil MSC for industrial use based on groundwater protection*
SAI-Ind *soil MSC for industrial use based on inhalation, ingestion, and dermal contact*

All excavated material would be transported and disposed of at a permitted disposal facility. After excavation, confirmation samples will be collected and analyzed for perchlorate and

mercury (only select locations). Once confirmation sampling results meet the cleanup level, the excavation area would be backfilled with clean soil and reseeded.

This alternative requires five year reviews because the soil removal is only to industrial levels and soil contamination above unrestricted use would remain at the site.

5.3 Selection Criteria

Each removal action alternative was evaluated against the following criteria: effectiveness, implementability, and cost. These criteria are discussed in greater detail in Section 5.0 of each of the EE/CA reports (Shaw, 2009a and 2009b). These criteria are defined as follows:

Effectiveness. This evaluation criterion assesses the degree of protection to human health and the environment provided by an alternative. The evaluation determines if the alternative achieves the RAOs and explains how the alternative reduces, eliminates, and/or controls risks posed by each of the potential exposure pathways identified for the site. Compliance with applicable or relevant and appropriate requirements (ARARs) is also assessed along with the potential effects the construction and implementation of the alternative may have on human health and the environment (e.g., what are the risks to worker health and safety). Factors to be evaluated include protection of the workers and the community during the implementation of removal actions, environmental impacts resulting from the implementation of the removal actions, and the length of time required to implement the action.

Implementability. This evaluation criterion assesses the technical and administrative feasibility of implementing an alternative. Technical feasibility addresses the difficulties and unknowns associated with a technology, the reliability of a technology, the ease of undertaking future removal actions, and the ability to monitor the effectiveness of the system. Administrative feasibility refers to the activities required to coordinate with regulatory agencies and the availability of equipment and services.

Cost. This criterion evaluates the capital, and operation and maintenance costs associated with an alternative. Present worth analysis is used to evaluate expenditures that occur over multiple years (maximum 30 years).

5.4 Recommended Selected Action

This section presents descriptions of the removal action alternatives that were selected at each of the sites. These actions are expected to protect human health and the environment from soil contamination at the sites.

5.4.1 Former Pistol Range

Investigation results and modeling for the former Pistol Range led to the following conclusions about the nature of the threat posed by the site:

- Surface and near-surface soil at and near portions of the target embankment are contaminated with lead at levels exceeding the SAI-Ind.
- Sediment, surface water, and groundwater have not been adversely impacted.
- Vertical migration of lead will not cause the groundwater to exceed the GW-Ind (i.e., the maximum contaminant level) for lead in the future.
- If excavated, soil exceeding the SAI-Ind will also likely be a RCRA hazardous waste due to lead contamination.

Alternative 3, Excavation and Off-site Disposal, addresses the soil contamination at the former Pistol Range in a manner that is cost-effective, consistent with future land use as a wildlife refuge, and protects the future maintenance worker. Alternative 3 activities include development of work plans, delineation and excavation of the contaminated soil, collection of confirmation samples from the excavation, characterization/transport/disposal of waste, restoration of the site, and notification recordation of the suitability for nonresidential use with Harrison County. Limited monitoring in the form of Letters of Certification from the Army or the Transferee to TCEQ every five years will take place to document that site use is consistent with nonresidential use. This alternative completely removes and disposes of soils containing lead at concentrations that exceed the SAI-Ind. The removal of lead contaminated soil above the industrial cleanup level would preclude the necessity for physical mechanisms such as fencing to prevent human access and/or exposure to these soils, and the necessity for inspection/maintenance of the physical mechanisms over the long term.

The estimated cost to implement this removal action, including the 5-year reviews, is approximately $381,000. The cost details are included in the EE/CA (Shaw, 2009a).

5.4.2 LHAAP-04, Former Pilot Wastewater Treatment Plant

The investigations and assessment of data revealed that even though there has been no impact to the groundwater from the high concentrations of perchlorate in soil, the soil movement over land or leaching to groundwater may occur from the high perchlorate concentrations in the soil. Additionally, there was localized mercury contamination identified after closure activities (ACE, 1997). Alternative 2, Excavation and Off-site Disposal, addresses the soil contamination at LHAAP-04 in a manner that will be protective of the hypothetical future maintenance worker and of the surrounding surface waters/groundwater. Alternative 2 activities consist of development of work plans, delineation of excavation area, excavation of the contaminated soil, collection of confirmation samples from the excavation, characterization/transport/disposal of

waste, restoration of the site, installation of a groundwater monitoring well after soil removal, and notification recordation of the suitability for nonresidential use with Harrison County. Limited monitoring in the form of Letters of Certification from the Army or the Transferee to TCEQ every five years will take place to document that site use is consistent with nonresidential use.

The estimated cost to implement this removal action, including the 5-year reviews for a 30-year period is approximately $473,000. Details about the alternative can be found in the EE/CA (Shaw, 2009b).

As noted in Section 3.0, perchlorate contaminated soil does not yield unacceptable risks under the current and reasonably anticipated land use at LHAAP-04. The Army, however, is implementing the CERCLA removal action for this site using a performance based contract (PBC). The PBC contractor has proposed excavation of perchlorate-contaminated soil as a means of addressing the potential for future groundwater contamination so that the need for continued monitoring of groundwater in areas where elevated perchlorate soil concentrations are currently located will be minimized or eliminated.

5.5 Trade Off Analysis

The selected removal action alternatives were chosen because they were determined to be effective at protecting human health and the environment while also being implementable and cost effective. The basis for these determinations is provided in the EE/CA reports (Shaw, 2009a and 2009b) and is discussed below.

5.5.1 Former Pistol Range

The comparative analysis of the removal action alternatives for the former Pistol Range is summarized below.

Effectiveness. Each of the alternatives provides varying levels of human health protection. Alternative 1, No Action, does not achieve the RAOs and does not comply with the chemical-specific ARAR for lead (the TCEQ SAI-Ind value of 1,000 mg/kg for lead [TCEQ, 2006]). Alternatives 2 and 3 both satisfy the RAO for the former Pistol Range and comply with the ARAR for lead. Alternative 2 relies on LUCs and does not provide contaminant removal or treatment, but would be protective of human health because LUCs would prevent unacceptable human exposure to soil contaminants through physical, legal, and administrative mechanisms. However, Alternative 2 is not fully compatible with future use as a wildlife refuge since it would restrict maintenance worker access to certain portions of the former Pistol Range. Alternative 3 provides a higher level of overall protection than Alternative 2 by excavating lead contaminated soils above the cleanup level and transporting them to an off-site disposal facility.

Alternative 3 may pose potential short-term risks associated with construction activities and handling of contaminated soils. The use of engineering controls (e.g., covering stock piles or wetting exposed soil), air monitoring, and adequate personal protective equipment may minimize such risks. With the exception of truck traffic during material transport to the disposal facility, the local community would not be significantly impacted by remediation activities.

Implementability. All three alternatives can be readily implemented from both technical and administrative perspectives.

Cost. No cost is associated with Alternative 1. Alternative 2, LUCs, has a total net present value of $285,000. Alternative 3 has the highest cost – total net present value of $381,000 – because it involves excavation and off-site disposal.

While Alternative 3 is the highest cost alternative, it meets the RAO and the chemical-specific ARAR for lead in a manner that is compatible with the future use of the site. It is the alternative with the greatest long-term effectiveness and has manageable short-term risks. Therefore, Alternative 3 is selected as the most appropriate removal action for the former Pistol Range.

5.5.2 LHAAP-04, Former Pilot Wastewater Treatment Plant

The two alternatives evaluated for LHAAP-04 were compared to one another as follows:

Effectiveness. Alternative 1, No Action, involves no activities to prevent impacts to groundwater or surface water resources and does not meet the chemical-specific ARARs because contaminants remain in soil above cleanup levels. The chemical-specific ARAR for mercury is the TCEQ SAI-Ind value 150 µg/kg and the chemical-specific ARAR for perchlorate is 7,200 µg/kg, the soil GWP-Ind MSC protective of groundwater (TCEQ, 2006). Alternative 2, Excavation and Off-site Disposal, meets the RAOs, is permanently effective in preventing impacts to groundwater and surface water because contamination above the remedial goals is removed from the site, and meets chemical-specific ARARs.

The short-term impacts of Alternative 2 can be mitigated through the use of proper dust suppressant measures that will control windblown emissions of contaminated dust. Proper personal protective equipment will be required for site workers. The length of time required to implement and complete Excavation and Off-site Disposal is estimated to be less than nine months.

Implementability. Both No Action and Excavation and Off-site Disposal are considered to be administratively and technically implementable.

Cost. While the No Action alternative has no associated cost, Excavation and Off-site Disposal has a total net present value of approximately $473,000.

While Alternative 2 is the higher cost alternative, it meets the RAOs and the chemical-specific ARARs for perchlorate and mercury. It is also compatible with the future use of the site, has long-term effectiveness, and has minimal short-term impacts. Therefore Alternative 2 is selected as the most appropriate removal action for LHAAP-04.

6.0 Expected Change in the Situation Should Action Be Delayed or Not Taken

If the removal actions outlined in this Action Memorandum are delayed or are not implemented, the potential exists for the following:

Former Pistol Range

(1) Human contact with soil containing lead at concentrations exceeding the SAI-Ind. That level is sufficiently high to constitute a threat to public health as defined by factor (i) under §300.415(b)(2) of the NCP: "Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contamination."

LHAAP-04, Former Pilot Wastewater Treatment Plant

(1) Human contact with soil in localized areas containing mercury at concentrations exceeding the SAI-Ind. Mercury concentrations constitute a threat as defined by factor (i) under §300.415(b)(2) of the NCP: "Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contamination."

(2) Contamination of groundwater/surface water via leaching and migration of perchlorate. The site conditions constitute a threat as defined by factor (iv) under §300.415(b)(2) of the NCP: "High levels of … pollutants or contaminants in soils largely at or near the surface that may migrate."

7.0 Outstanding Policy Issues

None.

8.0 Enforcement

The U.S. Army's BRAC Division is the lead DoD organization for execution of the environmental response at the LHAAP.

9.0 Highlights of Community Participation

All public involvement requirements have been satisfied in conjunction with development of the EE/CAs. A RAB was formed in 2004 to provide for the discussion and exchange of information related to the closure of the LHAAP between government agencies and the public. The RAB meetings are held quarterly and are open to the public. The public was informed of the administrative record file location at the Marshall Public Library in Marshall, Texas that has been established for the LHAAP. Status of field investigations have been discussed during quarterly RAB meetings when investigation activities occurred.

The EE/CA reports for the former Pistol Range (Shaw, 2009a) and LHAAP-04 (Shaw, 2009b) were available to the public at the Marshall Public Library before March 13, 2009, and at the public meeting held in conjunction with the quarterly RAB meeting on March 24, 2009, at the Karnack Community Center in Karnack, Texas. The public was notified of availability, review period, and public meeting for the EE/CA reports in the Marshall News Messenger on March 8, 2009, and the Shreveport Times on March 15, 2009. The formal 30-day public review and comment period began on March 15 and extended through April 15, 2009. No public comments were received during this period.

10.0 Recommendation

This decision document represents the selected removal actions for the former Pistol Range site and LHAAP-04, the former Pilot Wastewater Treatment Plant at LHAAP, developed in accordance with CERCLA as amended, and not inconsistent with the NCP. The recommendations presented in this document are based on the administrative record for the file. The removal actions, as presented in the EE/CAs, were endorsed by the regulatory agencies; based on the analysis presented, the regulatory agencies agree that the recommended actions are appropriate and will be implemented in accordance with CERCLA and the NCP.

Former Pistol Range. Conditions at the former Pistol Range meet §300.415(b)(2)(i) of the NCP for a removal, and approval is requested for the proposed removal action. The total cost of this action is approximately $381,000.

LHAAP-04. Conditions at LHAAP-04, the former Pilot Wastewater Treatment Plant, meet §300.415(b)(2)(i) and §300.415(b)(2)(iv) of the NCP for a removal, and approval is requested for the proposed removal action. The total cost of this action is approximately $473,000.

This Action Memorandum was developed in accordance with CERCLA, as amended, and the NCP. The U.S. Army approves the following removal actions as the most appropriate response at each site:

- **Former Pistol Range** – Excavation and off-site disposal of soil with greater than 1,000 mg/kg lead to prevent human ingestion, inhalation, and dermal contact.
- **LHAAP-04, Former Pilot Wastewater Treatment Plant** – Excavation and off-site disposal of soil with greater than 7.2 mg/kg perchlorate to prevent possible cross-contamination of groundwater and greater than 0.15 mg/kg mercury to prevent human ingestion, inhalation, and dermal contact.

The document has been approved by the undersigned.

Thomas E. Lederle

Thomas E. Lederle
Chief, Industrial Branch
Base Realignment and Closure Division

30 July 2009
Date

11.0 References

Anderson Columbia Environmental (ACE), 1997, *Closure Report, Pilot Wastewater Treatment Plant, Longhorn Army Ammunition Plant, Karnack, Texas, EPA Identification No. TX6213820583, Solid Waste Registration No. 30990*, September.

Jacobs Engineering Corporation (Jacobs), 2002, *Final Remedial Investigation Report Addendum for the Group 4 Sites Remedial Investigation Report, Site 04, 05, 67 and Hydrocarbon Study), Longhorn Army Ammunition Plant, Karnack, Texas*, Oak Ridge, Tennessee, February.

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

Shaw Environmental, Inc. (Shaw), 2007, *Final Installation-Wide Baseline Ecological Risk Assessment, Longhorn Army Ammunition Plant, Karnack, Texas, Houston, Texas*, November.

Shaw, 2009a, *Final Engineering Evaluation/Cost Analysis, Former Pistol Range, Longhorn Army Ammunition Plant, Texas*, February.

Shaw, 2009b, *Final Engineering Evaluation/Cost Analysis, LHAAP-04, Former Pilot Wastewater Treatment Plant, Group 4, Longhorn Army Ammunition Plant, Texas*, March.

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

Texas Commission on Environmental Quality (TCEQ), 2006, Updated Examples of Standard No. 2, Appendix II Medium-Specific Concentration, March 31, 2006.

FINAL

REMOVAL ACTION WORK PLAN
FORMER PISTOL RANGE AND LHAAP-04
FORMER PILOT WASTEWATER TREATMENT PLANT, GROUP 4
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

AUGUST 2009

Shaw® Shaw Environmental, Inc.

Date: *August 3, 2009*

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 Removal Action Work Plan Former Pistol Range and LHAAP-04, Former Pilot Wastewater Treatment Plant, Group 4
Longhorn Army Ammunition Plant, Karnack, Texas, August 2009

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	August 2009	**Final Removal Action Work Plan Former Pistol Range and LHAAP-04, Former Pilot Wastewater Treatment Plant, Group 4** Longhorn Army Ammunition Plant, Karnack, Texas

Aaron – Enclosed please find two copies of Shaw's final version of the above-named document.

The document has been distributed according to the list below. Please call if any questions or comments.

Sincerely:

Praveen Srivastav
Project Manager

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

3010 Briarpark Drive, Suite 400, Houston, Texas 77042 *Phone: (713) 996-4522/Fax: (713) 996-4436*

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

August 3, 2009

DAIM-ODB-LO

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

Re: Final Removal Action Work Plan Former Pistol Range and LHAAP-04, Former Pilot Wastewater Treatment Plant, Group 4
Longhorn Army Ammunition Plant, Karnack, Texas, August 2009

Dear Mr. Tzhone,

The above-referenced document is being transmitted to you for your review. 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/S. Fiehler, USACE, Tulsa District, OK
A. Williams, USACE, Tulsa District, OK
M. Mechenes, USAEC, MD
P. Srivastav, Shaw – Houston, TX (for project files)

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

August 3, 2009

DAIM-ODB-LO

Ms. Fay Duke
Texas Commission on Environmental Quality
TCEQ Environmental Cleanup Section I, Team 2, MC-136
12100 Park 35 Circle, Bldg D
Austin, TX 78753

Re: Final Removal Action Work Plan Former Pistol Range and LHAAP-04, Former Pilot Wastewater Treatment Plant, Group 4
Longhorn Army Ammunition Plant, Karnack, Texas, August 2009
SUP 126

Dear Ms. Duke,

The above-referenced document is being transmitted to you for your review. 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, 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/S. Fiehler, USACE, Tulsa District, OK
M. Mechenes, USAEC, MD
A. Williams, USACE, Tulsa District, OK
P. Srivastav, Shaw, Houston, TX (for project files)

Comments on Draft Final Removal Action Work Plan (published May 2009)
Former Pistol Range and LHAAP-04 Former Pilot Wastewater Treatment Plant, Group 4
Longhorn Army Ammunition Plant, Karnack, Texas

July 2009

Reviewer: Stephen Tzhone, USEPA Region 6, 214-665-8409
Respondents: Praveen Srivastav, Susan Watson, Shaw Environmental, Inc.

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

Comment #	Page	Section/ Paragraph	Comment	C, D[1], E or X	Revised Response	A or D[2]
1			EPA did not see any information on the preferred route for truck traffic or emergency medical information, such as where to take injured personnel, hospital location, etc. Would that be presented elsewhere (i.e., the Installation-wide Plan)?	C	The emergency medical information (contacts, route to hospital, etc.) is included in Appendix A of the Installation-Wide Work Plan, Longhorn Army Ammunition Plant, Karnack, Texas, Dated January 2006 and Amended October 2008.	A
2		Section 1.1.1	Section 1.1.1 is an introduction to the Former Pistol Range. The soil discusses soil contamination at the site, but never actually mentions that the contaminant of concern is lead (even though since the site was a pistol site, lead would be the obvious contaminant of concern). Suggest adding lead as the COC in this section just in case a person not familiar with this site reads this document.	C	Lead will be added to the second sentence of the second paragraph of Section 1.1.1 as follows: " . . . where the soil was contaminated with lead at levels . . . "	A
3		Section 1.1.2 3rd paragraph	Section 1.1.2, 3rd paragraph, states that based on previous studies no impact to the groundwater was determined from groundwater investigations, which is somewhat correct since there are no wells actually in the area of known soil contamination. Several of the previous soil boreholes sampled at this site appear to be in the groundwater table indicating that soil to groundwater contamination probably has occurred at this location. What is the depth to water at this site?	C	Depth to groundwater in November 2007 was approximately 8 feet bgs.	A
4			Soil borehole 04SB13 has a 2,870 value for perchlorate at a depth of 23.5-24.5 which would be a soil sample collected from within the water table, so the groundwater is already contaminated with perchlorate at this site. This location is slightly upgradient of the main excavation area and isn't a candidate for soil removal due to soil concentration below removal standards. Soil samples from 04SB08 and 04SB07 have detections of perchlorate at deeper depths that were collected within the water table. Perchlorate is in the water table at this site even though the wells outside the area don't have any detection. There could be a several source areas based on the data.	C	The GWP-Ind is exceeded at only one location, i.e. 04SB08 at 9-10 feet bgs, which may be at the top of the saturated zone. The soil samples from 04SB07, 04SB08, and 04SB13 collected at depths greater than 19 feet bgs are likely to be in the saturated zone, but had perchlorate concentrations below the GWP-Ind. It is possible that the groundwater at these locations also has some perchlorate, but the concentrations in the groundwater may or may not be above the GW-Ind. The new well to be installed will provide definitive data. USEPA's comment regarding multiple sources is noted. Irrespective of the number of sources, the RAWP calls for removal of all soil exceeding GWP-Ind.	A

Comments on Draft Final Removal Action Work Plan (published May 2009)
Former Pistol Range and LHAAP-04 Former Pilot Wastewater Treatment Plant, Group 4
Longhorn Army Ammunition Plant, Karnack, Texas

July 2009

Reviewer: Stephen Tzhone, USEPA Region 6, 214-665-8409
Respondents: Praveen Srivastav, Susan Watson, Shaw Environmental, Inc.

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

Comment #	Page	Section/ Paragraph	Comment	C, D[1], E or X	Revised Response	A or D[2]
5			Does 04SB07 have a typo for the deepest soil sample (21.5 to 21.5)?	C	Depth should be 19 to 20 feet bgs for deepest sample at 04SB07. Figure 1-4 will be revised.	A
6		Figure 2-2	Additional mercury samples are being proposed to the north in the concrete pad area which is a good idea and the current work plan describes the rationale and how it will be accomplished in great detail. SB-13 had a hit of 400 for mercury, but there are no previous soil borehole holes to the southwest or west that would show the outer extent of this contamination. Recommend collecting at least two more DPT samples for mercury to the west and southwest of SB-13.	D	The additional samples collected beneath the concrete pad detected mercury at very low estimated concentrations (<40 ug/kg) as indicated on the revised Figure 2-2. The sample collected just to the north of SB-13, 04SLAB01, had an estimated concentration 0.0384 mg/kg at 3 to 3.5 feet bgs. This sample is north/northwest of SB-13. The area directly to the west of SB-13 is also covered by concrete. Since the concentrations under the slab were all below the cleanup level of 0.15 mg/kg, and the area to the west of SB-13 is covered by concrete, it is unlikely that there are high mercury concentrations in the soil directly to the west of SB-13. The soil up to the edge of the slab will be excavated to 4 feet bgs. Shaw will split the confirmation wall sample along the wall as follows: One confirmation wall sample will be from the southwest excavation corner to the edge of the slab near 04SLAB01, and one confirmation wall sample will be from near 04SLAB01 to the corner near SB-9. The first sample should be representative of the soil to the west of SB-13, and if it indicates mercury concentrations are above 0.15 mg/kg, the concrete will be removed and the area will be excavated.	A
			In addition, 04SB02 had some relatively large hits of perchlorate. There are no soil samples collected for perchlorate to the south of this location to show that there isn't any other further contaminated soil. The DPT samples that are being collected to the west of this location near the electric pole will help delineate to the west, but not to the south. Suggest adding one more DPT south of this location just outside the site boundary line.	D	Confirmation samples of the excavation floor and walls will determine if additional contaminated soil remains to the south.	A

Comments on Draft Final Removal Action Work Plan (published May 2009)
Former Pistol Range and LHAAP-04 Former Pilot Wastewater Treatment Plant, Group 4
Longhorn Army Ammunition Plant, Karnack, Texas

July 2009

Reviewer: Stephen Tzhone, USEPA Region 6, 214-665-8409
Respondents: Praveen Srivastav, Susan Watson, Shaw Environmental, Inc.

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

Comment #	Page	Section/ Paragraph	Comment	C, D[1], E or X	Revised Response	A or D[2]
7			After the preliminary soil sampling following the current work plan it is assumed that the known soil contamination would be delineated and a new map or soil removal would be provided. Please add a similar statement to the text.	C	The premobilization DPT sampling at LHAAP-04 was conducted. Attached is a revised Figure 2-2 which shows the results of the DPT samples. Also attached is a revised Figure 2-4 which indicates the initial concrete slab removal and excavation to an initial depth of 5 feet below top of slab. The word "optional" will be removed Section 2.7.	A
8			The work plan includes details on QA/QC of soil removed and so forth, but there doesn't seem to be a plan to collect QA/QC for samples collected during the preliminary work or during the work. Please provide details on QA/QC on soil samples and sample frequency.	C	Per Section 7.3.2, Appendix C, Chemical Data Acquisition, of the Installation-Wide Work Plan, Longhorn Army Ammunition Plant, Karnack, Texas, dated January 2006 and Amended October 2008, QC Replicate Samples will be collected for every 10 or less field samples. If requested, Shaw can collect a QA replicate sample for EPA.	A
9			There are only five wells in the general vicinity of the area of concern with no wells actually located within the contaminated area. The groundwater flow direction(s) were determined from 2007 mass water level data which takes into account water levels from outside the current map shown (good use of the data). The density of wells in this area is pretty limited, but groundwater levels that have been collected in this area in the past have shown a similar pattern with a hydrologic high at this site. Based on the current groundwater elevation map and past soil samples, there is the potential to have two plumes originating from this site, one to the southeast and one to the northeast. The plan to install a new well near 04SB11 is a good idea to help determine the groundwater flow direction and if there is a perchlorate plume originating from this area. Please provide rationale on this current proposed well location.	C/D	Based on the contaminated area and groundwater gradient from November/December 2007 (EE/CA), any plume would likely be to the southwest. Any groundwater contamination from the location of the highest soil concentration (STEP-04 SS06) is likely to be captured in 04WW01, which has been clean. In Section 2.11, after the second sentence of the first paragraph, the following will be added: "The placement of the well will be finalized following receipt of confirmation sample results. Well placement recommendation will be submitted for regulatory approval prior to well installation."	A
			Are there any plans to determine the nature and extent of potential groundwater contamination at LHAAP-04? Additional wells on the southwest (04SS03 area) and even the northeast of the pad (04SB01 area) would help define if the perchlorate contamination in the groundwater.	C	The new well will be used to monitor the groundwater to evaluate the effectiveness of the removal of the soil-to-groundwater pathway. If the new well has contamination that continues after source removal, a new course of action will be discussed at that time.	A

Comments on Draft Final Removal Action Work Plan (published May 2009)
Former Pistol Range and LHAAP-04 Former Pilot Wastewater Treatment Plant, Group 4
Longhorn Army Ammunition Plant, Karnack, Texas

July 2009

Reviewer: Fay Duke, TCEQ, 512-239-2443
Respondents: Praveen Srivastav, Susan Watson, Shaw Environmental, Inc.

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

Comment #	Page	Section/ Paragraph	Comment	C, D[1], E or X	Response	A or D[2]
1		Section 2.5	It states that excavated soil will be stockpiled and covered with plastic sheeting or placed in covered roll-off containers pending the result of waste characterization samples. Additionally, it states in Section 2.8.2 that temporary soil stockpile will be placed on the concrete pad if the soil under the concrete is clean or be placed near the road. Please note that all temporary stockpile area must be constructed to prevent cross contamination and have measures to control surface water run on and run off.	C	Measures will be taken to prevent cross-contamination and to control surface run on and run off as described in Section 3.8 of the Installation-Wide Work Plan, i.e., temporary berms will be constructed and the staging area will be underlain with two layers of 6-mil polyethylene.	A
2		Section 2.10	It states that excavated area would be backfilled with cleaned fill from an approved off-site source. Please clarify the criteria being used to approve the fill and whether soil sampling is planned for the fill materials.	C	The fourth sentence of Section 2.10 will be deleted and the following text will be added as an additional paragraph: "Clean fill will be obtained from an off-site borrow source. Existing documentation from the borrow source will be reviewed to evaluate if it is clean compared to background, SAI-Ind and GWP-Ind values. If necessary, Shaw will collect representative samples from the borrow source for environmental testing."	A
3		Section 2.11	It states that after the complete of site restoration, a monitoring well will be installed near 04SB11. What is the rational for the well installation at this location? We believe that if only one well is installed to evaluate whether the groundwater has been impacted by the soil contamination found at this site, the well should be located near/down gradient of the location with highest concentrations and with the deepest soil contamination. We believe the well should be installed near/downgradient of 04SB08.	C	Please see response to EPA Comment #9.	A It is my understanding from the responses that location of the additional well is deferred until the completion of the soil excavation.

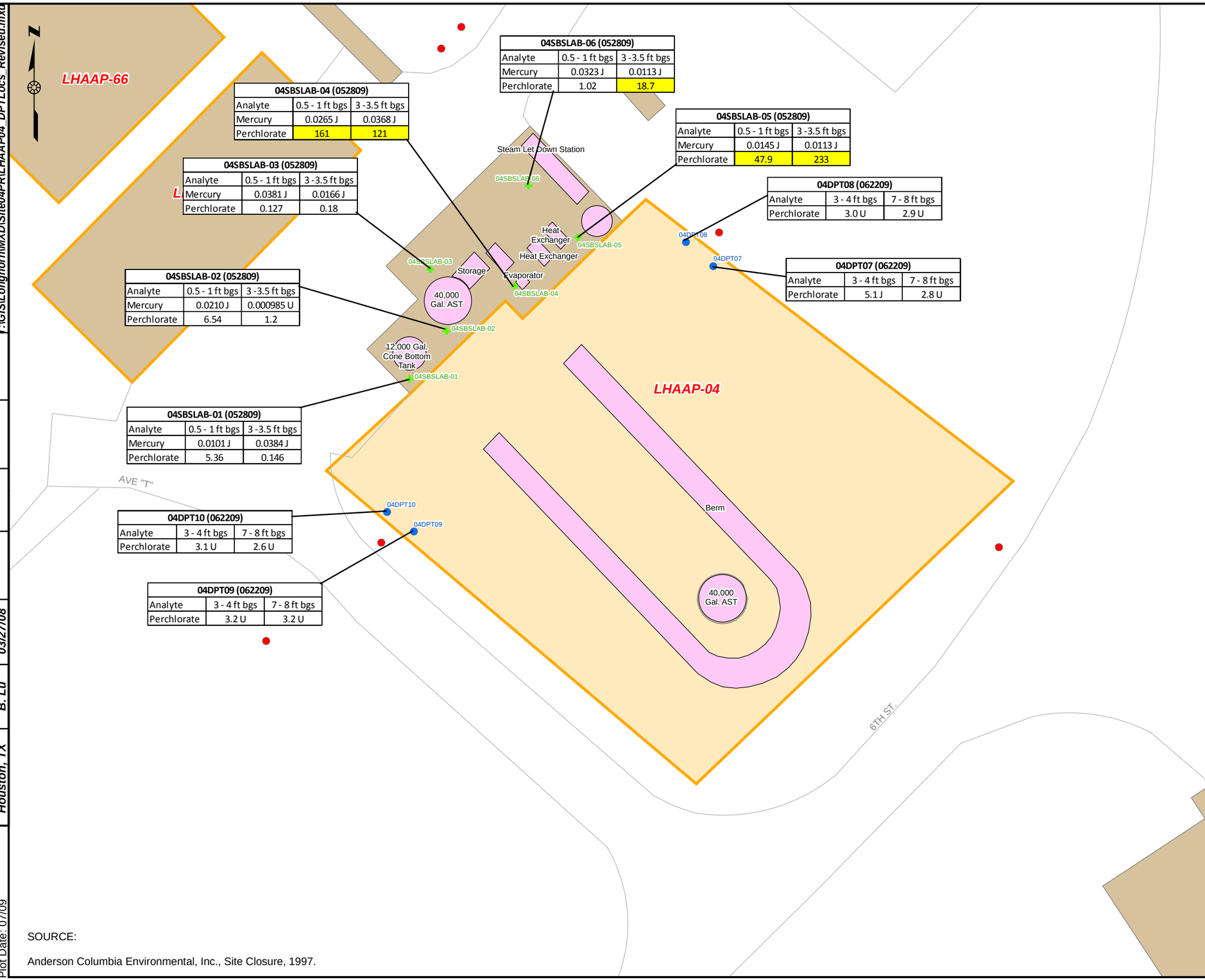
Comments on Draft Final Removal Action Work Plan (published May 2009)
Former Pistol Range and LHAAP-04 Former Pilot Wastewater Treatment Plant, Group 4
Longhorn Army Ammunition Plant, Karnack, Texas

July 2009

Reviewer: Fay Duke, TCEQ, 512-239-2443
Respondents: Praveen Srivastav, Susan Watson, Shaw Environmental, Inc.

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

Comment #	Page	Section/ Paragraph	Comment	C, D[1], E or X	Response	A or D[2]
4		Section 2.5 and Section 2.12	It states the boundaries of the completed soil excavations will be surveyed. Please note that if confirmation cannot be achieve to indicate that all contaminated soil above cleanup levels were removed, the depth of excavation should be surveyed so that it can be recorded in the deed.	C	Excavation depth measurements will be collected along the walls from ground surface to depth of the excavation or to groundwater interface. Only the boundaries and surface elevation will be surveyed. Survey data and excavation dimensions (including depth) will be included in the Closure Report. Later surveying for recordation purposes will be limited to the site boundaries since the entire site (both LHAAP-04 and Pistol Range) is restricted to nonresidential use.	A If contaminated soil above the MSCs for direct contact are left in place and not excavated, the deed recordation must include the information of the depth at which the contamination remained.
5		Air Monitoring (Appendix A)	It states that real-time aerosol monitors will be placed in the work area and at the downwind site perimeter. It also states that the location maybe adjusted to compensate for changes of wind direction. Please clarify the method of determining the wind direction.	C	The wind direction will be determined by visual observation of wind sock.	A



04SBSLAB-06 (052809)		
Analyte	0.5 - 1 ft bgs	3 -3.5 ft bgs
Mercury	0.0323 J	0.0113 J
Perchlorate	1.02	18.7

04SBSLAB-04 (052809)		
Analyte	0.5 - 1 ft bgs	3 -3.5 ft bgs
Mercury	0.0265 J	0.0368 J
Perchlorate	161	121

04SBSLAB-05 (052809)		
Analyte	0.5 - 1 ft bgs	3 -3.5 ft bgs
Mercury	0.0145 J	0.0113 J
Perchlorate	47.9	233

04SBSLAB-03 (052809)		
Analyte	0.5 - 1 ft bgs	3 -3.5 ft bgs
Mercury	0.0381 J	0.0166 J
Perchlorate	0.127	0.18

04DPT08 (062209)		
Analyte	3 - 4 ft bgs	7 - 8 ft bgs
Perchlorate	3.0 U	2.9 U

04SBSLAB-02 (052809)		
Analyte	0.5 - 1 ft bgs	3 -3.5 ft bgs
Mercury	0.0210 J	0.000985 U
Perchlorate	6.54	1.2

04DPT07 (062209)		
Analyte	3 - 4 ft bgs	7 - 8 ft bgs
Perchlorate	5.1 J	2.8 U

04SBSLAB-01 (052809)		
Analyte	0.5 - 1 ft bgs	3 -3.5 ft bgs
Mercury	0.0101 J	0.0384 J
Perchlorate	5.36	0.146

04DPT10 (062209)		
Analyte	3 - 4 ft bgs	7 - 8 ft bgs
Perchlorate	3.1 U	2.6 U

04DPT09 (062209)		
Analyte	3 - 4 ft bgs	7 - 8 ft bgs
Perchlorate	3.2 U	3.2 U

LEGEND

- Live Electric Pole
- DPT Sample Location - Near Electric Pole
- DPT Sample Location - Through Concrete Slab
- Road
- Former Operation Structure (Raised Pad)
- Concrete Slab
- Site

AST -- Aboveground Storage Tank

NOTES:

1. Results in milligrams per kilogram.
2. Yellow highlighted sample results are above the proposed cleanup level.

0 15 30 60 Feet

SOURCE:

Anderson Columbia Environmental, Inc., Site Closure, 1997.

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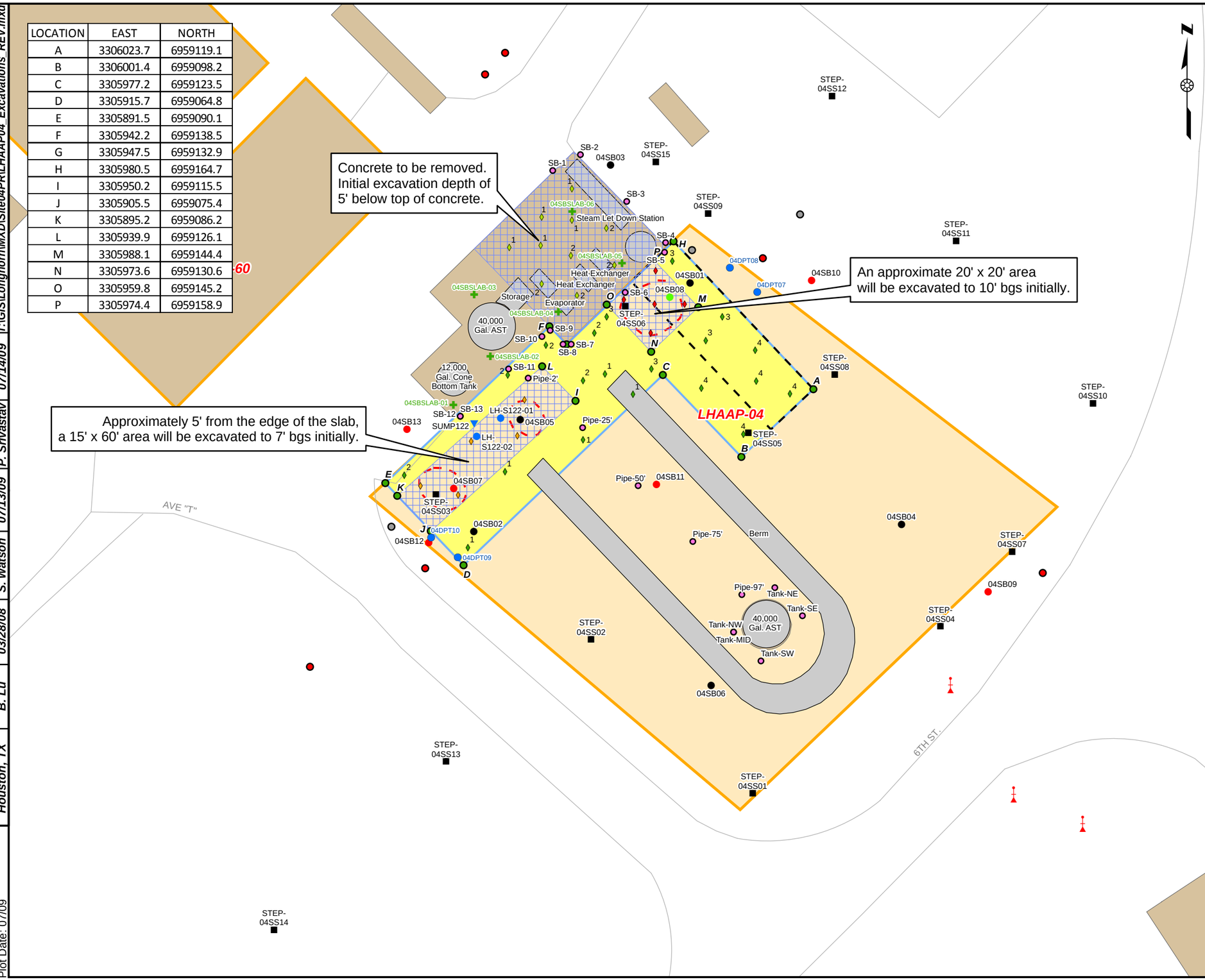
FIGURE 2-2 (REVISED)

PRE-MOBILIZATION SAMPLE RESULTS
LHAAP-04

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

FILE PATH: T:\GIS\Longhorn\MXD\Site04PRI\LHAAP04_DPTLocs_Revised.mxd
APPROVED BY
CHECKED BY
DRAWN BY: B. Lu 03/27/08
OFFICE: Houston, TX
Plot Date: 07/09

LOCATION	EAST	NORTH
A	3306023.7	6959119.1
B	3306001.4	6959098.2
C	3305977.2	6959123.5
D	3305915.7	6959064.8
E	3305891.5	6959090.1
F	3305942.2	6959138.5
G	3305947.5	6959132.9
H	3305980.5	6959164.7
I	3305950.2	6959115.5
J	3305905.5	6959075.4
K	3305895.2	6959086.2
L	3305939.9	6959126.1
M	3305988.1	6959144.4
N	3305973.6	6959130.6
O	3305959.8	6959145.2
P	3305974.4	6959158.9



LEGEND

- DPT Sample Location - Near Electric Pole
- DPT Sample Location - Through Concrete Slab
- Electrical Line Pole
- Pole Only
- Hydrant
- 4' Depth Composite Sample (floor grab location)
- 5' Depth Composite Sample (floor grab location)
- 7' Depth Composite Sample (floor grab location)
- 10' Depth Composite Sample (floor grab location)
- Sump
- Soil Boring Associated with Sump122
- 2007 Soil Sampling Location (Shaw, 2007)
- 2006 Soil Sampling Location (Shaw, 2006)
- 2002 Surface Soil Sample (STEP, 2003)
- 2000 Soil Boring (Jacobs, 2002b)
- 1997 Soil Boring (ACE, 1997)
- Road
- Excavation Area Deepter than 5' bgs
- Former Location of Operational Structure
- Approximate Location of Pilot Study Plot
- Initial Excavation of 4 Feet
- Initial Area of Excavation Deeper than 4 Feet
- 4' bgs Initially
- Concrete Slab
- Site

NOTE:

A confirmation sample will be collected from the floor for approximately every 750 square feet and from each overexcavated area.

bgs - below ground surface

Samples will be analyzed for perchlorate.

0 15 30 60 Feet

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TULSA DISTRICT
TULSA, OKLAHOMA

FIGURE 2-4 (REVISED)

INITIAL EXCAVATION AREAS
LHAAP-04

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Lu	03/28/08	S. Watson	07/13/09	P. Srivastav	07/14/09	T:\GIS\Longhorn\MXD\Site04PR\LHAAP04_Excavations_REV.mxd

Plot Date: 07/09

FINAL

REMOVAL ACTION WORK PLAN
FORMER PISTOL RANGE AND LHAAP-04, FORMER PILOT WASTEWATER TREATMENT PLANT, GROUP 4
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Prepared for

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

Prepared by

Shaw Environmental, Inc.
3010 Briarpark, Suite 400
Houston, Texas 77042

Contract No. W912QR-04-D-0027, Task Order No. DS02
Shaw Project No. 117591

August 2009

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Acronyms and Abbreviations

ARAR	applicable or relevant and appropriate requirements
ASTM	ASTM International (formerly American Society for Testing and Materials)
bgs	below ground surface
CDAP	Chemical Data Acquisition Plan
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CQCP	Contractor Quality Control Plan
DPT	Direct Push Technology
EE/CA	Engineering Evaluation/Cost Analysis
GPR	ground penetrating radar
GPS	Global Positioning System
GWP-Ind	soil MSC for industrial use based on groundwater protection
GWTP	groundwater treatment plant
HASP	Health and Safety Plan
HDPE	high-density polyethylene
LHAAP	Longhorn Army Ammunition Plant
LHAAP-04	Former Pilot Wastewater Treatment Plant
MARC	Multiple Award Remediation Contract
mg/kg	milligrams per kilogram
MSC	medium-specific concentration
PVC	polyvinyl chloride
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RAO	removal action objective
SAI-Ind	soil MSC for industrial use based on inhalation, ingestion, and dermal contact
Shaw	Shaw Environmental, Inc.
SOP	Standard Operating Procedure
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TCLP	toxicity characteristic leaching procedure
TO	Task Order
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
XRF	x-ray fluorescence

1.0 Introduction

Shaw Environmental, Inc. (Shaw) has been contracted by the U.S. Army Corps of Engineers (USACE) Tulsa District to complete the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) response at multiple sites at the former Longhorn Army Ammunition Plant (LHAAP) near Karnack, Texas. This Work Plan for the Former Pistol Range and the Former Pilot Wastewater Treatment Plant (LHAAP-04) is a part of the response. This work is being performed under the Louisville District's Multiple Award Remediation Contract (MARC) No. W912QR-04-D-0027, Task Order (TO) DS02, with oversight by the USACE, Tulsa District.

1.1 Background

LHAAP is located in central-east Texas in the northeastern corner of Harrison County, approximately 14 miles northeast of Marshall, Texas (see **Figure 1-1**). The facility occupies approximately 8,416 acres between State Highway 43 in Karnack, Texas, and the western shore of Caddo Lake. Caddo Lake is a large freshwater lake that bounds LHAAP to the north and east. The eastern fence of LHAAP is 3.5 miles from the Texas-Louisiana state border.

1.1.1 Former Pistol Range

The former Pistol Range is located in the southeastern portion of LHAAP (**Figure 1-2**). The approximately 0.4 acre site lies within a rectangular clearing at the end of Robert Avenue, south of Avenue Q. The site is the eastern portion of a rectangular field and is approximately 110 feet north to south by 150 feet east to west (approximately 0.4 acres). The target area was a wooded slope adjacent to the east end of the clearing. The area was used as a small arms firing range by base security personnel from the 1950s until 2004 for small arms qualification and recertification.

Preliminary field investigations were conducted at the Pistol Range in 1995, with subsequent site investigations in 2006 (soil sampling for site characterization) and 2007 (groundwater sampling and vertical delineation of soil contamination). The investigations showed that there had been no impact to groundwater, but identified areas at the former Pistol Range where the soil was contaminated with lead at levels that exceed the Texas Commission on Environmental Quality (TCEQ) soils medium-specific concentration (MSC) for industrial use based on inhalation, ingestion, and dermal contact (SAI-Ind). There have been no previous removal actions at the former Pistol Range (Shaw, 2009a).

1.1.2 LHAAP-04, Former Pilot Wastewater Treatment Plant

LHAAP-04 occupies approximately 1/2 acre in the central portion of LHAAP at the northwest corner of 6th and 60th Streets adjacent to the former fire station (**Figure 1-2**). In 1984, the Former Pilot Wastewater Treatment Plant began operation. Wastewater from sumps throughout LHAAP was trucked to the plant for treatment. After the wastewater settled, it was transferred to one of two storage tanks, and then pumped through a heat exchanger to an evaporation tower. Solids were shipped off site for disposal. Sludge from the settling tanks was blown down and drummed weekly, then burned at Burning Ground No. 3 (LHAAP-18/24) (Plexus Scientific Corporation, 2005).

The demolition and disposal of the Former Pilot Wastewater Treatment Facility and its associated hazardous waste was completed in the summer of 1997 as part of the Resource Conservation and Recovery Act (RCRA) closure of the plant.

Various sampling events were conducted at LHAAP-04 from 1993 through 2008 to assess the contamination from the operations at LHAAP-04 (Shaw, 2009b) and its impact to the soil and/or groundwater. No impact to the groundwater was determined from the groundwater investigations. Following RCRA closure of LHAAP-04, soil sampling was conducted (Anderson Columbia Environmental, 1997), and LHAAP-04 was approved for closure according to the Risk Reduction Rule Standard 2 in 1998 with the stipulation that the remaining soil contamination be addressed under the CERCLA (Shaw, 2009b). The soil sampling results after 1998 delineated the perchlorate contamination in the soil at concentrations that are above the TCEQ soil MSC for industrial use based on groundwater protection (GWP-Ind) (TCEQ, 2006). Within the perchlorate contaminated soil area is an isolated area of mercury contamination that is above the SAI-Ind. There have been no removal actions undertaken at LHAAP-04; however, a pilot study was conducted in 2000 and 2001. During the study, three different carbon sources were mixed into the top 12 inches of soil. The applications resulted in reductions in perchlorate concentrations in surface soil but results varied in deeper soil.

1.2 Remedial Action Objectives

The removal action alternatives that will be implemented at the former Pistol Range and LHAAP-04 were developed in accordance with the CERCLA, as amended by the Superfund Amendments and Reauthorization Act of 1986, and the National Oil and Hazardous Substances Contingency Plan (40 Code of Federal Regulations [CFR] Part 300). The actions were developed based on the assumption that land use at both sites will be industrial (e.g., wildlife refuge). Both removal actions assume that land use notification will be recorded at the Harrison County courthouse to indicate that the property is suitable for nonresidential use. It is also assumed that these removal actions will be the final actions at both sites.

1.2.1 Former Pistol Range

A removal action at the former Pistol Range must protect human health and meet applicable or relevant and appropriate requirements (ARARs). As noted in the Engineering Evaluation/Cost Analysis (EE/CA) (Shaw, 2009a), ecological risk is not an issue at the former Pistol Range. Therefore, any proposed removal action need not specifically address ecological risk except as it forms the basis of certain ARARs. The threat that must be addressed at the former Pistol Range is soil contamination that could adversely affect human health via ingestion, inhalation, and direct contact (Shaw, 2009a).

The removal action objective (RAO) for the former Pistol Range, consistent with the reasonably anticipated future use as a wildlife refuge, can be described as follows:

- Minimize the potential for human contact with soil containing lead at concentrations that could adversely affect future maintenance workers

This objective was the basis for formulating and evaluating removal alternatives and selecting a removal action. The U.S. Army will implement the following response at the former Pistol Range:

- Excavate soil contaminated with lead exceeding industrial use levels and dispose of the soil off site at an approved landfill.

1.2.2 LHAAP-04, Former Pilot Wastewater Treatment Plant

Portions of LHAAP-04 contain soil with concentrations of perchlorate that are a potential source of groundwater and surface water contamination. Additionally, there is a localized area of mercury contamination that exceeds levels protective of future maintenance workers. The implementation of the removal action derived from the EE/CA (Shaw, 2009b) is expected to considerably improve the environmental conditions and reduce the potential human health threat.

The RAOs for LHAAP-04 include:

- Protection of human health and the environment by eliminating the threat for potential releases of perchlorate from contaminated soil to groundwater.
- Protection of human health and the environment by eliminating the threat for potential releases of perchlorate and mercury from contaminated soil to surface water.
- Protection of human health by eliminating the potential for exposure to mercury contaminated surface soils for a future maintenance worker.

These objectives were used as the basis for formulating and evaluating removal alternatives and selecting a removal action. The U.S. Army will implement the following at LHAAP-04:

- Excavate soil contaminated with perchlorate exceeding levels with the potential to cross-contaminate groundwater and dispose that soil offsite at an approved landfill.
- Excavate soil contaminated with mercury exceeding industrial use levels and dispose of that soil off site at an approved landfill.

1.3 Cleanup Levels

Both sites involve the removal of soil exceeding their respective cleanup levels, and the subsequent transport of these soils to an appropriately licensed off-site facility for disposal. Once confirmation sampling results meet the proposed cleanup levels, the excavation area will be backfilled with clean soil and reseeded.

The tables below present the cleanup levels for each site.

Table 1-1
Former Pistol Range
Proposed Cleanup Levels

Chemical	Concentration (mg/kg)	Basis[a]
Lead	1,000	SAI-Ind

Notes and Abbreviations:

[a] *Texas Commission on Environmental Quality, Updated Examples of Standard No. 2, Appendix II Medium-Specific Concentrations (MSCs) dated March 31, 2006*

mg/kg *milligrams per kilogram*

SAI-Ind *Soil MSC for industrial use based on inhalation, ingestion, and dermal contact*

Table 1-2
LHAAP-04, Former Pilot Wastewater Treatment Plant
Proposed Cleanup Levels

Chemical	Concentration (mg/kg)	Basis[a]
Perchlorate	7.2	GWP-Ind
Mercury[b]	0.15	SAI-Ind

Notes and Abbreviations:

[a] *Texas Commission on Environmental Quality, Updated Examples of Standard No. 2, Appendix II Medium-Specific Concentrations (MSCs) dated March 31, 2006*

[b] *Mercury cleanup level is limited to the excavation wall adjacent to the concrete pad.*

mg/kg *milligrams per kilogram*

GWP-Ind *Soil MSC for industrial use based on groundwater protection*

SAI-Ind *Soil MSC for industrial use based on inhalation, ingestion, and dermal contact*

1.4 Areas of Contamination

Based on available sampling data, the soil at the former Pistol Range has been identified as a medium of concern due to the presence of lead concentrations exceeding the TCEQ SAI-Ind value of 1,000 milligrams per kilogram (mg/kg). Lead concentrations exceeding the TCEQ SAI-Ind value were detected in the 0-0.5 foot interval at locations N50,E25; N50,0; and N75,0 and the 0.5-1.0 feet interval at N50,E25. Based on the sampling results, the area of lead contaminated soil exceeding the TCEQ SAI-Ind is estimated to be less than 2,500 ft^2. This area is illustrated on **Figure 1-3** as the region bounded by the 1,000 mg/kg concentration contour. The depth of lead contaminated soil at the former Pistol Range varies from 0.5 foot to 1.0 foot over the contaminated area. Therefore, the volume of soil at the former Pistol Range that exceeds the SAI-Ind is estimated to be 150 cubic yards (in-place) (Shaw, 2009a).

The scope of the proposed action for the contaminated soil at LHAAP-04 site addresses an area of approximately 4,100 square feet (estimated volume of approximately 840 cubic yards) as shown on **Figure 1-4** (Shaw, 2009b). The mercury contaminated soil is along the concrete pad and is encompassed within the larger perchlorate contaminated soil area. The depth of contaminated soil at LHAAP-04 begins at ground surface with the excavation boundaries shown on **Figure 1-4**. However, there are areas within that boundary with greater depths. The deepest excavation is anticipated to be 10 feet below ground surface (bgs) in an area of approximately 400 square feet near 04SB08.

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
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Plot Date: 04/08

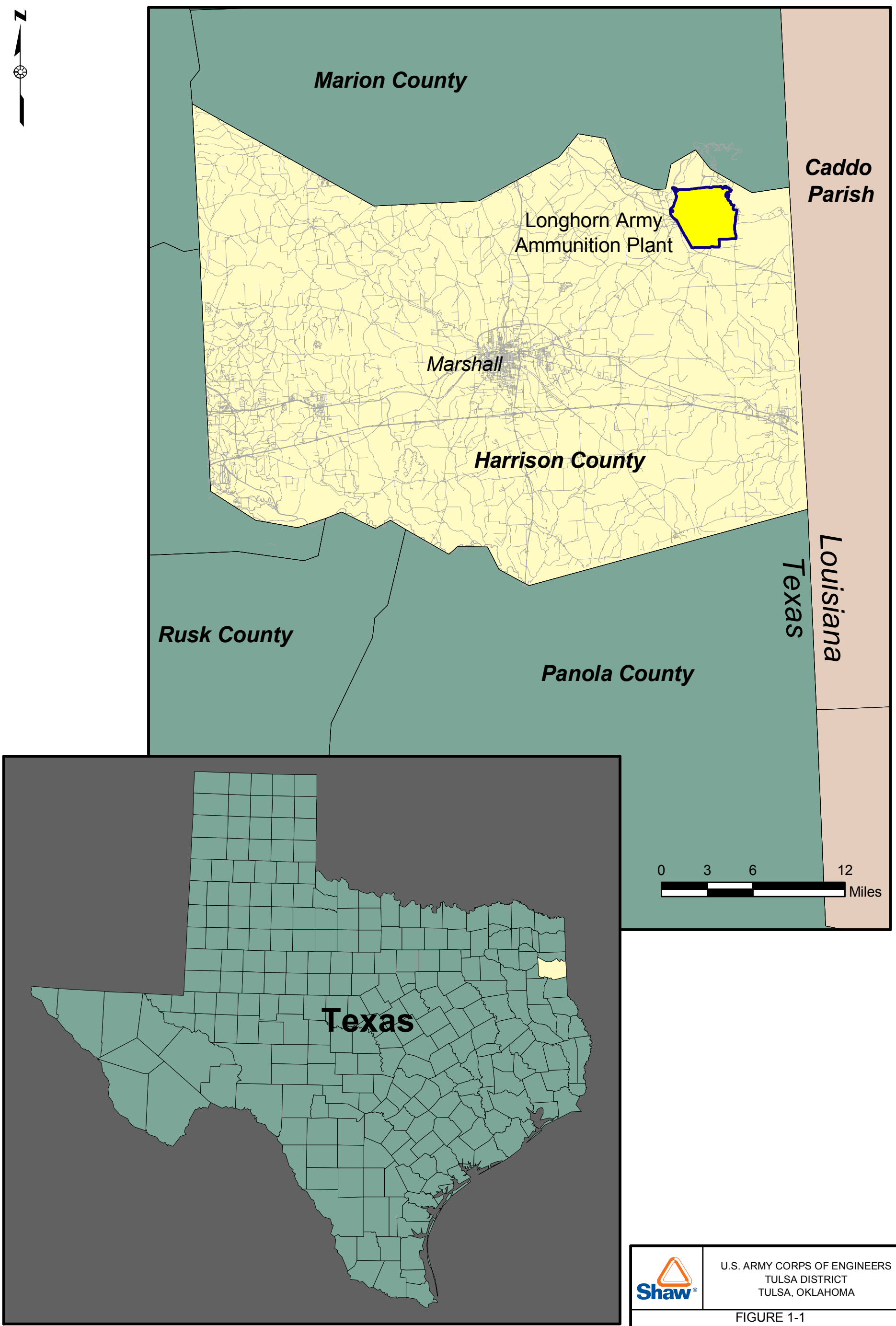

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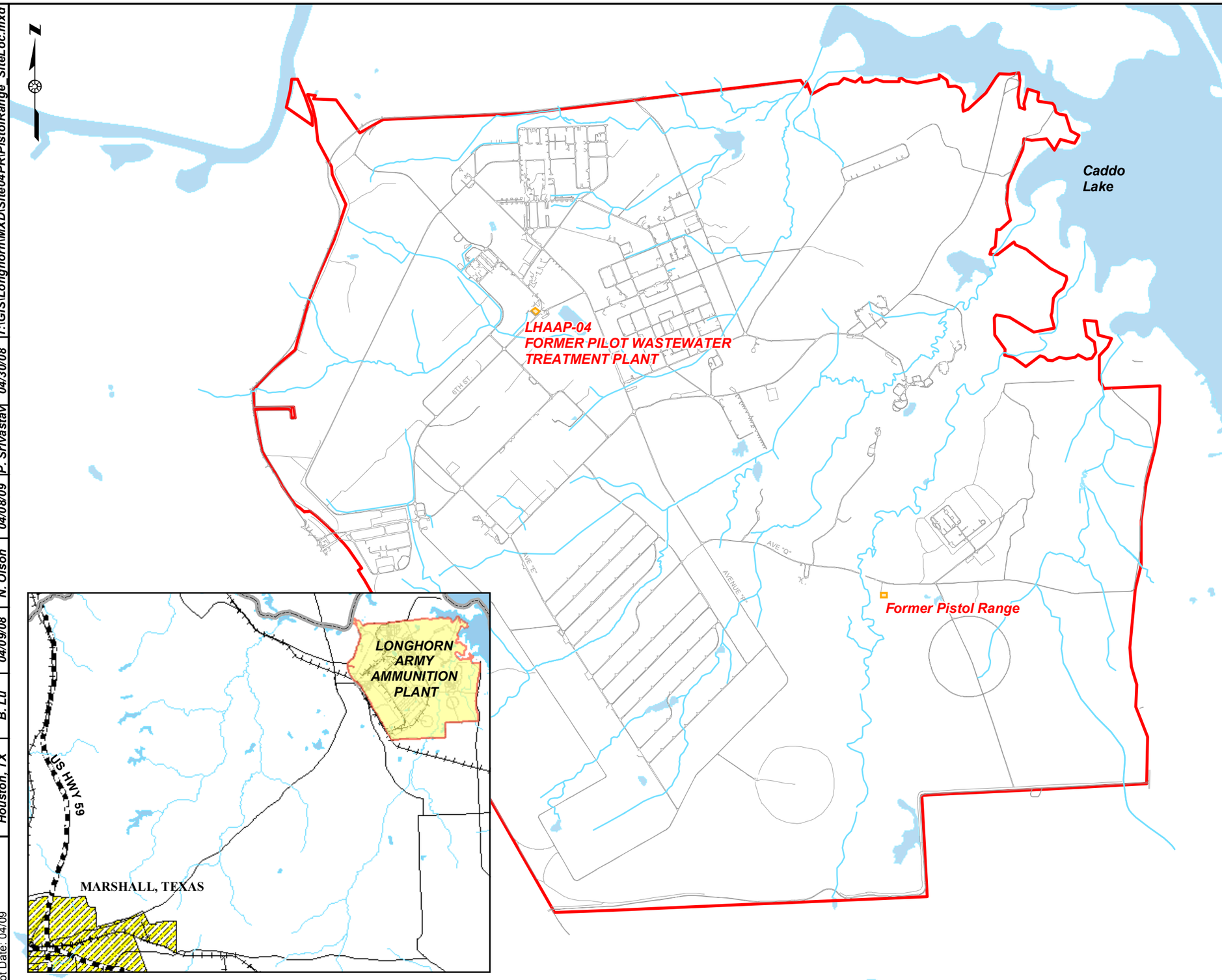
FIGURE 1-1
LOCATION OF LONGHORN ARMY AMMUNITION PLANT, HARRISON COUNTY, TEXAS

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS



LEGEND

- Stream
- Road
- Site
- Lake
- LHAAP Boundary

0 1,250 2,500 5,000 Feet

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TULSA, OKLAHOMA

FIGURE 1-2

SITE LOCATION MAP

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Lu	04/09/08	N. Olson	04/08/09	P. Srivastav	04/30/08	T:\GIS\Longhorn\MXD\Site04PR\PistolRange_SiteLoc.mxd

Plot Date: 04/09

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Plot Date: 04/09

LEGEND

- XRF Sediment Sample Location
- XRF Sample Location
- Area of Removal Boundary
- Lead Concentration Contour
- Stream
- Road
- Approximate Firing Line Location
- 25-foot Grid
- Target Embankment
- Pistol Range

NOTES:

1. LOD is level of detection.
2. Lead concentrations are in milligrams per kilogram.
3. 1,000 contour is boundary of area of removal.

0 20 40 80 Feet

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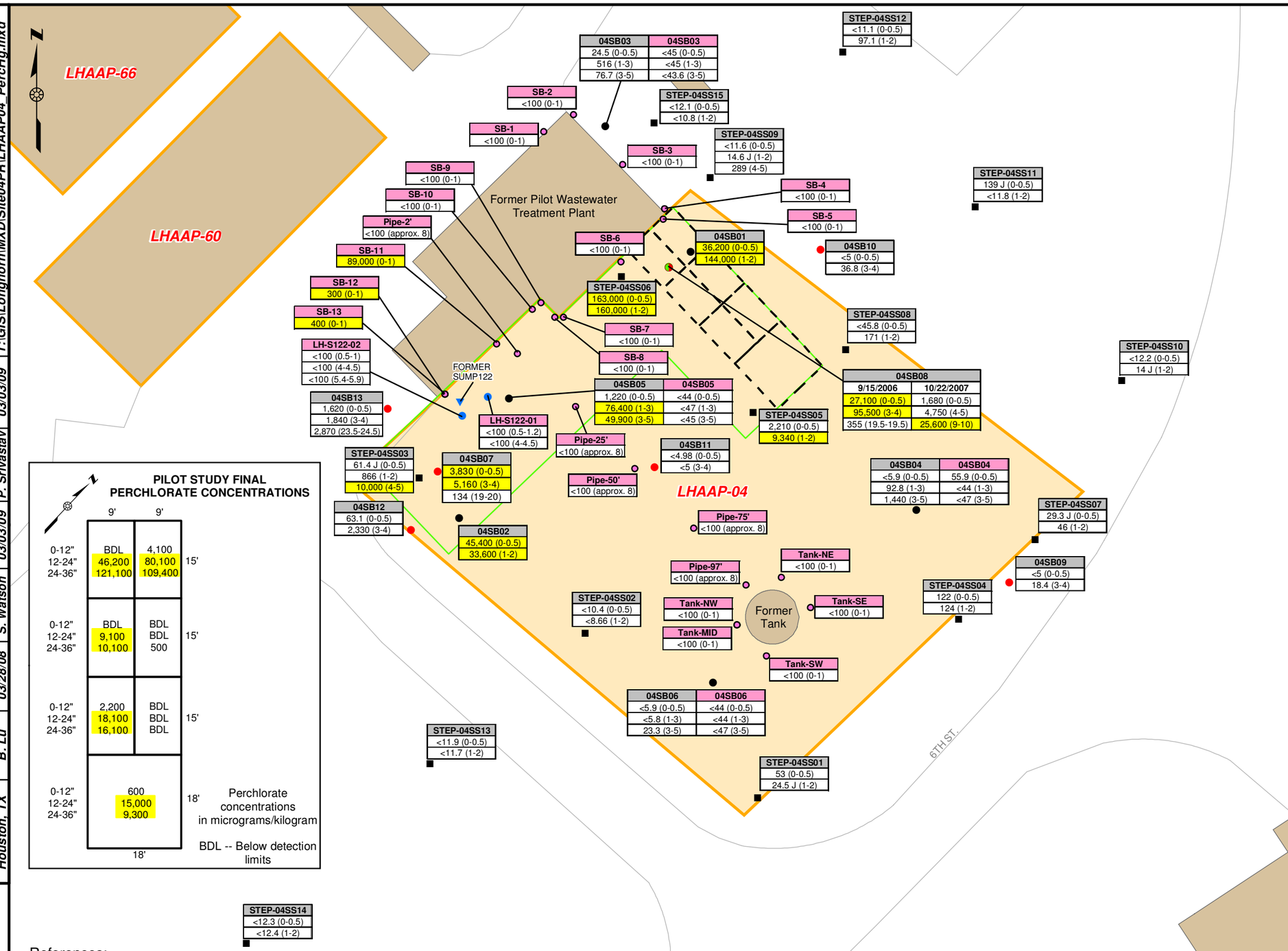
TULSA, OKLAHOMA

FIGURE 1-3

AREA OF CONTAMINATION
FORMER PISTOL RANGE

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS



LEGEND

- Former Sump Location
- Soil Boring Associated to Sump122
- 2007 Soil Sampling Location (Shaw, 2007)
- 2006 Soil Sampling Location (Shaw, 2006)
- 2002 Surface Soil Sample (STEP, 2003)
- 2000 Soil Boring (Jacobs, 2002b)
- 1997 Soil Boring (ACE, 1997)
- Road
- Approximate Location of Pilot Study Plot
- Boundary of Proposed Excavation Area
- Building or Concrete Slab
- Site
- 04SB09 <10 (0-0.5) 18.4 (3-4) — Perchlorate Sampling Results
- SB-1 <100 (0-1) — Mercury Sampling Results
- Concentrations Exceeding Medium-Specific Concentration (See Notes 4 & 5)

NOTES:
1. Concentrations reported in micrograms per kilogram (µg/kg).
2. Depth intervals are in feet below ground surface.
3. Pilot study plot information is from "Pilot Scale In-Situ Bioremediation of Perchlorate-Contaminated Soils at the Longhorn Army Ammunition Plant" by V. Nzengung, K. C. Das, and J. R. Kastner of University of Georgia, 2001.
4. 150 µg/kg Mercury soil medium-specific concentration for industrial use based on inhalation, ingestion, and dermal.
5. 7,200 µg/kg Perchlorate soil medium-specific concentration for industrial use based on groundwater protection.
6. Northeast end of excavation was moved approximately 7-feet southwest of the boundary presented in the EE/CA (Shaw 2009b) based on additional field measurements and photographs of PLANTECO pilot study plot.

0 15 30 60 Feet

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FIGURE 1-4

AREAS OF CONTAMINATION
LHAAP-04

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	FILE PATH
Houston, TX	B. Lu 03/28/08	S. Watson 03/03/09	P. Srivastav 03/03/09	T:\GIS\Longhorn\MXD\Site04PR\LHAAP04_PercHg.mxd

Plot Date: 03/09

References:

Jacobs Engineering Group, Inc., 2002b, Final Remedial Investigation Report Addendum for the Group 4 Sites Remedial Investigation Report: Sites 04, 08, 67, and Hydrocarbon Study, Longhorn Army Ammunition Plant, Karnack, Texas, Oak Ridge, TN, Feburary.
Solutions to Environmental Problems, Inc. (STEP), 2005, Draft Final Project Report, Plant-Wide Perchlorate Investigation, Longhorn Army Ammunition Plant, Karnack, Texas, Oak Ridge, TN, April.
Anderson Columbia Environmental, (ACE), 1997, Closure Report, Pilot Wastewater Treatment Plant, Longhorn Army Ammunition Plant, Karnack, TX, EPA Identification TX 6213820 5B3, Solid Waste Registration No. 30990, September.
Shaw, 2008, Final Data Evaluation Report, Chemical Concentrations in Soil Associated with LHAAP-35/36 Sumps, Longhorn Army Ammunition Plant, Karnack, Texas, Houston, Texas, January.

2.0 Field Activities

This section describes the field activities planned at the former Pistol Range and LHAAP-04. Typically, general activities apply to both sites. Site-specific activities are described in associated subsections. The field activities to be conducted under this Work Plan are outlined below:

- Pre-mobilization activities
- Preliminary activities/mobilization
- Site clearing
- Plug and abandon well at former Pistol Range
- Soil excavation
- Confirmation soil sampling
- Optional concrete removal, LHAAP-04
- Waste management
- Decontamination
- Site restoration
- Installation of monitoring well, LHAAP-04
- Demobilization
- Reporting
- Schedule

The field activities will be conducted in accordance with the Site-Specific Supplement to Health and Safety Plan (HASP) in **Appendix A**. The work will be routinely inspected in accordance with the Contractor Quality Control Plan (CQCP) in **Appendix B**. Additional information regarding these tasks can be found in Appendix C, Chemical Data Acquisition Plan (CDAP), and Appendix D, Field Procedures of the Final Installation-Wide Work Plan (Shaw, 2006).

2.1 Pre-mobilization Activities

A pre-construction meeting will be held for the U.S. Army, U.S. Environmental Protection Agency (USEPA), LHAAP, and Shaw prior to the initiation of field activities.

Prior to mobilization, Shaw will secure any applicable permits and notifications. These may include federal, state and local requirements. Shaw will also secure utility clearance for water, sewer, gas, electric, and communication. A ground penetrating radar (GPR) was used to locate any underground utilities. The GPR unit was aided by an approved instrument that induced current upon any underground utility lines (except fiber optic lines), thus allowing the utility line to be located using a signal receiver. Once all lines were identified, pin flags and marking tape were used to mark the utilities (**Figure 2-1**).

Shaw will inspect LHAAP-04 to identify overhead electrical lines that may restrict removal activities and electrical poles within or near the excavation at LHAAP-04 that have the potential to become unstable as soil is removed. As necessary, Shaw will either shut down power, reroute power, remove poles, and/or ensure that the poles are guy-wired for stability. If power must be shut down, the power outage will be coordinated with groundwater treatment plant (GWTP) and fire station operations.

At the former Pistol Range, pre-mobilization activities will consist of sampling at location N75,E25-lower due to an x-ray fluorescence (XRF) lead result of 750.8 mg/kg. As discussed in the EE/CA for the former Pistol Range (Shaw, 2009a), XRF results at the former Pistol Range tended to underestimate laboratory analytical results. Therefore, a sample from N75, E25-lower will be submitted to an analytical laboratory for lead analysis. The analytical result will be compared to the cleanup level (presented in **Table 1-1**). If the result exceeds the cleanup level or the pre-mobilization sample is not collected, the boundary of the excavation will be expanded to include this location.

Shaw advanced six soil borings at LHAAP-04 for the purpose of collecting soil samples beneath the concrete slab along the north-western side of the site. Before those borings were advanced, utilities such as water, gas, and sewer were located. Historic site maps and drawings were consulted to ensure sampling locations are not in close proximity to buried lines. The concrete slab was penetrated in six locations near the tank pad/foundations. The locations are shown on **Figure 2-2**. The concrete slab is approximately 4 inches thick where the penetrations were done. The tank pads are approximately 8 inches thick. Soil samples were collected from immediately below the pad and at approximately 3 feet bgs with a Direct Push Technology (DPT) probe. The soil samples were analyzed for perchlorate and mercury. The soil sample results were compared to cleanup levels (**Section 1.3**). The levels were exceeded in the soil beneath the slab at three locations, and the slab in that area will be removed and handled as discussed in **Section 2.7**, Concrete Removal.

Additional pre-mobilization soil samples collected at LHAAP-04 were to determine how close the excavation is likely to approach the nearby electrical poles. Samples were collected at four locations as shown on **Figure 2-2**. At each location, two soil samples were collected: 3-4 feet bgs and 7-8 feet bgs. Based on these results, the active line power poles will not be in the excavation.

2.2 Preliminary Activities/Mobilization

Shaw anticipates mobilizing the following personnel:

- Site supervisor
- Quality control/safety manager

- Two equipment operators
- One laborer/sample technician

Those personnel will utilize the following major equipment:

- Tracked excavator
- Water truck
- Three pickup trucks
- Roll-off boxes
- Dozer

Attachments for the excavator will also be mobilized as necessary if the concrete slab at LHAAP-04 must be removed.

2.3 Site Setup

A Global Positioning System (GPS) will be used to delineate and mark the excavation areas per **Figure 2-3** and **Figure 2-4**. The potential areas of excavation will then be marked with survey stakes, pin flags, paint, or other appropriate marking.

The areas to initially be excavated will be established prior to mobilization of the excavation personnel. The existing XRF sample results and the result of the premobilization sample at N75,E25-lower will be used to identify the initial limits of excavation at the former Pistol Range.

Once the excavation areas have been delineated, removal of shrubs and other vegetative cover within the excavation areas would commence. Clearing of the vegetation will largely be conducted using a tractor mounted bush hog and other conventional equipment. At the former Pistol Range, large numbers of bullets or casings have not been observed during investigations. Such “source” material may be hidden by vegetation, and could bias any confirmation sampling. Therefore, small vegetation and vegetation debris will be removed from the area to be excavated and a surrounding zone of approximately 25 feet. The area will be sprayed with a defoliant to destroy any hazardous vegetation (e.g., poison ivy), and then will be cleared using brush mowers and/or weed eaters. Larger shrubs will be left in place where practical; no trees over 4-inch diameter will be removed. The area will be raked by mechanical equipment and/or by hand to remove vegetative debris and allow visual observation of the ground surface. Unless it contains soil, the vegetative debris will be stockpiled on site and allowed to decay naturally. If portions of the vegetative debris contain soil, that material will be disposed with the soil from the excavation.

Site set-up for both excavations will include setting up a decontamination station. The equipment decontamination station would be constructed with non-permeable material such as

high-density polyethylene (HDPE) for containment purposes. This decontamination station will be bermed to ensure containment of any decontamination liquids. Since the only water needs are for decontamination, water would be trucked to the site and, if necessary, stored in a portable tank.

2.4 Well Abandonment

Prior to excavation activities, one monitoring well (PRWW01) must be plugged and abandoned. Monitoring well abandonment will be in accordance with Shaw Standard Operating Procedure (SOP) EI-GSO40 and the requirements described in Task 2 of the CQCP (**Appendix B**). A state of Texas licensed driller will be contracted to perform the abandonment. A truck mounted drill rig will be used to pull the monitoring well casing from the ground. Once the casing is removed, bentonite grout will be pumped into the cavity to seal the borehole and prevent formation of a conduit from the ground surface to the subsurface. If the well casing and screen cannot be entirely pulled from the ground, the well will be grouted in place. The concrete pad and four bollards will be removed from the ground and disposed of by the contracted drilling company as municipal waste.

2.5 Soil Excavation

Initial excavation limits will be established as described in **Section 2.3**. Excavated soils will be stockpiled on and covered with plastic sheeting or placed in covered roll-off containers pending the results of waste characterization samples. Vertical excavation will stop if groundwater or bedrock is encountered.

Excavation and soil handling activities will be performed utilizing standard health and safety practices to minimize airborne particle generation and exposure pathways that might place workers at risk. Air monitoring will be conducted in work areas to determine if airborne emissions exceed acceptable levels. Modified Level D personal protective equipment and decontamination equipment is proposed (**Appendix A**).

Excavation of both sites will be performed using a 12–14 ton excavator or equivalent. Additionally, a water truck will be on site during excavation activities for decontamination and dust suppression.

The Site Superintendent and QC Manager will mark the corners of the completed excavation at each site for subsequent surveying (see **Section 2.12**). They will also measure and document the depths of excavation, including any depth variations across the excavation.

In the event of rainfall, storm water runoff from surrounding areas will be diverted, as feasible, away from the excavation. After the rainfall event, any storm water in the excavation will be pumped to a tank, allowed to settle, and then conveyed to the GWTP.

2.5.1 Former Pistol Range

The quantity of lead-contaminated soils requiring excavation is estimated to be approximately 150 cubic yards, or 225 tons. Excavation will proceed until confirmatory analysis has determined that all lead contamination above the TCEQ SAI-Ind value of 1,000 mg/kg has been removed. The project team will first inspect the cleared area for evidence of bullet pockets or other range debris (e.g., casings). Such isolated locations will be excavated until no further debris or bullet fragments are observed. Then the project team will proceed to excavate the pre-designated limits of excavation (**Figure 2-3**). Because XRF results tended to slightly underestimate the laboratory results for soil lead concentrations (Shaw, 2009a), certain sample locations (e.g., N75, E25-lower, which had an XRF lead result of 750.8 mg/kg) may be included by expanding the excavation.

Excavated material will be segregated in separate stockpiles or roll-off containers based on the suspected level of contamination. One composite sample will be collected for each approximate 100 tons of excavated material and submitted to an off-site laboratory for toxicity characteristic leaching procedure (TCLP) metals analysis to confirm whether or not the soil is classified as a hazardous waste. That sampling will be performed in accordance with the requirements described in Task 4 of the CQCP (**Appendix B**). Based on waste classification, the soil will be loaded and transported by truck to the appropriate permitted disposal facility.

2.5.2 LHAAP-04, Former Pilot Wastewater Treatment Plant

Total volume of contaminated soils to be excavated at LHAAP-04 is estimated to be 840 cubic yards, or 1,260 tons. Based on the soil sampling data, an area for an initial 4-foot-deep excavation has been proposed. Three areas where perchlorate concentrations are greater than 7,200 micrograms per kilogram below the 4-foot-depth, will be excavated by a 2-foot-depth beyond the sampled depth. These depths vary from 5 feet to 10 feet. These areas are shown on **Figure 2-4**. After the initial excavation, the wall adjacent to the concrete pad will be tested for both mercury and perchlorate. The other walls and floor will be tested for perchlorate only. Soil will be excavated until the confirmation sample results (from the excavation floor and side walls) indicate soil concentrations below the cleanup levels identified in **Table 1-2** or when groundwater is encountered.

To the extent practical, the excavator will be used to excavate the contaminated soils and directly place the soils into roll-off boxes or dump trucks that would take the soils to a permitted landfill. However, on-site stockpiling may be required depending on soil volumes and logistics.

During excavation, some abandoned water lines, an abandoned sewer line, and lines to a tank may be encountered. These lines will be investigated before removal to ensure that they are not active and truly are abandoned. If it is determined that the lines are not active, they will be

removed or be abandoned in place. Inactive lines that are cut by the excavation will be plugged with grout.

Five electric power poles are in close proximity to the proposed excavation at LHAAP-04 (see **Figure 2-1**):

Pole #1: one abandoned pole 2 feet beyond the northeast end of the excavation
Pole #2: one live pole 17 feet beyond the northeast end of the excavation
Pole #3: one abandoned pole 34 feet beyond the northeast end of the excavation
Pole #4: one live pole 9 feet beyond the southwest end of the proposed excavation
Pole #5: one abandoned pole 8 feet beyond the southwest end of the proposed excavation

Because it is so close to the proposed excavation, Pole #1 will be removed using the excavator.

If excavation to 4 feet bgs occurs no closer than 4 feet to a pole, the pole should not need to be abandoned. A licensed engineer will review poles for stability if:

- Excavation takes place within 4 feet of a pole.
- Excavation at 4 feet from a pole is greater than 4 feet bgs.
- A pole shows visual evidence of shifting.

If considered potentially unstable, the power poles will be braced or removed. Power lines will be rerouted as necessary if poles are removed.

2.6 Confirmation Soil Sampling

2.6.1 Former Pistol Range

In adherence to Task 4 of the CQCP (**Appendix B**), confirmation sampling will be conducted concurrently with excavation activities to document that the remaining soils meet established cleanup levels. Excavation will continue until the TCEQ SAI-Ind value of 1,000 mg/kg has been met. It is estimated that ten samples (five on the floor, four from the sides [one for every 50 feet of perimeter], and one field duplicate) will be collected during excavation activities and sent to an off-site laboratory for lead analysis.

2.6.2 LHAAP-04, Former Pilot Wastewater Treatment Plant

Confirmation sampling will be conducted concurrently with excavation and will document that the remaining soils meet established cleanup levels. After the initial excavation, the wall adjacent to the concrete pad will be tested for both mercury and perchlorate. The other walls and floor will be tested for perchlorate only. Excavation would continue until concentrations in the soil are less than the cleanup levels identified in **Table 1-2**. A 5-point composite soil sample will be collected from approximately every 750 square feet of the excavation floor area and of each

wall. If contaminants are detected in the composite samples above their cleanup levels, the area will be excavated an additional foot. This would continue until confirmation samples demonstrate the contaminants remaining in the soil are below their cleanup level or until groundwater is encountered.

In the event that groundwater is encountered and a floor sample cannot be collected, a linear 5-point composite sample will be collected from each excavation sidewall. The individual grab samples will be collected from the sidewalls just above the groundwater interface. If the linear 5-point composite sidewall sample is above the cleanup level, then additional excavation of the sidewall will be conducted to the groundwater interface depth. Thus, vadose zone soil that is identified as exceeding the cleanup levels would be removed.

Additional details for sampling and analysis are found in the Final Installation-Wide Work Plan, Appendix C, CDAP (Shaw, 2006).

2.7 Concrete Removal at LHAAP-04

The pre-mobilization soil sample results beneath the concrete slab at LHAAP-04 exceeded the cleanup levels. The slab will be removed, and the soil beneath the slab will be excavated as shown on **Figure 2-4**. The concrete will be broken using an excavator with a hammer attachment. The concrete will be staged separately from soil and crushed to below 6-inch size using a crusher attachment on the excavator. The concrete will be tested for perchlorate and mercury. If the perchlorate and mercury levels are below cleanup standards, the concrete will be used as a portion of the backfill for the completed excavation. If the perchlorate or mercury exceed cleanup standards, the concrete will be disposed off site at an approved landfill.

2.8 Waste Management

This section specifies methods and procedures to be implemented by Shaw to verify that waste generated during site activities are handled, transported, stored, and disposed in compliance with applicable federal, state, and local rules and regulations. Waste management activities will be conducted in accordance with the requirements presented in Task 6 of the CQCP (**Appendix B**).

Description of Wastes. Excavation activities at both the former Pistol Range and LHAAP-04 are expected to generate the following waste streams:

Waste Type	Estimated Quantity
Lead Contaminated Soil	225 tons
Perchlorate and Mercury Contaminated Soil	2,000 tons
Decontamination Water and Drill Cuttings	330 gallons [(6) 55-gallon drums]
Miscellaneous Wastes (PPE, paper towels, rags, etc.)	---

Waste Characterization. Waste characterization samples will be collected and analyzed to ensure that the waste materials are not hazardous. For the contaminated soil, a waste characterization sample will be collected for every 100 cubic yards from either the stockpile or the roll-off containers as required by the disposal facility. Sample analysis will be conducted by an off-site laboratory. For waste liquids, composite samples will be collected from the 55-gallon drums of waste water generated. The results will be used to classify and code wastes in accordance with the requirements of 30 Texas Administrative Code (TAC) 335, Subchapter R. Additional details for disposal sampling are found in the Final Installation-Wide Work Plan, Appendix C, CDAP and Appendix D, Field Procedures (Shaw, 2006).

Decontamination liquids will be stored in a portable tank for subsequent disposal. One waste characterization sample will be collected in accordance with Shaw SOP EI-FS115 and submitted to an off-site laboratory for total RCRA method analysis. Following waste characterization analysis, the liquid will be disposed at an off-site hazardous waste facility if found to be hazardous, or at the GWTP at LHAAP-18/24 if determined to be non-hazardous.

Waste Accumulation. The contaminated soil will be staged on site in either lined roll-off containers or stockpiled. The roll-off containers and/or the stockpiled soil will be covered in the event of rainfall. The non-hazardous decontamination water and drill cuttings will be stored in 55-gallon drums until disposal at the LHAAP GWTP. The miscellaneous wastes will be placed in plastic bags until disposal.

Waste Disposal. Each waste type generated during the field activities would require a different disposal method. These include:

Waste Type	Disposal Method
Soil and Concrete: RCRA Non-Hazardous	RCRA Subtitle D Landfill
Soil: RCRA Hazardous	RCRA Subtitle C Landfill
Decontamination Water-Non-Hazardous Waste	LHAAP Groundwater Treatment Plant (GWTP)
Miscellaneous Wastes	Municipal Solid Waste

Disposal Facility Selection. Shaw would select the final disposal facility for the waste based on several factors:

- TSDF capacity to accommodate incoming waste;
- Solicitation of bids using applicable Federal Acquisition Regulations;

- Verification of permits and insurance (at time of award); and,
- The disposal facility must meet the permit compliance requirements.

Selection of the off-site disposal facility will follow the acceptability criteria in accordance with USEPA's Offsite Rule (40 CFR 300.440).

Waste Transportation and Disposal. It is assumed that all materials generated will be transported and disposed of as non-hazardous waste and sent to an off-site permitted disposal facility.

Any wastes or contaminated media classified as hazardous and transferred off-site or transported in commerce along public rights-of-way must meet U.S. Department of Transportation requirements for hazardous materials as well as the specific requirements for the type of waste (e.g., RCRA, solid waste). These include packaging, labeling, marking, manifesting, and placarding requirements for the specific waste type. In addition, all wastes sent off site must also meet the Texas waste acceptance criteria for disposal facilities (30 TAC 451, Subchapter B).

2.8.1 Former Pistol Range

Excavated contaminated soil may be consolidated on site in a staging area before being sent off site for disposal.

2.8.2 LHAAP-04, Former Pilot Wastewater Treatment Plant

If the soil under the concrete pad is clean, the roll-offs and/or temporary soil stockpile will be placed on it for easy access using the excavator. If the soil beneath the concrete pad is contaminated, the roll-offs and/or temporary soil stockpile will be placed near the road to allow easy access and direct loading of trucks using the excavator.

2.9 Decontamination of Equipment and Personnel

A permanent decontamination station is located at the on-site GWTP at LHAAP-18/24 and can accommodate large equipment. As noted in **Section 2.3**, temporary decontamination pads will be constructed at an approved on-site location as needed to decontaminate equipment and prevent cross-contamination between sites. The decontamination pad will be approximately 15 feet in length and width, bermed, and covered with HDPE sheeting. Wash water will be contained and transported to the GWTP for disposal when necessary. Equipment used for the excavation and handling of contaminated soil will be inspected for contamination prior to leaving the site. Contaminated soil that adheres to the equipment will be removed by mechanical means. If contamination is still visibly present after mechanical cleaning, equipment will be rinsed with decontamination liquids. Further information on decontamination procedures are found in the Final Installation-Wide Work Plan, Appendix D, Field Procedures (Shaw, 2006).

Personnel shall be decontaminated as indicated in the Site-Specific Supplement to HASP (see **Appendix A**).

2.10 Site Restoration

Once the excavation has been completed, Shaw will restore the site and demobilize. As needed, backfill operations would proceed after excavation activities are complete. The areas would be backfilled with a clean fill and would have approximately 6 inches of topsoil applied. The area will be graded, if necessary, to match the original topography and to ensure positive drainage and reseeded per applicable USACE requirements.

Clean fill will be obtained from an off-site borrow source. Existing documentation from the borrow source will be reviewed to evaluate if it is clean compared to background, SAI-Ind, and GWP-Ind values. If necessary, Shaw will collect representative samples from the borrow source for environmental testing.

2.11 Installation of Monitoring Well at LHAAP-04

After site restoration activities are complete, a shallow zone monitoring well, 04WW04, will be installed in/or adjacent to the soil excavation area at LHAAP-04. The monitoring well will be installed near 04SB11 sample location or just north of it. The placement of the well will be finalized following receipt of confirmation sample results. Well placement recommendation will be submitted for regulatory approval prior to well installation. Following development, groundwater samples will be collected from the monitoring well to evaluate the effectiveness of the removal of the soil-to-groundwater pathway. Well installation and groundwater sampling will be performed in accordance with the requirements presented in Tasks 8 and 9 of the CQCP (**Appendix B**).

The monitoring well will be drilled and installed using a hollow-stem auger or mud rotary drill rig depending upon site conditions. Fill material will not be sampled, but samples of native soil will be collected continuously using a split barrel core sampler advanced ahead of the drill bit. The soil samples will be described according to ASTM D2488-00, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), and logged on USACE Engineering Form 1836 (Drilling Log) or equivalent. The monitoring well will be constructed with flush-joint threaded, schedule 40, polyvinyl chloride (PVC). The monitoring well will be installed in the annulus of the hollow-stem auger. The PVC well screen for each well will be 0.01-inch slotted and 10 feet in length.

Additional details for well installation, well development and sampling are found in the Final Installation-Wide Work Plan, Appendix C, CDAP and Appendix D, Field Procedures (Shaw, 2006).

2.12 Surveying

A State of Texas-licensed professional land surveyor will survey the boundaries of the completed soil excavations and the location and elevation of the newly installed monitoring well at LHAAP-04. If after excavation it is determined that soils above the SAI-Ind for lead (Pistol Range) or SAI-Ind for mercury (LHAAP-04) are remaining and cannot feasibly be excavated, the locations above the SAI-Ind will be staked and surveyed for elevation and northing/easting readings. The horizontal coordinates (northing and easting) will be surveyed to the nearest 0.1 foot and will be based on the North American Datum of 1983. The vertical elevations of the top of well (top-of-casing) at LHAAP-04 will be surveyed to nearest 0.01 feet. The ground surface elevation at the LHAAP-04 well location will be surveyed to the nearest 0.1 feet. To ensure compatibility with pre-existing well elevations, the top-of-casing for the nearest existing well will be surveyed. If discrepancies are noted, the USACE will be consulted for resolution. Surveying will be in accordance with the requirements described in Task 10 of the CQCP (**Appendix B**).

2.13 Restoration

The excavated areas will be regraded to blend with the surrounding topography. Clean fill soil will be imported as necessary to match the surrounding grade and ensure positive drainage. The soil will be placed using the excavator and, if needed, a dozer. Compaction will be incidental to placement.

At restored areas of the former Pistol Range, erosion control matting will be applied to the slope, and flat areas will be seeded and mulched.

At LHAAP-04, the restored surface will be seeded and mulched. Shaw will confer with the Army regarding the acceptability of the grass seed for the sites prior to application.

2.14 Demobilization

Upon completion of site restoration operations, Shaw will remove temporary facilities, perform final equipment decontamination, and demobilize personnel.

2.15 Reporting

After the removal action has been completed and the final inspection approved by the Army, a Closure Report will be prepared. Compilation of the information for the report will occur throughout the duration of the removal actions. The report should include site drawings, sample data, copies of all manifests, and a narrative of the removal actions. The completed Draft Closure Report will be submitted to the Army for review and comment. Following this, a Draft Final Closure Report will be submitted to the regulatory agencies for review and comment. When regulatory agency comments have been resolved, the Final Closure Report will be issued.

2.16 Schedule

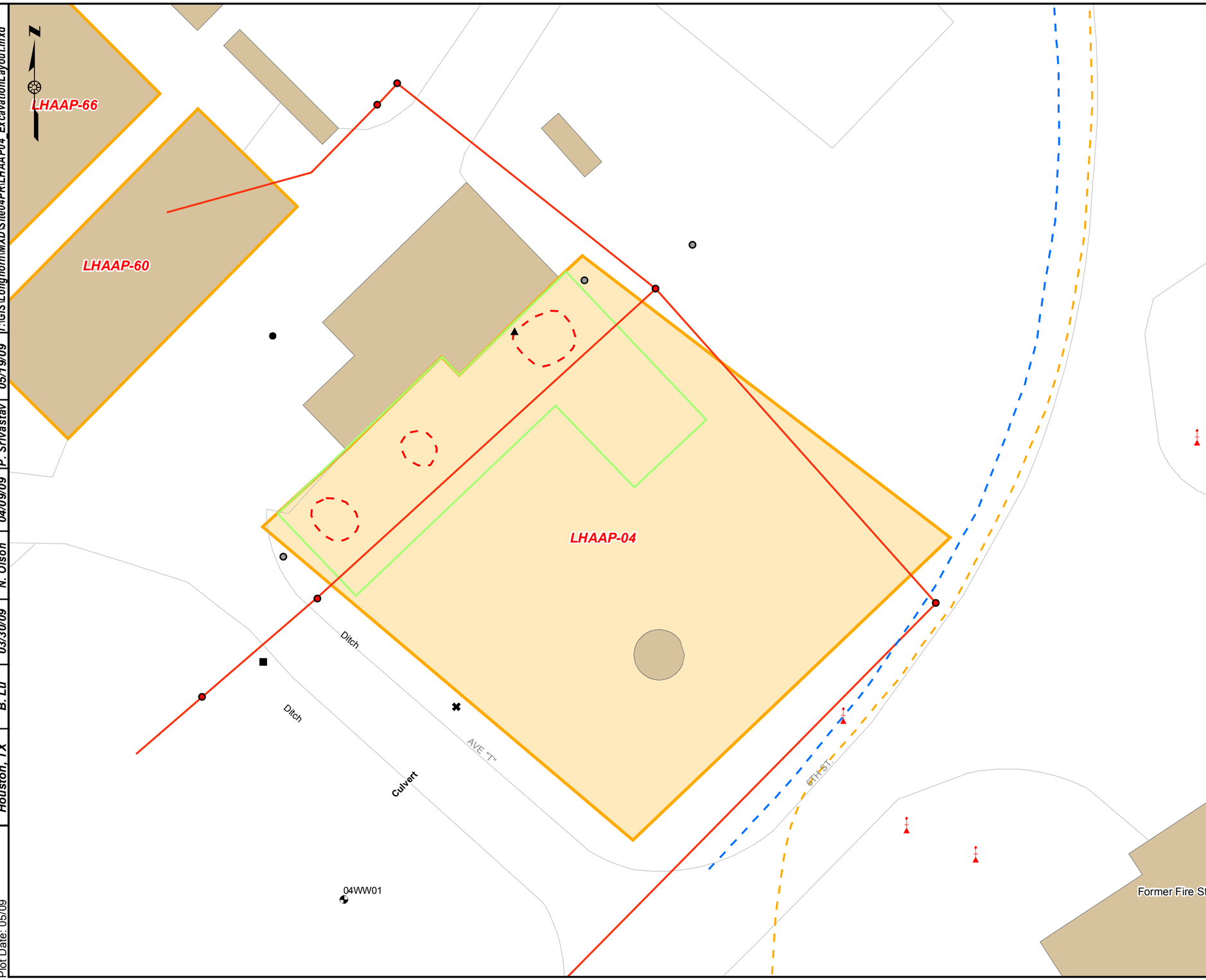
The estimated length of time for construction activities including site setup, clearing and grubbing, excavation, disposal, confirmatory sampling, waste characterization and site restoration is approximately 4½ weeks. **Table 2-1** shows the anticipated duration for each of the major site activities.

Table 2-1
Durations for Major Site Activities

Activities	Duration
Mobilization/Site Setup	1 Day
Excavation:	
Former Pistol Range	2 Days
LHAAP-04	8 Days
Confirmation Sampling and Analysis (each site)	3 Days
Backfill	5 Days
Site Restoration	2 Days
Monitoring Well at LHAAP-04	1 Day
Exceptions:	
Concrete breakup and overexcavation	5 Days +
Resample	3 Days
Estimated Duration	28 Days to 40 Days

Note:
Does not include pre-mobilization activities or rerouting of utilities.

Currently, a former power plant adjacent to LHAAP-04 is being demolished. Due to the associated movement of trucks and material through May 2009, Shaw's mobilization to LHAAP-04 is anticipated to begin in June 2009.



OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Lu	03/30/09	N. Olson	04/09/09	P. Srivastav	05/19/09	T:\GIS\Longhorn\MXD\Site04PR\LHAAP04_ExcavationLayout.mxd

Plot Date: 05/09

LEGEND

- Electrical Line Pole
- Pole Only
- Hydrant
- Abandoned Eye Wash and Shower
- Hose Bib
- Sanitary Sewer Cleanout
- Water Valve
- Shallow Monitoring Well
- Located communications line 3 ft below ground surface
- Located water line 3 ft below ground surface
- Electrical Line
- Road
- Initial Excavation of 4 Feet
- Initial Area of Excavation Deeper than 4 Feet
- Concrete Slab
- Site

Note:

Northeast end of excavation was moved approximately 7-feet southwest of the boundary presented in the EE/CA (Shaw 2009b) based on additional field measurements and photographs of PLANTECO pilot study plot.

0 15 30 60 Feet

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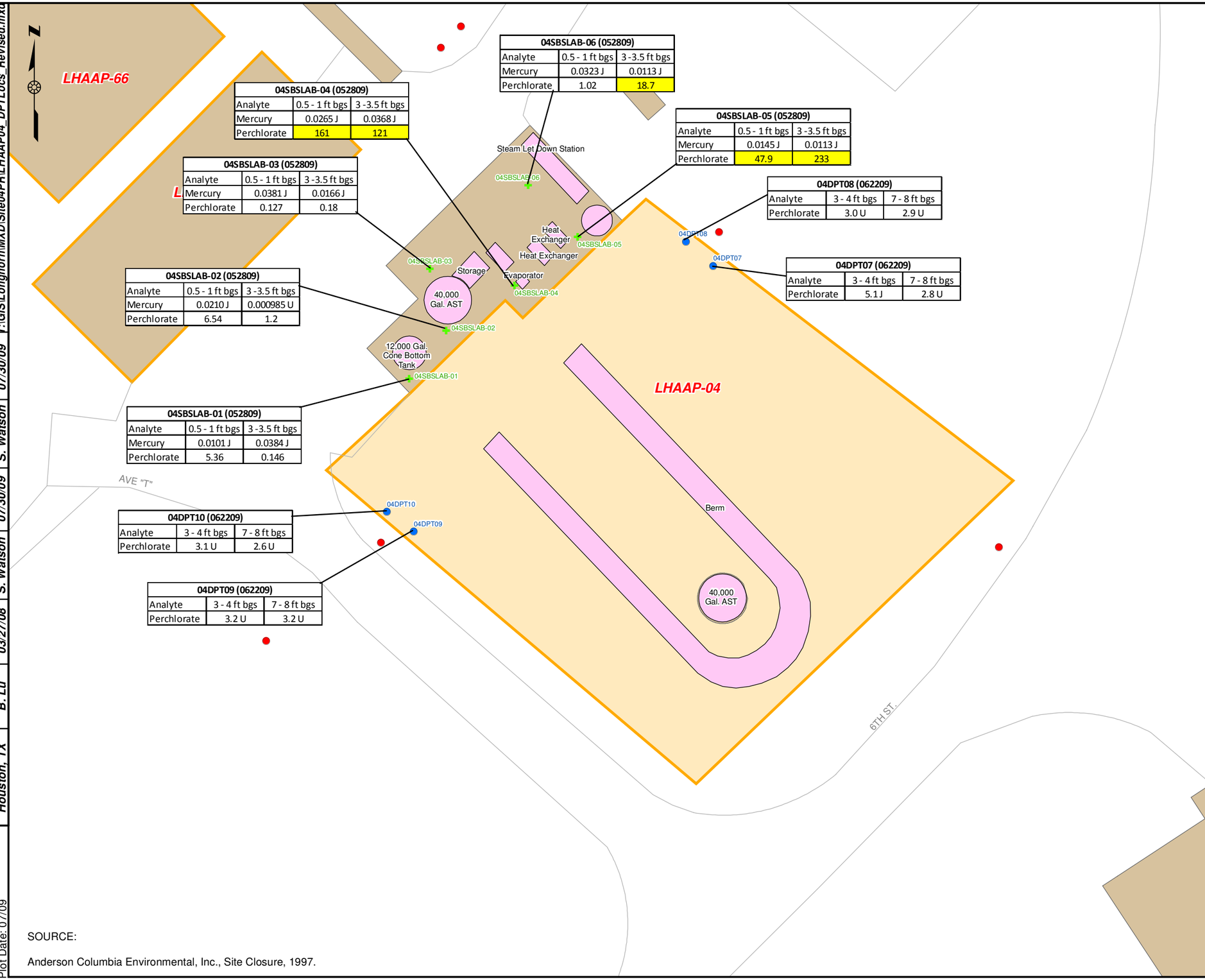
TULSA DISTRICT
TULSA, OKLAHOMA

FIGURE 2-1

LOCATION OF UTILITIES
LHAAP-04

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS



04SBSLAB-06 (052809)		
Analyte	0.5 - 1 ft bgs	3 -3.5 ft bgs
Mercury	0.0323 J	0.0113 J
Perchlorate	1.02	18.7

04SBSLAB-04 (052809)		
Analyte	0.5 - 1 ft bgs	3 -3.5 ft bgs
Mercury	0.0265 J	0.0368 J
Perchlorate	161	121

04SBSLAB-05 (052809)		
Analyte	0.5 - 1 ft bgs	3 -3.5 ft bgs
Mercury	0.0145 J	0.0113 J
Perchlorate	47.9	233

04SBSLAB-03 (052809)		
Analyte	0.5 - 1 ft bgs	3 -3.5 ft bgs
Mercury	0.0381 J	0.0166 J
Perchlorate	0.127	0.18

04DPT08 (062209)		
Analyte	3 - 4 ft bgs	7 - 8 ft bgs
Perchlorate	3.0 U	2.9 U

04SBSLAB-02 (052809)		
Analyte	0.5 - 1 ft bgs	3 -3.5 ft bgs
Mercury	0.0210 J	0.000985 U
Perchlorate	6.54	1.2

04DPT07 (062209)		
Analyte	3 - 4 ft bgs	7 - 8 ft bgs
Perchlorate	5.1 J	2.8 U

04SBSLAB-01 (052809)		
Analyte	0.5 - 1 ft bgs	3 -3.5 ft bgs
Mercury	0.0101 J	0.0384 J
Perchlorate	5.36	0.146

04DPT10 (062209)		
Analyte	3 - 4 ft bgs	7 - 8 ft bgs
Perchlorate	3.1 U	2.6 U

04DPT09 (062209)		
Analyte	3 - 4 ft bgs	7 - 8 ft bgs
Perchlorate	3.2 U	3.2 U

LEGEND

- Live Electric Pole
- DPT Sample Location - Near Electric Pole
- DPT Sample Location - Through Concrete Slab
- Road
- Former Operation Structure (Raised Pad)
- Concrete Slab
- Site

AST -- Aboveground Storage Tank

NOTES:

1. Results in milligrams per kilogram.
2. Yellow highlighted sample results are above the proposed cleanup level.

0 15 30 60 Feet

SOURCE:

Anderson Columbia Environmental, Inc., Site Closure, 1997.

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TULSA, OKLAHOMA

FIGURE 2-2

PRE-MOBILIZATION SAMPLE RESULTS
LHAAP-04

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Lu	03/27/08	S. Watson	07/30/09	S. Watson	07/30/09	T:\GIS\Longhorn\MXD\Site04PR\LHAAP04_DPTLocs_Revised.mxd

Plot Date: 07/09

LOCATION	EAST	NORTH
A	3314847.9	6951929.7
B	3314857.5	6951929.7
C	3314871.2	6951904.3
D	3314890.4	6951893.8
E	3314890.4	6951880.5
F	3314870.8	6951866.3
G	3314848.7	6951866.3
H	3314832.9	6951882.6
I	3314832.9	6951899.7
J	3314837.5	6951904.7

LEGEND

- XRF Sediment Sample Location
- XRF Sample Location
- Lead Concentration Contour
- Stream
- Road
- Approximate Firing Line Location
- Excavation Area
- 25-foot Grid
- Target Embankment
- Pistol Range

NOTES:

1. LOD is level of detection.
2. Lead concentrations are in milligrams per kilogram.
3. 1,000 contour is boundary of area of removal.

0 20 40 80 Feet

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TULSA DISTRICT
TULSA, OKLAHOMA

FIGURE 2-3

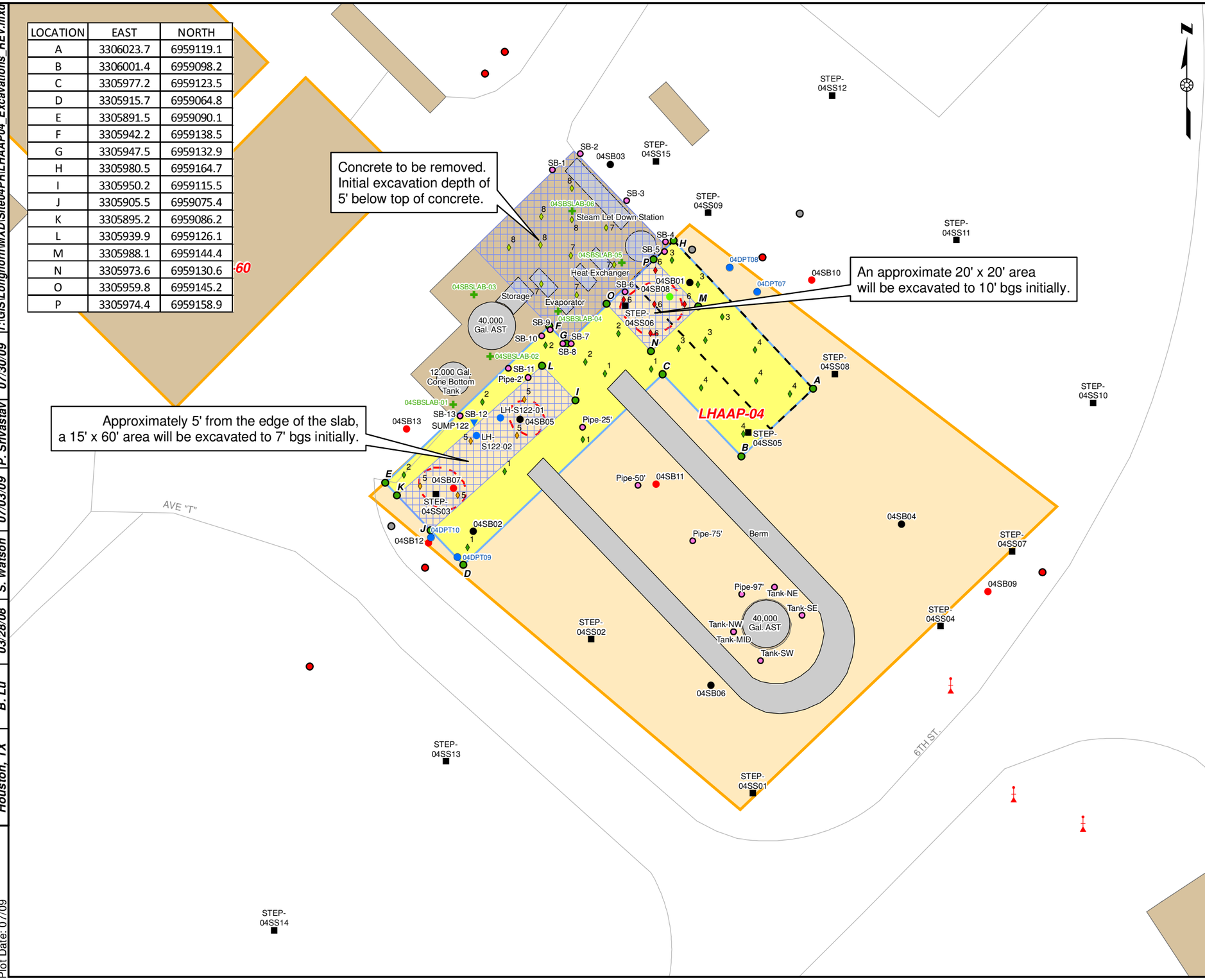
INITIAL EXCAVATION AREA
FORMER PISTOL RANGE

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	GWT	1/09/07	N. Olson	04/09/09	P. Srivastav	03/03/09	T:\GIS\LonghornMXD\Site04PR\PistolRange_InitialExcavations.mxd

Plot Date: 05/09

LOCATION	EAST	NORTH
A	3306023.7	6959119.1
B	3306001.4	6959098.2
C	3305977.2	6959123.5
D	3305915.7	6959064.8
E	3305891.5	6959090.1
F	3305942.2	6959138.5
G	3305947.5	6959132.9
H	3305980.5	6959164.7
I	3305950.2	6959115.5
J	3305905.5	6959075.4
K	3305895.2	6959086.2
L	3305939.9	6959126.1
M	3305988.1	6959144.4
N	3305973.6	6959130.6
O	3305959.8	6959145.2
P	3305974.4	6959158.9



LEGEND

- DPT Sample Location - Near Electric Pole
- DPT Sample Location - Through Concrete Slab
- Electrical Line Pole
- Pole Only
- Hydrant
- 4' Depth Composite Sample (floor grab location)
- 5' Depth Composite Sample (floor grab location)
- 7' Depth Composite Sample (floor grab location)
- 10' Depth Composite Sample (floor grab location)
- Sump
- Soil Boring Associated with Sump122
- 2007 Soil Sampling Location (Shaw, 2007)
- 2006 Soil Sampling Location (Shaw, 2006)
- 2002 Surface Soil Sample (STEP, 2003)
- 2000 Soil Boring (Jacobs, 2002b)
- 1997 Soil Boring (ACE, 1997)
- Road
- Excavation Area Deepter than 5' bgs
- Former Location of Operational Structure
- Approximate Location of Pilot Study Plot
- Initial Excavation of 4 Feet
- Initial Area of Excavation Deeper than 4 Feet
- 4' bgs Initially
- Concrete Slab
- Site

NOTE:

A confirmation sample will be collected from the floor for approximately every 750 square feet and from each overexcavated area.

bgs - below ground surface

Samples will be analyzed for perchlorate.

0 15 30 60 Feet

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

FIGURE 2-4

INITIAL EXCAVATION AREAS
LHAAP-04

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Lu	03/28/08	S. Watson	07/03/09	P. Srivastav	07/30/09	T:\GIS\Longhorn\MXD\Site04PR\LHAAP04_Excavations_REV.mxd

Plot Date: 07/09

3.0 Health and Safety

The HASP (the latest revision of Appendix A of the Installation-Wide Work Plan [Shaw, 2006]) incorporates health and safety policies and safe operating procedures for individual project site activities. These procedures allow work activities to be carried out in a controlled, effective manner, consistent with Shaw policies.

Information specific to the removal action activities at the former Pistol Range and LHAAP-04 is provided in **Appendix A**. This information includes PPE levels, air monitoring requirements, and activity hazard analyses. These items supplement the HASP; they do not replace it. This information is not addressed by the site-wide HASP because the hazards are unique to the proposed work.

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

3.1 Work near Overhead Electric Lines

Because of its potential importance at LHAAP-04, this section emphasizes that Shaw will adhere to safety procedure HS308, Underground/Overhead Utility Contact Prevention (Shaw E & I, 2006) for clearance of equipment prior to commencement of activities in proximity to power lines. **Table 3-1** (USACE, 2008) identifies the minimum clearance from energized overhead electric lines.

Table 3-1
Minimum Clearance from Energized Overhead Electric Lines

Voltage (nominal, kV, alternating current)	Minimum Rated Clearance
Up to 50	10 ft (3 m)
51 – 200	15 ft (4.6 m)
201 – 350	20 ft (6 m)
351 – 500	25 ft (7.6 m)
501 – 650	30 ft (9.1 m)
651 – 800	35 ft (10.7 m)
801 – 950	40 ft (12.2 m)
951 – 1100	45 ft (13.7 m)
Clearance values calculated using: (Initial kV-50kV) x (4 in/10 kV) x (1 ft/12 in) = increased distance (ft) over 10 ft. Add this value to 10 ft to yield minimum rated clearance	

Notes and Abbreviations:

All dimensions are distances from live part to employee. Source: USACE, 2008

ft feet *kV kilovolts*
in inches *m meters*

4.0 Quality Assurance/Quality Control

The CQCP provides information on quality assurance/quality control (QA/QC) procedures for this project. The CQCP identifies personnel, procedures, controls, instructions, tests, verifications, documents, and forms to be used and the types of records to be maintained. The CQCP addresses quality control requirements specific to each major feature of work, including special steps that apply to the former Pistol Range and LHAAP-04. The CQCP is provided in **Appendix B**.

The USACE Three-Phase QC process will be used to enforce QA/QC requirements and include preparatory inspections, initial inspections, and follow-up inspections. The three-phases of inspections will target each definable feature of work during the execution of project activities.

5.0 References

Anderson Columbia Environmental, 1997, *Closure Report, Pilot Wastewater Treatment Plant, Longhorn Army Ammunition Plant, Karnack, Texas, EPA Identification No. TX6213820583, Solid Waste Registration No. 30990*, September.

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

Shaw Environmental, Inc. (Shaw), 2006, *Final Installation-Wide Work Plan, Longhorn Ammunition Plant, Karnack, Texas*, Houston, Texas, January.

Shaw, 2009a, *Final Engineering Evaluation/Cost Analysis, Former Pistol Range, Longhorn Army Ammunition Plant, Karnack, Texas*, Houston, Texas, February.

Shaw, 2009b, *Final Engineering Evaluation/Cost Analysis, LHAAP-04, Former Pilot Wastewater Treatment Plant, Longhorn Army Ammunition Plant, Karnack, Texas*, Houston, Texas, March.

Texas Commission on Environmental Quality (TCEQ), 2006, Updated Examples of Standard No. 2, Appendix II Medium-Specific Concentration, March 31, 2006.

U.S. Army Corps of Engineers, 2008, *Safety and Health Requirements Manual, EM 385-1-1*, September.

Appendix A

Site-Specific Supplement to Health and Safety Plan

APPENDIX A
SITE-SPECIFIC SUPPLEMENT TO HEALTH AND SAFETY PLAN

FINAL

REMOVAL ACTION WORK PLAN
FORMER PISTOL RANGE AND LHAAP-04,
FORMER PILOT WASTEWATER TREATMENT PLANT, GROUP 4
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Prepared for

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

Prepared by

Shaw Environmental, Inc.
3010 Briarpark Drive, Suite 400
Houston, Texas 77042

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

August 2009

PPE Levels

LHAAP-04 Concrete Coring

Level D – Modified PPE:

- Hard hat meeting ANSI Z89.1 specifications.
- Safety glasses with side shields meeting ANSI Z87.1 specifications.
- Safety-toed work boots meeting ANSI Z41 specifications.
- Nitrile surgical gloves (inner or double layer).
- Hearing protection (if necessary or required).
- High visibility vests (ground personnel when working near heavy equipment or vehicular traffic).
- Work gloves, such as leather, cotton, or other material that provides cut/abrasion resistance (as necessary).

LHAAP-04 Direct Push Soil Sampling

Level D – Modified PPE:

- Hard hat meeting ANSI Z89.1 specifications.
- Safety glasses with side shields meeting ANSI Z87.1 specifications.
- Safety-toed work boots meeting ANSI Z41 specifications.
- Nitrile surgical gloves (inner or double layer).
- Hearing protection (if necessary or required).
- High visibility vests (ground personnel when working near heavy equipment or vehicular traffic).
- Work gloves, such as leather, cotton, or other material that provides cut/abrasion resistance (as necessary).

LHAAP-04 Soil Excavation, Soil Handling, Concrete Demolition, Soil or Concrete Load-out, and Monitoring Well Installation

Level D – Modified PPE:

- Hard hat meeting ANSI Z89.1 specifications.
- Safety glasses with side shields meeting ANSI Z87.1 specifications.
- Safety-toed work boots meeting ANSI Z41 specifications.
- Nitrile surgical gloves (inner or double layer).

- Disposable Tyvek® coveralls with hoods, elastic wrists, and ankles.
- Chemical resistant boot covers and/or outer boots (polyvinyl chloride [PVC]/latex/neoprene when there is potential for shoe/boot contact with contaminated soil or water).
- Hearing protection (if necessary or required).
- High visibility vests (ground personnel when working near heavy equipment or vehicular traffic).
- Work gloves, such as leather, cotton, or other material that provides cut/abrasion resistance (as necessary).

Former Pistol Range Excavation, Soil Handling, or Load-out

Level D – Modified PPE:

- Hard hat meeting ANSI Z89.1 specifications.
- Safety glasses with side shields meeting ANSI Z87.1 specifications.
- Safety-toed work boots meeting ANSI Z41 specifications.
- Nitrile surgical gloves (inner or double layer).
- Disposable Tyvek® coveralls with hoods, elastic wrists, and ankles.
- Chemical resistant boot covers and/or outer boots (polyvinyl chloride [PVC]/latex/neoprene when there is potential for shoe/boot contact with contaminated soil or water).
- Hearing protection (if necessary or required).
- High visibility vests (ground personnel when working near heavy equipment or vehicular traffic).
- Work gloves, such as leather, cotton, or other material that provides cut/abrasion resistance (as necessary).

Air Monitoring

LHAAP-04 and Former Pistol Range

Real-Time Aerosol Monitor

Real-time aerosol monitors (MIE pDR-1000 or equivalent) shall be used to monitor dust emissions during contaminated soil excavation, soil removal, soil handling, soil loading, concrete boring, concrete demolition, and other dust generating activities. The real-time aerosol monitors will be placed in the work area (near areas where ground personnel are working) and at the downwind site perimeter. The selected placement of these instruments may need to be adjusted throughout the workday to compensate for changes of wind direction.

Real-Time Aerosol Monitoring Action Levels

The real-time aerosol monitors will be set to alarm when the instantaneous aerosol concentration reaches 1.0 mg/m^3. The alarm will be used to indicate that additional dust control is necessary.

The real-time aerosol monitors are capable of collecting and integrating the aerosol concentrations throughout the workday into a TWA. Aerosol monitors shall be visually checked on an hourly basis during dust generating activities to verify that the TWA remains below 1.0 mg/m^3. Aerosol monitors registering time-weighted average aerosol concentrations at or above 2.0 mg/m^3 require that workers upgrade to Level C PPE and indicate that additional dust control measures are necessary. Failure to control workday time-weighted average dust concentrations to below 4.0 mg/m^3 shall necessitate ceasing dust generating activities and contacting the PM and HSM for implementing alternate work practices.

The full work-shift time-integrated concentrations will be evaluated at the conclusion of each workday to verify aerosol concentrations are maintained below action levels.

Personal Air Sampling (Time-Integrated)

Time-integrated air sampling may be performed at the discretion of the HSM, if air-monitoring action levels are exceeded.

Medical Surveillance

LHAAP-04 and Former Pistol Range

There are no special medical surveillance requirements in addition to the requirements of 29 CFR 1910.120(f), which are already in place.

Activity Hazard Analysis (AHA)

Activity: Concrete Coring Analyzed by/date: James R. Joice / 03-24-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Arrival of new personnel at site.	New personnel.	All personnel shall attend the site orientation training.
	Failure to plan.	Complete JSA for task, as specified in Shaw HS 045, Job Safety Analysis.
Unload equipment.	Heavy lifting, strains, and sprains.	No individual shall lift any object that weighs over 60 pounds.
		Use proper lifting techniques.
		Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.
Concrete coring.	Intrusive activities.	Follow procedure for Intrusive Activities Permit in Health and Safety Plan (HASP) and follow Shaw HS 308, Underground/Overhead Utility Contact Prevention.
		Underground utilities shall be located and marked prior to commencing coring activity.
	Contaminated concrete or soil.	Wear PPE as specified in the HASP.
		Perform air monitoring as specified in the HASP.
		Notify the Site Safety and Health Officer (SSHO) if odors are detected.
		Perform decontamination as specified in the HASP.
	Use of hand tools.	Inspect hand tools daily and before each use.
		Tools, which are damaged, shall be removed from service.
		Personnel shall work in a manner and pace to reduce strains and overexertion.
		Follow the cutting tool procedures, which are specified in the HASP.

Activity Hazard Analysis (AHA)

Activity: Concrete Coring Analyzed by/date: James R. Joice / 03-24-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Concrete coring (continued).	Noise.	Personnel working in vicinity of equipment shall wear hearing protection to reduce exposures to below the OSHA limits.
	Use of coring machine.	All components of the machine that has a direct bearing on the safety of the operation shall be inspected at the beginning of each shift and when possible, observed during operation. All guards for moving machinery shall be in place. The machine shall not be used if it is not in a safe operating condition. A copy of the coring machine manual shall be available at the job site and reviewed/followed by coring personnel. Personnel shall be aware of pinch-point hazards and work in a manner to prevent injuries. Hands shall be kept out of areas that may present a pinching hazard and personnel shall not position themselves between equipment. The operator shall verbally alert employees and visually ensure employees are clear from dangerous parts of equipment prior to starting or engaging equipment. Coring equipment shall be equipped with a guard and an emergency shutdown device. All crew members shall know the location and operation of the kill switch.
	Tip over of coring machine.	The coring machine shall be positioned in a level fashion with stands and outriggers set.
	Moving/operating parts and equipment.	The coring tool shall be maintained or cleaned only when the machine is shut-off. Crew members shall not wear loose clothing or jewelry.

Activity Hazard Analysis (AHA)

Activity: Concrete Coring Analyzed by/date: James R. Joice / 03-24-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Concrete coring (continued).	Open borings.	The coring-holes shall be covered, secured, and flagged when work is not in progress.
	Fire.	Smoking is permitted in designated areas only.
		A 20-B:C fire extinguisher shall be available in each work and fueling area.
		Do not start gasoline-powered equipment in fueling area (at least 10 feet away).
		Store gasoline in safety cans with flash arresters and spring-loaded vents.
	Slips, trips, and falls.	Keep work areas clear and maintain housekeeping.
		Do not jump from elevated surfaces.
		Use caution when walking on rocky, slippery, or uneven terrain
	Hand injuries.	Items to be handled shall be inspected for sharp edges or protrusions prior to being handled.
		Wear leather gloves when handling sharp materials.
		Be aware of and avoid pinch point hazards.
		Use cutting tool procedures in HASP.
		Wear PPE and tape joints to keep insects away from the skin.
		Use 3M Ultrathon (N,N-diethyl-m-toluamide) and Repel Permanone (permethrins) to repel chiggers, mosquitoes, and ticks.
		Check limbs/body for insects/insect bites before showering.
		Notify SSHO of flu-like symptoms.

Activity Hazard Analysis (AHA)

Activity: Concrete Coring Analyzed by/date: James R. Joice / 03-24-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Concrete coring (continued).	Heat stress and cold stress. Severe weather.	Follow procedures outlined in the HASP. The SSHO will monitor weather conditions each day in order to plan and prepare for hazardous conditions. The SSHO will identify a suitable tornado shelter at each work location. Work activities will be suspended prior to weather conditions becoming hazardous so that workers have ample time to seek shelter. Upon seeing lightning or hearing thunder, outdoor activities shall be suspended and personnel shall be evacuated to safe areas (inside vehicles, buildings, or tornado shelters as appropriate). When clouds with dark bases and wind speeds pick up, anticipate thunderstorms and the potential for tornadoes. Those who have been struck by lightning did not seek cover in a timely fashion. Follow the procedures in the HASP.

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
PPE First aid kit Leather gloves Concrete Coring Machine Insect repellant Repel Permanone Fire extinguishers Air monitoring instruments Hearing protection	Site inspections (daily) Intrusive activities permit Coring machine (prior to each use) Verify tornado shelter available Monitor approaching storms Fire extinguishers (weekly) Hand tools (before each use) Extension cords (before each use)	HAZWOPER Site orientation Hazard Communication Review equipment operator's manual Hearing conservation Biological hazard identification and control Emergency procedures Tornado shelter locations Lightning Safety Procedures Fire extinguisher use

Activity Hazard Analysis (AHA)

Activity: Subsurface Soil Sampling Analyzed by/date: James R. Joice / 03-24-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Arrival of new personnel at site.	New personnel.	All personnel shall attend the site orientation training.
	Failure to plan.	Complete JSA for task, as specified in Shaw HS 045, Job Safety Analysis.
Unload equipment.	Heavy lifting, strains, and sprains.	No individual shall lift any object that weighs over 60 pounds.
		Use proper lifting techniques.
		Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.
Direct-pushing and subsurface soil sampling.	Intrusive activities.	Follow procedure for Intrusive Activities Permit in Health and Safety Plan (HASP) and follow Shaw HS 308, Underground/Overhead Utility Contact Prevention.
		Underground utilities shall be located and marked prior to commencing direct push activity.
Competent Person Drilling Oversight:	Contaminated water or soil.	Wear PPE as specified in the HASP.
		Perform air monitoring as specified in the HASP.
		Notify the Site Safety and Health Officer (SSHO) if odors are detected.
		Perform decontamination as specified in the HASP.
	Use of hand tools.	Inspect hand tools daily and before each use.
		Tools, which are damaged, shall be removed from service.
		Personnel shall work in a manner and pace to reduce strains and overexertion.
		Follow the cutting tool procedures, which are specified in the HASP.

Activity Hazard Analysis (AHA)

Activity: Subsurface Soil Sampling Analyzed by/date: James R. Joice / 03-24-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Direct-pushing and subsurface soil sampling (continued).	Use of direct-push equipment.	Inspect direct-push equipment prior to use and daily thereafter - particular attention shall be given to hydraulic lines and fittings. Verify all personnel are instructed in emergency shut-down procedures. All crewmembers, including geologists, shall know the location and operation of the kill switch. Personnel shall be cautious of moving equipment, such as the hydraulic cylinder and rams. Be aware of pinch-point hazards and work in a manner to prevent injuries. Direct push crewmembers shall not wear loose clothing or jewelry. The operator shall verbally alert employees and visually verify employees are clear from dangerous parts of equipment prior to starting or engaging equipment. Be aware of and avoid hot surfaces from heat generated from engine. Review operator's manual and Geoprobe Systems safety information: http://www.geoprobe.com/service/safety.htm
	Noise.	Personnel working in vicinity of equipment shall wear hearing protection while equipment is in the hammering mode to reduce exposures to below the OSHA limits. Noise dosimetry shall be performed on personnel when operating the direct-push rig in the hammering mode. Double hearing protection may be necessary if in direct-push is in hammering mode.
	Use of methanol (if necessary).	Properly label all containers and review MSDS. Use PPE including nitrile gloves and chemical splash goggles.

Activity Hazard Analysis (AHA)

Activity: Subsurface Soil Sampling Analyzed by/date: James R. Joice / 03-24-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Direct-pushing and subsurface soil sampling (continued).	Use of methanol (continued).	A portable eyewash station shall be readily available in the area where methanol is being used. Personnel who sustain contact with methanol shall immediately wash the affected area with soap and water (eyes should be irrigated for 15 minutes with potable water) and seek immediate medical attention
	Fire.	Smoking is permitted in designated areas only. A 20-B:C fire extinguisher shall be available in each work and fueling area. Do not start gasoline-powered equipment in fueling area (at least 10 feet away). Store gasoline in safety cans with flash arresters and spring-loaded vents.
	Slips, trips, and falls.	Keep work areas clear and maintain housekeeping. Do not jump from elevated surfaces. Use caution when walking on rocky, slippery, or uneven terrain
	Hand injuries.	Items to be handled shall be inspected for sharp edges prior to being handled. Wear leather gloves when handling sharp materials. Be aware of and avoid pinch point hazards. Use cutting tool procedures in HASP.

Activity Hazard Analysis (AHA)

Activity: Subsurface Soil Sampling Analyzed by/date: James R. Joice / 03-24-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Direct-pushing and subsurface soil sampling (continued).	Insect/animal bites/West Nile Virus.	Review injury potential with workers. Wear PPE and tape joints to keep insects away from the skin. Use 3M Ultrathon (N,N-diethyl-m-toluamide) and Repel Permanone (permethrins) to repel chiggers, mosquitoes, and ticks. Check limbs/body for insects/insect bites before showering. Notify SSHO of flu-like symptoms.
	Contact dermatitis and poison ivy.	Wear long-sleeve shirts/trousers or Tyvek® coveralls to avoid skin contact with plants or other skin irritants. Identify and review poisonous plants with workers. Avoid unnecessary clearing of plant/vegetation areas. Cover vegetation with plastic (visqueen) where work raises exposure potential. Apply protective cream/lotion to exposed skin to prevent poison ivy or similar reactions. Identify workers who are known to easily contract poison ivy.
	Heat stress and cold stress.	Follow procedures outlined in the HASP.

Activity Hazard Analysis (AHA)

Activity: Subsurface Soil Sampling Analyzed by/date: James R. Joice / 03-24-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Direct-pushing and subsurface soil sampling (continued).	Severe weather.	The SSHO will monitor weather conditions each day in order to plan and prepare for hazardous conditions. The SSHO will identify a suitable tornado shelter at each work location. Work activities will be suspended prior to weather conditions becoming hazardous so that workers have ample time to seek shelter. Upon seeing lightning or hearing thunder, outdoor activities shall be suspended and personnel shall be evacuated to safe areas (inside vehicles, buildings, or tornado shelters as appropriate). When clouds with dark bases and wind speeds pick up, anticipate thunderstorms and the potential for tornadoes. Those who have been struck by lightning did not seek cover in a timely fashion. Follow the procedures in the HASP.

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
PPE First aid kit Leather gloves Insect repellant Repel Permanone Fire extinguishers Eyewash station Air monitoring instruments Hearing protection Noise dosimeter	Site inspections (daily) Intrusive activities permit Direct-push equipment (before use and daily) Survey areas for poisonous plants, insects, and animals Check body for ticks Verify tornado shelter available Monitor approaching storms Fire extinguishers (weekly) Eyewash station (daily) Hand tools (before each use) Extension cords (before each use)	HAZWOPER Competent Person Drilling Oversight Site orientation Hazard Communication Review equipment operator's manual Review Geoprobe Systems safety information Hearing conservation Biological hazard identification and control Emergency procedures Tornado shelter locations Lightning Safety Procedures Fire extinguisher use

Activity Hazard Analysis (AHA)

Activity: Excavation at LHAAP-04 Analyzed by/date: James R. Joice / 04-08-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Excavation at LHAAP-04. Excavation Competent Person:	New personnel. Failure to properly plan daily activities. Site contaminants. Underground and overhead utilities. Fire.	All personnel shall attend the site orientation training, which shall include Lead Awareness Training. Complete JSA for task, as specified in Shaw HS 045, Job Safety Analysis. Wear PPE as specified in the HASP. Set up work zones and decontamination facilities. Perform air sampling as specified in the HASP. Wash hands and face before eating, drinking, smoking, or chewing. Locate and mark underground utilities prior to commencing activity (follow Shaw HS 308). Identify overhead utilities in work areas and travel routes. Verify voltages in overhead electric lines; the minimum distances from electrical lines must be observed (EM 385-1-1 Table 11-1). Contact utility company to de-energize overhead electric line in LHAAP-04 work area during excavation activities. Verify overhead line has been de-energized, visibly grounded, tested, and locked-out/tagged-out. Remain aware of overhead power lines and maintain safe clearances – use spotters when excavating near line. Adjust size of equipment to maintain clearance from overhead line. Place signs or decals in equipment and dump trucks to maintain at least 10-feet clearance from de-energized line. Post overhead hazard warning signs on ground at excavation area. All electrical, gas, and telephone utilities are to be hand dug within three feet of utility markings. Smoke only in designated areas. Provide 20-B:C fire extinguishers in work area.

Activity Hazard Analysis (AHA)

Activity: Excavation at LHAAP-04 Analyzed by/date: James R. Joice / 04-08-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Excavation at LHAAP-04 (continued).	Noise.	Wear hearing protection when in noisy areas or when operating power tools to reduce noise exposures to below the OSHA limits. Perform noise monitoring on equipment operators and ground personnel working in the vicinity of noisy equipment.
	Use of mechanical / heavy equipment.	Only qualified personnel shall be permitted to operate equipment. Inspect equipment daily after the initial USACE inspection. Deficiencies in equipment shall be noted on the inspection form. Equipment found to be unsafe shall not be used. All equipment shall be operated at safe speeds and in a safe manner. Wear safety belts and hearing protection. Shut down all equipment with energies dissipated prior to performing maintenance activities – lock out/tag out procedures may apply. Do not wear loose clothing, and stay clear of moving parts. All mobile equipment shall have backing alarms. Ground personnel, working near heavy equipment, shall wear high visibility conspicuity vests. Ground personnel shall not position themselves between equipment and stationary objects. Personnel are only permitted to approach equipment after a signal from the operator. Personnel shall verify that all mechanical guards are in place and functioning properly.

Activity Hazard Analysis (AHA)

Activity: Excavation at LHAAP-04 Analyzed by/date: James R. Joice / 04-08-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Excavation at LHAAP-04 (continued).	Excavation.	The competent person shall inspect the excavation to determine soil classification and specify proper sloping. Inspect excavations (when personnel entry is required) daily, any time conditions change. Store excavated material at least 2 feet from the edge of the excavation; prevent excessive loading of the excavation face. Provide sufficient stairs, ladders, or ramps when workers enter excavations over four feet. Treat trenches over four feet deep as confined spaces. Slope, bench, or shore excavations over five feet deep, if worker entry is required. Provide at least two means of exit for personnel working in excavations.
	Dust.	Control dust by frequent wetting of soils and concrete.
	Hand injuries.	Items to be handled shall be inspected for sharp edges and protrusions prior to being handled. Wear leather gloves. Be aware of and avoid pinch point hazards.
	Electrical.	Ground fault circuit interrupters shall be used on all portable electrical equipment, power tools, and extension cords. Only hard or extra-hard usage extension cords shall be used. Extension cords, power tools, and lighting equipment shall be inspected before each use, protected from damage, and kept out of wet areas.
	Use of hand tools.	Select the proper tool – do not improvise. Check the condition of tools before starting (do not use damaged tools). Be aware of who and what is around you when using hand tools. Check your position, footing, and grip before tool use.

Activity Hazard Analysis (AHA)

Activity: Excavation at LHAAP-04 Analyzed by/date: James R. Joice / 04-08-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPAL STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Excavation at LHAAP-04 (continued).	Struck-by abandoned utility poles.	Excavator used to remove abandoned utility poles shall be equipped with Falling Object Guarding System (FOGS) and front windshield guard. Keep all ground personnel twice the horizontal distance of pole height from pole when removing or felling poles. Size poles to manageable lengths prior to moving, handling, and loading. Use grapple or thumb to handle or maneuver poles.
	Heavy lifting, strains, and sprains.	No individual shall lift any object that weighs over 60 pounds. Use proper lifting techniques. Multiple employees or the use of mechanical lifting devices are required for lifting objects over the 60-pound limit.
	Dump truck operations.	Re-evaluate overhead hazards prior to allowing dump trucks onto the project site. Barricade areas with overhead hazards with caution tape to prevent dump bed from contact. In areas where it is not feasible to use barricades, then spotters and overhead hazard warning signs shall be provided: however, the minimum distances from electrical lines must be observed (EM 385-1-1 Table 11-1). Wear seat belts while trucks are in motion at the project site. Assist trucks when backing is necessary.
	Slips, trips, and falls.	Work areas clear shall be kept organized during work activities. Personnel shall not jump from equipment or elevated surfaces. Use caution when walking on rough terrain or overgrown areas or slippery surfaces.

Activity Hazard Analysis (AHA)

Activity: Excavation at LHAAP-04 Analyzed by/date: James R. Joice / 04-08-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Excavation at LHAAP-04 (continued).	Use of Bentonite or Portland cement to abandon pipes.	Read and follow MSDS for each operational hazardous chemical used. Personnel shall handle dry materials in a manner to limit dust generation. Avoid inhalation of dust or wear respiratory protection. Avoid physical contact with grout, cement, or concrete. Safety glasses and glove use is required when contact with grout, cement, or concrete is possible/probable. Personnel who sustain skin contact shall immediately wash the affected area with soap and water (eyes should be irrigated for 15 minutes with potable water) and report the incident to the Site Supervisor. Avoid allowing Bentonite to accumulate in work area as Bentonite can be extremely slippery – use caution when walking/working on slippery surfaces.
	Severe weather.	The Site Superintendent will monitor weather conditions each day in order to plan and prepare for hazardous conditions. The Site Superintendent will identify a suitable tornado shelter at each work location. Work activities will be suspended prior to weather conditions becoming hazardous so that workers have ample time to seek shelter. Upon seeing lightning or hearing thunder, outdoor activities shall be suspended and personnel shall be evacuated to safe areas (inside vehicles, buildings, or storm shelters as appropriate). When clouds with dark bases and wind speeds pick up, anticipate thunderstorms and the potential for tornadoes. Those who have been struck by lightning did not seek cover in a timely fashion. Follow the procedures in HASP.

Activity Hazard Analysis (AHA)

Activity: Excavation at LHAAP-04 Analyzed by/date: James R. Joice / 04-08-09 Reviewed by/date: William Squire / 07-30-09

PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
Excavation at LHAAP-04 (continued).	Irritating and toxic plants/insects.	Review injury potential with workers. Observe work areas at a distance to determine if wasps/bees are active or nesting. Wear PPE and tape joints to keep insects away from the skin. Use protective insect repellents containing N,N-Diethyl-m-toluamide (DEET), e.g., 3M Ultrathon or equivalent and clothing insecticide preparations containing 0.5 percent permethrins (Repel Permanone) to prevent insect bites. Check limbs/body for insects/insect bites before showering. Notify SSHO of flu-like symptoms. Identify and review poisonous plants with workers. Identify workers who are known to contract poison ivy. Inspect work areas for poisonous plants. Wear long-sleeve shirts/trousers or Tyvek® coveralls to avoid skin contact with plants or other skin irritants. Avoid unnecessary clearing of plant/vegetation areas. Apply protective cream/lotion to exposed skin to prevent poison ivy or similar reactions. Note: There are pre-exposure and post-exposure poison ivy preparations that should be on hand in case poison ivy is encountered.
	Heat stress and cold stress.	Follow heat stress and cold stress procedures in HASP.

Activity Hazard Analysis (AHA)

Activity: Excavation at LHAAP-04 Analyzed by/date: James R. Joice / 04-08-09 Reviewed by/date: William Squire / 07-30-09

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
PPE, as specified in the HASP Air monitoring instruments Leather gloves Fire extinguishers Hearing protection First aid kit AM/FM radio	Site inspections (daily) Heavy equipment (USACE form prior to use) Heavy equipment (daily) Tools (before each use) Dump trucks (daily) Fire extinguishers (weekly) Underground utilities location (prior to intrusive activities) Overhead hazards (prior to entering work areas) Excavations (daily) Identify pinch point hazards Hand tools (before use)	Site orientation HAZWOPER Hazard communication Lifting/back safety Qualified operators Fire extinguisher use Lockout/tagout procedures Excavation Competent Person Emergency procedures Lightning Safety Procedures

Appendix B

Contractor Quality Control Plan

APPENDIX B
CONTRACTOR QUALITY CONTROL PLAN

FINAL

REMOVAL ACTION WORK PLAN
FORMER PISTOL RANGE AND LHAAP-04,
FORMER PILOT WASTEWATER TREATMENT PLANT, GROUP 4
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Prepared for

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

Prepared by

Shaw Environmental, Inc.
3010 Briarpark Drive, Suite 400
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Contract Number W912QR-04-D-0027
Task Order No. DS02

August 2009

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Acronyms and Abbreviations

CDAP	Chemical Data Acquisition Plan
CQC	contractor quality control
CQCP	Contractor Quality Control Plan
CQCSM	Contractor Quality Control System Manager
DPT	Direct Push Technology
GPS	Global Positioning System
HASP	Health and Safety Plan
LHAAP	Longhorn Army Ammunition Plant
MARC	Multiple Award Remediation Contract
OSHA	Occupational Safety and Health Administration
PPE	personal protection equipment
QAR	quality assurance representative
QC	quality control
Shaw	Shaw Environmental, Inc.
SSO	Site Safety Officer
TO	task order
USACE	U.S. Army Corps of Engineers

1.0 Introduction

The U.S. Army Corps of Engineers (USACE), Tulsa District, contracted Shaw Environmental, Inc. (Shaw), under the Louisville District's Multiple Award Remediation Contract (MARC) No. W912QR-04-D0027, Task Order (TO) No. DS02, to perform closure of multiple environmental sites at Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas. TO DS02 is being administered by the Tulsa District of USACE.

LHAAP is located in central-east Texas, in Harrison County, between State Highway 43 at Karnack, Texas, and Caddo Lake. Figure 1-1 of the Work Plan shows the location of LHAAP and surrounding communities.

The objective of this TO is to perform investigations, collect data, perform remediation activities at multiple sites on an expedited basis to achieve site closures and bring as many sites as possible into the long-term management/long-term operation stage as early as possible. This Contractor Quality Control Plan (CQCP) documents quality control (QC) requirements that will be implemented during investigation and remediation of the former Pistol Range and LHAAP-04.

2.0 Contractor Quality Control Plan Purpose and Scope

2.1 Contractor Quality Control Plan Purpose

This CQCP establishes procedures that enable common project field activities to be completed successfully and documents QC requirements for services provided by Shaw and its subcontractors during project activities at the former Pistol Range and LHAAP-04. This plan describes requirements for organizing, planning, performing, reviewing, documenting, and reporting activities that may affect the quality of the work. This CQCP applies the specific requirements of Shaw's Contractor Quality Control (CQC) System to this project by establishing controls for:

- QC staff organization and authority
- Workmanship
- Construction activities for major definable features of work
- Records
- Inspections and tests
- Documentation
- Audits
- Subcontractor performance

This plan references standard field procedures, policies, regulations, and practices required to implement the work. A controlled copy of applicable Field Procedures from Appendix D (Final Installation-Wide Work Plan, Longhorn Army Ammunition Plant, Shaw, 2006) will be available as a reference document.

2.2 Contractor Quality Control Plan Scope

This CQCP is applicable to the work proposed at the former Pistol Range and LHAAP-04, including the major definable features of site work (or major project tasks) identified below:

Task 1 – Mobilization and Site Setup
Task 2 – Monitoring Well Abandonment
Task 3 – Soil Excavation and Disposal
Task 4 – Soil Sampling
Task 5 – Direct Push Technology (DPT) Sampling
Task 6 – Investigation-Derived Waste Management
Task 7 – Concrete Removal
Task 8 – Monitoring Well/Compliance Well Installation
Task 9 – Groundwater Sampling
Task 10 – Surveying
Task 11 – Site Restoration and Demobilization

2.3 Acceptance of Contractor Quality Control Plan

Work within the scope of this plan will not be started prior to providing this CQCP to USACE, unless otherwise permitted by USACE. Any proposed changes to this CQCP will require notification to USACE in writing. Proposed changes are subject to the approval of USACE.

3.0 Organization and Responsibilities

3.1 Personnel and Structure

The Contractor Quality Control System Manager (CQCSM) coordinates implementation of this CQCP with the Site Superintendent, Remediation Manager, and the Project Manager.

3.2 Duties and Responsibilities

The duties and responsibilities of personnel with regard to the CQC program are briefly outlined below. Duties and responsibilities of health and safety personnel are presented in Appendix A, Health and Safety Plan (HASP) (Shaw, 2006).

Project Manager: The Project Manager is responsible for all activities on the project, and directs and monitors the Site Superintendent in planning, coordinating, and controlling the work. The Project Manager has overall responsibility for establishing the CQCP and for its implementation, and he has the authority to access the required resources throughout Shaw to ensure compliance with the contract requirements.

Remediation Manager: The Remediation Manager will direct investigation and remediation activities and will be responsible for the overall preparation of submittals related to investigation and remediation activities. This individual will direct the technical staff during daily operations. He/she will coordinate and supervise human health/ecological risk assessment activities, feasibility studies, and decision documents and will ensure that regulatory requirements are met and will support the Project Manager with regulatory interaction. Other responsibilities include overseeing drilling, geologic interpretation, and required modeling.

Project Hydrogeologist: The Project Hydrogeologist reports to the Remediation Manager and is responsible for site investigation technical assurance. This individual will oversee the site investigation activities. The project hydrogeologist has the following duties and authorities:

- Plan and oversee site drilling and monitoring well installation
- Select the well screening intervals
- Perform and/or oversee the purging and sampling of newly installed monitoring wells and existing monitoring wells
- Perform and/or oversee the preservation, packaging, and shipping of samples to an off-site, fixed laboratory for environmental analyses
- Ensure documentation accuracy, completeness, and consistency among field team members

- Stop work that deviates from the contract documents or is otherwise nonconforming or unsafe.

CQCSM: The CQCSM is responsible for the overall management of the project CQC program during field activities. Depending on the extent of on-going field work, the CQCSM may perform dual roles of CQC management and site safety management. When serving as CQCSM/Site Safety Officer (SSO), this individual receives administrative and day-to-day direction from the Remediation Manager. This individual is responsible to the Shaw Program QC Manager for direction on matters that may affect the QC requirements for the project and to the Shaw Program Health and Safety Manager for safety-related matters. The CQCSM/SSO is assigned the following duties:

- Monitor and verify that the work is performed in accordance with the contract requirements
- Review and verify the disposition of discrepancy and corrective action reports
- Perform QC inspections and surveillance, and report daily on project QC
- Monitor project submittals in accordance with submittal register requirements
- Submit QC reports to the USACE Field Representative/Quality Assurance Representative (QAR) on a daily basis, unless other arrangements are agreed to by the USACE

The CQCSM has the authority to reject materials and workmanship that do not comply with project requirements, and to stop nonconforming work activities (see **Figure 3-1**). This individual will also verify conformance with the HASP.

Site Superintendent: The Site Superintendent is responsible to the Remediation Manager and the Project Manager for day-to-day supervision of the on-site remedial activities. The Site Superintendent's involvement in QC includes communicating the necessity of quality workmanship in all remedial activities to the on-site project staff.

Program QC Manager: The Program QC Manager is responsible to review, monitor, and report the conformance to QC requirements set forth in the CQCP. He may also advise the CQCSM on QC methods and practices. He will maintain a record of his quality monitoring activities and will inform the CQCSM of his monitoring activities. He shall also be responsible for performing periodic internal audits, and reporting his findings to the CQCSM.

Subcontractors: Shaw assumes overall responsibility for conformance to the quality requirements for the subcontracted items and services. Subcontractors are responsible to the Project Manager and Remediation Manager for completing the portion of work assigned to them,

and to the CQCSM for CQCP activities. They shall verify that their construction and materials comply with the requirements of the contract plans and specifications. Subcontractors include organizations supplying quality-related items or services to the project.

3.3 Qualification of Personnel

Shaw personnel assigned to the project are qualified to perform the tasks to which they are assigned. The Project Manager and the Remediation Manager will appraise the qualification of professional and/or technical personnel assigned to the project. The appraisal will include the comparison of the requirements of the job assignment with the relevant experience and training of the prospective assignee.

Shaw Environmental, Inc.
3010 Briarpark, Suite 400
Houston, Texas 77042

To:	William Squire
From:	John W. Patin, QC Manager
Date:	August, 2009
Subject:	Contractor Quality Control System Manager, Letter of Authority U.S. Army Corps of Engineers, Tulsa District MARC Contract No. W912QR-04-D0027, Task Order No. DS02

This letter describes the responsibilities and authority delegated to you in your capacity as the Contractor Quality Control System Manager for Site Closure of Multiple Sites at Longhorn Army Ammunition Plant, Karnack, Texas.

In this position, you are responsible for the implementation and enforcement of the CQCP and site specific addenda. You will use the plan to verify that the quality of materials, workmanship, operations, and safety monitoring conforms to the Work Plan, its appendices, and addenda.

Your responsibilities include identifying and reporting quality problems, rejecting nonconforming materials, initiating corrective actions, and requesting solutions for nonconforming activities. You have the authority to control or stop project activities until satisfactory disposition and implementation of corrective actions are achieved. Detailed responsibilities and guidelines are given in the Work Plan, its appendices, and addenda.

Figure 3-1
Letter of Authority

4.0 Contractor Quality Control Systems

4.1 Control Measures

The CQCP provides measures to verify and document that the work performed complies with the requirements specified in the contract documents. These measures include:

- CQC inspections
- Document control
- Submittals
- Completion inspection
- Records

Procedures for implementing the above measures are included throughout the CQCP. The CQCP may be supplemented by additional guidelines or instructions for implementing the work and/or verifying compliance with the contract requirements.

4.2 Quality Control Monitoring

The project CQC program is monitored to verify that the program is in compliance with the CQCP. Monitoring activities are performed by the Shaw Program QC Manager, or his representative, and include the review of daily QC reporting and instructions, or directions given to the CQCSM on QC matters. If required, an assessment of the project's CQC system is performed. If performed, the assessment includes the following items:

- Subcontractor performance
- Field operation and records
- CQC and health and safety inspections, testing, and records
- Document control
- Training records

4.3 Quality Control Testing

As applicable, the CQCSM monitors the equipment/materials testing firm and/or analytical laboratory activities to verify the following:

- Execution of required tests
- Location of tests
- Timely and accurate reporting of test results
- Correct frequency of tests
- Completeness of documentation

5.0 Inspection Plan

QC inspections include inspection of equipment, materials, testing procedures, documentation/submittals, and workmanship before, during, and after each definable feature of work. QC inspections are performed by the CQCSM in accordance with the Three-Phase Contractor Quality Control System. The CQCSM gives the USACE QAR advance notification (at least 24 hours) of formal inspections.

Definable features of site work (or major work tasks) for which QC inspections will be performed are addressed below.

Definable Features of Site Work:

Task 1 – Mobilization and Site Setup
Task 2 – Monitoring Well Abandonment
Task 3 – Soil Excavation and Disposal
Task 4 – Soil Sampling
Task 5 – DPT Sampling
Task 6 – Investigation-Derived Waste Management
Task 7 – Concrete Removal
Task 8 – Monitoring Well/Compliance Well Installation
Task 9 – Groundwater Sampling
Task 10 – Surveying
Task 11 – Site Restoration and Demobilization

Other site remediation activities that constitute definable features of site work will be defined within site-specific addenda to the work plan. Those addenda will also identify related QC inspection requirements.

5.1 Task 1 – Mobilization and Site Setup

Following approval of the Work Plan, Shaw will mobilize the necessary personnel and equipment to prepare the site for investigation activities. Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Site personnel have the necessary Occupational Safety and Health Administration (OSHA) training and medical surveillance statements/certifications
- Heavy equipment (e.g., drilling rig) has undergone safety and preventive maintenance checks, and is suitable for the task for which it will be used.
- Measuring and test equipment has undergone calibration and/or calibration checks to assure accuracy and precision.

- The project team understands the investigation/remediation requirements.
- Site personnel have received a HASP by the SSO and have acknowledged this review by signing the HASP acknowledgment form.
- Installed government property plan (when applicable) is reviewed and implemented for the equipment to be installed on site.
- Work zones and decontamination facilities are established in accordance with the HASP.
- Material storage areas are kept orderly.
- Site security measures are adequately maintained to prevent unauthorized access.
- Work zones are clearly demarcated using temporary barricading or fencing as required.

Once the site is mobilized and set up, field activities will commence.

5.2 Task 2 – Monitoring Well Abandonment

Shaw will abandon monitoring wells that were installed during any investigation and remediation activities as needed. Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Preparatory meetings are held with work crews to discuss the regulatory requirements for well abandonment.
- Personnel associated with this task have applicable OSHA training and medical surveillance certifications.
- Worker protection is adequate for the associated task hazards.
- Abandonment activities will employ a well driller licensed in the state of Texas.
- Well abandonment materials and equipment are suitable and approved for use prior to starting the work.
- Well locations and top of casing elevations are verified and recorded in a logbook prior to abandonment.
- Required agency permits and/or notifications are completed prior to starting abandonment activities.
- Waste generated during abandonment activities is handled and disposed according to the waste management plan.
- Quantity and depth measurements are made and recorded accurately the amount of grout used, depth below ground surface of the top of the grout once the grout

has settled and hardened, and the amount of cover soil placed and compacted above the top of the grout to re-establish a level ground surface.

- A multi-purpose completion report and/or well abandonment log is accurately completed for each abandoned well and submitted to the State of Texas. Copies are maintained in the project file until submitted to the USACE with the final report.

5.3 Task 3 – Soil Excavation and Disposal

Soil samples will also be collected from excavations for confirmation sampling. Contaminated soils will be excavated, removed and disposed off site. Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Underground utilities are marked and digging permits are obtained prior to excavation activities.
- Preparatory meetings are held with work crews to discuss the scope of work for excavation and removal of contaminated soil.
- Personnel associated with this task have applicable OSHA training and medical surveillance certifications.
- Worker protection is adequate for the associated task hazards.
- The excavations boundaries are marked in the field for each location and the proposed depths of excavations are confirmed prior to excavation activity.
- Field documentation is legible, accurate, and complete.
- Confirmation samples are screened using properly calibrated field instruments and selected samples are sent to off-site laboratory for confirmation analysis.
- Following confirmation sampling, the excavated areas are backfilled, compacted and tested the degree of compaction.
- The contaminated soils are staged at a designated place pending waste characterization and subsequent disposal.
- The excavation boundaries are surveyed by a surveyor licensed in the State of Texas.

Shaw will restore the sites to their original grade and condition as necessary.

5.3.1 Field Screening

The soil and groundwater samples will be screened in the field for confirmation and will be sent to a laboratory for confirmation analyses. Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Sampling personnel have reviewed the Chemical Data Acquisition Plan (CDAP) and understand the scope of work.
- The CQCSM/SSO has briefed sampling personnel on task hazards and the appropriate personal protective equipment (PPE) level before sampling screening begins.
- A sampling equipment checklist is developed for this task and is reviewed with sampling personnel before sampling begins.
- Field screening instrumentation is calibrated before the start of the work and at the end of the sampling day.
- Calibrated equipment will be uniquely identified by using either the manufacturer's serial number or other means.

Calibration records traceable to the equipment will be readily available for reference. In addition, the results of calibrations and records of repairs will be recorded in a logbook.

5.4 Task 4 – Soil Sampling

Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Sampling personnel have reviewed the CDAP (Shaw, 2006), Work Plan, and any related documents regarding the scope of work.
- The CQCSM/SSO has briefed sampling personnel on task hazards and the appropriate PPE level before sampling begins.
- A sampling equipment checklist is developed for this task and is reviewed with sampling personnel before sampling begins.
- The specified sampling equipment and materials are used for sample collection.
- Sampling equipment decontamination procedures are performed according to the CDAP.
- Sampling documentation procedures in the CDAP are followed and field documentation is legible, accurate, and complete.
- Quality assurance and QC samples are collected at prescribed frequencies in accordance with CDAP protocols and procedures.
- Sample labels, custody seals, and chain-of-custody forms contain pertinent sampling and analytical information before samples are packaged and shipped off site for laboratory analysis.
- Sampling and analytical records are maintained in the project file (in secured area).

- All field instruments are calibrated at the start of the testing day.

5.5 Task 5 – DPT Sampling

Shaw will penetrate the concrete slab and collect soil samples beneath the slab using DPT. Shaw will also collect soil samples using DPT near specific electric poles. Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Sampling personnel have reviewed the CDAP (Shaw, 2006), Work Plan, and any related documents regarding the scope of work.
- The CQCSM/SSO has briefed sampling personnel on task hazards and the appropriate PPE level before sampling begins.
- A sampling equipment checklist is developed for this task and is reviewed with sampling personnel before sampling begins.
- The specified sampling equipment and materials are used for sample collection.
- Sampling equipment decontamination procedures are performed according to the CDAP.
- Sampling documentation procedures in the CDAP are followed and field documentation is legible, accurate, and complete.
- Quality assurance and QC samples are collected at prescribed frequencies in accordance with CDAP protocols and procedures.
- Sample labels, custody seals, and chain-of-custody forms contain pertinent sampling and analytical information before samples are packaged and shipped off site for laboratory analysis.
- Sampling and analytical records are maintained in the project file (in secured area).
- All field instruments are calibrated at the start of the testing day.

5.6 Task 6 – Investigation-Derived Waste Management

Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Waste generated during the project activities will be segregated by type (e.g., soil cuttings, PPE, well development and purging liquids, trash/debris) and stored in approved 55-gallon drums or other containers.
- Waste containers are labeled with a waterproof marker according to the Work Plan, indicating the content, accumulation date, waste code(s) (if known) and pertinent analytical information.

- Waste handling activities are documented in the field logbook and a tracking log is prepared that indicates waste type, point of waste generation (i.e., well number) container size and type, accumulation date, storage location, disposal destination, transporter name, shipping paper/manifest number, and transportation and disposal dates.
- Waste containers are leak proof and stored in a secure storage area.
- Waste storage area is clearly demarcated using barricade tape and/or temporary barricade fencing, as required.
- Waste container and storage area inspections are performed on a weekly basis (at a minimum) and documented in the field logbook and/or in a standard inspection form.

5.7 Task 7 – Concrete Removal

If the concrete slab is contaminated, it will be excavated, removed and disposed off site. Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Underground utilities are marked and digging permits are obtained prior to excavation activities
- Preparatory meetings are held with work crews to discuss the scope of work for excavation and removal of contaminated soil.
- Personnel associated with this task have applicable OSHA training and medical surveillance certifications.
- Worker protection is adequate for the associated task hazards.
- The excavations boundaries are marked in the field for each location and the proposed depths of excavations are confirmed prior to excavation activity.
- Field documentation is legible, accurate, and complete.
- The excavated areas are backfilled, compacted and tested the degree of compaction.
- The contaminated broken-up concrete slab pieces are staged at a designated place pending waste characterization and subsequent disposal.
- The excavation boundaries are surveyed by a surveyor licensed in the State of Texas.

Shaw will restore the sites to their original grade and condition as necessary.

5.8 Task 8 – Monitoring Well/Compliance Well Installation

Groundwater monitoring well construction materials and specifications are provided in Appendix D (Shaw, 2006). The specifications conform to the following:

- Engineering and Design – *Monitoring Well Design, Installation, and Documentation at Hazardous, Toxic, and Radioactive Waste Sites*, EM 1110-1-4000 (USACE, 1998)
- Technical Requirements – *Locations and Standards of Completion for Wells*, Texas Administrative Code Title 16, Part 4, Chapter 76, Section 76.1000 (State of Texas, 2001)
- Monitor-Well Construction Specifications, Texas Administrative Code Title 30, Part 1, Chapter 330, Subchapter I, Section 330.242 (State of Texas, 1993)

Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Drilling locations are marked/staked in the field and verified against those in the approved drawings prior to well drilling.
- Underground utilities that transect the sites are located and marked, and their depths are known, so as to avoid damaging them during drilling activities.
- Digging permits (when applicable) are obtained prior to the start of work.
- Qualified drilling firms are procured to perform this task.
- The driller is licensed by the Texas Department of Licensing and Regulation and maintains a current license, in good standing.
- Personnel associated with this task have applicable OSHA training and medical surveillance certifications.
- The CQCSM/SSO has briefed personnel on task-specific hazards and the appropriate PPE to be worn and performed a job safety analysis for well drilling and installation.
- Drilling personnel have reviewed the HASP and signed the acknowledgement form.
- Task crews undergo preparatory briefing to verify their understanding of the scope of work and health and safety issues.
- Drilling team leader (i.e., Shaw Hydrogeologist) instructs the drilling crew of the depth of the well and its construction, and documents those instructions in the field notes.
- Drilling team leader documents the suitability of the construction materials.

- Construction materials meet specifications, are contaminant-free, and shipped/ received in good order.
- Well construction details are properly logged on forms and in the site logbook.
- Incomplete construction is protected from surface-water infiltration.
- Completed construction conforms to work plan requirements, specifications and drawings for well installation and surface completion.
- Generated soil cuttings, decontamination fluids, and contaminated PPE are handled and disposed of in accordance with the waste disposal requirements described in Section 3.7 of the Installation-Wide Work Plan and Attachment 10 of Appendix D, and state and federal regulations.
- Adjacent ground surfaces are protected from spillage during drilling operations.
- Well filter pack, bentonite, and grout volumes are calculated and documented in the field log book.
- Bentonite seal and grout is allowed to hydrate/cure sufficiently prior to beginning well development.
- Monitoring well development equipment, methods, and stabilization measurements are performed in accordance with the CDAP (Shaw, 2006).
- Well development fluids are handled, characterized, and disposed of in accordance with the requirements addressed in section 2.8 of the Work Plan, and state and federal regulations. Field screening requirements are listed in **Section 5.3.1** of this CQCP. Additional information on field screening procedures is found in Appendix D, Attachment 1 (Shaw, 2006).
- Disturbance of property surrounding drilling site is minimized.

Ground water sampling will commence following monitoring well installation and development.

5.9 Task 9 – Groundwater Sampling

Following the installation of groundwater monitoring wells, Shaw will collect groundwater samples for laboratory analyses. Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Sampling personnel have reviewed the CDAP and Work Plan and understand the scope of work.
- The CQCSM/SSO has briefed sampling personnel on task hazards and the appropriate PPE level before sampling begins.

- A sampling equipment checklist is developed for this task and is reviewed with sampling personnel before sampling begins.
- Well depth and depth-to-water measurements are performed consistently from a common location at top-of-well casing (e.g., notch in top of casing or northern lip of casing).
- Well water volume is calculated accurately using well measurements.
- Well is purged of the required quantity of well water and water quality is stabilized as defined by the CDAP prior to sample collection.
- Purged water is contained in drums and managed in accordance with Work Plan waste handling requirements. Field screening procedures is found in Appendix D, Attachment 1.
- The specified sampling equipment and materials are used for sample collection.
- The sampling team leader (i.e., Shaw Hydrogeologist) has instructed samplers on the sampling procedures and protocols and has assigned specific duties and responsibilities to each team member.
- Sampling equipment decontamination procedures are performed according to the CDAP.
- Sampling documentation procedures in the CDAP are followed and field documentation is legible, accurate, and complete.
- Quality assurance and QC samples are collected at prescribed frequencies in accordance with CDAP protocols and procedures.
- Sample labels, custody seals, and chain-of-custody forms contain pertinent sampling and analytical information before samples are packaged and shipped off site for laboratory analysis.
- Sampling and analytical records are maintained in the project file (in secured area).
- All field instruments are calibrated at the start of the testing day.

5.10 Task 10 – Surveying

Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- A qualified land surveyor licensed by the State of Texas is employed to perform well surveying.
- Survey datum (vertical and horizontal) used is consistent with the work plan requirements and/or historical datum.

- Survey team undergoes preparatory meeting to verify their understanding of the scope of work.
- Surveying equipment is operative and properly calibrated.
- Instrument calibration is performed per manufacturer instructions.
- Survey points are clearly marked or labeled (e.g., notch in the top of casing and/or brass surveying marker embedded in surface pad).
- Field documentation is legible, accurate, and complete.
- Worker protection is adequate for the associated task hazards.

For identifying locations of soil samples and limits of excavation, a Global Positioning System (GPS) may be used in lieu of land surveying. Using the Three-Phase CQC system, the CQCSM will monitor this task to affirm the following:

- Survey team undergoes preparatory meeting to verify their understanding of the scope of work.
- Surveying equipment is operative and properly calibrated.
- Instrument calibration is performed per manufacturer instructions.
- Survey points are clearly marked or labeled
- Field documentation is legible, accurate, and complete.
- Worker protection is adequate for the associated task hazards.

5.11 Task 11 – Site Restoration and Demobilization

Shaw will restore the site and demobilize once response complete is attained. Using the Three-Phase CQC System, the CQCSM will affirm the following:

- Equipment installed for the purposes of this project, and not intended to be operated after this project is demobilized.
- Information for remaining equipment or installed materials has been submitted to LHAAP and USACE.

5.12 Other Site Remediation Tasks

Shaw will perform various site remedial activities to include optimizing the existing on site groundwater treatment plant, soil/groundwater flushing, and instituting bioremedial solutions where applicable. Using the Three-Phase CQC system, the CQCSM will monitor these tasks as

appropriate. Specific QC requirements for these tasks will be identified in site-specific addenda to the work plan.

6.0 Document Control

6.1 Documentation

The CQCSM maintains current records of QC activities and tests performed, including those of suppliers and subcontractors. The records will be maintained as evidence that required control measures and tests have been performed, and indicate the results of the activities. Photographic documentation is also maintained for this project in accordance with **Section 6.4** of this plan.

6.2 Daily CQC Report

A Daily CQC Report is completed and maintained by the CQCSM using a standard form. The form is provided in **Attachment 1**. As applicable, standard forms used to document safety, technical, and operations aspects of daily field activities will be attached to the Daily CQC Report.

6.3 Daily Weather Conditions/Lost Time Report

A Daily Weather Conditions/Lost Time Report is prepared daily by the CQCSM. A report form is provided at the end of this section. Lost time will be logged into the report in increments of 25% (in other words, 0%, 25%, 50%, 75% or 100%). The amount of lost time incurred will be agreed upon and initialed by the CQCSM and the Corps of Engineers' QAR or Technical Manager overseeing the project work. Upon completion of the report for the specified period of time, one copy of the report should be submitted to the QAR/Technical Manager once each month during fieldwork and an extra copy should be maintained by the CQCSM for future reference.

6.4 Photographs

The CQCSM will photograph the project activities. Photographs will be taken on a regular basis during the course of the project to document the work, events, and equipment used. The frequency and number of pictures taken will depend upon the activities occurring and the amount of documentation needed. The Project Manager or Remediation manager will use judgment to determine the frequency and number of pictures taken; however, a sufficient quantity of pictures will be taken to effectively document the TO.

Pictures will be taken using 35mm film or digital medium (using a digital camera or video camera). Photos will be documented on a project log (see standard form in **Attachment 1**), which includes the photo number, date, time, description of the task depicted, and the view direction (e.g., facing northwest). A copy of the photo log, pictures, slides/videos, and digital media will be maintained in Project Files.

6.5 Review of Vendor Submittals

Vendors and subcontractors are required to expeditiously submit items such as drawings, test data, and specifications to Shaw for review to enable timely submittals to USACE. Shaw technical and CQC personnel review each submittal for compliance with contract documents. If acceptable, the item is stamped or indicated as such, and forwarded to USACE for review and acceptance.

If unacceptable, errors or deficiencies are identified and returned to the vendor or subcontractor for correction. The corrected document is resubmitted to Shaw for review until it meets contract requirements.

6.6 Government Property Accounting and Control

If applicable, Shaw will acquire, manage, and dispose of government property. At the completion of the project, all real property (removed and/or installed) will be listed on a Property Inventory Sheet.

6.7 Submittals

The Project Manager, Remediation Manager, the Program Controls Engineer, and the CQCSM are responsible for project submittals. A submittal register prepared for this project is given in **Figure 6-1**.

SUBMITTAL REGISTER

DACA56-94-D-0020
TO No. 0109

TITLE AND LOCATION: **Longhorn Army Ammunition Plant – Former Pistol Range and LHAAP-04**

CONTRACTOR: Shaw Environmental Inc.

				TYPE OF SUBMITTAL									CLASSI-FICATION			CONTRACTOR SCHEDULE DATES			CONTRACTOR ACTION			GOVT. ACTION		
TRANSMITTAL NO a.	ITEM NO b.	SPEC PARA NO c.	DESCRIPTION OF ITEM SUBMITTED d.	DATA e.	DRAWINGS f.	INSTRUCTIONS g.	SCHEDULES h.	STATEMENTS i.	REPORTS j.	CERTIFICATES k.	SAMPLES l.	RECORDS m.	INFO ONLY n.	GOVT. APPROVED o.	REVIEWER p.	SUBMIT q.	APPROVAL NEEDED BY r.	MAT'L NEEDED BY s.	CODE t.	DATE u.	SUBMIT TO GOVT v.	CODE w.	DATE x.	REMARKS
			Work Plan (and Appendices)		X	X	X							X		Per Project Schedule								
			Site Personnel OSHA Medical & Training Certificates							X		X	X			Prior to start of work								
			CQC and Safety Reports						X				X			Daily								
			Well Construction Methods/Specifications	X	X								X			Per Work Plan								
			Transporter ID, Insurance Cert							X			X			Prior to subcontract award								
			Manifests/Shipping Papers									X	X			Prior to shipment								
			Disposal Facility ID	X									X			Prior to subcontract award								
			Environmental Inspection Sheets									X	X			Per Work Plan								
			Groundwater Sampling Results	X					X				X			Upon data evaluation								
			Survey Drawings (As-built)		X									X		Upon completion								
			Well Construction Completion Forms									X		X		To State of Texas within 30 days of construction completion								
			Well Abandonment Forms									X		X		To the State of Texas within 30 days of construction completion								
			Drilling Logs & Groundwater Sampling Forms									X				With Daily QC Reports								

Figure 6-1
Submittal Register

7.0 Subcontractor Quality Control

Subcontractors for this project are responsible for compliance with the QC requirements of their respective subcontract. Subcontractors include organizations supplying quality related items or services to the project. Shaw assumes overall responsibility for conformance to the quality requirements for the subcontracted items and services.

Subcontract documents should include the requirements for personnel qualifications, technical performance levels, QC procedures, acceptability criteria, and documentation. The CQCSM, or his designee, reviews the subcontract procurement documents to verify that the QC requirements are communicated to the subcontractor.

Each subcontractor is required to identify an adequately qualified individual within the organization to perform QC duties. The qualifications of this individual are submitted to the CQCSM for review and approval. The CQCSM coordinates the QC functions with the designated subcontractor QC representative. The Project Manager, or his authorized designee, assists the CQCSM in managing subcontractor QC.

The CQCSM is responsible for the performance of inspections, surveillance, document reviews, audits, and other QC functions to verify compliance with the subcontract requirements. These activities are documented on inspection reports, checklists, audit reports, field logs, or other forms appropriate to the function performed.

For field operations, the CQCSM performs QC inspections before, during, and after the subcontractor activities, to the extent required, to verify that the subcontractor is in compliance with the QC requirements of the contract and the applicable subcontract documents.

Audits of subcontractor activities are conducted by the CQCSM as necessary to verify compliance with the CQCP. Objective evidence of conformance to the subcontract documents is reviewed during the audits.

8.0 References

Shaw Environmental and Infrastructure, Inc. (Shaw E & I), 2005, *Standard Operating Procedures: Technical, ShawNet and Intranet for the Shaw Group, Inc.*, Baton Rouge, Louisiana (February 2006).

Shaw Environmental, Inc. (Shaw), 2006, *Final Installation-Wide Work Plan, Longhorn Army Ammunition Plant, Karnack, Texas*, Houston, Texas, January.

State of Texas, 2001, Administrative Code Title 16, Part 4, Chapter 76, Section 76.1000, *Technical Requirements – Locations and Standards of Completion for Wells*, Austin, Texas.

State of Texas, 1993, Texas Administrative Code Title 30, Part 1, Chapter 330, Subchapter I, Section 330.242, *Monitor-Well Construction Specifications*, Austin, Texas.

U.S. Army Corps of Engineers, 1998, *Engineering and Design – Monitoring Well Design, Installation, and Documentation at Hazardous, Toxic, and Radioactive Waste Sites*, EM 1110-1-4000.

Attachment 1

Field Forms

- Preparatory Inspection Check List
- Initial/Follow-Up Inspection Form
- Final Inspection Form(s)
- Daily Contractor Quality Control Report
- Daily Weather Conditions/Lost Time Report
- Photo Log Form
- Corrective Action Report

PREPARATORY INSPECTION CHECKLIST

Shaw Environmental, Inc.
3010 Briarpark Drive
Houston, Texas 77042

Project Name:_____
Project Location_____
Project No.:_____

Plan or Specification Title/Section:_____ **Drawing Nos.:**_____

A. Personnel present *(use back of form to list additional personnel)*

Name	Position	Company

B. Submittals involved: *(use back of form to list additional submittals)*

Number and Type	Description	Indicate Contractor of Government Approval

C. Are all materials on hand and in accordance with approvals: ☐ Yes ☐ No
List all deficiencies:

_____
_____
_____

D. Test required: (list/reference all quality control tests with their required frequencies):

_____
_____
_____

E. Accident prevention preplanning (list all health and safety items discussed):

_____
_____
_____

CQCSM: _____

INITIAL/FOLLOW-UP INSPECTION FORM

Shaw Environmental, Inc.
3010 Briarpark Drive
Houston, Texas 77042

Project Name:_____
Project Location_____
Project No.:_____

(check one)

INITIAL PHASE CHECK LIST ☐ **OR**
FOLLOW-UP PHASE CHECK LIST ☐

Plan or Specification Section:_____ Drawing Nos.:_____

A. Personnel present:

Name	Position	Company

B. Materials are in strict conformance with contract specifications: ☐ Yes ☐ No
If no, explain:

C. Work being performed is in strict conformance with contract specifications: ☐ Yes ☐ No
If no, explain:

D. Workmanship is acceptable: ☐ Yes ☐ No
If improvement is needed, explain:

CQCSM: _____

FINAL INSPECTION FORM

Shaw Environmental, Inc.
3010 Briarpark Drive
Houston, Texas 77042

Project Name:_____
Project Location_____
Shaw Project No.:_____

FINAL INSPECTION FORM

Plan or Specification Title/Section:_____Drawing Nos.:_____

Inspected Work (list feature(s) of work inspected):

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

Performance Specification by Contract Delivery Order Reference	Status of Inspection

On behalf of Shaw, I certify that the work inspected is complete and meets the performance specifications cited above and that all material and equipment used and work performed was completed in accordance with approved plans and work instructions and meets contract delivery order requirements.

CQCSM _____ Date_____/_____/_____

Site Manager_____ Date_____/_____/_____

DAILY CONTRACTOR QUALITY CONTROL REPORT

Shaw Environmental, Inc.
3010 Briarpark Drive
Houston, Texas 77042

Project Name:_____
Project Location:_____
Shaw Report No.:_____

WEATHER: ( ) Clear ( ) P. Cloudy ( ) Cloudy
Wind_____
Temperature: High_____ Low_____
Precipitation: Today_____ Previous Period (i.e., weekend)_____
Site Conditions:_____
Lost Time Due to Inclement Weather: _____%

PRIME CONTRACTOR/SUBCONTRACTORS AND AREAS OF RESPONSIBILITY/LABOR COUNT:
(Include number, trade, hours, employer, location, and description of work.)

a.

b.

c.

d.

e.

f.

WORK PERFORMED: (Include location and description of work performed including equipment used. Refer to work performed by prime and/or subcontractors as previously designated by letter above. Attached subcontractor daily activity reports when applicable):

MATERIALS AND/OR EQUIPMENT DELIVERED: (Include a description of materials and/or equipment, quantity, date/hours used, date of safety check, and supplier)

Page 1 of 3

RESULTS OF SURVEILLANCE: (Include satisfactory work completed or deficiencies with action to be taken.)
a. Preparatory Inspection: (Attach Minutes)

b. Initial Inspection: (Attach Minutes)

c. Follow-up Inspection: (List results of inspection compared to specification requirements.)

d. Safety Inspection: (Include safety violations and corrective actions taken.)

OFF-SITE SURVEILLANCE ACTIVITIES: (Include action taken.)

QC TESTS PERFORMED AND RESULTS: (As required by plans and/or specifications.)

VERBAL INSTRUCTIONS RECEIVED OR GIVEN: (List any instructions received from government personnel or given by Shaw on construction deficiencies identified, required retesting, etc., and the corresponding action to be taken.)

CHANGED CONDITIONS/DELAYS/CONFLICTS ENCOUNTERED: (List any conflicts with the delivery order [i.e., Scope of Work and/or drawings], delays to the project attributable to site, and weather conditions, etc.)

Page 2 of 3

SUBMITTALS REVIEWED: (Include submittal number, specification reference, and name of submitter.)

MEETINGS: (List the meetings, i.e., Health and Safety, Site Operations, Cost/Schedule, etc.)

VISITORS:

REMARKS: (Any additional information pertinent to the project not defined by the previous entries.)

CONTRACTOR'S VERIFICATION: The above report is complete and correct. All material and equipment used and work performed during this reporting period are in compliance with the contract plans and specifications except as noted above.

_____ _____/_____/_____

Shaw CQCSM (or designee) Date

Page 3 of 3

DAILY WEATHER CONDITIONS/LOST TIME REPORT

DAILY WEATHER CONDITIONS/LOST TIME REPORT FOR WEEK/MONTH OF_____

Contract No.:_____ Delivery Order No.:_____ Project:_____

Contractor:_____

DAY	DATE	W/C. L/T	% LOST	ACTIVITY DELAYED	REMARKS	CONCUR	
						CQCR	QAR
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							

Weather Conditions (W/C): R - Precipitation, C - Extreme Temperature, M - Muddy Site Conditions W - Extreme Winds
Other Lost Time Conditions (L/T): D - Demobilized, S - Standby

Representative of the Contractor_____

Representative of the Government_____

PHOTO LOG FORM

PROJECT PHOTO LOG

Project Name:_____ Project Location:_____ Project No.:_____

Photo No.	Date	Time	Task and Description	View Direction

CORRECTIVE ACTION REPORT

Shaw Environmental, Inc.
3010 Briarpark Drive
Houston, Texas 77042

Project Name:_____
Project Location:_____
Report No.:_____

DESCRIPTION OF PROBLEM:_____

PERSONNEL RESPONSIBLE FOR INVESTIGATIVE PROCESS:_____

RECOMMENDED CORRECTIVE ACTIONS:_____

PERSONNEL RESPONSIBLE FOR IMPLEMENTATION OF CORRECTIVE ACTIONS:_____

RESULTING ACTIONS AND EFFECTIVENESS OF THOSE ACTIONS:_____

PERSONNEL RESPONSIBLE FOR MONITORING EFFECTIVENESS OF CORRECTIVE ACTIONS:_____

FINAL DISPOSITION APPROVED BY:

Name:_____ Title:_____

Date:_____

Name:_____ Title:_____

Date:_____

COPIES TO:

Shaw® Shaw Environmental, Inc.

Date: ***August 17, 2009***

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 Site Investigation Report, LHAAP-03 (Waste Collection Pad Near Building 722-P, Paint Shop)**
Longhorn Army Ammunition Plant, Karnack, Texas

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

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

Item No:	*No. of Copies*	*Date:*	*Document Title*
1	2	August 2009	**Final Site Investigation Report, LHAAP-03 (Waste Collection Pad Near Building 722-P, Paint Shop)** Longhorn Army Ammunition Plant, Karnack, Texas

Aaron – Enclosed please find the final version of the above-named report for your records.

The document has been distributed according to the list below. Please call if any questions or comments.

Sincerely:

Praveen Srivastav
Project Manager

Distribution List:
Ms. Rose Zeiler – BRAC-LHAAP
Mr. Matthew Mechenes – AEC
Ms. Fay Duke – TCEQ (2)
Mr. Steve Tzhone – EPA (2)
Mr. Dale Vodak - TCEQ
Mr. Paul Bruckwicki –USFWS
Mr. John Lambert/Scottie Fiehler (distributed by A. Williams) - USACE

3010 Briarpark Drive, Suite 400, Houston, Texas 77042 ***Phone: (713) 996-4522/Fax: (713) 996-4436***

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

August 17, 2009

DAIM-BD-LO

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

Re: Final Site Investigation Report LHAAP-03 (Waste Collection Pad Near Building 722-P, Paint Shop), Longhorn Army Ammunition Plant, Karnack, Texas, August 2009

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 document has also been posted on Shaw's LHAAP Project Portal.

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, 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/S. Fiehler, USACE, Tulsa District, OK
M. Mechenes, USAEC, MD
A. Williams, USACE, Tulsa District, OK
P. Srivastav, Shaw, Houston, TX (for project files)

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

August 17, 2009

DAIM-ODB-LO

Ms. Fay Duke
Texas Commission on Environmental Quality
TCEQ Environmental Cleanup Section I, Team 2, MC-136
12100 Park 35 Circle, Bldg D
Austin, TX 78753

Re: Final Site Investigation Report LHAAP-03 (Waste Collection Pad Near Building 722-P, Paint Shop), Longhorn Army Ammunition Plant, Karnack, Texas, August 2009

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, 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/S. Fiehler, USACE, Tulsa District, OK
M. Mechenes, USAEC, MD
A. Williams, USACE, Tulsa District, OK
P. Srivastav, Shaw, Houston, TX (for project files)

Comments on Draft Final Site Investigation Report, LHAAP-03 (published September 2007)
(Waste Site at Building 722-P, Paint Shop)
Longhorn Army Ammunition Plant, Karnack, Texas

October 2007

Reviewers: Fay Duke, Texas Commission on Environmental Quality;
Scott Harris, U.S. Environmental Protection Agency, Region 6
Respondents: Shaw E & I, Inc.

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

Comment #	Page	Section/ Paragraph	Comment	C, D[1], E or X	Response	A or D[2]
Fay Duke, TCEQ, Letter dated October 15, 2007						
1	2-2	General	We note than an elevated concentration of lead was detected in the soil sample from the 0-0.5 foot interval at soil boring 03SB03-01. The concentration is present in excess of the Soil-Ind level of 1000 mg/kg, the GWP-Ind level of 1.5 mg/kg and the site-specific background concentration. Although several soil borings were installed in the area around the location of 03SB03-01, no lead analyses were performed for the shallow soil intervals. We believe additional assessment for surface soil within this area must be performed to fully delineate the affected surface soil.	C	Additional assessment was conducted as suggested. The document will be revised to incorporate the new data. In Section 2.0, the last sentence in paragraph 3, the last two sentences in paragraph four and the fifth paragraph were deleted (see response to TCEQ comment #4). Paragraphs 3 and 4 and 6 and 7 were combined to become the new paragraph 5. The following will replace paragraphs 3, 4, 5, 6, and 7 in **Section 2.0**: "The shop area is designated as LHAAP-58. This area also includes the vacuum truck parking (LHAAP-02), Building 722-P waste collection (LHAAP-03), the Pilot Wastewater Treatment Plant (PWTP, LHAAP-04), vehicle wash rack and oil/water separator (LHAAP-56), Building 725 (LHAAP-59), former pesticide storage buildings (LHAAP-60), water treatment plant effluent settling ponds (LHAAP-61), Building 209 (LHAAP-65), Building 401 transformer (LHAAP-66), mobile storage tank parking (LHAAP-68), and service station (underground storage tanks, USTs, LHAAP-69). Because LHAAP-03 is included within the LHAAP-35A(58) site, data from previous investigations of soil and groundwater near LHAAP-03 were included in the investigation of LHAAP-35A(58) (Shop Area) (Jacobs, 2002), and subsequent investigation results were summarized in the Plexus (2005) report. All sampling activities and analytical methods used to provide data for this report are described in the Installation-Wide Work Plan (Shaw, 2006a). At LHAAP-03, Shaw advanced six soil borings denoted 03SB01, 03SB02, 03SB03, 03SB04, 03SB05, and 03SB06 at locations shown in **Figure 1-2**. Borings 03SB01, 03SB02, and 03SB03 were sampled in August 2006, and a second sample (03SB01-01-R) was collected in September 2006 for reanalysis for SVOCs. Borings 03SB04, 03SB05, and 03SB06 were sampled in December 2006 for further investigation of lead in soil. Soil borings were advanced using a	A
1 *(cont.)*						

Comments on Draft Final Site Investigation Report, LHAAP-03 (published September 2007)
(Waste Site at Building 722-P, Paint Shop)
Longhorn Army Ammunition Plant, Karnack, Texas

October 2007

Reviewers: Fay Duke, Texas Commission on Environmental Quality;
Scott Harris, U.S. Environmental Protection Agency, Region 6
Respondents: Shaw E & I, Inc.

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

Comment #	Page	Section/ Paragraph	Comment	C, D[1], E or X	Response	A or D[2]
1 *(cont.)*					hand auger and two samples were collected from each boring at 0 to 0.5 feet below ground surface (bgs) and 3 to 4 feet bgs. In October 2007, surface soil samples were collected offset from the original soil samples (03SB04 through 03SB06) and identified as 03SB07 (offset from 03SB04), 03SB08 (offset from 03SB05), and 03SB09 (offset from 03SB06) as shown on **Figure 2-1**. Soil samples were collected from the 0 to 0.5 foot bgs interval and analyzed for metals. Maximum lead results were 505, 2320, and 75.4 milligrams per kilogram (mg/kg) respectively. The samples collected from 03SB07 and 03SB08 were also subjected to leaching tests. In December 2007, additional soil borings (03SB10 through 03SB17) were installed and soil samples analyzed for metals. Samples were collected from the 0 to 0.5 ft bgs interval, the 3 to 4 ft bgs interval and the 6 to 7 ft bgs interval surface. The sample collected at 03SB11-(6-7) exceeded the applicable MSCs for arsenic, lead, and mercury. (See **Table 3-5a**). In November 2008, a soil boring offset to 03SB11 was advanced using a hollow stem auger. Soil samples were collected at subsurface intervals 10 to 11 ft bgs and 14 to 15 ft bgs for vertical delineation. Total lead results were 4.15 and 4.39 mg/kg respectively. The boring was converted to monitoring well 03WW01 and a groundwater sample was collected and analyzed for total metals." The groundwater sampling results will be included in the final report as **Table 3-6**, a copy of which is attached. See response to TCEQ comment #3. A new **Figure 2-1**, Soil Sampling Results, will be included and is attached to this RTC for clarification.	

Comments on Draft Final Site Investigation Report, LHAAP-03 (published September 2007)
(Waste Site at Building 722-P, Paint Shop)
Longhorn Army Ammunition Plant, Karnack, Texas

October 2007

Reviewers: Fay Duke, Texas Commission on Environmental Quality;
Scott Harris, U.S. Environmental Protection Agency, Region 6
Respondents: Shaw E & I, Inc.

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

Comment #	Page	Section/ Paragraph	Comment	C, D[1], E or X	Response	A or D[2]
2 2 *(cont.)*	2-2	General	We note that several samples have concentrations of contaminants of concerns (COC) exceeding the GWP-Ind MSC. Under RRR Std 2, the person must demonstrate that contaminant of concerns in soil do not pose the potential for a future release of leachate in excess of the acceptable groundwater concentrations (GW-Ind). Because several compounds were detected at concentrations above the GWP-Ind in soil at several locations, one additional soil sample adjacent to the location of 03SB03-01 was collected in 2007 for soil and leachate analysis. However, we believe the additional sampling results were inconclusive because the soil concentrations of all metal compounds in the additional sample were much lower than the original sample (in some cases, they were two to three orders of magnitude lower than the original sample). We believe that additional samples are necessary to confirm soils in these areas are below the applicable MSC.	C	Additional soil samples were collected from the area around the 03SB03 location. Two samples collected within 10 feet of the 03SB03 location that showed high levels of total lead were from locations 03SB07 and 03SB08. SPLP analysis was conducted on these samples. Results are above the GW-Ind value and are presented in **Table 3-3**. A revised **Table 3-3** is attached. The last two paragraphs in **Section 2.0** have been revised as follows: "Sample 03SB03-01-SPLP was collected on May 4, 2007 at a location within 6 inches of the original sample location 03SB03-01 and subjected to the Synthetic Precipitation Leaching Procedure (SPLP) Method 1312 and total soil analyses. The samples collected from 03SB07 and 03SB08 in October 2007 were also subjected to leaching tests and total soil analysis. The SPLP leachate and the total sample were analyzed for metals and SVOCs by the above methods. Results of total soil and leachate analyses are described in **Sections 3.2** and **3.3**. Detailed sample collection and handling procedures are described in the Work Plan Addendum (Shaw, 2006b). Soil boring logs are attached in **Appendix A**." Shaw developed Standard 3 MSCs for chemicals in soil that are protective of groundwater at the Waste Collection Pad Site at Building 722-P, Paint Shop, LHAAP-03 using the Soil Attenuation Model (SAM). The MSC values were developed according to the TCEQ Texas Risk Reduction Rules, Title 30 Texas Administrative Code (TAC) Chapter 335 (30 TAC §335 and updates.) The Chemicals of Concern (COCs) at LHAAP-03, based on comparisons to MSCs for soil, are antimony, arsenic, barium, cadmium, chromium, copper, lead, and mercury. (See revised **Tables 3-1a** and **3-1b** attached.) **Sections 3.1.1, 3.2, 3.3,** and **4.0** have been revised and new sections (**Sections 3.4** and **3.5**) have been added. The sections are attached. The calculation of Standard 3 MSCs for these COCs that are protective of groundwater using the SAM model and associated tables will be included in a new **Appendix B** (attached).	A

Comments on Draft Final Site Investigation Report, LHAAP-03 (published September 2007)
(Waste Site at Building 722-P, Paint Shop)
Longhorn Army Ammunition Plant, Karnack, Texas

October 2007

Reviewers: Fay Duke, Texas Commission on Environmental Quality;
Scott Harris, U.S. Environmental Protection Agency, Region 6
Respondents: Shaw E & I, Inc.

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

Comment #	Page	Section/ Paragraph	Comment	C, D[1], E or X	Response	A or D[2]
3			We acknowledge that groundwater assessment in this area is being conducted as part of site LHAAP-35A(58). The closest monitoring wells located near soil boring 03SB03 are 35WW001, 35WW002 and LHSMW005. We note that lead concentrations excess of the MSC were previously detected in monitoring well 35WW002. These wells have been recently sampled and analyzed for organic compounds. However, based on our review of historical records, the last time these wells were sampled for metals was in 1998. In light of the recent soil sampling result, we believe the wells in this area should be sampled for metals to evaluate whether the groundwater are impacted with metal contaminants. Additional, as we previously commented in the Data Gap Report (Shaw Environmental Inc., April 2007), we believe that the extent of groundwater contamination at site LHAAP-35A(58) is not defined down gradient of LHSMW05 and LHSMW07. We believe additional wells should be installed and sampled for organic and metal constituents.	C	Noted. Groundwater issues related to LHAAP-35A(58) are addressed under the Feasibility Study for LHAAP-35A(58). Monitoring wells 35AWW01 (intermediate), 35AWW02 (deep), and the newly installed shallow monitoring well 35AWW08 are located upgradient of LHAAP-03, and are not expected to be impacted by LHAAP-03. Monitoring well 03WW01 was collocated with soil boring 03SB11 where a high lead concentration of 6,760 mg/kg was detected at a depth of 6 to 7 ft bgs. This is the most likely location where any groundwater impact may occur. Therefore, a monitoring well was installed at this location after collecting two deeper soil samples from the boring. A groundwater sample collected from the monitoring well showed 0.00575 mg/L for lead, below the MSC value of 0.015 mg/L, and 0.0414 mg/L for arsenic above the MSC of 0.01 mg/L. A new **Table 3-6, Comparison of Chemical Concentrations in Groundwater to TCEQ Medium-Specific Concentrations for Groundwater**, was added to the document. A copy of **Table 3-6** is attached. See response to TCEQ comment #1.	A
4		General	It is noted that previous soil samples collected in the area of stained soil west of Building 206, (near Building 722-P) was evaluated against the industrial outdoor worker Medium Specific Screening Levels established by USEPA Region 6 guidance. Please explain why EPA screening levels are being used if the site is to be closed under RRR Standard 2.	C	The reviewer is referring to paragraph 5 in Section 2.0, Field Investigations, on page 2-1. The purpose of this section is to discuss previous investigations in the area near LHAAP-03. Paragraph 5 discusses sampling of "stained soil" conducted by Plexus (2005) in the area. Plexus had collected a soil sample from the stained soil and compared the data to MSSLs. The results of the comparison are discussed in paragraph 5 based on the text in Section 3.1.2 of the Plexus (2005) report. However, a review of the sample location with respect to site LHAAP-03 revealed that the sample location was not near Building 722-P at LHAAP-03. In fact, the sample was located near Building 206, approximately 400 feet to the east of the site and across a road (see attached map, **Figure 3-2** [Plexus Report]). Please see attached map for reference. The sample is thus not relevant to site LHAAP-03 and the paragraph will be	A

Comments on Draft Final Site Investigation Report, LHAAP-03 (published September 2007)
(Waste Site at Building 722-P, Paint Shop)
Longhorn Army Ammunition Plant, Karnack, Texas

October 2007

Reviewers: Fay Duke, Texas Commission on Environmental Quality;
Scott Harris, U.S. Environmental Protection Agency, Region 6
Respondents: Shaw E & I, Inc.

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

Comment #	Page	Section/ Paragraph	Comment	C, D[1], E or X	Response	A or D[2]
					deleted from the document.	
5		General	Finally, please note that a deed certification must be filed in the county record in order to comply with the non-residential soil requirements for site closure/remediation under RR Standard 2. The deed certification must indicate that future land use is considered suitable for non-residential use. An example format of the deed certification is provided in 30 Texas Administrative Code §335.569.	C	Noted.	A
Scott Harris, EPA, email dated October 15, 2007						
1	2-1	Section 2.0	I found no discussion or illustration of the referenced (Plexus, 2005) "Surface and subsurface soil samples" collected from stained soil west of Building 206."	C	The fifth paragraph of Section 2.0 will be removed from the document since the sample from the "stained soil west of Building 206" is not associated with the site and is approximately 400 feet away.	
2	2-1	Section 2.0	What is the rationale for referencing Region 6 (2006) EPA guidance data in evaluating these data?	C	The fifth paragraph of Section 2.0 will be removed from the document since the sample from the "stained soil west of Building 206" is not associated with the site and is approximately 400 feet away.	
3	3-5	Section 3.0	The conclusion that "the soil concentration of arsenic at the 03SB03 location is protective of groundwater" requires a presumption of no future migration and bounding of the horizontal and vertical extent. Please clarify the understood local groundwater gradient to demonstrate whether the referenced monitoring wells used for the evaluation are close enough, downgradient and able to provide representative samples to support this.		The paragraph will be removed from the document. See response to TCEQ comment #2.	

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Longhorn Army Ammunition Plant, Karnack, Texas

October 2007

Reviewers: Fay Duke, Texas Commission on Environmental Quality;
Scott Harris, U.S. Environmental Protection Agency, Region 6
Respondents: Shaw E & I, Inc.

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

Comment #	Page	Section/ Paragraph	Comment	C, D[1], E or X	Response	A or D[2]
4	3-5	Section 3.0	Related to horizontal and vertical extent, there needs to be more discussion of how the single resample is seen as adequate to support the assertion that contamination is "highly localized."	C	A new **Section 3.5, COC Concentrations in Groundwater,** was added and is attached.	
5		General	Other issues relate specifically to the application of RRR Standard 2 by TCEQ. I concur with Fay on those, and will defer to her detailed comments.	C	Noted.	
Additional Proposed Change						
		General		N/A	The title of the "Draft Final Site Investigation Report, LHAAP-03 (Waste Site at Building 722-P, Paint Shop)" will be changed to "Final Site Investigation Report LHAAP-03 (Waste Collection Pad Near Building 722-P, Paint Shop)" to better describe the site.	

The distributions of background concentrations are shown in the Final Background Soil Study Report (Shaw, 2004) and are repeated in **Table 3-2**. If the background data have either the normal or lognormal distribution, the 95 percent UPL was calculated according to the equation (USEPA, 1992):

$$UPL_{0.95} = X + t_{n-1,0.95} \times S \times (1+1/n)^{1/2} \qquad \textbf{Equation 1}$$

where:

$UPL_{0.95}$	=	the 95 percent UPL
X	=	mean background concentration
$t_{n-1,0.95}$	=	Student's t value for n-1 degrees of freedom and 95 percent confidence
S	=	standard deviation of the mean
n	=	number of samples

If the data were shown to be both normally and lognormally distributed, the distribution having the higher p value above 0.05 was used for the 95 percent UPL calculation. If the data were lognormally distributed, the 95 percent UPL value used (**Table 3-2**) is the antilogarithm of the value calculated by **Equation 1**.

Nonparametric methods were used if the data do not have either the normal or lognormal distribution. The 95 percent UPL concentration was determined by ranking the data from highest to lowest and calculating the 95th percentile rank according to the equation:

$$UPL_{0.95} = 95^{th} \text{ percentile} = 0.95(n+1) \qquad \textbf{Equation 2}$$

where:

$UPL_{0.95}$	=	concentration occupying the 95th percentile rank
95th percentile	=	the 95th percentile rank of the of the data set
n	=	number of samples

This 95th percentile is the same as the 95 percent UPL according to the assumptions made in **Equation 1**.

3.1.1 Comparison of Chemical Concentrations to Medium-Specific Concentrations

Under the TCEQ RRR, future use of LHAAP as a wildlife refuge corresponds to commercial/industrial land-use standards. Therefore, the MSC concentrations used in the identification of soil COPCs are the Risk Reduction Standard 2 Soil Ingestion, Inhalation, and Dermal Contact for Industrial Use (SAI-Ind) and Groundwater Protection Standard for Industrial

Use (GWP-Ind) values (TCEQ, 2006). The MSC values are protective at a target risk level of 1E-06 for carcinogens and a target hazard quotient of 1 for noncarcinogens. In cases where contaminants have both carcinogenic and noncancer toxicity factors, the MSC represents the lower (more conservative) value.

The SAI-Ind MSC values are risk-based soil concentrations developed to protect human health from exposure via ingestion, inhalation, and dermal absorption pathways under commercial/industrial land-use assumptions. The GWP-Ind MSC values were developed to protect groundwater resources from leaching of chemicals from soil, and correspond to potential use of groundwater under commercial/industrial land use assumptions. As with SAI-Ind MSCs, the GWP-Ind values provided in TCEQ (2006) tables are the more conservative MSC if the chemical acts as both a carcinogen and a noncarcinogen.

3.2 Results of Comparisons to Regulatory Concentrations

The TCEQ risk-based MSCs used for COPC identification are given in TCEQ (1998) guidance and in current tables (TCEQ, 2006). The applicable MSCs (**Table 3-1a** and **3-1b**) represent the lower of the SAI-Ind and the GWP-Ind MSC values unless the MQL, or the lower of the surface and subsurface soil background concentrations is greater, in accordance with TCEQ guidance [30TAC§335.559(g)].

No VOCs were detected at concentrations above applicable MSCs (**Table 3-1a** and **3-1b**) in any sample analyzed, and are of no further concern at LHAAP-03. Fifteen SVOCs have SDL concentrations identified for diluted samples (03SB01-01-QC, 03SB02-01, and 03SB03-01), and were not detected in any of the undiluted samples (**Table 3-1a**). Results of reanalysis of sample 03SB01-01 without dilution (see sample 03SB01-01-R, **Table 3-1a**) showed that the soil at 03SB01-1 did not contain detectable SVOCs. A soil sample from location 03SB03-01 was also analyzed by the SPLP method as described in **Section 3.3**.

These SVOCs were identified as COPCs only as a result of the sample dilution, which raised the SQL above the Texas applicable MSC, and were not detected in undiluted samples from the same location (03SB01-01-R and 03SB01-02). Further, these SVOC are not related to LHAAP-03 processes, and thus, are considered to be of no further concern at LHAAP-03. Aluminum, beryllium, cobalt, manganese, nickel, selenium, silver, thallium, vanadium, and zinc were not detected with concentrations above applicable MSCs in any of the samples (**Table 3-1a** and **3-1b**). No metals were detected with concentrations above the MSCs in boring 03SB16.

Antimony, arsenic, barium, cadmium, chromium, copper, lead, or mercury were detected in one or more samples from 03SB01 through 03SB15, and 03SB17 with concentrations above applicable MSCs values. Sample 03SB03-01 contained the greatest number of metals with concentrations above applicable MSCs (**Table 3-1a**). Samples from 03SB11 contained the

second greatest number of metals above applicable MSCs (arsenic, barium, cadmium, chromium, lead, and mercury). Samples from 03SB09 contained arsenic, cadmium, chromium, and lead above applicable MSCs. Samples from 03SB014 contained cadmium, chromium, and lead above applicable MSCs. Samples from 03SB015 contained arsenic, cadmium, and lead above applicable MSCs. Samples from 03SB02, 03SB04, 03SB05, 03SB06, 03SB10, 03SB12, 03SB13, and 03SB17 contained only lead above the applicable MSC.

Samples from 03SB07 and 03SB08 contained arsenic, chromium, and lead above applicable MSCs. Because the samples from 03SB07 and 03SB08 collected in October 2007 contained lead at 95.8 milligrams per kilogram (mg/kg) and 2,320 mg/kg, respectively, samples 03SB07(0-0.5)R and 03SB08(0-0.5)R were collected from these locations and were subjected to SPLP tests as described below.

3.3 Synthetic Precipitation Leaching Procedure Analysis

The SPLP analyses were conducted to determine if constituents in the soil could potentially impact groundwater via leaching. Three samples from locations 03SB03, 03SB07, and 03SB08 were subjected to SPLP analysis. Sample 03SB03-01 contained all the metals that were detected above applicable MSCs, and had elevated SDL values above applicable MSCs for 15 SVOCs as a result of sample dilution (**Table 3-1a**). An additional sample (03SB03-01-Total) was taken from the original sample 03SB03-01 location and subjected to the SPLP test as provided in 30 TAC §335.559(g)(2)(B). The portion of sample 03SB03-01-Total that was subjected to SPLP analysis is designated as 03SB03-01-SPLP. SVOCs that were not detected in the original sample 03SB03-01, but which were identified as having SDL concentrations above applicable MSCs only because of dilution (**Table 3-1a**), are chemicals that have MQL values above the MSC values (GWP-Ind), and have MDL and MQL values that are within a factor of two. Results of the 03SB03-01-Total analysis are shown in **Table 3-3**. Results of SPLP analysis for 03SB03-01-SPLP are shown in **Table 3-4**. All SVOC compounds were nondetected in sample 030SB03-01-SPLP. All detected concentrations of metals in leachate from sample 030SB03-01-SPLP were below the applicable MSC for groundwater (GW-Ind) except arsenic, which exceeds the GW-Ind (**Table 3-4**). The arsenic concentration that exceeds the GW-Ind MSC in this sample suggests that leaching of arsenic from soil may threaten groundwater at LHAAP-03, although the arsenic concentration in the corresponding soil sample (03SB03-01-Total) is below applicable MSC levels (**Table 3-3**). However, the total concentrations of the COCs in the 03SB03-01-Total sample (**Table 3-3**) were significantly lower than the total concentrations in the original sample 03SB03-01. The SPLP results were, therefore, inconclusive and it was decided to repeat the SPLP analysis at two other locations.

Samples 03SB07(0-0.5)R and 03SB08(0-0.5)R contained lead concentrations of 505 mg/kg and 2,320 mg/kg, respectively. Results of SPLP test leachate analysis of samples 03SB07(0-0.5)R

and 03SB08(0-0.5)R are shown in **Table 3-4**. Concentrations of antimony, arsenic, lead, and zinc exceed GW-Ind values in leachate from sample 03SB07(0-0.5)R, and antimony, chromium, lead, and zinc exceed GW-Ind values in leachate from sample 03SB08(0-0.5)R suggesting that leaching of these metals from soil may threaten groundwater (**Table 3-4**). However, antimony and zinc concentrations in the corresponding soil samples 03SB07(0-0.5)R and 03SB08(0-0.5)R are below applicable MSC levels (**Table 3-1a** and **3-1b**). The concentrations of arsenic, chromium, and lead in both soil samples exceed applicable MSC levels.

3.4 Standard 3 Medium Specific Concentrations for Soil

Because soil concentrations and SPLP leachate concentrations of selected metals exceed screening values (**Tables 3-1a**, **3-1b, 3-3**, and **3-4**), and published MSCs and SPLP test are considered conservative, Standard 3 MSCs were developed for all COCs in soil at LHAAP-03 (antimony, arsenic, barium, cadmium, chromium, copper, lead, and mercury, see **Section 2**). Standard 3 MSC values that are protective of groundwater were developed using the Soil Attenuation Model (SAM) according to the TCEQ Risk Reduction Rules (30 TAC §335 and updates). The development of Applicable Standard 3 Commercial/Industrial Soil MSCs using the SAM model is described in **Appendix B**.

Concentrations of COCs in soil were compared to Applicable Standard 3 Commercial/Industrial Soil MSCs developed using SAM calculations as shown in **Table 3-5a** and **3-5b**. Soil borings where COC concentrations exceed their Applicable Standard 3 Commercial/Industrial Soil MSCs are shown in **Figure 2-1**.

Concentrations above MSCs were measured at 03SB03 (antimony, arsenic, cadmium, copper, lead, and mercury), 03SB07 (arsenic and lead), 03SB08 (arsenic and lead), 03SB09 (arsenic and cadmium), 03SB11 (arsenic, lead, and mercury), 03SB12 (arsenic and cadmium), and 03SB15 (arsenic and lead). COC concentrations were confined to surface soil (<0.5 feet bgs) except at 03SB11 and 03SB15.

Boring 03SB11 contained arsenic, lead, and mercury above MSCs at 6 to 7 feet bgs.

Boring 03SB15 contained elevated lead concentrations at 0.5 feet bgs and arsenic concentrations at 6-7 feet bgs (**Table 3-5a** and **3-5b**). Soil at Boring 03SB15 contained lead concentrations in the upper 0.5 feet bgs (150 mg/kg) above the Applicable Standard 3 MSC (130 mg/kg) (**Figure 2-1**). However, the lead concentrations in soil at 3 to 4 feet bgs (14.1 mg/kg) and at 6 to 7 feet bgs (60 mg/kg) are below the MSC at this boring. Arsenic concentrations at all three elevations in this boring (3.84 mg/kg, 1.77 mg/kg, and 7.62 mg/kg) are similar to the background concentration (5.9 mg/kg, **Appendix B**, Table B-5).

3.5 COC Concentrations in Groundwater

Groundwater data from the new well 03WW01 installed at LHAAP-03 in 2008 (**Figure 2-1**) was further evaluated for the potential transport of COC concentrations to groundwater at LHAAP-03. Groundwater samples from well 03WW01 were analyzed for all COCs identified in soil at LHAAP-03 (antimony, arsenic, barium, cadmium, chromium, copper, lead, and mercury, see **Section 3**).

Results of analysis of groundwater samples collected from well 03WW01 in November 2008 for metals (**Table 3-6**) indicate that arsenic was detected at a concentration of 0.0414 milligrams per liter (mg/L), which exceeds the MCL concentration of 0.010 mg/L. All other metals were either not detected or were detected with concentrations below their respective GW-Ind values (**Table 3-6**). These comparisons indicate that the Applicable Standard 3 MSCs developed in **Appendix B** are consistent with protection of groundwater for antimony, barium, cadmium, chromium, copper, lead, and mercury.

4.0 Results and Conclusions

All concentrations of chemicals are below SAI-Ind MSC values for soil at all sampling locations, except where the Applicable TCEQ Risk-Based MSC equals the MQL or the background concentration for a chemical (**Table 3-1a** and **3-1b**). No VOCs were detected at concentrations above applicable MSCs (**Table 3-1a** and **3-1b**) in any sample analyzed, and are of no further concern at LHAAP-03.

Concentrations of 15 SVOCs exceed SDL values for diluted samples (03SB01-01-QC, 03SB02-01, and 03SB03-01), but were not detected in any of the undiluted samples. Subsequent reanalysis of one sample without dilution (03SB01-01-R) showed that soil at this location did not contain detectable SVOCs.

The results of SPLP tests and SAM modeling efforts indicate the potential for transport of metals from soil to groundwater. The results of SPLP tests suggest that arsenic from soil at the 03SB03-01 location may threaten groundwater (**Table 3-4**) although the arsenic concentration in the corresponding soil sample (03SB03-01-Total) is below applicable MSC levels, which corresponds to background (**Table 3-3**).

Concentrations of antimony, arsenic, lead, and zinc exceed GW-Ind values in SPLP leachate from samples 03SB07(0-0.5)R and 03SB08(0-0.5)R and indicate potential leaching to groundwater (**Table 3-4**), but only arsenic and lead concentrations measured in these soil samples exceed soil MSCs developed by the SAM model (**Table 3-5a** and **3-5b**). All of these exceedances occur in samples from the upper 0.5 feet bgs of soil.

Arsenic was detected at a concentration slightly above the MCL concentration at 03WW01 (0.010 mg/L). All other metals were either not detected in groundwater, or were detected with concentrations below their regulatory limits.

The COCs identified based on comparison of soil sampling data to Applicable Standard 3 MSCs (soil to groundwater pathway) are antimony, arsenic, cadmium, copper, lead, and mercury. Soil borings with COC concentrations above Applicable Standard 3 MSC values in the upper 0.5 feet bgs (03SB03, 03SB07, 03SB08, 03SB09, 03SB10, and 03SB15) lie within an oval area of approximately 40 feet in its largest dimension and located south of LHAAP-03 (**Figure 2-1**).

Note that background concentrations serve as Applicable Standard 3 MSCs for antimony, arsenic, and cadmium (**Appendix B**, Table B-5) and represent the 95% UPL for both surface and subsurface soil concentrations reported previously (Shaw, 2004). These values are applied in **Table 3-5a** and **3-5b** as the most appropriate value to serve as the cleanup level for both surface

and subsurface soil at LHAAP-03, and differ slightly from the separate surface and subsurface soil background values shown in **Table 3-1a** and **3-1b**, the lower of which was used to provide a conservative identification of COCs. When the lower of surface and subsurface background concentrations is applied to develop Applicable Standard 3 MSCs in **Table 3-5a** and **3-5b**, the resulting comparison of COC concentrations to Applicable Standard 3 MSCs is the same, and the above conclusions based on the comparison remain the same. Soil at boring 03SB15 contained lead concentrations in the upper 0.5 feet bgs (150 mg/kg) above the Applicable Standard 3 MSC (130 mg/kg) (**Figure 2-1**). However, the lead concentrations in soil in the vertical profile, at 3 to 4 feet bgs (14.1 mg/kg) and at 6 to 7 feet bgs (60 mg/kg), are below the MSC at this boring. This indicates that lead has not migrated downward in excess of the Applicable Standard 3 MSCs and thus the soil at this location is not likely to threaten groundwater (**Table 3-6**). Arsenic concentrations in all three samples from this boring are similar to the background concentration.

Arsenic, lead, and mercury concentrations that were measured above their MSC concentrations at boring 03SB11 were located at 6 to 7 feet bgs. The concentration of arsenic measured in groundwater at monitoring well 03WW01, which was converted from boring 03SB11, was 0.0414 mg/L (**Table 3-6**), above the MCL value for arsenic (0.010 mg/L), indicating that the Applicable Standard 3 MSC for arsenic predicts groundwater impact as expected. The concentrations of lead and mercury measured in monitoring well 03WW01 groundwater are below their respective MCL values (**Table 3-6**) indicating that the groundwater protective soil MSCs developed for these lead and mercury metals (**Appendix B**) conservatively over predict the impact of these metals on groundwater. Likewise, groundwater analysis results showing undetected or low concentrations of antimony, barium, cadmium, chromium, copper, lead, and mercury that are below MCLs, (**Table 3-6**) also indicate that Applicable Standard 3 MSCs developed for these metals in soil at LHAAP-03 are conservatively protective of groundwater.

Tables

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION_CODE					Background		Applicable	03SB01				03SB01				03SB01				03SB01				03SB02				03SB02				03SB03			
	SAMPLE_NO								03SB01-01				03SB01-01-QC				03SB01-01-R				03SB01-02				03SB02-01				03SB02-02				03SB03-01			
	SAMPLE_DATE	TCEQ				Concentrations in Soil			8/29/2006				8/29/2006				9/20/2006				8/29/2006				8/29/2006				8/29/2006				8/29/2006			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				3 - 4 Ft				0 - 0.5 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG[d]				FD[d]				REG				REG[d]				REG[d]				REG				REG[d]			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
METALS	Aluminum	1.0E+06	1.0E+04	10	20	1.63E+04	2.08E+04	1.6E+04	6510	1		JH	5840	1							12500	1			4570	1			5630	1			3030	1		
METALS	Antimony	4.9E+02	6.0E-01	0.05	0.1	9.40E-01	1.60E+00	9.4E-01	0.148	1		JL	0.092	1	J	JL					0.115	1	U	UJL	0.063	1	J	JL	0.102	1	U	UJL	8.550	1		JL
METALS	Arsenic	2.0E+02	1.0E+00	0.075	0.3	4.81E+00	5.54E+00	4.8E+00	1.830	1			1.650	1							0.883	1			1.440	1			0.845	1			6.090	1		
METALS	Barium	1.7E+05	2.0E+02	0.1	0.5	1.52E+02	8.55E+01	2.0E+02	70.20	1			69.40	1		JH					47.40	1		JH	35.20	1		JH	23.80	1		JH	167.00	1		JH
METALS	Beryllium	2.7E+02	4.0E-01	0.012	0.5	6.45E-01	7.66E-01	6.5E-01	0.437	1	J	J	0.422	1	J	J					0.392	1	J	J	0.352	1	J	J	0.111	1	J	J	0.217	1	J	J
METALS	Cadmium	1.5E+03	5.0E-01	0.05	0.5	1.40E+00	4.00E-01	5.0E-01	0.203	1	J	J	0.210	1	J	J					0.057	1	U	U	0.090	1	J	J	0.054	1	U	U	1.430	1		
METALS	Calcium	NE	NE	NA	NA	NA	NA	--	20100	1			16800	1							387	1			774	1			33	1			98400	10		
METALS	Chromium	3.5E+05	1.0E+01	0.12	1	2.66E+01	3.01E+01	2.7E+01	31.20	1			25.70	1							12.80	1			15.90	1			9.11	1			267.00	1		
METALS	Cobalt	1.1E+05	6.1E+02	0.12	1	7.23E+00	5.61E+00	6.1E+02	3.130	1			2.930	1							2.400	1			2.920	1			0.884	1			7.220	1		
METALS	Copper	7.4E+04	1.3E+02	0.5	1	5.55E+00	9.25E+00	1.3E+02	6.16	1			5.46	1							3.32	1			2.31	1			2.18	1			269.00	1		
METALS	Iron	NE	NE	NA	NA	NA	NA	--	10600	1			11400	1							9530	1			23500	1			6350	1			14700	1		
METALS	Lead	1.0E+03	1.5E+00	0.1	0.2	2.26E+01	1.14E+01	1.1E+01	24.70	1.00			22.50	1							7.20	1			19.50	1			4.66	1			5830	200		
METALS	Magnesium	NE	NE	NA	NA	NA	NA	--	519	1		JH	411	1		JH					610	1		JH	200	1		JH	240	1		JH	2980	1		JH
METALS	Manganese	1.1E+05	1.4E+03	0.1	0.5	1.25E+03	2.01E+02	1.4E+03	844	10			810	10							26	1			175	1			22	1			92	1		
METALS	Mercury	1.5E-01	2.0E-01	0.01	0.25	8.19E-02	3.60E-01	2.5E-01	0.0448	1	J		0.0490	1	J	J					0.0126	1	J	J	0.0252	1	J	J	0.0121	1	J	J	0.4830	1		
METALS	Nickel	1.2E+04	2.0E+02	0.5	2	6.98E+00	1.16E+01	2.0E+02	5.75	1			5.10	1							4.11	1			3.04	1			1.92	1			7.43	1		
METALS	Potassium	NE	NE	NA	NA	NA	NA	--	276	1			249	1							376	1			153	1			253	1			195	1		
METALS	Selenium	9.3E+03	5.0E+00	0.1	0.2	3.48E+00	5.57E+00	5.0E+00	0.252	1		JL	0.228	1	J	JL					0.204	1	J	JL	0.152	1	J	JL	0.198	1	J	JL	0.322	1		JL
METALS	Silver	2.9E+03	5.1E+01	0.25	2	3.10E-01	3.70E-01	5.1E+01	1.780	1	U	U	0.232	1	J	J					1.740	1	U	U	1.670	1	U	U	1.610	1	U	U	2.190	1		
METALS	Sodium	NE	NE	NA	NA	NA	NA	--	32.4	1			31.4	1							148.0	1			16.8	1	J	J	14.4	1	J	J	25.1	1		
METALS	Thallium	1.5E+02	2.0E-01	0.01	0.02	4.70E-01	NE	4.7E-01	0.0411	1			0.0306	1							0.2070	1			0.0863	1			0.1090	1			0.0317	1		
METALS	Vanadium	3.0E+03	7.2E+01	0.25	0.5	3.21E+01	4.46E+01	7.2E+01	23.7	1		JH	21.7	1		JH					18.9	1		JH	30.9	1		JH	16.2	1		JH	18.5	1		JH
METALS	Zinc	4.1E+05	3.1E+03	0.5	1	6.16E+01	2.02E+01	3.1E+03	44.50	1		JH	40.60	1		JH					14.60	1		JH	26.30	1		JH	7.18	1		JH	2310.00	10		JH
SEMIVOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.083	0.165	NE	NE	7.0E+00				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.083	0.165	NE	NE	6.0E+01				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.083	0.165	NE	NE	7.1E+01				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.083	0.165	NE	NE	7.5E+00				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	2,4,5-Trichlorophenol	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	2,4,6-Trichlorophenol	2.6E+02	2.6E+00	0.083	0.165	NE	NE	2.6E+00				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	2,4-Dichlorophenol	3.1E+03	3.1E+01	0.083	0.165	NE	NE	3.1E+01				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	2,4-Dimethylphenol	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	2,4-Dinitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01				R	4.630	5	U	U	1.050	1	U	U	0.935	1	U	U	4.530	5	U	U	0.868	1	U	U	8.500	10	U	U
SEMIVOLATILES	2,4-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01				R	0.484	5	U	U	0.109	1	U	U	0.095	1	U	U	0.453	5	U	U	0.089	1	U	U	0.851	10	U	U
SEMIVOLATILES	2,6-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01				R	0.484	5	U	U	0.109	1	U	U	0.095	1	U	U	0.453	5	U	U	0.089	1	U	U	0.851	10	U	U
SEMIVOLATILES	2-Chloronaphthalene	7.1E+04	8.2E+02	0.083	0.165	NE	NE	8.2E+02				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	2-Chlorophenol	4.0E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	2-Methylnaphthalene	3.6E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	2-Methylphenol	5.1E+04	5.1E+02	0.083	0.165	NE	NE	5.1E+02				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	2-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00				R	4.630	5	U	U	1.050	1	U	U	0.935	1	U	U	4.530	5	U	U	0.868	1	U	U	8.500	10	U	U
SEMIVOLATILES	2-Nitrophenol	2.0E+03	3.1E+00	0.083	0.165	NE	NE	3.1E+00				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	3,3'-Dichlorobenzidine	6.4E+00	6.4E-02	0.165	0.330	NE	NE	3.3E-01				R	0.968	5	U	U	0.217	1	U	U	0.189	1	U	U	0.907	5	U	U	0.178	1	U	U	1.701	10	U	U
SEMIVOLATILES	3-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00				R	4.630	5	U	U	1.050	1	U	U	0.935	1	U	U	4.530	5	U	U	0.868	1	U	U	8.500	10	U	U
SEMIVOLATILES	4,6-Dinitro-2-methylphenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01				R	4.630	5	U	U	1.050	1	U	U	0.935	1	U	U	4.530	5	U	U	0.868	1	U	U	8.500	10	U	U
SEMIVOLATILES	4-Bromophenyl phenyl ethe	1.6E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01				R	0.484	5	U	U	0.109	1	U	U	0.095	1	U	U	0.453	5	U	U	0.089	1	U	U	0.851	10	U	U
SEMIVOLATILES	4-Chloro-3-methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	4-Chloroaniline	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	4-Chlorophenyl phenyl ethe	1.2E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01				R	0.484	5	U	U	0.109	1	U	U	0.095	1	U	U	0.453	5	U	U	0.089	1	U	U	0.851	10	U	U
SEMIVOLATILES	4-Methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	4-Nitroaniline	7.5E+02	7.5E+00	0.330	0.825	NE	NE	7.5E+00				R	4.630	5	U	U	1.050	1	U	U	0.935	1	U	U	4.530	5	U	U	0.868	1	U	U	8.500	10	U	U
SEMIVOLATILES	4-Nitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01				R	4.630	5	U	U	1.050	1	U	U	0.935	1	U	U	4.530	5	U	U	0.868	1	U	U	8.500	10	U	U
SEMIVOLATILES	Acenaphthene	3.0E+01	6.1E+02	0.083	0.165	NE	NE	3.0E+01				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION_CODE								03SB01				03SB01				03SB01				03SB01				03SB02				03SB02				03SB03			
	SAMPLE_NO					Background			03SB01-01				03SB01-01-QC				03SB01-01-R				03SB01-02				03SB02-01				03SB02-02				03SB03-01			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	8/29/2006				8/29/2006				9/20/2006				8/29/2006				8/29/2006				8/29/2006				8/29/2006			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				3 - 4 Ft				0 - 0.5 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG[d]				FD[d]				REG				REG[d]				REG[d]				REG				REG[d]			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
SEMIVOLATILES	Acenaphthylene	5.3E+04	6.1E+02	0.083	0.165	NE	NE	6.1E+02				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Anthracene	2.7E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Benzo(a)anthracene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01				R	0.484	5	U	U	0.109	1	U	U	0.095	1	U	U	0.453	5	U	U	0.089	1	U	U	0.851	10	U	U
SEMIVOLATILES	Benzo(a)pyrene	3.4E-01	2.0E-02	0.083	0.165	1.54E-02	NE	1.7E-01				R	0.484	5	U	U	0.109	1	U	U	0.095	1	U	U	0.453	5	U	U	0.089	1	U	U	0.851	10	U	U
SEMIVOLATILES	Benzo(b)fluoranthene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01				R	0.484	5	U	U	0.109	1	U	U	0.095	1	U	U	0.453	5	U	U	0.089	1	U	U	0.851	10	U	U
SEMIVOLATILES	Benzo(ghi)perylene	2.7E+04	3.1E+02	0.083	0.165	1.23E-02	NE	3.1E+02				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Benzo(k)fluoranthene	3.4E+01	3.9E-01	0.083	0.165	1.30E-02	NE	3.9E-01				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Benzoic Acid	4.1E+06	4.1E+04	0.330	0.825	NE	NE	4.1E+04				R	4.630	5	U	U	1.050	1	U	U	0.935	1	U	U	4.530	5	U	U	0.868	1	U	U	8.500	10	U	U
SEMIVOLATILES	Benzyl Alcohol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03	1.920	10	U	R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	bis(2-Chloroethoxy)methane	9.0E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01				R	0.484	5	U	U	0.109	1	U	U	0.095	1	U	U	0.453	5	U	U	0.089	1	U	U	0.851	10	U	U
SEMIVOLATILES	bis(2-Chloroethyl)ether	3.2E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01				R	0.484	5	U	U	0.109	1	U	U	0.095	1	U	U	0.453	5	U	U	0.089	1	U	U	0.851	10	U	U
SEMIVOLATILES	bis(2-Chloroisopropyl)ether	1.5E+02	4.1E+00	0.083	0.165	NE	NE	4.1E+00				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	bis(2-Ethylhexyl)phthalate	6.5E+01	6.0E-01	0.083	0.165	NE	NE	6.0E-01				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Butyl benzyl phthalate	2.0E+05	2.0E+03	0.083	0.165	NE	NE	2.0E+03				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Chrysene	3.4E+02	3.9E+00	0.083	0.165	1.51E-02	NE	3.9E+00				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Dibenzo(a,h)anthracene	3.4E-01	2.0E-02	0.083	0.165	NE	NE	1.7E-01				R	0.484	5	U	U	0.109	1	U	U	0.095	1	U	U	0.453	5	U	U	0.089	1	U	U	0.851	10	U	U
SEMIVOLATILES	Dibenzofuran	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Diethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Dimethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	di-n-Butyl phthalate	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	di-n-Octyl phthalate	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Fluoranthene	3.6E+04	4.1E+02	0.083	0.165	2.29E-02	NE	4.1E+02				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Fluorene	3.6E+04	4.1E+02	0.083	0.165	NE	NE	4.1E+02				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Hexachlorobenzene	1.0E+00	1.0E-01	0.083	0.165	NE	NE	1.7E-01				R	0.484	5	U	U	0.109	1	U	U	0.095	1	U	U	0.453	5	U	U	0.089	1	U	U	0.851	10	U	U
SEMIVOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.083	0.165	NE	NE	2.0E+00				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Hexachlorocyclopentadiene	1.4E+01	5.0E+00	0.083	0.165	NE	NE	5.0E+00				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Hexachloroethane	7.5E+02	1.0E+01	0.083	0.165	NE	NE	1.0E+01				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Indeno(1,2,3-cd)pyrene	3.4E+00	3.9E-02	0.083	0.165	1.43E-02	NE	1.7E-01				R	0.484	5	U	U	0.109	1	U	U	0.095	1	U	U	0.453	5	U	U	0.089	1	U	U	0.851	10	U	U
SEMIVOLATILES	Isophorone	3.0E+04	3.0E+02	0.083	0.165	NE	NE	3.0E+02				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Naphthalene	2.7E+02	2.0E+02	0.083	0.165	NE	NE	2.0E+02				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Nitrobenzene	2.7E+02	5.1E+00	0.083	0.165	NE	NE	5.1E+00				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	n-Nitroso-di-n-propylamine	1.6E-01	4.1E-03	0.083	0.165	NE	NE	1.7E-01				R	0.484	5	U	U	0.109	1	U	U	0.095	1	U	U	0.453	5	U	U	0.089	1	U	U	0.851	10	U	U
SEMIVOLATILES	n-Nitrosodiphenylamine	2.3E+02	5.8E+00	0.083	0.165	NE	NE	5.8E+00				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Pentachlorophenol	1.4E+01	1.0E-01	0.330	0.825	NE	NE	8.3E-01				R	1.937	5	U	U	0.435	1	U	U	0.378	1	U	U	1.813	5	U	U	0.356	1	U	U	3.402	10	U	U
SEMIVOLATILES	Phenanthrene	2.7E+04	3.1E+02	0.083	0.165	NE	NE	3.1E+02				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Phenol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Pyrene	2.7E+04	3.1E+02	0.083	0.165	1.94E-02	NE	3.1E+02				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SOLIDS	Percent Solids	NE	NE	NE	NE	NE	NE	--	85.1	1			85.2	1			75.9	1			87.2	1			91.0	1			92.7	1			97.0	1		
VOLATILES	1,1,1,2-Tetrachloroethane	1.1E+02	1.1E+01	0.0005	0.005	NE	NE	1.1E+01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,1,1-Trichloroethane	3.4E+03	2.0E+01	0.0005	0.005	NE	NE	2.0E+01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,1,2,2-Tetrachloroethane	9.8E+00	1.4E+00	0.0005	0.005	NE	NE	1.4E+00	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,1,2-Trichloroethane	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,1-Dichloroethane	1.3E+03	1.0E+03	0.0010	0.005	NE	NE	1.0E+03	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,1-Dichloroethene	3.8E+02	7.0E-01	0.0005	0.005	NE	NE	7.0E-01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,1-Dichloropropene	1.9E+00	2.9E-01	0.0005	0.005	NE	NE	2.9E-01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,2,3-Trichlorobenzene	2.0E+03	3.1E+01	0.0005	0.005	NE	NE	3.1E+01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,2,3-Trichloropropane	8.2E-01	4.1E-03	0.0010	0.005	NE	NE	5.0E-03	0.0012	1	U	U	0.0012	1	U	U					0.0011	1	U	U	0.0011	1	U	U	0.0011	1	U	U	0.0010	1	U	U
VOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,2,4-Trimethylbenzene	1.4E+02	5.1E+02	0.0005	0.005	NE	NE	1.4E+02	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,2-Dibromo-3-chloropropan	2.0E+00	2.0E-02	0.0020	0.005	NE	NE	2.0E-02	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,2-Dibromoethane	1.0E-01	5.0E-03	0.0005	0.005	NE	NE	5.0E-03	0.0006	1	U	U	0.0006	1	U	U					0.0006	1	U	U	0.0005	1	U	U	0.0005	1	U	U	0.0005	1	U	U

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION_CODE					Background		Applicable	03SB01				03SB01				03SB01				03SB01				03SB02				03SB02				03SB03			
	SAMPLE_NO								03SB01-01				03SB01-01-QC				03SB01-01-R				03SB01-02				03SB02-01				03SB02-02				03SB03-01			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		TCEQ	8/29/2006				8/29/2006				9/20/2006				8/29/2006				8/29/2006				8/29/2006				8/29/2006			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		Risk-Based	0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				3 - 4 Ft				0 - 0.5 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	MSC [c]	REG[d]				FD[d]				REG				REG[d]				REG[d]				REG				REG[d]			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft		Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
VOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.0005	0.005	NE	NE	6.0E+01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,2-Dichloroethane	4.7E-01	5.0E-01	0.0005	0.005	NE	NE	4.7E-01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,2-Dichloropropane	2.5E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,2-Dimethylbenzene (o-X	4.8E+04	1.0E+03	0.0005	0.005	NE	NE	1.0E+03	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,3,5-Trimethylbenzene	1.2E+02	5.1E+02	0.0005	0.005	NE	NE	1.2E+02	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.0005	0.005	NE	NE	7.1E+01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,3-Dichloropropane	8.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.0005	0.005	NE	NE	7.5E+00	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	2,2-Dichloropropane	2.4E+01	4.2E+00	0.0005	0.005	NE	NE	4.2E+00	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	2-Butanone	4.2E+04	6.1E+03	0.0025	0.010	NE	NE	6.1E+03	0.0129	1	U	U	0.0112	1	U	U					0.0104	1	U	U	0.0111	1	U	U	0.0125	1	U	U	0.0101	1	U	U
VOLATILES	2-Chloroethyl vinyl ether	3.0E+00	2.6E-01	0.0020	0.010	NE	NE	2.6E-01	0.0129	1	U	U	0.0112	1	U	U					0.0104	1	U	U	0.0111	1	U	U	0.0125	1	U	U	0.0101	1	U	U
VOLATILES	2-Chlorotoluene	3.5E+03	2.0E+02	0.0005	0.005	NE	NE	2.0E+02	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	2-Hexanone	8.7E+01	6.1E+02	0.0025	0.010	NE	NE	8.7E+01	0.0129	1	U	U	0.0112	1	U	U					0.0104	1	U	U	0.0111	1	U	U	0.0125	1	U	U	0.0101	1	U	U
VOLATILES	4-Chlorotoluene	4.8E+00	2.0E+02	0.0005	0.005	NE	NE	4.8E+00	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Acetone	2.5E+03	9.2E+03	0.0050	0.010	NE	NE	2.5E+03	0.0129	1	U	U	0.0112	1	U	U					0.0104	1	U	U	0.0133	1			0.0125	1	U	U	0.0101	1	U	U
VOLATILES	Benzene	1.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Bromobenzene	1.6E+02	2.0E+02	0.0005	0.005	NE	NE	1.6E+02	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Bromochloromethane	3.4E+02	4.1E+02	0.0005	0.005	NE	NE	3.4E+02	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Bromodichloromethane	9.2E+01	4.6E-01	0.0005	0.005	NE	NE	4.6E-01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Bromoform	8.5E+01	3.6E+00	0.0005	0.005	NE	NE	3.6E+00	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Bromomethane	4.9E+00	1.4E+01	0.0010	0.010	NE	NE	4.9E+00	0.0129	1	U	U	0.0112	1	U	U					0.0104	1	U	U	0.0111	1	U	U	0.0125	1	U	U	0.0101	1	U	U
VOLATILES	Carbon disulfide	1.5E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Carbon tetrachloride	6.3E-01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Chlorobenzene	5.9E+02	1.0E+01	0.0005	0.005	NE	NE	1.0E+01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Chloroethane	1.7E+04	4.1E+03	0.0010	0.010	NE	NE	4.1E+03	0.0129	1	U	U	0.0112	1	U	U					0.0104	1	U	U	0.0111	1	U	U	0.0125	1	U	U	0.0101	1	U	U
VOLATILES	Chloroform	5.2E-01	1.0E+02	0.0005	0.005	NE	NE	5.2E-01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Chloromethane	3.8E+00	2.2E+01	0.0020	0.010	NE	NE	3.8E+00	0.0129	1	U	U	0.0112	1	U	U					0.0104	1	U	U	0.0111	1	U	U	0.0125	1	U	U	0.0101	1	U	U
VOLATILES	cis-1,2-Dichloroethene	2.5E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	cis-1,3-Dichloropropene	3.4E+01	5.3E-01	0.0005	0.005	NE	NE	5.3E-01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Dibromochloromethane	6.8E+02	3.4E+00	0.0005	0.005	NE	NE	3.4E+00	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Dibromomethane	2.7E+02	3.8E+01	0.0005	0.005	NE	NE	3.8E+01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Dichlorodifluoromethane	3.1E+03	2.0E+03	0.0010	0.010	NE	NE	2.0E+03	0.0129	1	U	U	0.0112	1	U	U					0.0104	1	U	U	0.0111	1	U	U	0.0125	1	U	U	0.0101	1	U	U
VOLATILES	Ethylbenzene	6.9E+03	7.0E+01	0.0005	0.005	NE	NE	7.0E+01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.0005	0.005	NE	NE	2.0E+00	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Isopropylbenzene	9.0E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	m,p-Xylenes [e]	3.3E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0008	1	J	J
VOLATILES	Methyl isobutyl ketone	3.5E+04	8.2E+02	0.0025	0.010	NE	NE	8.2E+02	0.0129	1	U	U	0.0112	1	U	U					0.0104	1	U	U	0.0111	1	U	U	0.0125	1	U	U	0.0101	1	U	U
VOLATILES	Methylene chloride	1.6E+01	5.0E-01	0.0010	0.005	NE	NE	5.0E-01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Naphthalene	2.7E+02	2.0E+02	0.0005	0.010	NE	NE	2.0E+02	0.0129	1	U	U	0.0112	1	U	U					0.0104	1	U	U	0.0111	1	U	U	0.0125	1	U	U	0.0101	1	U	U
VOLATILES	n-BUTYLBENZENE	5.7E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	n-PROPYLBENZENE	5.9E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	p-ISOPROPYLTOLUENE	6.7E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	sec-BUTYLBENZENE	5.4E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Styrene	2.3E+04	1.0E+01	0.0005	0.005	NE	NE	1.0E+01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	tert-BUTYLBENZENE	4.5E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Tetrachloroethene	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01	0.0065	1	U	U	0.0056	1	U	U					0.0041	1	J	J	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Toluene	2.5E+04	1.0E+02	0.0005	0.005	NE	NE	1.0E+02	0.0013	1	J	J	0.0016	1	J	J					0.0010	1	J	J	0.0056	1	U	U	0.0018	1	J	J	0.0020	1	J	J
VOLATILES	trans-1,2-Dichloroethene	2.4E+03	1.0E+01	0.0005	0.005	NE	NE	1.0E+01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	trans-1,3-Dichloropropene	4.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Trichloroethene	6.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Trichlorofluoromethane	3.8E+03	3.1E+03	0.0010	0.010	NE	NE	3.1E+03	0.0129	1	U	U	0.0112	1	U	U					0.0104	1	U	U	0.0111	1	U	U	0.0125	1	U	U	0.0101	1	U	U

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE					Background		Applicable	03SB01				03SB01				03SB01				03SB01				03SB02				03SB02				03SB03			
	SAMPLE_NO								03SB01-01				03SB01-01-QC				03SB01-01-R				03SB01-02				03SB02-01				03SB02-02				03SB03-01			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		TCEQ	8/29/2006				8/29/2006				9/20/2006				8/29/2006				8/29/2006				8/29/2006				8/29/2006			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		Risk-Based	0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				3 - 4 Ft				0 - 0.5 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	MSC [c]	REG[d]				FD[d]				REG				REG[d]				REG[d]				REG				REG[d]			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft		Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
VOLATILES	Vinyl acetate	8.0E+02	1.0E+04	0.0010	0.010	NE	NE	8.0E+02	0.0129	1	U	U	0.0112	1	U	U					0.0104	1	U	U	0.0111	1	U	U	0.0125	1	U	U	0.0101	1	U	U
VOLATILES	Vinyl chloride	6.6E-02	2.0E-01	0.0010	0.010	NE	NE	6.6E-02	0.0129	1	U	U	0.0112	1	U	U					0.0104	1	U	U	0.0111	1	U	U	0.0125	1	U	U	0.0101	1	U	U

Notes and Abbreviations:

Shading in column indicates SDL values that exceed the Applicable MSC.

Concentration exceeds Applicable MSC.

[a] Value provided by the Texas Commission on Environmental Quality (TCEQ) as updated through March 2006 available on the TCEQ website at http://www.tceq.state.tx.us/remediation/rrr.html.

[b] Lower of surface and subsurface soil background concentrations used in these comparisons

[c] Shading in column indicates Applicable MSC equal to MQL for the chemical as provided in 30TAC§335.

[d] Where Applicable MSC is equal to MQL, value equals the SDL, which is the MDL adjusted for sample specific analytical factors.

[e] MSC value shown is for m-xylene, the more conservative of m- and p-xylene isomers.

95% UPL - 95% Upper Prediction Limit of background concentration calculated as described in TCEQ correspondence.
FD - field duplicate sample
H - estimate is high
J - Estimated value. Chemical was detected above the method detection limit but below the MQL.
L - estimate is low
NE - value not established
R - data rejected
REG - regular sample
U - compound validated as not detected above MDL shown

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB03				03SB04				03SB05				03SB06				03SB07				03SB07				03SB08			
	SAMPLE_NO					Background			03SB03-02				03SB04-01				03SB05-01				03SB06-01				03SB07 (0-0_5)				03SB07(0-0.5)R				03SB08 (0-0_5)			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	8/29/2006				12/19/2006				12/19/2006				12/19/2006				10/23/2007				23-Oct-07				23-Oct-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	3 - 4 Ft				3 - 4 Ft				3 - 4 Ft				3 - 4 Ft				0-0.5 Ft				0-0.5				0-0.5 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG[d]				REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
METALS	Aluminum	1.0E+06	1.0E+04	10	20	1.63E+04	2.08E+04	1.6E+04	10600	1																										
METALS	Antimony	4.9E+02	6.0E-01	0.05	0.1	9.40E-01	1.60E+00	9.4E-01	0.112	1	U	UJL																	0.062	1	J	J				
METALS	Arsenic	2.0E+02	1.0E+00	0.075	0.3	4.81E+00	5.54E+00	4.8E+00	1.110	1																			6.98	1						
METALS	Barium	1.7E+05	2.0E+02	0.1	0.5	1.52E+02	8.55E+01	2.0E+02	57.40	1		JH																	57.20	25						
METALS	Beryllium	2.7E+02	4.0E-01	0.012	0.5	6.45E-01	7.66E-01	6.5E-01	0.349	1	J	J																								
METALS	Cadmium	1.5E+03	5.0E-01	0.05	0.5	1.40E+00	4.00E-01	5.0E-01	0.057	1	U	U																	0.206	1						
METALS	Calcium	NE	NE	NA	NA	NA	NA	--	319	1																										
METALS	Chromium	3.5E+05	1.0E+01	0.12	1	2.66E+01	3.01E+01	2.7E+01	14.80	1																			50	25						
METALS	Cobalt	1.1E+05	6.1E+02	0.12	1	7.23E+00	5.61E+00	6.1E+02	4.650	1																			7.090	1						
METALS	Copper	7.4E+04	1.3E+02	0.5	1	5.55E+00	9.25E+00	1.3E+02	2.92	1																			4.08	1						
METALS	Iron	NE	NE	NA	NA	NA	NA	--	11500	1																										
METALS	Lead	1.0E+03	1.5E+00	0.1	0.2	2.26E+01	1.14E+01	1.1E+01	19.90	1			108.00	1		J	54.20	1		J	28.20	1		J	95.80	10			505	25			2320	100		
METALS	Magnesium	NE	NE	NA	NA	NA	NA	--	530	1		JH																								
METALS	Manganese	1.1E+05	1.4E+03	0.1	0.5	1.25E+03	2.01E+02	1.4E+03	178	1																			213.0	25						
METALS	Mercury	1.5E-01	2.0E-01	0.01	0.25	8.19E-02	3.60E-01	2.5E-01	0.0290	1	J	J																								
METALS	Nickel	1.2E+04	2.0E+02	0.5	2	6.98E+00	1.16E+01	2.0E+02	3.98	1																			4.54	1						
METALS	Potassium	NE	NE	NA	NA	NA	NA	--	347	1																										
METALS	Selenium	9.3E+03	5.0E+00	0.1	0.2	3.48E+00	5.57E+00	5.0E+00	0.388	1		JL																	0.376	1						
METALS	Silver	2.9E+03	5.1E+01	0.25	2	3.10E-01	3.70E-01	5.1E+01	1.680	1	U	U																	0.073	1	J	J				
METALS	Sodium	NE	NE	NA	NA	NA	NA	--	70.8	1																										
METALS	Thallium	1.5E+02	2.0E-01	0.01	0.02	4.70E-01	NE	4.7E-01	0.0520	1																			0.0792	1						
METALS	Vanadium	3.0E+03	7.2E+01	0.25	0.5	3.21E+01	4.46E+01	7.2E+01	29.8	1		JH																	26.0	1						
METALS	Zinc	4.1E+05	3.1E+03	0.5	1	6.16E+01	2.02E+01	3.1E+03	25.20	1		JH																	424.00	25						
SEMIVOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.083	0.165	NE	NE	7.0E+00	0.189	1	U	U																								
SEMIVOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.083	0.165	NE	NE	6.0E+01	0.189	1	U	U																								
SEMIVOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.083	0.165	NE	NE	7.1E+01	0.189	1	U	U																								
SEMIVOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.083	0.165	NE	NE	7.5E+00	0.189	1	U	U																								
SEMIVOLATILES	2,4,5-Trichlorophenol	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03	0.189	1	U	U																								
SEMIVOLATILES	2,4,6-Trichlorophenol	2.6E+02	2.6E+00	0.083	0.165	NE	NE	2.6E+00	0.189	1	U	U																								
SEMIVOLATILES	2,4-Dichlorophenol	3.1E+03	3.1E+01	0.083	0.165	NE	NE	3.1E+01	0.189	1	U	U																								
SEMIVOLATILES	2,4-Dimethylphenol	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02	0.189	1	U	U																								
SEMIVOLATILES	2,4-Dinitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01	0.944	1	U	U																								
SEMIVOLATILES	2,4-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01	0.095	1	U	U																								
SEMIVOLATILES	2,6-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01	0.095	1	U	U																								
SEMIVOLATILES	2-Chloronaphthalene	7.1E+04	8.2E+02	0.083	0.165	NE	NE	8.2E+02	0.189	1	U	U																								
SEMIVOLATILES	2-Chlorophenol	4.0E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01	0.189	1	U	U																								
SEMIVOLATILES	2-Methylnaphthalene	3.6E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01	0.189	1	U	U																								
SEMIVOLATILES	2-Methylphenol	5.1E+04	5.1E+02	0.083	0.165	NE	NE	5.1E+02	0.189	1	U	U																								
SEMIVOLATILES	2-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00	0.944	1	U	U																								
SEMIVOLATILES	2-Nitrophenol	2.0E+03	3.1E+00	0.083	0.165	NE	NE	3.1E+00	0.189	1	U	U																								
SEMIVOLATILES	3,3'-Dichlorobenzidine	6.4E+00	6.4E-02	0.165	0.330	NE	NE	3.3E-01	0.189	1	U	U																								
SEMIVOLATILES	3-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00	0.944	1	U	U																								
SEMIVOLATILES	4,6-Dinitro-2-methylphenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01	0.944	1	U	U																								
SEMIVOLATILES	4-Bromophenyl phenyl ethe	1.6E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01	0.095	1	U	U																								
SEMIVOLATILES	4-Chloro-3-methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01	0.189	1	U	U																								
SEMIVOLATILES	4-Chloroaniline	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01	0.189	1	U	U																								
SEMIVOLATILES	4-Chlorophenyl phenyl ethe	1.2E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01	0.095	1	U	U																								
SEMIVOLATILES	4-Methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01	0.189	1	U	U																								
SEMIVOLATILES	4-Nitroaniline	7.5E+02	7.5E+00	0.330	0.825	NE	NE	7.5E+00	0.944	1	U	U																								
SEMIVOLATILES	4-Nitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01	0.944	1	U	U																								
SEMIVOLATILES	Acenaphthene	3.0E+01	6.1E+02	0.083	0.165	NE	NE	3.0E+01	0.189	1	U	U																								

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB03				03SB04				03SB05				03SB06				03SB07				03SB07				03SB08			
	SAMPLE_NO					Background			03SB03-02				03SB04-01				03SB05-01				03SB06-01				03SB07 (0-0_5)				03SB07(0-0.5)R				03SB08 (0-0_5)			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	8/29/2006				12/19/2006				12/19/2006				12/19/2006				10/23/2007				23-Oct-07				23-Oct-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	3 - 4 Ft				3 - 4 Ft				3 - 4 Ft				3 - 4 Ft				0-0.5 Ft				0-0.5				0-0.5 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG[d]				REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
SEMIVOLATILES	Acenaphthylene	5.3E+04	6.1E+02	0.083	0.165	NE	NE	6.1E+02	0.189	1	U	U																								
SEMIVOLATILES	Anthracene	2.7E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03	0.189	1	U	U																								
SEMIVOLATILES	Benzo(a)anthracene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01	0.095	1	U	U																								
SEMIVOLATILES	Benzo(a)pyrene	3.4E-01	2.0E-02	0.083	0.165	1.54E-02	NE	1.7E-01	0.095	1	U	U																								
SEMIVOLATILES	Benzo(b)fluoranthene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01	0.095	1	U	U																								
SEMIVOLATILES	Benzo(ghi)perylene	2.7E+04	3.1E+02	0.083	0.165	1.23E-02	NE	3.1E+02	0.189	1	U	U																								
SEMIVOLATILES	Benzo(k)fluoranthene	3.4E+01	3.9E-01	0.083	0.165	1.30E-02	NE	3.9E-01	0.189	1	U	U																								
SEMIVOLATILES	Benzoic Acid	4.1E+06	4.1E+04	0.330	0.825	NE	NE	4.1E+04	0.944	1	U	U																								
SEMIVOLATILES	Benzyl Alcohol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03	0.189	1	U	U																								
SEMIVOLATILES	bis(2-Chloroethoxy)methane	9.0E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01	0.095	1	U	U																								
SEMIVOLATILES	bis(2-Chloroethyl)ether	3.2E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01	0.095	1	U	U																								
SEMIVOLATILES	bis(2-Chloroisopropyl)ether	1.5E+02	4.1E+00	0.083	0.165	NE	NE	4.1E+00	0.189	1	U	U																								
SEMIVOLATILES	bis(2-Ethylhexyl)phthalate	6.5E+01	6.0E-01	0.083	0.165	NE	NE	6.0E-01	0.347	1																										
SEMIVOLATILES	Butyl benzyl phthalate	2.0E+05	2.0E+03	0.083	0.165	NE	NE	2.0E+03	0.189	1	U	U																								
SEMIVOLATILES	Chrysene	3.4E+02	3.9E+00	0.083	0.165	1.51E-02	NE	3.9E+00	0.189	1	U	U																								
SEMIVOLATILES	Dibenzo(a,h)anthracene	3.4E-01	2.0E-02	0.083	0.165	NE	NE	1.7E-01	0.095	1	U	U																								
SEMIVOLATILES	Dibenzofuran	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01	0.189	1	U	U																								
SEMIVOLATILES	Diethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03	0.189	1	U	U																								
SEMIVOLATILES	Dimethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03	0.189	1	U	U																								
SEMIVOLATILES	di-n-Butyl phthalate	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03	0.189	1	U	U																								
SEMIVOLATILES	di-n-Octyl phthalate	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02	0.189	1	U	U																								
SEMIVOLATILES	Fluoranthene	3.6E+04	4.1E+02	0.083	0.165	2.29E-02	NE	4.1E+02	0.189	1	U	U																								
SEMIVOLATILES	Fluorene	3.6E+04	4.1E+02	0.083	0.165	NE	NE	4.1E+02	0.189	1	U	U																								
SEMIVOLATILES	Hexachlorobenzene	1.0E+00	1.0E-01	0.083	0.165	NE	NE	1.7E-01	0.095	1	U	U																								
SEMIVOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.083	0.165	NE	NE	2.0E+00	0.189	1	U	U																								
SEMIVOLATILES	Hexachlorocyclopentadiene	1.4E+01	5.0E+00	0.083	0.165	NE	NE	5.0E+00	0.189	1	U	U																								
SEMIVOLATILES	Hexachloroethane	7.5E+02	1.0E+01	0.083	0.165	NE	NE	1.0E+01	0.189	1	U	U																								
SEMIVOLATILES	Indeno(1,2,3-cd)pyrene	3.4E+00	3.9E-02	0.083	0.165	1.43E-02	NE	1.7E-01	0.095	1	U	U																								
SEMIVOLATILES	Isophorone	3.0E+04	3.0E+02	0.083	0.165	NE	NE	3.0E+02	0.189	1	U	U																								
SEMIVOLATILES	Naphthalene	2.7E+02	2.0E+02	0.083	0.165	NE	NE	2.0E+02	0.189	1	U	U																								
SEMIVOLATILES	Nitrobenzene	2.7E+02	5.1E+00	0.083	0.165	NE	NE	5.1E+00	0.189	1	U	U																								
SEMIVOLATILES	n-Nitroso-di-n-propylamine	1.6E-01	4.1E-03	0.083	0.165	NE	NE	1.7E-01	0.095	1	U	U																								
SEMIVOLATILES	n-Nitrosodiphenylamine	2.3E+02	5.8E+00	0.083	0.165	NE	NE	5.8E+00	0.189	1	U	U																								
SEMIVOLATILES	Pentachlorophenol	1.4E+01	1.0E-01	0.330	0.825	NE	NE	8.3E-01	0.378	1	U	U																								
SEMIVOLATILES	Phenanthrene	2.7E+04	3.1E+02	0.083	0.165	NE	NE	3.1E+02	0.189	1	U	U																								
SEMIVOLATILES	Phenol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03	0.189	1	U	U																								
SEMIVOLATILES	Pyrene	2.7E+04	3.1E+02	0.083	0.165	1.94E-02	NE	3.1E+02	0.189	1	U	U																								
SOLIDS	Percent Solids	NE	NE	NE	NE	NE	NE	--	87.3	1			76.1	1			81.3	1			81.5	1			90.7				90.7	1			90.8			
VOLATILES	1,1,1,2-Tetrachloroethane	1.1E+02	1.1E+01	0.0005	0.005	NE	NE	1.1E+01	0.0046	1	U	U																								
VOLATILES	1,1,1-Trichloroethane	3.4E+03	2.0E+01	0.0005	0.005	NE	NE	2.0E+01	0.0046	1	U	U																								
VOLATILES	1,1,2,2-Tetrachloroethane	9.8E+00	1.4E+00	0.0005	0.005	NE	NE	1.4E+00	0.0046	1	U	U																								
VOLATILES	1,1,2-Trichloroethane	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01	0.0046	1	U	U																								
VOLATILES	1,1-Dichloroethane	1.3E+03	1.0E+03	0.0010	0.005	NE	NE	1.0E+03	0.0046	1	U	U																								
VOLATILES	1,1-Dichloroethene	3.8E+02	7.0E-01	0.0005	0.005	NE	NE	7.0E-01	0.0046	1	U	U																								
VOLATILES	1,1-Dichloropropene	1.9E+00	2.9E-01	0.0005	0.005	NE	NE	2.9E-01	0.0046	1	U	U																								
VOLATILES	1,2,3-Trichlorobenzene	2.0E+03	3.1E+01	0.0005	0.005	NE	NE	3.1E+01	0.0046	1	U	U																								
VOLATILES	1,2,3-Trichloropropane	8.2E-01	4.1E-03	0.0010	0.005	NE	NE	5.0E-03	0.0011	1	U	U																								
VOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00	0.0046	1	U	U																								
VOLATILES	1,2,4-Trimethylbenzene	1.4E+02	5.1E+02	0.0005	0.005	NE	NE	1.4E+02	0.0046	1	U	U																								
VOLATILES	1,2-Dibromo-3-chloropropan	2.0E+00	2.0E-02	0.0020	0.005	NE	NE	2.0E-02	0.0046	1	U	U																								
VOLATILES	1,2-Dibromoethane	1.0E-01	5.0E-03	0.0005	0.005	NE	NE	5.0E-03	0.0006	1	U	U																								

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB03				03SB04				03SB05				03SB06				03SB07				03SB07				03SB08			
	SAMPLE_NO					Background			03SB03-02				03SB04-01				03SB05-01				03SB06-01				03SB07 (0-0_5)				03SB07(0-0.5)R				03SB08 (0-0_5)			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	8/29/2006				12/19/2006				12/19/2006				12/19/2006				10/23/2007				23-Oct-07				23-Oct-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	3 - 4 Ft				3 - 4 Ft				3 - 4 Ft				3 - 4 Ft				0-0.5 Ft				0-0.5				0-0.5 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG[d]				REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
VOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.0005	0.005	NE	NE	6.0E+01	0.0046	1	U	U																								
VOLATILES	1,2-Dichloroethane	4.7E-01	5.0E-01	0.0005	0.005	NE	NE	4.7E-01	0.0046	1	U	U																								
VOLATILES	1,2-Dichloropropane	2.5E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01	0.0046	1	U	U																								
VOLATILES	1,2-Dimethylbenzene (o-X	4.8E+04	1.0E+03	0.0005	0.005	NE	NE	1.0E+03	0.0046	1	U	U																								
VOLATILES	1,3,5-Trimethylbenzene	1.2E+02	5.1E+02	0.0005	0.005	NE	NE	1.2E+02	0.0046	1	U	U																								
VOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.0005	0.005	NE	NE	7.1E+01	0.0046	1	U	U																								
VOLATILES	1,3-Dichloropropane	8.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00	0.0046	1	U	U																								
VOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.0005	0.005	NE	NE	7.5E+00	0.0046	1	U	U																								
VOLATILES	2,2-Dichloropropane	2.4E+01	4.2E+00	0.0005	0.005	NE	NE	4.2E+00	0.0046	1	U	U																								
VOLATILES	2-Butanone	4.2E+04	6.1E+03	0.0025	0.010	NE	NE	6.1E+03	0.0304	1																										
VOLATILES	2-Chloroethyl vinyl ether	3.0E+00	2.6E-01	0.0020	0.010	NE	NE	2.6E-01	0.0092	1	U	U																								
VOLATILES	2-Chlorotoluene	3.5E+03	2.0E+02	0.0005	0.005	NE	NE	2.0E+02	0.0046	1	U	U																								
VOLATILES	2-Hexanone	8.7E+01	6.1E+02	0.0025	0.010	NE	NE	8.7E+01	0.0092	1	U	U																								
VOLATILES	4-Chlorotoluene	4.8E+00	2.0E+02	0.0005	0.005	NE	NE	4.8E+00	0.0046	1	U	U																								
VOLATILES	Acetone	2.5E+03	9.2E+03	0.0050	0.010	NE	NE	2.5E+03	0.9080	50	J	J																								
VOLATILES	Benzene	1.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01	0.0046	1	U	U																								
VOLATILES	Bromobenzene	1.6E+02	2.0E+02	0.0005	0.005	NE	NE	1.6E+02	0.0046	1	U	U																								
VOLATILES	Bromochloromethane	3.4E+02	4.1E+02	0.0005	0.005	NE	NE	3.4E+02	0.0046	1	U	U																								
VOLATILES	Bromodichloromethane	9.2E+01	4.6E-01	0.0005	0.005	NE	NE	4.6E-01	0.0046	1	U	U																								
VOLATILES	Bromoform	8.5E+01	3.6E+00	0.0005	0.005	NE	NE	3.6E+00	0.0046	1	U	U																								
VOLATILES	Bromomethane	4.9E+00	1.4E+01	0.0010	0.010	NE	NE	4.9E+00	0.0092	1	U	U																								
VOLATILES	Carbon disulfide	1.5E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03	0.0046	1	U	U																								
VOLATILES	Carbon tetrachloride	6.3E-01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01	0.0046	1	U	U																								
VOLATILES	Chlorobenzene	5.9E+02	1.0E+01	0.0005	0.005	NE	NE	1.0E+01	0.0046	1	U	U																								
VOLATILES	Chloroethane	1.7E+04	4.1E+03	0.0010	0.010	NE	NE	4.1E+03	0.0092	1	U	U																								
VOLATILES	Chloroform	5.2E-01	1.0E+02	0.0005	0.005	NE	NE	5.2E-01	0.0046	1	U	U																								
VOLATILES	Chloromethane	3.8E+00	2.2E+01	0.0020	0.010	NE	NE	3.8E+00	0.0092	1	U	U																								
VOLATILES	cis-1,2-Dichloroethene	2.5E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00	0.0046	1	U	U																								
VOLATILES	cis-1,3-Dichloropropene	3.4E+01	5.3E-01	0.0005	0.005	NE	NE	5.3E-01	0.0046	1	U	U																								
VOLATILES	Dibromochloromethane	6.8E+02	3.4E+00	0.0005	0.005	NE	NE	3.4E+00	0.0046	1	U	U																								
VOLATILES	Dibromomethane	2.7E+02	3.8E+01	0.0005	0.005	NE	NE	3.8E+01	0.0046	1	U	U																								
VOLATILES	Dichlorodifluoromethane	3.1E+03	2.0E+03	0.0010	0.010	NE	NE	2.0E+03	0.0092	1	U	U																								
VOLATILES	Ethylbenzene	6.9E+03	7.0E+01	0.0005	0.005	NE	NE	7.0E+01	0.0046	1	U	U																								
VOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.0005	0.005	NE	NE	2.0E+00	0.0046	1	U	U																								
VOLATILES	Isopropylbenzene	9.0E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03	0.0046	1	U	U																								
VOLATILES	m,p-Xylenes [e]	3.3E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03	0.0046	1	U	U																								
VOLATILES	Methyl isobutyl ketone	3.5E+04	8.2E+02	0.0025	0.010	NE	NE	8.2E+02	0.0092	1	U	U																								
VOLATILES	Methylene chloride	1.6E+01	5.0E-01	0.0010	0.005	NE	NE	5.0E-01	0.0046	1	U	U																								
VOLATILES	Naphthalene	2.7E+02	2.0E+02	0.0005	0.010	NE	NE	2.0E+02	0.0048	1	J	J																								
VOLATILES	n-BUTYLBENZENE	5.7E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02	0.0046	1	U	U																								
VOLATILES	n-PROPYLBENZENE	5.9E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02	0.0046	1	U	U																								
VOLATILES	p-ISOPROPYLTOLUENE	6.7E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03	0.0046	1	U	U																								
VOLATILES	sec-BUTYLBENZENE	5.4E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02	0.0046	1	U	U																								
VOLATILES	Styrene	2.3E+04	1.0E+01	0.0005	0.005	NE	NE	1.0E+01	0.0046	1	U	U																								
VOLATILES	tert-BUTYLBENZENE	4.5E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02	0.0046	1	U	U																								
VOLATILES	Tetrachloroethene	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01	0.0046	1	U	U																								
VOLATILES	Toluene	2.5E+04	1.0E+02	0.0005	0.005	NE	NE	1.0E+02	0.0046	1	U	U																								
VOLATILES	trans-1,2-Dichloroethene	2.4E+03	1.0E+01	0.0005	0.005	NE	NE	1.0E+01	0.0046	1	U	U																								
VOLATILES	trans-1,3-Dichloropropene	4.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00	0.0046	1	U	U																								
VOLATILES	Trichloroethene	6.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01	0.0046	1	U	U																								
VOLATILES	Trichlorofluoromethane	3.8E+03	3.1E+03	0.0010	0.010	NE	NE	3.1E+03	0.0092	1	U	U																								

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB03				03SB04				03SB05				03SB06				03SB07				03SB07				03SB08			
	SAMPLE_NO					Background			03SB03-02				03SB04-01				03SB05-01				03SB06-01				03SB07 (0-0_5)				03SB07(0-0.5)R				03SB08 (0-0_5)			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	8/29/2006				12/19/2006				12/19/2006				12/19/2006				10/23/2007				23-Oct-07				23-Oct-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	3 - 4 Ft				3 - 4 Ft				3 - 4 Ft				3 - 4 Ft				0-0.5 Ft				0-0.5				0-0.5 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG[d]				REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
VOLATILES	Vinyl acetate	8.0E+02	1.0E+04	0.0010	0.010	NE	NE	8.0E+02	0.0092	1	U	U																								
VOLATILES	Vinyl chloride	6.6E-02	2.0E-01	0.0010	0.010	NE	NE	6.6E-02	0.0092	1	U	U																								

Notes and Abbreviations:

Shading in column indicates SDL values that exceed the Applicable MSC.

Concentration exceeds Applicable MSC.

[a] Value provided by the Texas Commission on Environmental Quality (TCEQ) as updated through March 2006 available on the TCEQ website at http://www.tceq.state.tx.us/remediation/rrr.html.

[b] Lower of surface and subsurface soil background concentrations used in these comparisons

[c] Shading in column indicates Applicable MSC equal to MQL for the chemical as provided in 30TAC§335.

[d] Where Applicable MSC is equal to MQL, value equals the SDL, which is the MDL adjusted for sample specific analytical factors.

[e] MSC value shown is for m-xylene, the more conservative of m- and p-xylene isomers.

95% UPL - 95% Upper Prediction Limit of background concentration calculated as described in TCEQ correspondence.
FD - field duplicate sample
H - estimate is high
J - Estimated value. Chemical was detected above the method detection limit but below the MQL.
L - estimate is low
NE - value not established
R - data rejected
REG - regular sample
U - compound validated as not detected above MDL shown

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION_CODE					Background		Applicable	03SB08				03SB09				03SB09				03SB10				03SB10				03SB10				03SB11			
	SAMPLE_NO								03SB08(0-0.5)R				03SB09 (0-0_5)				03SB09(0-0_5)R				03SB10-(0-0_5)				03SB10-(3-4)				03SB10-(6-7)				03SB11-(0-0_5)			
	SAMPLE_DATE	TCEQ				Concentrations in Soil			23-Oct-07				23-Oct-07				23-Oct-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		Applicable	0-0.5 Ft				0-0.5 FT				0-0.5 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based			REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
METALS	Aluminum	1.0E+06	1.0E+04	10	20	1.63E+04	2.08E+04	1.6E+04	5180	1							7790	1			6710	1		J	13700	1			8510	1			8370	1		
METALS	Antimony	4.9E+02	6.0E-01	0.05	0.1	9.40E-01	1.60E+00	9.4E-01	0.121	1		JL					0.054	1	U	U	0.574	10	U	U	0.630	10	U	U	0.601	10	U	U	0.632	10	U	U
METALS	Arsenic	2.0E+02	1.0E+00	0.075	0.3	4.81E+00	5.54E+00	4.8E+00	10.800	1							6.120	1			3.480	10			2.070	10	J	J	1.290	10	J	J	1.010	10	J	J
METALS	Barium	1.7E+05	2.0E+02	0.1	0.5	1.52E+02	8.55E+01	2.0E+02	48.80	1							57.60	1			100.00	1			66.90	1			54.80	1			229.00	1		
METALS	Beryllium	2.7E+02	4.0E-01	0.012	0.5	6.45E-01	7.66E-01	6.5E-01	0.347	1	J	J					0.259	1	J	J	0.492	1			0.494	1			0.423	1	J	J	0.475	1	J	J
METALS	Cadmium	1.5E+03	5.0E-01	0.05	0.5	1.40E+00	4.00E-01	5.0E-01	0.166	1	J	J					1.440	1			0.592	10	U	U	0.631	10	U	U	0.637	10	U	U	0.668	10	U	U
METALS	Calcium	NE	NE	NA	NA	NA	NA	--	3520	1							56000	10			2110	1			814	1			737	1			1150	1		
METALS	Chromium	3.5E+05	1.0E+01	0.12	1	2.66E+01	3.01E+01	2.7E+01	28.00	1							62.70	1			11.80	10			9.41	10			7.23	10			5.10	10		
METALS	Cobalt	1.1E+05	6.1E+02	0.12	1	7.23E+00	5.61E+00	6.1E+02	3.160	1							3.740	1			6.160	1		JL	3.180	1			3.090	1			3.460	1		
METALS	Copper	7.4E+04	1.3E+02	0.5	1	5.55E+00	9.25E+00	1.3E+02	2.95	1							11.50	1			4.08	1			4.42	1			2.83	1			3.53	1		
METALS	Iron	NE	NE	NA	NA	NA	NA	--	16400	1							23900	1			13800	1		J	12800	1		J	8860	1		J	8970	1		J
METALS	Lead	1.0E+03	1.5E+00	0.1	0.2	2.26E+01	1.14E+01	1.1E+01	701.00	100			57.7	10			75.40	10			18.90	10			11.30	10			9.17	10			8.76	10		
METALS	Magnesium	NE	NE	NA	NA	NA	NA	--	167	1							22800	1			471	1		J	813	1			610	1			769	1		
METALS	Manganese	1.1E+05	1.4E+03	0.1	0.5	1.25E+03	2.01E+02	1.4E+03	161	1							66	1			579	1			51	1			33	1			43	1		
METALS	Mercury	1.5E-01	2.0E-01	0.01	0.25	8.19E-02	3.60E-01	2.5E-01	0.1170	1	J	J					0.0241	1	J	J	0.0242	1	J	J	0.0126	1	U	U	0.0127	1	U	U	0.0134	1	U	U
METALS	Nickel	1.2E+04	2.0E+02	0.5	2	6.98E+00	1.16E+01	2.0E+02	2.68	1							4.12	1			5.56	1			5.44	1			4.10	1			4.85	1		
METALS	Potassium	NE	NE	NA	NA	NA	NA	--	180	1							350	1			264	1			406	1			234	1			220	1		
METALS	Selenium	9.3E+03	5.0E+00	0.1	0.2	3.48E+00	5.57E+00	5.0E+00	0.397	1							0.356	1			1.150	10	U	U	1.260	10	U	U	1.200	10	U	U	1.260	10	U	U
METALS	Silver	2.9E+03	5.1E+01	0.25	2	3.10E-01	3.70E-01	5.1E+01	0.246	1	J	J					0.689	1	J	J	0.224	1	U	U	0.273	1	J	J	0.238	1	U	U	0.246	1	U	U
METALS	Sodium	NE	NE	NA	NA	NA	NA	--	13.3	1	J	J					79.8	1			31.2	1			268.0	1			282.0	1			326.0	1		
METALS	Thallium	1.5E+02	2.0E-01	0.01	0.02	4.70E-01	NE	4.7E-01	0.0707	1							0.0815	1			0.1230	10	J	J	0.1660	10	J	J	0.1200	10	U	U	0.1260	10	U	U
METALS	Vanadium	3.0E+03	7.2E+01	0.25	0.5	3.21E+01	4.46E+01	7.2E+01	24.7	1							39.1	1			19.6	1			23.3	1			17.6	1			13.1	1		
METALS	Zinc	4.1E+05	3.1E+03	0.5	1	6.16E+01	2.02E+01	3.1E+03	70.50	1							1640	10			27.50	1			18.60	1			12.10	1			10.70	1		
SEMIVOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.083	0.165	NE	NE	7.0E+00																												
SEMIVOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.083	0.165	NE	NE	6.0E+01																												
SEMIVOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.083	0.165	NE	NE	7.1E+01																												
SEMIVOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.083	0.165	NE	NE	7.5E+00																												
SEMIVOLATILES	2,4,5-Trichlorophenol	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03																												
SEMIVOLATILES	2,4,6-Trichlorophenol	2.6E+02	2.6E+00	0.083	0.165	NE	NE	2.6E+00																												
SEMIVOLATILES	2,4-Dichlorophenol	3.1E+03	3.1E+01	0.083	0.165	NE	NE	3.1E+01																												
SEMIVOLATILES	2,4-Dimethylphenol	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02																												
SEMIVOLATILES	2,4-Dinitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																												
SEMIVOLATILES	2,4-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01																												
SEMIVOLATILES	2,6-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01																												
SEMIVOLATILES	2-Chloronaphthalene	7.1E+04	8.2E+02	0.083	0.165	NE	NE	8.2E+02																												
SEMIVOLATILES	2-Chlorophenol	4.0E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																												
SEMIVOLATILES	2-Methylnaphthalene	3.6E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																												
SEMIVOLATILES	2-Methylphenol	5.1E+04	5.1E+02	0.083	0.165	NE	NE	5.1E+02																												
SEMIVOLATILES	2-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00																												
SEMIVOLATILES	2-Nitrophenol	2.0E+03	3.1E+00	0.083	0.165	NE	NE	3.1E+00																												
SEMIVOLATILES	3,3'-Dichlorobenzidine	6.4E+00	6.4E-02	0.165	0.330	NE	NE	3.3E-01																												
SEMIVOLATILES	3-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00																												
SEMIVOLATILES	4,6-Dinitro-2-methylphenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																												
SEMIVOLATILES	4-Bromophenyl phenyl ethe	1.6E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01																												
SEMIVOLATILES	4-Chloro-3-methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																												
SEMIVOLATILES	4-Chloroaniline	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																												
SEMIVOLATILES	4-Chlorophenyl phenyl ethe	1.2E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01																												
SEMIVOLATILES	4-Methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																												
SEMIVOLATILES	4-Nitroaniline	7.5E+02	7.5E+00	0.330	0.825	NE	NE	7.5E+00																												
SEMIVOLATILES	4-Nitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																												
SEMIVOLATILES	Acenaphthene	3.0E+01	6.1E+02	0.083	0.165	NE	NE	3.0E+01																												

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB08				03SB09				03SB09				03SB10				03SB10				03SB10				03SB11			
	SAMPLE_NO					Background			03SB08(0-0.5)R				03SB09 (0-0_5)				03SB09(0-0_5)R				03SB10-(0-0_5)				03SB10-(3-4)				03SB10-(6-7)				03SB11-(0-0_5)			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	23-Oct-07				23-Oct-07				23-Oct-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-0.5 Ft				0-0.5 FT				0-0.5 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based		REG				REG				REG				REG				REG				REG				REG		
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
SEMIVOLATILES	Acenaphthylene	5.3E+04	6.1E+02	0.083	0.165	NE	NE	6.1E+02																												
SEMIVOLATILES	Anthracene	2.7E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																												
SEMIVOLATILES	Benzo(a)anthracene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01																												
SEMIVOLATILES	Benzo(a)pyrene	3.4E-01	2.0E-02	0.083	0.165	1.54E-02	NE	1.7E-01																												
SEMIVOLATILES	Benzo(b)fluoranthene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01																												
SEMIVOLATILES	Benzo(ghi)perylene	2.7E+04	3.1E+02	0.083	0.165	1.23E-02	NE	3.1E+02																												
SEMIVOLATILES	Benzo(k)fluoranthene	3.4E+01	3.9E-01	0.083	0.165	1.30E-02	NE	3.9E-01																												
SEMIVOLATILES	Benzoic Acid	4.1E+06	4.1E+04	0.330	0.825	NE	NE	4.1E+04																												
SEMIVOLATILES	Benzyl Alcohol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																												
SEMIVOLATILES	bis(2-Chloroethoxy)methane	9.0E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01																												
SEMIVOLATILES	bis(2-Chloroethyl)ether	3.2E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01																												
SEMIVOLATILES	bis(2-Chloroisopropyl)ether	1.5E+02	4.1E+00	0.083	0.165	NE	NE	4.1E+00																												
SEMIVOLATILES	bis(2-Ethylhexyl)phthalate	6.5E+01	6.0E-01	0.083	0.165	NE	NE	6.0E-01																												
SEMIVOLATILES	Butyl benzyl phthalate	2.0E+05	2.0E+03	0.083	0.165	NE	NE	2.0E+03																												
SEMIVOLATILES	Chrysene	3.4E+02	3.9E+00	0.083	0.165	1.51E-02	NE	3.9E+00																												
SEMIVOLATILES	Dibenzo(a,h)anthracene	3.4E-01	2.0E-02	0.083	0.165	NE	NE	1.7E-01																												
SEMIVOLATILES	Dibenzofuran	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																												
SEMIVOLATILES	Diethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03																												
SEMIVOLATILES	Dimethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03																												
SEMIVOLATILES	di-n-Butyl phthalate	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03																												
SEMIVOLATILES	di-n-Octyl phthalate	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02																												
SEMIVOLATILES	Fluoranthene	3.6E+04	4.1E+02	0.083	0.165	2.29E-02	NE	4.1E+02																												
SEMIVOLATILES	Fluorene	3.6E+04	4.1E+02	0.083	0.165	NE	NE	4.1E+02																												
SEMIVOLATILES	Hexachlorobenzene	1.0E+00	1.0E-01	0.083	0.165	NE	NE	1.7E-01																												
SEMIVOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.083	0.165	NE	NE	2.0E+00																												
SEMIVOLATILES	Hexachlorocyclopentadiene	1.4E+01	5.0E+00	0.083	0.165	NE	NE	5.0E+00																												
SEMIVOLATILES	Hexachloroethane	7.5E+02	1.0E+01	0.083	0.165	NE	NE	1.0E+01																												
SEMIVOLATILES	Indeno(1,2,3-cd)pyrene	3.4E+00	3.9E-02	0.083	0.165	1.43E-02	NE	1.7E-01																												
SEMIVOLATILES	Isophorone	3.0E+04	3.0E+02	0.083	0.165	NE	NE	3.0E+02																												
SEMIVOLATILES	Naphthalene	2.7E+02	2.0E+02	0.083	0.165	NE	NE	2.0E+02																												
SEMIVOLATILES	Nitrobenzene	2.7E+02	5.1E+00	0.083	0.165	NE	NE	5.1E+00																												
SEMIVOLATILES	n-Nitroso-di-n-propylamine	1.6E-01	4.1E-03	0.083	0.165	NE	NE	1.7E-01																												
SEMIVOLATILES	n-Nitrosodiphenylamine	2.3E+02	5.8E+00	0.083	0.165	NE	NE	5.8E+00																												
SEMIVOLATILES	Pentachlorophenol	1.4E+01	1.0E-01	0.330	0.825	NE	NE	8.3E-01																												
SEMIVOLATILES	Phenanthrene	2.7E+04	3.1E+02	0.083	0.165	NE	NE	3.1E+02																												
SEMIVOLATILES	Phenol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																												
SEMIVOLATILES	Pyrene	2.7E+04	3.1E+02	0.083	0.165	1.94E-02	NE	3.1E+02																												
SOLIDS	Percent Solids	NE	NE	NE	NE	NE	NE	--	90.8		1		91.3		1		91.3		1		84.4		1		79.3		1		78.5		1		74.8		1	
VOLATILES	1,1,1,2-Tetrachloroethane	1.1E+02	1.1E+01	0.0005	0.005	NE	NE	1.1E+01																												
VOLATILES	1,1,1-Trichloroethane	3.4E+03	2.0E+01	0.0005	0.005	NE	NE	2.0E+01																												
VOLATILES	1,1,2,2-Tetrachloroethane	9.8E+00	1.4E+00	0.0005	0.005	NE	NE	1.4E+00																												
VOLATILES	1,1,2-Trichloroethane	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																												
VOLATILES	1,1-Dichloroethane	1.3E+03	1.0E+03	0.0010	0.005	NE	NE	1.0E+03																												
VOLATILES	1,1-Dichloroethene	3.8E+02	7.0E-01	0.0005	0.005	NE	NE	7.0E-01																												
VOLATILES	1,1-Dichloropropene	1.9E+00	2.9E-01	0.0005	0.005	NE	NE	2.9E-01																												
VOLATILES	1,2,3-Trichlorobenzene	2.0E+03	3.1E+01	0.0005	0.005	NE	NE	3.1E+01																												
VOLATILES	1,2,3-Trichloropropane	8.2E-01	4.1E-03	0.0010	0.005	NE	NE	5.0E-03																												
VOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00																												
VOLATILES	1,2,4-Trimethylbenzene	1.4E+02	5.1E+02	0.0005	0.005	NE	NE	1.4E+02																												
VOLATILES	1,2-Dibromo-3-chloropropar	2.0E+00	2.0E-02	0.0020	0.005	NE	NE	2.0E-02																												
VOLATILES	1,2-Dibromoethane	1.0E-01	5.0E-03	0.0005	0.005	NE	NE	5.0E-03																												

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION_CODE								03SB08				03SB09				03SB09				03SB10				03SB10				03SB10				03SB11			
	SAMPLE_NO					Background			03SB08(0-0.5)R				03SB09 (0-0_5)				03SB09(0-0_5)R				03SB10-(0-0_5)				03SB10-(3-4)				03SB10-(6-7)				03SB11-(0-0_5)			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	23-Oct-07				23-Oct-07				23-Oct-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-0.5 Ft				0-0.5 FT				0-0.5 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based			REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
VOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.0005	0.005	NE	NE	6.0E+01																												
VOLATILES	1,2-Dichloroethane	4.7E-01	5.0E-01	0.0005	0.005	NE	NE	4.7E-01																												
VOLATILES	1,2-Dichloropropane	2.5E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																												
VOLATILES	1,2-Dimethylbenzene (o-X	4.8E+04	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																												
VOLATILES	1,3,5-Trimethylbenzene	1.2E+02	5.1E+02	0.0005	0.005	NE	NE	1.2E+02																												
VOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.0005	0.005	NE	NE	7.1E+01																												
VOLATILES	1,3-Dichloropropane	8.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00																												
VOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.0005	0.005	NE	NE	7.5E+00																												
VOLATILES	2,2-Dichloropropane	2.4E+01	4.2E+00	0.0005	0.005	NE	NE	4.2E+00																												
VOLATILES	2-Butanone	4.2E+04	6.1E+03	0.0025	0.010	NE	NE	6.1E+03																												
VOLATILES	2-Chloroethyl vinyl ether	3.0E+00	2.6E-01	0.0020	0.010	NE	NE	2.6E-01																												
VOLATILES	2-Chlorotoluene	3.5E+03	2.0E+02	0.0005	0.005	NE	NE	2.0E+02																												
VOLATILES	2-Hexanone	8.7E+01	6.1E+02	0.0025	0.010	NE	NE	8.7E+01																												
VOLATILES	4-Chlorotoluene	4.8E+00	2.0E+02	0.0005	0.005	NE	NE	4.8E+00																												
VOLATILES	Acetone	2.5E+03	9.2E+03	0.0050	0.010	NE	NE	2.5E+03																												
VOLATILES	Benzene	1.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																												
VOLATILES	Bromobenzene	1.6E+02	2.0E+02	0.0005	0.005	NE	NE	1.6E+02																												
VOLATILES	Bromochloromethane	3.4E+02	4.1E+02	0.0005	0.005	NE	NE	3.4E+02																												
VOLATILES	Bromodichloromethane	9.2E+01	4.6E-01	0.0005	0.005	NE	NE	4.6E-01																												
VOLATILES	Bromoform	8.5E+01	3.6E+00	0.0005	0.005	NE	NE	3.6E+00																												
VOLATILES	Bromomethane	4.9E+00	1.4E+01	0.0010	0.010	NE	NE	4.9E+00																												
VOLATILES	Carbon disulfide	1.5E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																												
VOLATILES	Carbon tetrachloride	6.3E-01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																												
VOLATILES	Chlorobenzene	5.9E+02	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																												
VOLATILES	Chloroethane	1.7E+04	4.1E+03	0.0010	0.010	NE	NE	4.1E+03																												
VOLATILES	Chloroform	5.2E-01	1.0E+02	0.0005	0.005	NE	NE	5.2E-01																												
VOLATILES	Chloromethane	3.8E+00	2.2E+01	0.0020	0.010	NE	NE	3.8E+00																												
VOLATILES	cis-1,2-Dichloroethene	2.5E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00																												
VOLATILES	cis-1,3-Dichloropropene	3.4E+01	5.3E-01	0.0005	0.005	NE	NE	5.3E-01																												
VOLATILES	Dibromochloromethane	6.8E+02	3.4E+00	0.0005	0.005	NE	NE	3.4E+00																												
VOLATILES	Dibromomethane	2.7E+02	3.8E+01	0.0005	0.005	NE	NE	3.8E+01																												
VOLATILES	Dichlorodifluoromethane	3.1E+03	2.0E+03	0.0010	0.010	NE	NE	2.0E+03																												
VOLATILES	Ethylbenzene	6.9E+03	7.0E+01	0.0005	0.005	NE	NE	7.0E+01																												
VOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.0005	0.005	NE	NE	2.0E+00																												
VOLATILES	Isopropylbenzene	9.0E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																												
VOLATILES	m,p-Xylenes [e]	3.3E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																												
VOLATILES	Methyl isobutyl ketone	3.5E+04	8.2E+02	0.0025	0.010	NE	NE	8.2E+02																												
VOLATILES	Methylene chloride	1.6E+01	5.0E-01	0.0010	0.005	NE	NE	5.0E-01																												
VOLATILES	Naphthalene	2.7E+02	2.0E+02	0.0005	0.010	NE	NE	2.0E+02																												
VOLATILES	n-BUTYLBENZENE	5.7E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																												
VOLATILES	n-PROPYLBENZENE	5.9E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																												
VOLATILES	p-ISOPROPYLTOLUENE	6.7E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																												
VOLATILES	sec-BUTYLBENZENE	5.4E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																												
VOLATILES	Styrene	2.3E+04	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																												
VOLATILES	tert-BUTYLBENZENE	4.5E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																												
VOLATILES	Tetrachloroethene	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																												
VOLATILES	Toluene	2.5E+04	1.0E+02	0.0005	0.005	NE	NE	1.0E+02																												
VOLATILES	trans-1,2-Dichloroethene	2.4E+03	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																												
VOLATILES	trans-1,3-Dichloropropene	4.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00																												
VOLATILES	Trichloroethene	6.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																												
VOLATILES	Trichlorofluoromethane	3.8E+03	3.1E+03	0.0010	0.010	NE	NE	3.1E+03																												

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB08				03SB09				03SB09				03SB10				03SB10				03SB10				03SB11			
	SAMPLE_NO					Background			03SB08(0-0.5)R				03SB09 (0-0_5)				03SB09(0-0_5)R				03SB10-(0-0_5)				03SB10-(3-4)				03SB10-(6-7)				03SB11-(0-0_5)			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	23-Oct-07				23-Oct-07				23-Oct-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-0.5 Ft				0-0.5 FT				0-0.5 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based					REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
VOLATILES	Vinyl acetate	8.0E+02	1.0E+04	0.0010	0.010	NE	NE	8.0E+02																												
VOLATILES	Vinyl chloride	6.6E-02	2.0E-01	0.0010	0.010	NE	NE	6.6E-02																												

Notes and Abbreviations:

Shading in column indicates SDL values that exceed the Applicable MSC.

Concentration exceeds Applicable MSC.

[a] Value provided by the Texas Commission on Environmental Quality (TCEQ) as updated through March 2006 available on the TCEQ website at http://www.tceq.state.tx.us/remediation/rrr.html.

[b] Lower of surface and subsurface soil background concentrations used in these comparisons

[c] Shading in column indicates Applicable MSC equal to MQL for the chemical as provided in 30TAC§335.

[d] Where Applicable MSC is equal to MQL, value equals the SDL, which is the MDL adjusted for sample specific analytical factors.

[e] MSC value shown is for m-xylene, the more conservative of m- and p-xylene isomers.

95% UPL - 95% Upper Prediction Limit of background concentration calculated as described in TCEQ correspondence.
FD - field duplicate sample
H - estimate is high
J - Estimated value. Chemical was detected above the method detection limit but below the MQL.
L - estimate is low
NE - value not established
R - data rejected
REG - regular sample
U - compound validated as not detected above MDL shown

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION_CODE					Background		Applicable	03SB11				03SB11				03SB12				03SB12				03SB12				03SB13				03SB13				03SB13			
	SAMPLE_NO					Concentrations in Soil			03SB11-(3-4)				03SB11-(6-7)				03SB12-(0-0_5)				03SB12-(3-4)				03SB12-(6-7)				03SB13-(0-0_5)				03SB13-(3-4)				03SB13-(6-7)			
	SAMPLE_DATE	TCEQ				(95% UPL, mg/kg) [b]		TCEQ	17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method				3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				REG				REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
METALS	Aluminum	1.0E+06	1.0E+04	10	20	1.63E+04	2.08E+04	1.6E+04	7420	1			7180	1			4580	1			12100	1			7030	1			6250	1			4720	1			5640	1		
METALS	Antimony	4.9E+02	6.0E-01	0.05	0.1	9.40E-01	1.60E+00	9.4E-01	0.595	10	U	U	0.579	10	U	U	0.586	10	U	U	3.060	50	U	U	0.555	10	U	UJL	0.597	10	U	U	0.596	10	U	U	0.621	10	U	U
METALS	Arsenic	2.0E+02	1.0E+00	0.075	0.3	4.81E+00	5.54E+00	4.8E+00	1.580	10	J	J	32.7	10			1.840	10	J	J	4.730	50	J	J	1.410	10	J	J	2.700	10	J	J	2.090	10	J	J	1.440	10	J	J
METALS	Barium	1.7E+05	2.0E+02	0.1	0.5	1.52E+02	8.55E+01	2.0E+02	119.00	1			106.00	1			53.30	1			45.50	1			32.00	1			72.10	1			51.60	1			61.90	1		
METALS	Beryllium	2.7E+02	4.0E-01	0.012	0.5	6.45E-01	7.66E-01	6.5E-01	0.368	1	J	J	0.370	1	J	J	0.418	1	J	J	0.399	1	J	J	0.213	1	J	J	0.461	1			0.283	1	J	J	0.323	1	J	J
METALS	Cadmium	1.5E+03	5.0E-01	0.05	0.5	1.40E+00	4.00E-01	5.0E-01	0.631	10	U	U	0.680	10	J	J	0.619	10	U	U	3.060	50	U	U	0.554	10	U	U	0.597	10	U	U	0.603	10	U	U	0.621	10	U	U
METALS	Calcium	NE	NE	NA	NA	NA	NA	--	972	1			4260	1			1030	1			1550	1			337	1			1420	1			804	1		J	1190	1		J
METALS	Chromium	3.5E+05	1.0E+01	0.12	1	2.66E+01	3.01E+01	2.7E+01	12.00	10			591	1000			6.86	10			13.70	50	J	J	6.40	10			13.40	10			7.77	10		J	6.73	10		J
METALS	Cobalt	1.1E+05	6.1E+02	0.12	1	7.23E+00	5.61E+00	6.1E+02	2.150	1			6.930	1			3.900	1			2.830	1			1.360	1			4.070	1			1.470	1			2.100	1		
METALS	Copper	7.4E+04	1.3E+02	0.5	1	5.55E+00	9.25E+00	1.3E+02	3.35	1			8.63	1			2.14	1			4.10	1			2.03	1			3.11	1			3.00	1			3.30	1		
METALS	Iron	NE	NE	NA	NA	NA	NA	--	8430	1		J	15000	1		J	8610	1		J	19800	1		J	6990	1		J	9510	1		J	5990	1			7550	1		
METALS	Lead	1.0E+03	1.5E+00	0.1	0.2	2.26E+01	1.14E+01	1.1E+01	36.30	10			6760	1000			19.60	10			10.60	50	J	J	5.17	10			19.20	10			8.36	10			8.61	10		
METALS	Magnesium	NE	NE	NA	NA	NA	NA	--	543	1			812	1			355	1			522	1			294	1			274	1			334	1			469	1		
METALS	Manganese	1.1E+05	1.4E+03	0.1	0.5	1.25E+03	2.01E+02	1.4E+03	55	1			175	1			382	1			69	1			76	1			274	5			66	1		J	192	1		J
METALS	Mercury	1.5E-01	2.0E-01	0.01	0.25	8.19E-02	3.60E-01	2.5E-01	0.0126	1	U	U	0.276	1			0.0341	1	J	J	0.0407	1	J	J	0.0138	1	J	J	0.0329	1	J	J	0.0204	1	J	J	0.0124	1	U	U
METALS	Nickel	1.2E+04	2.0E+02	0.5	2	6.98E+00	1.16E+01	2.0E+02	3.44	1			5.87	1			3.07	1			4.33	1			2.84	1			4.59	1			2.33	1			3.48	1		
METALS	Potassium	NE	NE	NA	NA	NA	NA	--	247	1			296	1			187	1			323	1			306	1			289	1			155	1			161	1		
METALS	Selenium	9.3E+03	5.0E+00	0.1	0.2	3.48E+00	5.57E+00	5.0E+00	1.190	10	U	U	1.160	10	U	U	1.170	10	U	U	6.120	50	U	U	1.110	10	U	U	1.190	10	U	U	1.190	10	U	U	1.240	10	U	U
METALS	Silver	2.9E+03	5.1E+01	0.25	2	3.10E-01	3.70E-01	5.1E+01	0.237	1	U	U	0.430	1			0.226	1	U	U	0.299	1	J	J	0.195	1	U	U	0.244	1	J	J	0.232	1	U	U	0.234	1	U	U
METALS	Sodium	NE	NE	NA	NA	NA	NA	--	202.0	1			38.0	1			30.2	1			120.0	1			28.2	1			50.7	1			102.0	1			164.0	1		
METALS	Thallium	1.5E+02	2.0E-01	0.01	0.02	4.70E-01	NE	4.7E-01	0.1190	10	U	U	0.1160	10	U	U	0.1170	10	U	U	0.6120	50	U	U	0.1110	10	U	U	0.1190	10	U	U	0.1190	10	U	U	0.1240	10	U	U
METALS	Vanadium	3.0E+03	7.2E+01	0.25	0.5	3.21E+01	4.46E+01	7.2E+01	17.5	1			21.6	1			19.3	1			33.9	1			22.2	1			19.0	1			15.0	1			12.3	1		
METALS	Zinc	4.1E+05	3.1E+03	0.5	1	6.16E+01	2.02E+01	3.1E+03	16.80	1			588	1			24.60	1			15.40	1			9.37	1			18.90	1			6.64	1			7.75	1		
SEMIVOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.083	0.165	NE	NE	7.0E+00																																
SEMIVOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.083	0.165	NE	NE	6.0E+01																																
SEMIVOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.083	0.165	NE	NE	7.1E+01																																
SEMIVOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.083	0.165	NE	NE	7.5E+00																																
SEMIVOLATILES	2,4,5-Trichlorophenol	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03																																
SEMIVOLATILES	2,4,6-Trichlorophenol	2.6E+02	2.6E+00	0.083	0.165	NE	NE	2.6E+00																																
SEMIVOLATILES	2,4-Dichlorophenol	3.1E+03	3.1E+01	0.083	0.165	NE	NE	3.1E+01																																
SEMIVOLATILES	2,4-Dimethylphenol	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02																																
SEMIVOLATILES	2,4-Dinitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																																
SEMIVOLATILES	2,4-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01																																
SEMIVOLATILES	2,6-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01																																
SEMIVOLATILES	2-Chloronaphthalene	7.1E+04	8.2E+02	0.083	0.165	NE	NE	8.2E+02																																
SEMIVOLATILES	2-Chlorophenol	4.0E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																																
SEMIVOLATILES	2-Methylnaphthalene	3.6E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																																
SEMIVOLATILES	2-Methylphenol	5.1E+04	5.1E+02	0.083	0.165	NE	NE	5.1E+02																																
SEMIVOLATILES	2-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00																																
SEMIVOLATILES	2-Nitrophenol	2.0E+03	3.1E+00	0.083	0.165	NE	NE	3.1E+00																																
SEMIVOLATILES	3,3'-Dichlorobenzidine	6.4E+00	6.4E-02	0.165	0.330	NE	NE	3.3E-01																																
SEMIVOLATILES	3-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00																																
SEMIVOLATILES	4,6-Dinitro-2-methylphenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																																
SEMIVOLATILES	4-Bromophenyl phenyl ethe	1.6E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01																																
SEMIVOLATILES	4-Chloro-3-methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																																
SEMIVOLATILES	4-Chloroaniline	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																																
SEMIVOLATILES	4-Chlorophenyl phenyl ethe	1.2E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01																																
SEMIVOLATILES	4-Methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																																
SEMIVOLATILES	4-Nitroaniline	7.5E+02	7.5E+00	0.330	0.825	NE	NE	7.5E+00																																
SEMIVOLATILES	4-Nitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																																
SEMIVOLATILES	Acenaphthene	3.0E+01	6.1E+02	0.083	0.165	NE	NE	3.0E+01																																

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION_CODE					Background		Applicable	03SB11				03SB11				03SB12				03SB12				03SB12				03SB13				03SB13				03SB13			
	SAMPLE_NO					Concentrations in Soil			03SB11-(3-4)				03SB11-(6-7)				03SB12-(0-0_5)				03SB12-(3-4)				03SB12-(6-7)				03SB13-(0-0_5)				03SB13-(3-4)				03SB13-(6-7)			
	SAMPLE_DATE	TCEQ							17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				REG				REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
SEMIVOLATILES	Acenaphthylene	5.3E+04	6.1E+02	0.083	0.165	NE	NE	6.1E+02																																
SEMIVOLATILES	Anthracene	2.7E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																																
SEMIVOLATILES	Benzo(a)anthracene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01																																
SEMIVOLATILES	Benzo(a)pyrene	3.4E-01	2.0E-02	0.083	0.165	1.54E-02	NE	1.7E-01																																
SEMIVOLATILES	Benzo(b)fluoranthene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01																																
SEMIVOLATILES	Benzo(ghi)perylene	2.7E+04	3.1E+02	0.083	0.165	1.23E-02	NE	3.1E+02																																
SEMIVOLATILES	Benzo(k)fluoranthene	3.4E+01	3.9E-01	0.083	0.165	1.30E-02	NE	3.9E-01																																
SEMIVOLATILES	Benzoic Acid	4.1E+06	4.1E+04	0.330	0.825	NE	NE	4.1E+04																																
SEMIVOLATILES	Benzyl Alcohol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																																
SEMIVOLATILES	bis(2-Chloroethoxy)methane	9.0E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01																																
SEMIVOLATILES	bis(2-Chloroethyl)ether	3.2E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01																																
SEMIVOLATILES	bis(2-Chloroisopropyl)ether	1.5E+02	4.1E+00	0.083	0.165	NE	NE	4.1E+00																																
SEMIVOLATILES	bis(2-Ethylhexyl)phthalate	6.5E+01	6.0E-01	0.083	0.165	NE	NE	6.0E-01																																
SEMIVOLATILES	Butyl benzyl phthalate	2.0E+05	2.0E+03	0.083	0.165	NE	NE	2.0E+03																																
SEMIVOLATILES	Chrysene	3.4E+02	3.9E+00	0.083	0.165	1.51E-02	NE	3.9E+00																																
SEMIVOLATILES	Dibenzo(a,h)anthracene	3.4E-01	2.0E-02	0.083	0.165	NE	NE	1.7E-01																																
SEMIVOLATILES	Dibenzofuran	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																																
SEMIVOLATILES	Diethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03																																
SEMIVOLATILES	Dimethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03																																
SEMIVOLATILES	di-n-Butyl phthalate	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03																																
SEMIVOLATILES	di-n-Octyl phthalate	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02																																
SEMIVOLATILES	Fluoranthene	3.6E+04	4.1E+02	0.083	0.165	2.29E-02	NE	4.1E+02																																
SEMIVOLATILES	Fluorene	3.6E+04	4.1E+02	0.083	0.165	NE	NE	4.1E+02																																
SEMIVOLATILES	Hexachlorobenzene	1.0E+00	1.0E-01	0.083	0.165	NE	NE	1.7E-01																																
SEMIVOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.083	0.165	NE	NE	2.0E+00																																
SEMIVOLATILES	Hexachlorocyclopentadiene	1.4E+01	5.0E+00	0.083	0.165	NE	NE	5.0E+00																																
SEMIVOLATILES	Hexachloroethane	7.5E+02	1.0E+01	0.083	0.165	NE	NE	1.0E+01																																
SEMIVOLATILES	Indeno(1,2,3-cd)pyrene	3.4E+00	3.9E-02	0.083	0.165	1.43E-02	NE	1.7E-01																																
SEMIVOLATILES	Isophorone	3.0E+04	3.0E+02	0.083	0.165	NE	NE	3.0E+02																																
SEMIVOLATILES	Naphthalene	2.7E+02	2.0E+02	0.083	0.165	NE	NE	2.0E+02																																
SEMIVOLATILES	Nitrobenzene	2.7E+02	5.1E+00	0.083	0.165	NE	NE	5.1E+00																																
SEMIVOLATILES	n-Nitroso-di-n-propylamine	1.6E-01	4.1E-03	0.083	0.165	NE	NE	1.7E-01																																
SEMIVOLATILES	n-Nitrosodiphenylamine	2.3E+02	5.8E+00	0.083	0.165	NE	NE	5.8E+00																																
SEMIVOLATILES	Pentachlorophenol	1.4E+01	1.0E-01	0.330	0.825	NE	NE	8.3E-01																																
SEMIVOLATILES	Phenanthrene	2.7E+04	3.1E+02	0.083	0.165	NE	NE	3.1E+02																																
SEMIVOLATILES	Phenol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																																
SEMIVOLATILES	Pyrene	2.7E+04	3.1E+02	0.083	0.165	1.94E-02	NE	3.1E+02																																
SOLIDS	Percent Solids	NE	NE	NE	NE	NE	NE	--	79.3	1			86.3	1			80.8	1			81.7	1			90.2	1			83.8	1			82.9	1			80.5	1		
VOLATILES	1,1,1,2-Tetrachloroethane	1.1E+02	1.1E+01	0.0005	0.005	NE	NE	1.1E+01																																
VOLATILES	1,1,1-Trichloroethane	3.4E+03	2.0E+01	0.0005	0.005	NE	NE	2.0E+01																																
VOLATILES	1,1,2,2-Tetrachloroethane	9.8E+00	1.4E+00	0.0005	0.005	NE	NE	1.4E+00																																
VOLATILES	1,1,2-Trichloroethane	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																																
VOLATILES	1,1-Dichloroethane	1.3E+03	1.0E+03	0.0010	0.005	NE	NE	1.0E+03																																
VOLATILES	1,1-Dichloroethene	3.8E+02	7.0E-01	0.0005	0.005	NE	NE	7.0E-01																																
VOLATILES	1,1-Dichloropropene	1.9E+00	2.9E-01	0.0005	0.005	NE	NE	2.9E-01																																
VOLATILES	1,2,3-Trichlorobenzene	2.0E+03	3.1E+01	0.0005	0.005	NE	NE	3.1E+01																																
VOLATILES	1,2,3-Trichloropropane	8.2E-01	4.1E-03	0.0010	0.005	NE	NE	5.0E-03																																
VOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00																																
VOLATILES	1,2,4-Trimethylbenzene	1.4E+02	5.1E+02	0.0005	0.005	NE	NE	1.4E+02																																
VOLATILES	1,2-Dibromo-3-chloropropan	2.0E+00	2.0E-02	0.0020	0.005	NE	NE	2.0E-02																																
VOLATILES	1,2-Dibromoethane	1.0E-01	5.0E-03	0.0005	0.005	NE	NE	5.0E-03																																

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION_CODE					Background		Applicable	03SB11				03SB11				03SB12				03SB12				03SB12				03SB13				03SB13				03SB13			
	SAMPLE_NO					Concentrations in Soil			03SB11-(3-4)				03SB11-(6-7)				03SB12-(0-0_5)				03SB12-(3-4)				03SB12-(6-7)				03SB13-(0-0_5)				03SB13-(3-4)				03SB13-(6-7)			
	SAMPLE_DATE	TCEQ							17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				REG				REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
VOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.0005	0.005	NE	NE	6.0E+01																																
VOLATILES	1,2-Dichloroethane	4.7E-01	5.0E-01	0.0005	0.005	NE	NE	4.7E-01																																
VOLATILES	1,2-Dichloropropane	2.5E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																																
VOLATILES	1,2-Dimethylbenzene (o-X	4.8E+04	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																																
VOLATILES	1,3,5-Trimethylbenzene	1.2E+02	5.1E+02	0.0005	0.005	NE	NE	1.2E+02																																
VOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.0005	0.005	NE	NE	7.1E+01																																
VOLATILES	1,3-Dichloropropane	8.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00																																
VOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.0005	0.005	NE	NE	7.5E+00																																
VOLATILES	2,2-Dichloropropane	2.4E+01	4.2E+00	0.0005	0.005	NE	NE	4.2E+00																																
VOLATILES	2-Butanone	4.2E+04	6.1E+03	0.0025	0.010	NE	NE	6.1E+03																																
VOLATILES	2-Chloroethyl vinyl ether	3.0E+00	2.6E-01	0.0020	0.010	NE	NE	2.6E-01																																
VOLATILES	2-Chlorotoluene	3.5E+03	2.0E+02	0.0005	0.005	NE	NE	2.0E+02																																
VOLATILES	2-Hexanone	8.7E+01	6.1E+02	0.0025	0.010	NE	NE	8.7E+01																																
VOLATILES	4-Chlorotoluene	4.8E+00	2.0E+02	0.0005	0.005	NE	NE	4.8E+00																																
VOLATILES	Acetone	2.5E+03	9.2E+03	0.0050	0.010	NE	NE	2.5E+03																																
VOLATILES	Benzene	1.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																																
VOLATILES	Bromobenzene	1.6E+02	2.0E+02	0.0005	0.005	NE	NE	1.6E+02																																
VOLATILES	Bromochloromethane	3.4E+02	4.1E+02	0.0005	0.005	NE	NE	3.4E+02																																
VOLATILES	Bromodichloromethane	9.2E+01	4.6E-01	0.0005	0.005	NE	NE	4.6E-01																																
VOLATILES	Bromoform	8.5E+01	3.6E+00	0.0005	0.005	NE	NE	3.6E+00																																
VOLATILES	Bromomethane	4.9E+00	1.4E+01	0.0010	0.010	NE	NE	4.9E+00																																
VOLATILES	Carbon disulfide	1.5E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																																
VOLATILES	Carbon tetrachloride	6.3E-01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																																
VOLATILES	Chlorobenzene	5.9E+02	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																																
VOLATILES	Chloroethane	1.7E+04	4.1E+03	0.0010	0.010	NE	NE	4.1E+03																																
VOLATILES	Chloroform	5.2E-01	1.0E+02	0.0005	0.005	NE	NE	5.2E-01																																
VOLATILES	Chloromethane	3.8E+00	2.2E+01	0.0020	0.010	NE	NE	3.8E+00																																
VOLATILES	cis-1,2-Dichloroethene	2.5E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00																																
VOLATILES	cis-1,3-Dichloropropene	3.4E+01	5.3E-01	0.0005	0.005	NE	NE	5.3E-01																																
VOLATILES	Dibromochloromethane	6.8E+02	3.4E+00	0.0005	0.005	NE	NE	3.4E+00																																
VOLATILES	Dibromomethane	2.7E+02	3.8E+01	0.0005	0.005	NE	NE	3.8E+01																																
VOLATILES	Dichlorodifluoromethane	3.1E+03	2.0E+03	0.0010	0.010	NE	NE	2.0E+03																																
VOLATILES	Ethylbenzene	6.9E+03	7.0E+01	0.0005	0.005	NE	NE	7.0E+01																																
VOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.0005	0.005	NE	NE	2.0E+00																																
VOLATILES	Isopropylbenzene	9.0E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																																
VOLATILES	m,p-Xylenes [e]	3.3E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																																
VOLATILES	Methyl isobutyl ketone	3.5E+04	8.2E+02	0.0025	0.010	NE	NE	8.2E+02																																
VOLATILES	Methylene chloride	1.6E+01	5.0E-01	0.0010	0.005	NE	NE	5.0E-01																																
VOLATILES	Naphthalene	2.7E+02	2.0E+02	0.0005	0.010	NE	NE	2.0E+02																																
VOLATILES	n-BUTYLBENZENE	5.7E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																																
VOLATILES	n-PROPYLBENZENE	5.9E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																																
VOLATILES	p-ISOPROPYLTOLUENE	6.7E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																																
VOLATILES	sec-BUTYLBENZENE	5.4E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																																
VOLATILES	Styrene	2.3E+04	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																																
VOLATILES	tert-BUTYLBENZENE	4.5E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																																
VOLATILES	Tetrachloroethene	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																																
VOLATILES	Toluene	2.5E+04	1.0E+02	0.0005	0.005	NE	NE	1.0E+02																																
VOLATILES	trans-1,2-Dichloroethene	2.4E+03	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																																
VOLATILES	trans-1,3-Dichloropropene	4.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00																																
VOLATILES	Trichloroethene	6.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																																
VOLATILES	Trichlorofluoromethane	3.8E+03	3.1E+03	0.0010	0.010	NE	NE	3.1E+03																																

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB11				03SB11				03SB12				03SB12				03SB12				03SB13				03SB13				03SB13			
	SAMPLE_NO					Background			03SB11-(3-4)				03SB11-(6-7)				03SB12-(0-0_5)				03SB12-(3-4)				03SB12-(6-7)				03SB13-(0-0_5)				03SB13-(3-4)				03SB13-(6-7)			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				REG				REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
VOLATILES	Vinyl acetate	8.0E+02	1.0E+04	0.0010	0.010	NE	NE	8.0E+02																																
VOLATILES	Vinyl chloride	6.6E-02	2.0E-01	0.0010	0.010	NE	NE	6.6E-02																																

Notes and Abbreviations:

Shading in column indicates SDL values that exceed the Applicable MSC.

Concentration exceeds Applicable MSC.

[a] Value provided by the Texas Commission on Environmental Quality (TCEQ) as updated through March 2006 available on the TCEQ website at http://www.tceq.state.tx.us/remediation/rrr.html.

[b] Lower of surface and subsurface soil background concentrations used in these comparisons

[c] Shading in column indicates Applicable MSC equal to MQL for the chemical as provided in 30TAC§335.

[d] Where Applicable MSC is equal to MQL, value equals the SDL, which is the MDL adjusted for sample specific analytical factors.

[e] MSC value shown is for m-xylene, the more conservative of m- and p-xylene isomers.

95% UPL - 95% Upper Prediction Limit of background concentration calculated as described in TCEQ correspondence.
FD - field duplicate sample
H - estimate is high
J - Estimated value. Chemical was detected above the method detection limit but below the MQL.
L - estimate is low
NE - value not established
R - data rejected
REG - regular sample
U - compound validated as not detected above MDL shown

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB14				03SB14				03SB14				03SB15				03SB15				03SB15			
	SAMPLE_NO					Background			03SB14-(0-0_5)				03SB14-(3-4)				03SB14-(6-7)				03SB15-(0-0_5)				03SB15-(3-4)				03SB15-(6-7)			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
METALS	Aluminum	1.0E+06	1.0E+04	10	20	1.63E+04	2.08E+04	1.6E+04	3580	1			5470	1			15100	1			5180	1			10100	1			5280	1		
METALS	Antimony	4.9E+02	6.0E-01	0.05	0.1	9.40E-01	1.60E+00	9.4E-01	0.588	10	U	U	0.60	10	U	U	0.622	10	U	U	0.571	10	U	U	0.599	10	U	U	0.572	10	U	U
METALS	Arsenic	2.0E+02	1.0E+00	0.075	0.3	4.81E+00	5.54E+00	4.8E+00	4.45	10			2.52	10	J	J	4.8	10			3.8	10			1.770	10	J	J	7.620	10		
METALS	Barium	1.7E+05	2.0E+02	0.1	0.5	1.52E+02	8.55E+01	2.0E+02	49	1			25.70	1			52.6	1			54.4	1			83.40	1			82.70	1		
METALS	Beryllium	2.7E+02	4.0E-01	0.012	0.5	6.45E-01	7.66E-01	6.5E-01	0.288	1	J	J	0.16	1	J	J	0.607	1			0.444	1			0.497	1			0.341	1	J	J
METALS	Cadmium	1.5E+03	5.0E-01	0.05	0.5	1.40E+00	4.00E-01	5.0E-01	0.70	10	J	J	0.60	10	U	U	0.623	10	U	U	0.665	10	J	J	0.608	10	U	U	0.574	10	U	U
METALS	Calcium	NE	NE	NA	NA	NA	NA	--	26300	10		J	371.00	1		J	609	1		J	1010	1		J	881	1		J	573	1		J
METALS	Chromium	3.5E+05	1.0E+01	0.12	1	2.66E+01	3.01E+01	2.7E+01	32.8	10		J	9.26	10		J	21.6	10		J	25.7	10		J	8.20	10		J	11.90	10		J
METALS	Cobalt	1.1E+05	6.1E+02	0.12	1	7.23E+00	5.61E+00	6.1E+02	6.86	1			1.70	1			5.310	1			3.270	1			3.710	1			2.600	1		
METALS	Copper	7.4E+04	1.3E+02	0.5	1	5.55E+00	9.25E+00	1.3E+02	3.18	1			1.96	1			6.640	1			2.460	1			3.78	1			2.43	1		
METALS	Iron	NE	NE	NA	NA	NA	NA	--	5380	1			9990	1			20400.0	1			6610.0	1			12300	1			6910	1		
METALS	Lead	1.0E+03	1.5E+00	0.1	0.2	2.26E+01	1.14E+01	1.1E+01	259	10			5.52	10			17.6	10			150.0	10			14.10	10			60.00	10		
METALS	Magnesium	NE	NE	NA	NA	NA	NA	--	13800	1			219.00	1			640	1			212	1			559	1			350	1		
METALS	Manganese	1.1E+05	1.4E+03	0.1	0.5	1.25E+03	2.01E+02	1.4E+03	374	1		J	39	1		J	25.1	1		J	79.4	1		J	200	1		J	81	1		J
METALS	Mercury	1.5E-01	2.0E-01	0.01	0.25	8.19E-02	3.60E-01	2.5E-01	0.175	1			0.01	1	U	U	0.040	1	J	J	0.043	1	J	J	0.0282	1	J	J	0.0115	1	U	U
METALS	Nickel	1.2E+04	2.0E+02	0.5	2	6.98E+00	1.16E+01	2.0E+02	3.04	1			2.92	1			5.160	1			3.560	1			3.88	1			2.60	1		
METALS	Potassium	NE	NE	NA	NA	NA	NA	--	153	1			212	1			308	1			213	1			297	1			189	1		
METALS	Selenium	9.3E+03	5.0E+00	0.1	0.2	3.48E+00	5.57E+00	5.0E+00	1.21	10	J	J	1.19	10	U	U	1.600	10	J	J	1.140	10	U	U	1.200	10	U	U	1.800	10	J	J
METALS	Silver	2.9E+03	5.1E+01	0.25	2	3.10E-01	3.70E-01	5.1E+01	0.353	1	J	J	0.22	1	U	U	0.302	1	J	J	0.210	1	U	U	0.220	1	U	U	0.213	1	U	U
METALS	Sodium	NE	NE	NA	NA	NA	NA	--	85.50	1			33.40	1			363	1			58	1			169.0	1			130.0	1		
METALS	Thallium	1.5E+02	2.0E-01	0.01	0.02	4.70E-01	NE	4.7E-01	0.118	10	U	U	0.12	10	U	U	0.173	10	J	J	0.114	10	U	U	0.1200	10	U	U	0.1140	10	U	U
METALS	Vanadium	3.0E+03	7.2E+01	0.25	0.5	3.21E+01	4.46E+01	7.2E+01	12.60	1			22.20	1			36.4	1			15.9	1			23.9	1			17.4	1		
METALS	Zinc	4.1E+05	3.1E+03	0.5	1	6.16E+01	2.02E+01	3.1E+03	228	1			12.90	1			15.6	1			44.8	1			13.90	1			167.00	1		
SEMIVOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.083	0.165	NE	NE	7.0E+00																								
SEMIVOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.083	0.165	NE	NE	6.0E+01																								
SEMIVOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.083	0.165	NE	NE	7.1E+01																								
SEMIVOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.083	0.165	NE	NE	7.5E+00																								
SEMIVOLATILES	2,4,5-Trichlorophenol	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03																								
SEMIVOLATILES	2,4,6-Trichlorophenol	2.6E+02	2.6E+00	0.083	0.165	NE	NE	2.6E+00																								
SEMIVOLATILES	2,4-Dichlorophenol	3.1E+03	3.1E+01	0.083	0.165	NE	NE	3.1E+01																								
SEMIVOLATILES	2,4-Dimethylphenol	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02																								
SEMIVOLATILES	2,4-Dinitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																								
SEMIVOLATILES	2,4-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01																								
SEMIVOLATILES	2,6-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01																								
SEMIVOLATILES	2-Chloronaphthalene	7.1E+04	8.2E+02	0.083	0.165	NE	NE	8.2E+02																								
SEMIVOLATILES	2-Chlorophenol	4.0E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																								
SEMIVOLATILES	2-Methylnaphthalene	3.6E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																								
SEMIVOLATILES	2-Methylphenol	5.1E+04	5.1E+02	0.083	0.165	NE	NE	5.1E+02																								
SEMIVOLATILES	2-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00																								
SEMIVOLATILES	2-Nitrophenol	2.0E+03	3.1E+00	0.083	0.165	NE	NE	3.1E+00																								
SEMIVOLATILES	3,3'-Dichlorobenzidine	6.4E+00	6.4E-02	0.165	0.330	NE	NE	3.3E-01																								
SEMIVOLATILES	3-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00																								
SEMIVOLATILES	4,6-Dinitro-2-methylphenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																								
SEMIVOLATILES	4-Bromophenyl phenyl ethe	1.6E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01																								
SEMIVOLATILES	4-Chloro-3-methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																								
SEMIVOLATILES	4-Chloroaniline	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																								
SEMIVOLATILES	4-Chlorophenyl phenyl ethe	1.2E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01																								
SEMIVOLATILES	4-Methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																								
SEMIVOLATILES	4-Nitroaniline	7.5E+02	7.5E+00	0.330	0.825	NE	NE	7.5E+00																								
SEMIVOLATILES	4-Nitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																								
SEMIVOLATILES	Acenaphthene	3.0E+01	6.1E+02	0.083	0.165	NE	NE	3.0E+01																								

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB14				03SB14				03SB14				03SB15				03SB15				03SB15			
	SAMPLE_NO					Background		Applicable	03SB14-(0-0_5)				03SB14-(3-4)				03SB14-(6-7)				03SB15-(0-0_5)				03SB15-(3-4)				03SB15-(6-7)			
	SAMPLE_DATE	TCEQ				Concentrations in Soil			17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
SEMIVOLATILES	Acenaphthylene	5.3E+04	6.1E+02	0.083	0.165	NE	NE	6.1E+02																								
SEMIVOLATILES	Anthracene	2.7E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																								
SEMIVOLATILES	Benzo(a)anthracene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01																								
SEMIVOLATILES	Benzo(a)pyrene	3.4E-01	2.0E-02	0.083	0.165	1.54E-02	NE	1.7E-01																								
SEMIVOLATILES	Benzo(b)fluoranthene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01																								
SEMIVOLATILES	Benzo(ghi)perylene	2.7E+04	3.1E+02	0.083	0.165	1.23E-02	NE	3.1E+02																								
SEMIVOLATILES	Benzo(k)fluoranthene	3.4E+01	3.9E-01	0.083	0.165	1.30E-02	NE	3.9E-01																								
SEMIVOLATILES	Benzoic Acid	4.1E+06	4.1E+04	0.330	0.825	NE	NE	4.1E+04																								
SEMIVOLATILES	Benzyl Alcohol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																								
SEMIVOLATILES	bis(2-Chloroethoxy)methane	9.0E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01																								
SEMIVOLATILES	bis(2-Chloroethyl)ether	3.2E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01																								
SEMIVOLATILES	bis(2-Chloroisopropyl)ether	1.5E+02	4.1E+00	0.083	0.165	NE	NE	4.1E+00																								
SEMIVOLATILES	bis(2-Ethylhexyl)phthalate	6.5E+01	6.0E-01	0.083	0.165	NE	NE	6.0E-01																								
SEMIVOLATILES	Butyl benzyl phthalate	2.0E+05	2.0E+03	0.083	0.165	NE	NE	2.0E+03																								
SEMIVOLATILES	Chrysene	3.4E+02	3.9E+00	0.083	0.165	1.51E-02	NE	3.9E+00																								
SEMIVOLATILES	Dibenzo(a,h)anthracene	3.4E-01	2.0E-02	0.083	0.165	NE	NE	1.7E-01																								
SEMIVOLATILES	Dibenzofuran	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																								
SEMIVOLATILES	Diethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03																								
SEMIVOLATILES	Dimethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03																								
SEMIVOLATILES	di-n-Butyl phthalate	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03																								
SEMIVOLATILES	di-n-Octyl phthalate	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02																								
SEMIVOLATILES	Fluoranthene	3.6E+04	4.1E+02	0.083	0.165	2.29E-02	NE	4.1E+02																								
SEMIVOLATILES	Fluorene	3.6E+04	4.1E+02	0.083	0.165	NE	NE	4.1E+02																								
SEMIVOLATILES	Hexachlorobenzene	1.0E+00	1.0E-01	0.083	0.165	NE	NE	1.7E-01																								
SEMIVOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.083	0.165	NE	NE	2.0E+00																								
SEMIVOLATILES	Hexachlorocyclopentadiene	1.4E+01	5.0E+00	0.083	0.165	NE	NE	5.0E+00																								
SEMIVOLATILES	Hexachloroethane	7.5E+02	1.0E+01	0.083	0.165	NE	NE	1.0E+01																								
SEMIVOLATILES	Indeno(1,2,3-cd)pyrene	3.4E+00	3.9E-02	0.083	0.165	1.43E-02	NE	1.7E-01																								
SEMIVOLATILES	Isophorone	3.0E+04	3.0E+02	0.083	0.165	NE	NE	3.0E+02																								
SEMIVOLATILES	Naphthalene	2.7E+02	2.0E+02	0.083	0.165	NE	NE	2.0E+02																								
SEMIVOLATILES	Nitrobenzene	2.7E+02	5.1E+00	0.083	0.165	NE	NE	5.1E+00																								
SEMIVOLATILES	n-Nitroso-di-n-propylamine	1.6E-01	4.1E-03	0.083	0.165	NE	NE	1.7E-01																								
SEMIVOLATILES	n-Nitrosodiphenylamine	2.3E+02	5.8E+00	0.083	0.165	NE	NE	5.8E+00																								
SEMIVOLATILES	Pentachlorophenol	1.4E+01	1.0E-01	0.330	0.825	NE	NE	8.3E-01																								
SEMIVOLATILES	Phenanthrene	2.7E+04	3.1E+02	0.083	0.165	NE	NE	3.1E+02																								
SEMIVOLATILES	Phenol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																								
SEMIVOLATILES	Pyrene	2.7E+04	3.1E+02	0.083	0.165	1.94E-02	NE	3.1E+02																								
SOLIDS	Percent Solids	NE	NE	NE	NE	NE	NE	--	83.6	1			83.4	1			80.3	1			87.5	1			82.2	1			87.1	1		
VOLATILES	1,1,1,2-Tetrachloroethane	1.1E+02	1.1E+01	0.0005	0.005	NE	NE	1.1E+01																								
VOLATILES	1,1,1-Trichloroethane	3.4E+03	2.0E+01	0.0005	0.005	NE	NE	2.0E+01																								
VOLATILES	1,1,2,2-Tetrachloroethane	9.8E+00	1.4E+00	0.0005	0.005	NE	NE	1.4E+00																								
VOLATILES	1,1,2-Trichloroethane	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																								
VOLATILES	1,1-Dichloroethane	1.3E+03	1.0E+03	0.0010	0.005	NE	NE	1.0E+03																								
VOLATILES	1,1-Dichloroethene	3.8E+02	7.0E-01	0.0005	0.005	NE	NE	7.0E-01																								
VOLATILES	1,1-Dichloropropene	1.9E+00	2.9E-01	0.0005	0.005	NE	NE	2.9E-01																								
VOLATILES	1,2,3-Trichlorobenzene	2.0E+03	3.1E+01	0.0005	0.005	NE	NE	3.1E+01																								
VOLATILES	1,2,3-Trichloropropane	8.2E-01	4.1E-03	0.0010	0.005	NE	NE	5.0E-03																								
VOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00																								
VOLATILES	1,2,4-Trimethylbenzene	1.4E+02	5.1E+02	0.0005	0.005	NE	NE	1.4E+02																								
VOLATILES	1,2-Dibromo-3-chloropropan	2.0E+00	2.0E-02	0.0020	0.005	NE	NE	2.0E-02																								
VOLATILES	1,2-Dibromoethane	1.0E-01	5.0E-03	0.0005	0.005	NE	NE	5.0E-03																								

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION_CODE								03SB14				03SB14				03SB14				03SB15				03SB15				03SB15			
	SAMPLE_NO					Background			03SB14-(0-0_5)				03SB14-(3-4)				03SB14-(6-7)				03SB15-(0-0_5)				03SB15-(3-4)				03SB15-(6-7)			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
VOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.0005	0.005	NE	NE	6.0E+01																								
VOLATILES	1,2-Dichloroethane	4.7E-01	5.0E-01	0.0005	0.005	NE	NE	4.7E-01																								
VOLATILES	1,2-Dichloropropane	2.5E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																								
VOLATILES	1,2-Dimethylbenzene (o-X	4.8E+04	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																								
VOLATILES	1,3,5-Trimethylbenzene	1.2E+02	5.1E+02	0.0005	0.005	NE	NE	1.2E+02																								
VOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.0005	0.005	NE	NE	7.1E+01																								
VOLATILES	1,3-Dichloropropane	8.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00																								
VOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.0005	0.005	NE	NE	7.5E+00																								
VOLATILES	2,2-Dichloropropane	2.4E+01	4.2E+00	0.0005	0.005	NE	NE	4.2E+00																								
VOLATILES	2-Butanone	4.2E+04	6.1E+03	0.0025	0.010	NE	NE	6.1E+03																								
VOLATILES	2-Chloroethyl vinyl ether	3.0E+00	2.6E-01	0.0020	0.010	NE	NE	2.6E-01																								
VOLATILES	2-Chlorotoluene	3.5E+03	2.0E+02	0.0005	0.005	NE	NE	2.0E+02																								
VOLATILES	2-Hexanone	8.7E+01	6.1E+02	0.0025	0.010	NE	NE	8.7E+01																								
VOLATILES	4-Chlorotoluene	4.8E+00	2.0E+02	0.0005	0.005	NE	NE	4.8E+00																								
VOLATILES	Acetone	2.5E+03	9.2E+03	0.0050	0.010	NE	NE	2.5E+03																								
VOLATILES	Benzene	1.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																								
VOLATILES	Bromobenzene	1.6E+02	2.0E+02	0.0005	0.005	NE	NE	1.6E+02																								
VOLATILES	Bromochloromethane	3.4E+02	4.1E+02	0.0005	0.005	NE	NE	3.4E+02																								
VOLATILES	Bromodichloromethane	9.2E+01	4.6E-01	0.0005	0.005	NE	NE	4.6E-01																								
VOLATILES	Bromoform	8.5E+01	3.6E+00	0.0005	0.005	NE	NE	3.6E+00																								
VOLATILES	Bromomethane	4.9E+00	1.4E+01	0.0010	0.010	NE	NE	4.9E+00																								
VOLATILES	Carbon disulfide	1.5E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																								
VOLATILES	Carbon tetrachloride	6.3E-01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																								
VOLATILES	Chlorobenzene	5.9E+02	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																								
VOLATILES	Chloroethane	1.7E+04	4.1E+03	0.0010	0.010	NE	NE	4.1E+03																								
VOLATILES	Chloroform	5.2E-01	1.0E+02	0.0005	0.005	NE	NE	5.2E-01																								
VOLATILES	Chloromethane	3.8E+00	2.2E+01	0.0020	0.010	NE	NE	3.8E+00																								
VOLATILES	cis-1,2-Dichloroethene	2.5E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00																								
VOLATILES	cis-1,3-Dichloropropene	3.4E+01	5.3E-01	0.0005	0.005	NE	NE	5.3E-01																								
VOLATILES	Dibromochloromethane	6.8E+02	3.4E+00	0.0005	0.005	NE	NE	3.4E+00																								
VOLATILES	Dibromomethane	2.7E+02	3.8E+01	0.0005	0.005	NE	NE	3.8E+01																								
VOLATILES	Dichlorodifluoromethane	3.1E+03	2.0E+03	0.0010	0.010	NE	NE	2.0E+03																								
VOLATILES	Ethylbenzene	6.9E+03	7.0E+01	0.0005	0.005	NE	NE	7.0E+01																								
VOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.0005	0.005	NE	NE	2.0E+00																								
VOLATILES	Isopropylbenzene	9.0E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																								
VOLATILES	m,p-Xylenes [e]	3.3E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																								
VOLATILES	Methyl isobutyl ketone	3.5E+04	8.2E+02	0.0025	0.010	NE	NE	8.2E+02																								
VOLATILES	Methylene chloride	1.6E+01	5.0E-01	0.0010	0.005	NE	NE	5.0E-01																								
VOLATILES	Naphthalene	2.7E+02	2.0E+02	0.0005	0.010	NE	NE	2.0E+02																								
VOLATILES	n-BUTYLBENZENE	5.7E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																								
VOLATILES	n-PROPYLBENZENE	5.9E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																								
VOLATILES	p-ISOPROPYLTOLUENE	6.7E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																								
VOLATILES	sec-BUTYLBENZENE	5.4E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																								
VOLATILES	Styrene	2.3E+04	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																								
VOLATILES	tert-BUTYLBENZENE	4.5E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																								
VOLATILES	Tetrachloroethene	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																								
VOLATILES	Toluene	2.5E+04	1.0E+02	0.0005	0.005	NE	NE	1.0E+02																								
VOLATILES	trans-1,2-Dichloroethene	2.4E+03	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																								
VOLATILES	trans-1,3-Dichloropropene	4.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00																								
VOLATILES	Trichloroethene	6.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																								
VOLATILES	Trichlorofluoromethane	3.8E+03	3.1E+03	0.0010	0.010	NE	NE	3.1E+03																								

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB14				03SB14				03SB14				03SB15				03SB15				03SB15			
	SAMPLE_NO					Background			03SB14-(0-0_5)				03SB14-(3-4)				03SB14-(6-7)				03SB15-(0-0_5)				03SB15-(3-4)				03SB15-(6-7)			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
VOLATILES	Vinyl acetate	8.0E+02	1.0E+04	0.0010	0.010	NE	NE	8.0E+02																								
VOLATILES	Vinyl chloride	6.6E-02	2.0E-01	0.0010	0.010	NE	NE	6.6E-02																								

Notes and Abbreviations:

Shading in column indicates SDL values that exceed the Applicable MSC.

Concentration exceeds Applicable MSC.

[a] Value provided by the Texas Commission on Environmental Quality (TCEQ) as updated through March 2006 available on the TCEQ website at http://www.tceq.state.tx.us/remediation/rrr.html.

[b] Lower of surface and subsurface soil background concentrations used in these comparisons

[c] Shading in column indicates Applicable MSC equal to MQL for the chemical as provided in 30TAC§335.

[d] Where Applicable MSC is equal to MQL, value equals the SDL, which is the MDL adjusted for sample specific analytical factors.

[e] MSC value shown is for m-xylene, the more conservative of m- and p-xylene isomers.

95% UPL - 95% Upper Prediction Limit of background concentration calculated as described in TCEQ correspondence.
FD - field duplicate sample
H - estimate is high
J - Estimated value. Chemical was detected above the method detection limit but below the MQL.
L - estimate is low
NE - value not established
R - data rejected
REG - regular sample
U - compound validated as not detected above MDL shown

Table 3-1b
Comparison of Chemical Concentration in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB16				03SB16				03SB16				03SB16				03SB16			
	SAMPLE_NO					Background			03SB16-(0-0_5)				03SB16-(0-0_5)-QA				03SB16-(3-4)				03SB16-(6-7)				03SB16-(6-7)-QA			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-.5 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				6-7 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				FD				REG				REG				FD			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ
METALS	Aluminum	1.0E+06	1.0E+04	10	20	1.63E+04	2.08E+04	1.6E+04	6840	1			9580	1			6760	1			7170	1			9680	1		
METALS	Antimony	4.9E+02	6.0E-01	0.05	0.1	9.40E-01	1.60E+00	9.4E-01	0.626	10	U		0.593	10	U	U	0.604	10	U	U	0.620	10	U	U	0.591	10	U	U
METALS	Arsenic	2.0E+02	1.0E+00	0.075	0.3	4.81E+00	5.54E+00	4.8E+00	2.030	10	U	J	4.340	10			1.510	10	J	J	2.650	10	J	J	2.840	10	J	J
METALS	Barium	1.7E+05	2.0E+02	0.1	0.5	1.52E+02	8.55E+01	2.0E+02	81.30	1	J		77.50	1			88.70	1			27.9	1			29.30	1		
METALS	Beryllium	2.7E+02	4.0E-01	0.012	0.5	6.45E-01	7.66E-01	6.5E-01	0.500	1			0.486	1			0.452	1			0.161	1	J	J	0.261	1	J	J
METALS	Cadmium	1.5E+03	5.0E-01	0.05	0.5	1.40E+00	4.00E-01	5.0E-01	0.313	10		U	0.593	10	U	U	0.614	10	U	U	0.639	10	U	U	0.592	10	U	U
METALS	Calcium	NE	NE	NA	NA	NA	NA	--	1110	1	U	J	1920	1			968	1		J	357	1			445	1		
METALS	Chromium	3.5E+05	1.0E+01	0.12	1	2.66E+01	3.01E+01	2.7E+01	8.23	10		J	17.70	10			7.58	10		J	7.440	10			10.80	10		
METALS	Cobalt	1.1E+05	6.1E+02	0.12	1	7.23E+00	5.61E+00	6.1E+02	4.630	1			4.760	1			4.470	1			1.330	1			1.580	1		
METALS	Copper	7.4E+04	1.3E+02	0.5	1	5.55E+00	9.25E+00	1.3E+02	3.16	1			3.84	1			3.36	1			2.390	1			3.19	1		
METALS	Iron	NE	NE	NA	NA	NA	NA	--	7330	1			8800	1			7890	1			9140	1		J	15400	1		J
METALS	Lead	1.0E+03	1.5E+00	0.1	0.2	2.26E+01	1.14E+01	1.1E+01	7.31	10			8.83	10			5.76	10			6.200	10			7.39	10		
METALS	Magnesium	NE	NE	NA	NA	NA	NA	--	291	1			436	1			284	1			281	1			365	1		
METALS	Manganese	1.1E+05	1.4E+03	0.1	0.5	1.25E+03	2.01E+02	1.4E+03	102	1		J	197	1			162	1		J	37.90	1			33	1		
METALS	Mercury	1.5E-01	2.0E-01	0.01	0.25	8.19E-02	3.60E-01	2.5E-01	0.0128	1		J	0.0146	1	J	J	0.0131	1	J	J	0.016	1	J	J	0.0140	1	J	J
METALS	Nickel	1.2E+04	2.0E+02	0.5	2	6.98E+00	1.16E+01	2.0E+02	4.64	1	J		5.79	1			4.59	1			2.550	1			3.87	1		
METALS	Potassium	NE	NE	NA	NA	NA	NA	--	309	1			476	1			301	1			280	1			399	1		
METALS	Selenium	9.3E+03	5.0E+00	0.1	0.2	3.48E+00	5.57E+00	5.0E+00	1.250	10		U	1.190	10	U	U	1.210	10	U	U	1.240	10	U	U	1.180	10	U	U
METALS	Silver	2.9E+03	5.1E+01	0.25	2	3.10E-01	3.70E-01	5.1E+01	0.239	1	U	U	0.225	1	U	U	0.221	1	U	U	0.242	1	J	J	0.227	1	J	J
METALS	Sodium	NE	NE	NA	NA	NA	NA	--	28.9	1	U		45.1	1			39.4	1			43.50	1			46.6	1		
METALS	Thallium	1.5E+02	2.0E-01	0.01	0.02	4.70E-01	NE	4.7E-01	0.1250	10		U	0.1190	10	U	U	0.1210	10	U	U	0.124	10	U	U	0.1180	10	U	U
METALS	Vanadium	3.0E+03	7.2E+01	0.25	0.5	3.21E+01	4.46E+01	7.2E+01	15.3	1	U		18.5	1			17.7	1			19.70	1			32.1	1		
METALS	Zinc	4.1E+05	3.1E+03	0.5	1	6.16E+01	2.02E+01	3.1E+03	9.85	1			13.60	1			10.40	1			9.11	1			13.80	1		
SEMIVOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.083	0.165	NE	NE	7.0E+00																				
SEMIVOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.083	0.165	NE	NE	6.0E+01																				
SEMIVOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.083	0.165	NE	NE	7.1E+01																				
SEMIVOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.083	0.165	NE	NE	7.5E+00																				
SEMIVOLATILES	2,4,5-Trichlorophenol	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03																				
SEMIVOLATILES	2,4,6-Trichlorophenol	2.6E+02	2.6E+00	0.083	0.165	NE	NE	2.6E+00																				
SEMIVOLATILES	2,4-Dichlorophenol	3.1E+03	3.1E+01	0.083	0.165	NE	NE	3.1E+01																				
SEMIVOLATILES	2,4-Dimethylphenol	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02																				
SEMIVOLATILES	2,4-Dinitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																				
SEMIVOLATILES	2,4-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	2,6-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	2-Chloronaphthalene	7.1E+04	8.2E+02	0.083	0.165	NE	NE	8.2E+02																				
SEMIVOLATILES	2-Chlorophenol	4.0E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																				
SEMIVOLATILES	2-Methylnaphthalene	3.6E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																				
SEMIVOLATILES	2-Methylphenol	5.1E+04	5.1E+02	0.083	0.165	NE	NE	5.1E+02																				
SEMIVOLATILES	2-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00																				
SEMIVOLATILES	2-Nitrophenol	2.0E+03	3.1E+00	0.083	0.165	NE	NE	3.1E+00																				
SEMIVOLATILES	3,3'-Dichlorobenzidine	6.4E+00	6.4E-02	0.165	0.330	NE	NE	3.3E-01																				
SEMIVOLATILES	3-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00																				
SEMIVOLATILES	4,6-Dinitro-2-methylphenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																				
SEMIVOLATILES	4-Bromophenyl phenyl ether	1.6E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	4-Chloro-3-methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																				
SEMIVOLATILES	4-Chloroaniline	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																				
SEMIVOLATILES	4-Chlorophenyl phenyl ether	1.2E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	4-Methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																				
SEMIVOLATILES	4-Nitroaniline	7.5E+02	7.5E+00	0.330	0.825	NE	NE	7.5E+00																				
SEMIVOLATILES	4-Nitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																				
SEMIVOLATILES	Acenaphthene	3.0E+01	6.1E+02	0.083	0.165	NE	NE	3.0E+01																				

Table 3-1b
Comparison of Chemical Concentration in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB17				03SB17				03SB17				03SB11-(10-11)				03SB11-(BOTTOM)			
	SAMPLE_NO					Background			03SB17-(0-0_5)				03SB17-(3-4)				03SB17-(6-7)				03SB11-111808				03SB11-111808			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	17-Dec-07				17-Dec-07				17-Dec-07				18-Nov-08				18-Nov-08			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-.5 Ft				3-4 Ft				6-7 Ft				10-11				14-15			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ
METALS	Aluminum	1.0E+06	1.0E+04	10	20	1.63E+04	2.08E+04	1.6E+04	4770	1			7480	1			6610	1			7080	1			4740	1		
METALS	Antimony	4.9E+02	6.0E-01	0.05	0.1	9.40E-01	1.60E+00	9.4E-01	0.587	10	U	U	0.712	10	U	U	0.592	10	U	U	0.414	1	U	U	0.427	1	U	U
METALS	Arsenic	2.0E+02	1.0E+00	0.075	0.3	4.81E+00	5.54E+00	4.8E+00	2.250	10	J	J	1.960	10	J	J	0.887	10	U	U	2.190	1			0.219	1	J	J
METALS	Barium	1.7E+05	2.0E+02	0.1	0.5	1.52E+02	8.55E+01	2.0E+02	67.60	1			31.60	1			50.60	1			29.40	1			32.80	1		
METALS	Beryllium	2.7E+02	4.0E-01	0.012	0.5	6.45E-01	7.66E-01	6.5E-01	0.390	1	J	J	0.466	1	J	J	0.378	1	J	J	0.341	1	J	J	0.226	1	J	J
METALS	Cadmium	1.5E+03	5.0E-01	0.05	0.5	1.40E+00	4.00E-01	5.0E-01	0.597	10	U	U	0.725	10	U	U	0.602	10	U	U	0.050	1	U	U	0.125	1	J	J
METALS	Calcium	NE	NE	NA	NA	NA	NA	--	1330	1			1280	1			1060	1			718	1			1830	1		
METALS	Chromium	3.5E+05	1.0E+01	0.12	1	2.66E+01	3.01E+01	2.7E+01	13.10	10			12.20	10			5.73	10			9.11	1			6.00	1		
METALS	Cobalt	1.1E+05	6.1E+02	0.12	1	7.23E+00	5.61E+00	6.1E+02	3.270	1			2.840	1			2.300	1			1.500	1			13.100	1		
METALS	Copper	7.4E+04	1.3E+02	0.5	1	5.55E+00	9.25E+00	1.3E+02	3.08	1			3.56	1			3.05	1			3.91	1			3.09	1		
METALS	Iron	NE	NE	NA	NA	NA	NA	--	8870	1	J		7780	1	J		6090	1	J		7800	1			2090	1		
METALS	Lead	1.0E+03	1.5E+00	0.1	0.2	2.26E+01	1.14E+01	1.1E+01	42.20	10			18.20	10			8.40	10			4.15	1			4.39	1		
METALS	Magnesium	NE	NE	NA	NA	NA	NA	--	265	1			748	1			646	1			862	1			1680	1		
METALS	Manganese	1.1E+05	1.4E+03	0.1	0.5	1.25E+03	2.01E+02	1.4E+03	238	1			18	1			13	1			33	1			24	1		
METALS	Mercury	1.5E-01	2.0E-01	0.01	0.25	8.19E-02	3.60E-01	2.5E-01	0.0402	1	J	J	0.0145	1	U	U	0.0120	1	U	U	0.0100	1	U	U	0.0100	1	U	U
METALS	Nickel	1.2E+04	2.0E+02	0.5	2	6.98E+00	1.16E+01	2.0E+02	3.55	1			4.10	1			3.36	1			7.22	1			14.80	1		
METALS	Potassium	NE	NE	NA	NA	NA	NA	--	184	1			174	1			171	1			588	1			364	1		
METALS	Selenium	9.3E+03	5.0E+00	0.1	0.2	3.48E+00	5.57E+00	5.0E+00	1.310	10	J	J	1.420	10	U	U	1.180	10	U	U	0.206	1	J	J	0.209	1	J	J
METALS	Silver	2.9E+03	5.1E+01	0.25	2	3.10E-01	3.70E-01	5.1E+01	0.292	1	J	J	0.255	1	U	U	0.228	1	U	U	0.209	1	J	J	0.213	1	U	U
METALS	Sodium	NE	NE	NA	NA	NA	NA	--	53.9	1			351.0	1			348.0	1			331.0	1			418.0	1		
METALS	Thallium	1.5E+02	2.0E-01	0.01	0.02	4.70E-01	NE	4.7E-01	0.1170	10	U	U	0.1420	10	U	U	0.1180	10	U	U	0.0730	1			0.1230	1		
METALS	Vanadium	3.0E+03	7.2E+01	0.25	0.5	3.21E+01	4.46E+01	7.2E+01	21.8	1			11.9	1			9.2	1			14.3	1			3.1	1		
METALS	Zinc	4.1E+05	3.1E+03	0.5	1	6.16E+01	2.02E+01	3.1E+03	38.70	1			9.55	1			8.51	1			16.70	1			22.00	1		
SEMIVOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.083	0.165	NE	NE	7.0E+00																				
SEMIVOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.083	0.165	NE	NE	6.0E+01																				
SEMIVOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.083	0.165	NE	NE	7.1E+01																				
SEMIVOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.083	0.165	NE	NE	7.5E+00																				
SEMIVOLATILES	2,4,5-Trichlorophenol	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03																				
SEMIVOLATILES	2,4,6-Trichlorophenol	2.6E+02	2.6E+00	0.083	0.165	NE	NE	2.6E+00																				
SEMIVOLATILES	2,4-Dichlorophenol	3.1E+03	3.1E+01	0.083	0.165	NE	NE	3.1E+01																				
SEMIVOLATILES	2,4-Dimethylphenol	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02																				
SEMIVOLATILES	2,4-Dinitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																				
SEMIVOLATILES	2,4-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	2,6-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	2-Chloronaphthalene	7.1E+04	8.2E+02	0.083	0.165	NE	NE	8.2E+02																				
SEMIVOLATILES	2-Chlorophenol	4.0E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																				
SEMIVOLATILES	2-Methylnaphthalene	3.6E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																				
SEMIVOLATILES	2-Methylphenol	5.1E+04	5.1E+02	0.083	0.165	NE	NE	5.1E+02																				
SEMIVOLATILES	2-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00																				
SEMIVOLATILES	2-Nitrophenol	2.0E+03	3.1E+00	0.083	0.165	NE	NE	3.1E+00																				
SEMIVOLATILES	3,3'-Dichlorobenzidine	6.4E+00	6.4E-02	0.165	0.330	NE	NE	3.3E-01																				
SEMIVOLATILES	3-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00																				
SEMIVOLATILES	4,6-Dinitro-2-methylphenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																				
SEMIVOLATILES	4-Bromophenyl phenyl ether	1.6E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	4-Chloro-3-methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																				
SEMIVOLATILES	4-Chloroaniline	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																				
SEMIVOLATILES	4-Chlorophenyl phenyl ether	1.2E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	4-Methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																				
SEMIVOLATILES	4-Nitroaniline	7.5E+02	7.5E+00	0.330	0.825	NE	NE	7.5E+00																				
SEMIVOLATILES	4-Nitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																				
SEMIVOLATILES	Acenaphthene	3.0E+01	6.1E+02	0.083	0.165	NE	NE	3.0E+01																				

Table 3-1b
Comparison of Chemical Concentration in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB16			03SB16			03SB16			03SB16			03SB16		
	SAMPLE_NO					Background			03SB16-(0-0_5)			03SB16-(0-0_5)-QA			03SB16-(3-4)			03SB16-(6-7)			03SB16-(6-7)-QA		
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	17-Dec-07			17-Dec-07			17-Dec-07			17-Dec-07			17-Dec-07		
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-.5 Ft			0-.5 Ft			3-4 Ft			6-7 Ft			6-7 Ft		
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG			FD			REG			REG			FD		
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result DF	LQ	VQ	Result DF	LQ	VQ	Result DF	LQ	VQ	Result DF	LQ	VQ	Result DF	LQ	VQ
SEMIVOLATILES	Acenaphthylene	5.3E+04	6.1E+02	0.083	0.165	NE	NE	6.1E+02															
SEMIVOLATILES	Anthracene	2.7E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03															
SEMIVOLATILES	Benzo(a)anthracene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01															
SEMIVOLATILES	Benzo(a)pyrene	3.4E-01	2.0E-02	0.083	0.165	1.54E-02	NE	1.7E-01															
SEMIVOLATILES	Benzo(b)fluoranthene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01															
SEMIVOLATILES	Benzo(ghi)perylene	2.7E+04	3.1E+02	0.083	0.165	1.23E-02	NE	3.1E+02															
SEMIVOLATILES	Benzo(k)fluoranthene	3.4E+01	3.9E-01	0.083	0.165	1.30E-02	NE	3.9E-01															
SEMIVOLATILES	Benzoic Acid	4.1E+06	4.1E+04	0.330	0.825	NE	NE	4.1E+04															
SEMIVOLATILES	Benzyl Alcohol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03															
SEMIVOLATILES	bis(2-Chloroethoxy)methane	9.0E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01															
SEMIVOLATILES	bis(2-Chloroethyl)ether	3.2E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01															
SEMIVOLATILES	bis(2-Chloroisopropyl)ether	1.5E+02	4.1E+00	0.083	0.165	NE	NE	4.1E+00															
SEMIVOLATILES	bis(2-Ethylhexyl)phthalate	6.5E+01	6.0E-01	0.083	0.165	NE	NE	6.0E-01															
SEMIVOLATILES	Butyl benzyl phthalate	2.0E+05	2.0E+03	0.083	0.165	NE	NE	2.0E+03															
SEMIVOLATILES	Chrysene	3.4E+02	3.9E+00	0.083	0.165	1.51E-02	NE	3.9E+00															
SEMIVOLATILES	Dibenzo(a,h)anthracene	3.4E-01	2.0E-02	0.083	0.165	NE	NE	1.7E-01															
SEMIVOLATILES	Dibenzofuran	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01															
SEMIVOLATILES	Diethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03															
SEMIVOLATILES	Dimethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03															
SEMIVOLATILES	di-n-Butyl phthalate	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03															
SEMIVOLATILES	di-n-Octyl phthalate	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02															
SEMIVOLATILES	Fluoranthene	3.6E+04	4.1E+02	0.083	0.165	2.29E-02	NE	4.1E+02															
SEMIVOLATILES	Fluorene	3.6E+04	4.1E+02	0.083	0.165	NE	NE	4.1E+02															
SEMIVOLATILES	Hexachlorobenzene	1.0E+00	1.0E-01	0.083	0.165	NE	NE	1.7E-01															
SEMIVOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.083	0.165	NE	NE	2.0E+00															
SEMIVOLATILES	Hexachlorocyclopentadiene	1.4E+01	5.0E+00	0.083	0.165	NE	NE	5.0E+00															
SEMIVOLATILES	Hexachloroethane	7.5E+02	1.0E+01	0.083	0.165	NE	NE	1.0E+01															
SEMIVOLATILES	Indeno(1,2,3-cd)pyrene	3.4E+00	3.9E-02	0.083	0.165	1.43E-02	NE	1.7E-01															
SEMIVOLATILES	Isophorone	3.0E+04	3.0E+02	0.083	0.165	NE	NE	3.0E+02															
SEMIVOLATILES	Naphthalene	2.7E+02	2.0E+02	0.083	0.165	NE	NE	2.0E+02															
SEMIVOLATILES	Nitrobenzene	2.7E+02	5.1E+00	0.083	0.165	NE	NE	5.1E+00															
SEMIVOLATILES	n-Nitroso-di-n-propylamine	1.6E-01	4.1E-03	0.083	0.165	NE	NE	1.7E-01															
SEMIVOLATILES	n-Nitrosodiphenylamine	2.3E+02	5.8E+00	0.083	0.165	NE	NE	5.8E+00															
SEMIVOLATILES	Pentachlorophenol	1.4E+01	1.0E-01	0.330	0.825	NE	NE	8.3E-01															
SEMIVOLATILES	Phenanthrene	2.7E+04	3.1E+02	0.083	0.165	NE	NE	3.1E+02															
SEMIVOLATILES	Phenol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03															
SEMIVOLATILES	Pyrene	2.7E+04	3.1E+02	0.083	0.165	1.94E-02	NE	3.1E+02															
SOLIDS	Percent Solids	NE	NE	NE	NE	NE	NE	--	79.9	1		84.3	1		81.4	1		78.2	1		84.5	1	
VOLATILES	1,1,1,2-Tetrachloroethane	1.1E+02	1.1E+01	0.0005	0.005	NE	NE	1.1E+01															
VOLATILES	1,1,1-Trichloroethane	3.4E+03	2.0E+01	0.0005	0.005	NE	NE	2.0E+01															
VOLATILES	1,1,2,2-Tetrachloroethane	9.8E+00	1.4E+00	0.0005	0.005	NE	NE	1.4E+00															
VOLATILES	1,1,2-Trichloroethane	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01															
VOLATILES	1,1-Dichloroethane	1.3E+03	1.0E+03	0.0010	0.005	NE	NE	1.0E+03															
VOLATILES	1,1-Dichloroethene	3.8E+02	7.0E-01	0.0005	0.005	NE	NE	7.0E-01															
VOLATILES	1,1-Dichloropropene	1.9E+00	2.9E-01	0.0005	0.005	NE	NE	2.9E-01															
VOLATILES	1,2,3-Trichlorobenzene	2.0E+03	3.1E+01	0.0005	0.005	NE	NE	3.1E+01															
VOLATILES	1,2,3-Trichloropropane	8.2E-01	4.1E-03	0.0010	0.005	NE	NE	5.0E-03															
VOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00															
VOLATILES	1,2,4-Trimethylbenzene	1.4E+02	5.1E+02	0.0005	0.005	NE	NE	1.4E+02															
VOLATILES	1,2-Dibromo-3-chloropropane	2.0E+00	2.0E-02	0.0020	0.005	NE	NE	2.0E-02															
VOLATILES	1,2-Dibromoethane	1.0E-01	5.0E-03	0.0005	0.005	NE	NE	5.0E-03															

Table 3-1b
Comparison of Chemical Concentration in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION_CODE								03SB17				03SB17				03SB17				03SB11-(10-11)				03SB11-(BOTTOM)			
	SAMPLE_NO					Background			03SB17-(0-0_5)				03SB17-(3-4)				03SB17-(6-7)				03SB11-111808				03SB11-111808			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	17-Dec-07				17-Dec-07				17-Dec-07				18-Nov-08				18-Nov-08			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-.5 Ft				3-4 Ft				6-7 Ft				10-11				14-15			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ
SEMIVOLATILES	Acenaphthylene	5.3E+04	6.1E+02	0.083	0.165	NE	NE	6.1E+02																				
SEMIVOLATILES	Anthracene	2.7E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																				
SEMIVOLATILES	Benzo(a)anthracene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01																				
SEMIVOLATILES	Benzo(a)pyrene	3.4E-01	2.0E-02	0.083	0.165	1.54E-02	NE	1.7E-01																				
SEMIVOLATILES	Benzo(b)fluoranthene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01																				
SEMIVOLATILES	Benzo(ghi)perylene	2.7E+04	3.1E+02	0.083	0.165	1.23E-02	NE	3.1E+02																				
SEMIVOLATILES	Benzo(k)fluoranthene	3.4E+01	3.9E-01	0.083	0.165	1.30E-02	NE	3.9E-01																				
SEMIVOLATILES	Benzoic Acid	4.1E+06	4.1E+04	0.330	0.825	NE	NE	4.1E+04																				
SEMIVOLATILES	Benzyl Alcohol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																				
SEMIVOLATILES	bis(2-Chloroethoxy)methane	9.0E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	bis(2-Chloroethyl)ether	3.2E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	bis(2-Chloroisopropyl)ether	1.5E+02	4.1E+00	0.083	0.165	NE	NE	4.1E+00																				
SEMIVOLATILES	bis(2-Ethylhexyl)phthalate	6.5E+01	6.0E-01	0.083	0.165	NE	NE	6.0E-01																				
SEMIVOLATILES	Butyl benzyl phthalate	2.0E+05	2.0E+03	0.083	0.165	NE	NE	2.0E+03																				
SEMIVOLATILES	Chrysene	3.4E+02	3.9E+00	0.083	0.165	1.51E-02	NE	3.9E+00																				
SEMIVOLATILES	Dibenzo(a,h)anthracene	3.4E-01	2.0E-02	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	Dibenzofuran	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																				
SEMIVOLATILES	Diethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03																				
SEMIVOLATILES	Dimethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03																				
SEMIVOLATILES	di-n-Butyl phthalate	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03																				
SEMIVOLATILES	di-n-Octyl phthalate	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02																				
SEMIVOLATILES	Fluoranthene	3.6E+04	4.1E+02	0.083	0.165	2.29E-02	NE	4.1E+02																				
SEMIVOLATILES	Fluorene	3.6E+04	4.1E+02	0.083	0.165	NE	NE	4.1E+02																				
SEMIVOLATILES	Hexachlorobenzene	1.0E+00	1.0E-01	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.083	0.165	NE	NE	2.0E+00																				
SEMIVOLATILES	Hexachlorocyclopentadiene	1.4E+01	5.0E+00	0.083	0.165	NE	NE	5.0E+00																				
SEMIVOLATILES	Hexachloroethane	7.5E+02	1.0E+01	0.083	0.165	NE	NE	1.0E+01																				
SEMIVOLATILES	Indeno(1,2,3-cd)pyrene	3.4E+00	3.9E-02	0.083	0.165	1.43E-02	NE	1.7E-01																				
SEMIVOLATILES	Isophorone	3.0E+04	3.0E+02	0.083	0.165	NE	NE	3.0E+02																				
SEMIVOLATILES	Naphthalene	2.7E+02	2.0E+02	0.083	0.165	NE	NE	2.0E+02																				
SEMIVOLATILES	Nitrobenzene	2.7E+02	5.1E+00	0.083	0.165	NE	NE	5.1E+00																				
SEMIVOLATILES	n-Nitroso-di-n-propylamine	1.6E-01	4.1E-03	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	n-Nitrosodiphenylamine	2.3E+02	5.8E+00	0.083	0.165	NE	NE	5.8E+00																				
SEMIVOLATILES	Pentachlorophenol	1.4E+01	1.0E-01	0.330	0.825	NE	NE	8.3E-01																				
SEMIVOLATILES	Phenanthrene	2.7E+04	3.1E+02	0.083	0.165	NE	NE	3.1E+02																				
SEMIVOLATILES	Phenol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																				
SEMIVOLATILES	Pyrene	2.7E+04	3.1E+02	0.083	0.165	1.94E-02	NE	3.1E+02																				
SOLIDS	Percent Solids	NE	NE	NE	NE	NE	NE	--	83.8	1			69	1			83	1		1	100	1			100	1		
VOLATILES	1,1,1,2-Tetrachloroethane	1.1E+02	1.1E+01	0.0005	0.005	NE	NE	1.1E+01																				
VOLATILES	1,1,1-Trichloroethane	3.4E+03	2.0E+01	0.0005	0.005	NE	NE	2.0E+01																				
VOLATILES	1,1,2,2-Tetrachloroethane	9.8E+00	1.4E+00	0.0005	0.005	NE	NE	1.4E+00																				
VOLATILES	1,1,2-Trichloroethane	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																				
VOLATILES	1,1-Dichloroethane	1.3E+03	1.0E+03	0.0010	0.005	NE	NE	1.0E+03																				
VOLATILES	1,1-Dichloroethene	3.8E+02	7.0E-01	0.0005	0.005	NE	NE	7.0E-01																				
VOLATILES	1,1-Dichloropropene	1.9E+00	2.9E-01	0.0005	0.005	NE	NE	2.9E-01																				
VOLATILES	1,2,3-Trichlorobenzene	2.0E+03	3.1E+01	0.0005	0.005	NE	NE	3.1E+01																				
VOLATILES	1,2,3-Trichloropropane	8.2E-01	4.1E-03	0.0010	0.005	NE	NE	5.0E-03																				
VOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00																				
VOLATILES	1,2,4-Trimethylbenzene	1.4E+02	5.1E+02	0.0005	0.005	NE	NE	1.4E+02																				
VOLATILES	1,2-Dibromo-3-chloropropane	2.0E+00	2.0E-02	0.0020	0.005	NE	NE	2.0E-02																				
VOLATILES	1,2-Dibromoethane	1.0E-01	5.0E-03	0.0005	0.005	NE	NE	5.0E-03																				

Table 3-1b
Comparison of Chemical Concentration in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB16				03SB16				03SB16				03SB16				03SB16			
	SAMPLE_NO					Background			03SB16-(0-0_5)				03SB16-(0-0_5)-QA				03SB16-(3-4)				03SB16-(6-7)				03SB16-(6-7)-QA			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-.5 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				6-7 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				FD				REG				REG				FD			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ
VOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.0005	0.005	NE	NE	6.0E+01																				
VOLATILES	1,2-Dichloroethane	4.7E-01	5.0E-01	0.0005	0.005	NE	NE	4.7E-01																				
VOLATILES	1,2-Dichloropropane	2.5E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																				
VOLATILES	1,2-Dimethylbenzene (o-Xylen	4.8E+04	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																				
VOLATILES	1,3,5-Trimethylbenzene	1.2E+02	5.1E+02	0.0005	0.005	NE	NE	1.2E+02																				
VOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.0005	0.005	NE	NE	7.1E+01																				
VOLATILES	1,3-Dichloropropane	8.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00																				
VOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.0005	0.005	NE	NE	7.5E+00																				
VOLATILES	2,2-Dichloropropane	2.4E+01	4.2E+00	0.0005	0.005	NE	NE	4.2E+00																				
VOLATILES	2-Butanone	4.2E+04	6.1E+03	0.0025	0.010	NE	NE	6.1E+03																				
VOLATILES	2-Chloroethyl vinyl ether	3.0E+00	2.6E-01	0.0020	0.010	NE	NE	2.6E-01																				
VOLATILES	2-Chlorotoluene	3.5E+03	2.0E+02	0.0005	0.005	NE	NE	2.0E+02																				
VOLATILES	2-Hexanone	8.7E+01	6.1E+02	0.0025	0.010	NE	NE	8.7E+01																				
VOLATILES	4-Chlorotoluene	4.8E+00	2.0E+02	0.0005	0.005	NE	NE	4.8E+00																				
VOLATILES	Acetone	2.5E+03	9.2E+03	0.0050	0.010	NE	NE	2.5E+03																				
VOLATILES	Benzene	1.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																				
VOLATILES	Bromobenzene	1.6E+02	2.0E+02	0.0005	0.005	NE	NE	1.6E+02																				
VOLATILES	Bromochloromethane	3.4E+02	4.1E+02	0.0005	0.005	NE	NE	3.4E+02																				
VOLATILES	Bromodichloromethane	9.2E+01	4.6E-01	0.0005	0.005	NE	NE	4.6E-01																				
VOLATILES	Bromoform	8.5E+01	3.6E+00	0.0005	0.005	NE	NE	3.6E+00																				
VOLATILES	Bromomethane	4.9E+00	1.4E+01	0.0010	0.010	NE	NE	4.9E+00																				
VOLATILES	Carbon disulfide	1.5E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																				
VOLATILES	Carbon tetrachloride	6.3E-01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																				
VOLATILES	Chlorobenzene	5.9E+02	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																				
VOLATILES	Chloroethane	1.7E+04	4.1E+03	0.0010	0.010	NE	NE	4.1E+03																				
VOLATILES	Chloroform	5.2E-01	1.0E+02	0.0005	0.005	NE	NE	5.2E-01																				
VOLATILES	Chloromethane	3.8E+00	2.2E+01	0.0020	0.010	NE	NE	3.8E+00																				
VOLATILES	cis-1,2-Dichloroethene	2.5E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00																				
VOLATILES	cis-1,3-Dichloropropene	3.4E+01	5.3E-01	0.0005	0.005	NE	NE	5.3E-01																				
VOLATILES	Dibromochloromethane	6.8E+02	3.4E+00	0.0005	0.005	NE	NE	3.4E+00																				
VOLATILES	Dibromomethane	2.7E+02	3.8E+01	0.0005	0.005	NE	NE	3.8E+01																				
VOLATILES	Dichlorodifluoromethane	3.1E+03	2.0E+03	0.0010	0.010	NE	NE	2.0E+03																				
VOLATILES	Ethylbenzene	6.9E+03	7.0E+01	0.0005	0.005	NE	NE	7.0E+01																				
VOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.0005	0.005	NE	NE	2.0E+00																				
VOLATILES	Isopropylbenzene	9.0E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																				
VOLATILES	m,p-Xylenes [e]	3.3E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																				
VOLATILES	Methyl isobutyl ketone	3.5E+04	8.2E+02	0.0025	0.010	NE	NE	8.2E+02																				
VOLATILES	Methylene chloride	1.6E+01	5.0E-01	0.0010	0.005	NE	NE	5.0E-01																				
VOLATILES	Naphthalene	2.7E+02	2.0E+02	0.0005	0.010	NE	NE	2.0E+02																				
VOLATILES	n-BUTYLBENZENE	5.7E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																				
VOLATILES	n-PROPYLBENZENE	5.9E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																				
VOLATILES	p-ISOPROPYLTOLUENE	6.7E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																				
VOLATILES	sec-BUTYLBENZENE	5.4E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																				
VOLATILES	Styrene	2.3E+04	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																				
VOLATILES	tert-BUTYLBENZENE	4.5E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																				
VOLATILES	Tetrachloroethene	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																				
VOLATILES	Toluene	2.5E+04	1.0E+02	0.0005	0.005	NE	NE	1.0E+02																				
VOLATILES	trans-1,2-Dichloroethene	2.4E+03	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																				
VOLATILES	trans-1,3-Dichloropropene	4.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00																				
VOLATILES	Trichloroethene	6.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																				
VOLATILES	Trichlorofluoromethane	3.8E+03	3.1E+03	0.0010	0.010	NE	NE	3.1E+03																				

Table 3-1b
Comparison of Chemical Concentration in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB17				03SB17				03SB17				03SB11-(10-11)				03SB11-(BOTTOM)			
	SAMPLE_NO					Background			03SB17-(0-0_5)				03SB17-(3-4)				03SB17-(6-7)				03SB11-111808				03SB11-111808			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	17-Dec-07				17-Dec-07				17-Dec-07				18-Nov-08				18-Nov-08			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-.5 Ft				3-4 Ft				6-7 Ft				10-11				14-15			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ
VOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.0005	0.005	NE	NE	6.0E+01																				
VOLATILES	1,2-Dichloroethane	4.7E-01	5.0E-01	0.0005	0.005	NE	NE	4.7E-01																				
VOLATILES	1,2-Dichloropropane	2.5E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																				
VOLATILES	1,2-Dimethylbenzene (o-Xylene	4.8E+04	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																				
VOLATILES	1,3,5-Trimethylbenzene	1.2E+02	5.1E+02	0.0005	0.005	NE	NE	1.2E+02																				
VOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.0005	0.005	NE	NE	7.1E+01																				
VOLATILES	1,3-Dichloropropane	8.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00																				
VOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.0005	0.005	NE	NE	7.5E+00																				
VOLATILES	2,2-Dichloropropane	2.4E+01	4.2E+00	0.0005	0.005	NE	NE	4.2E+00																				
VOLATILES	2-Butanone	4.2E+04	6.1E+03	0.0025	0.010	NE	NE	6.1E+03																				
VOLATILES	2-Chloroethyl vinyl ether	3.0E+00	2.6E-01	0.0020	0.010	NE	NE	2.6E-01																				
VOLATILES	2-Chlorotoluene	3.5E+03	2.0E+02	0.0005	0.005	NE	NE	2.0E+02																				
VOLATILES	2-Hexanone	8.7E+01	6.1E+02	0.0025	0.010	NE	NE	8.7E+01																				
VOLATILES	4-Chlorotoluene	4.8E+00	2.0E+02	0.0005	0.005	NE	NE	4.8E+00																				
VOLATILES	Acetone	2.5E+03	9.2E+03	0.0050	0.010	NE	NE	2.5E+03																				
VOLATILES	Benzene	1.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																				
VOLATILES	Bromobenzene	1.6E+02	2.0E+02	0.0005	0.005	NE	NE	1.6E+02																				
VOLATILES	Bromochloromethane	3.4E+02	4.1E+02	0.0005	0.005	NE	NE	3.4E+02																				
VOLATILES	Bromodichloromethane	9.2E+01	4.6E-01	0.0005	0.005	NE	NE	4.6E-01																				
VOLATILES	Bromoform	8.5E+01	3.6E+00	0.0005	0.005	NE	NE	3.6E+00																				
VOLATILES	Bromomethane	4.9E+00	1.4E+01	0.0010	0.010	NE	NE	4.9E+00																				
VOLATILES	Carbon disulfide	1.5E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																				
VOLATILES	Carbon tetrachloride	6.3E-01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																				
VOLATILES	Chlorobenzene	5.9E+02	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																				
VOLATILES	Chloroethane	1.7E+04	4.1E+03	0.0010	0.010	NE	NE	4.1E+03																				
VOLATILES	Chloroform	5.2E-01	1.0E+02	0.0005	0.005	NE	NE	5.2E-01																				
VOLATILES	Chloromethane	3.8E+00	2.2E+01	0.0020	0.010	NE	NE	3.8E+00																				
VOLATILES	cis-1,2-Dichloroethene	2.5E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00																				
VOLATILES	cis-1,3-Dichloropropene	3.4E+01	5.3E-01	0.0005	0.005	NE	NE	5.3E-01																				
VOLATILES	Dibromochloromethane	6.8E+02	3.4E+00	0.0005	0.005	NE	NE	3.4E+00																				
VOLATILES	Dibromomethane	2.7E+02	3.8E+01	0.0005	0.005	NE	NE	3.8E+01																				
VOLATILES	Dichlorodifluoromethane	3.1E+03	2.0E+03	0.0010	0.010	NE	NE	2.0E+03																				
VOLATILES	Ethylbenzene	6.9E+03	7.0E+01	0.0005	0.005	NE	NE	7.0E+01																				
VOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.0005	0.005	NE	NE	2.0E+00																				
VOLATILES	Isopropylbenzene	9.0E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																				
VOLATILES	m,p-Xylenes [e]	3.3E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																				
VOLATILES	Methyl isobutyl ketone	3.5E+04	8.2E+02	0.0025	0.010	NE	NE	8.2E+02																				
VOLATILES	Methylene chloride	1.6E+01	5.0E-01	0.0010	0.005	NE	NE	5.0E-01																				
VOLATILES	Naphthalene	2.7E+02	2.0E+02	0.0005	0.010	NE	NE	2.0E+02																				
VOLATILES	n-BUTYLBENZENE	5.7E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																				
VOLATILES	n-PROPYLBENZENE	5.9E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																				
VOLATILES	p-ISOPROPYLTOLUENE	6.7E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																				
VOLATILES	sec-BUTYLBENZENE	5.4E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																				
VOLATILES	Styrene	2.3E+04	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																				
VOLATILES	tert-BUTYLBENZENE	4.5E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																				
VOLATILES	Tetrachloroethene	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																				
VOLATILES	Toluene	2.5E+04	1.0E+02	0.0005	0.005	NE	NE	1.0E+02																				
VOLATILES	trans-1,2-Dichloroethene	2.4E+03	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																				
VOLATILES	trans-1,3-Dichloropropene	4.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00																				
VOLATILES	Trichloroethene	6.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																				
VOLATILES	Trichlorofluoromethane	3.8E+03	3.1E+03	0.0010	0.010	NE	NE	3.1E+03																				

Table 3-1b
Comparison of Chemical Concentration in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB16				03SB16				03SB16				03SB16				03SB16			
	SAMPLE_NO					Background			03SB16-(0-0_5)				03SB16-(0-0_5)-QA				03SB16-(3-4)				03SB16-(6-7)				03SB16-(6-7)-QA			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-.5 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				6-7 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				FD				REG				REG				FD			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ
VOLATILES	Vinyl acetate	8.0E+02	1.0E+04	0.0010	0.010	NE	NE	8.0E+02																				
VOLATILES	Vinyl chloride	6.6E-02	2.0E-01	0.0010	0.010	NE	NE	6.6E-02																				

Notes and Abbreviations:

Shading in column indicates SDL values that exceed the Applicable MSC.

Concentration exceeds Applicable MSC.

[a] Value provided by the Texas Commission on Environmental Quality (TCEQ) as updated through March 2006 available on the TCEQ website at http://www.tceq.state.tx.us/remediation/rrr.html.

[b] Lower of surface and subsurface soil background concentrations used in these comparisons

[c] Shading in column indicates Applicable MSC equal to MQL for the chemical as provided in 30TAC§335.

[d] Where Applicable MSC is equal to MQL, value equals the SDL, which is the MDL adjusted for sample specific analytical factors.

[e] MSC value shown is for m-xylene, the more conservative of m- and p-xylene isomers.

95% UPL - 95% Upper Prediction Limit of background concentration calculated as described in TCEQ correspondence.
FD - field duplicate sample
Ft - feet
H - estimate is high
J - Estimated value. Chemical was detected above the method detection limit but below the MQL.
L - Estimate is low
NE - value not established
R - data rejected
REG - regular sample
U - Compound validated as not detected above MDL shown.

Table 3-1b
Comparison of Chemical Concentration in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB17				03SB17				03SB17				03SB11-(10-11)				03SB11-(BOTTOM)			
	SAMPLE_NO					Background			03SB17-(0-0_5)				03SB17-(3-4)				03SB17-(6-7)				03SB11-111808				03SB11-111808			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	17-Dec-07				17-Dec-07				17-Dec-07				18-Nov-08				18-Nov-08			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-.5 Ft				3-4 Ft				6-7 Ft				10-11				14-15			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ
VOLATILES	Vinyl acetate	8.0E+02	1.0E+04	0.0010	0.010	NE	NE	8.0E+02																				
VOLATILES	Vinyl chloride	6.6E-02	2.0E-01	0.0010	0.010	NE	NE	6.6E-02																				

Notes and Abbreviations:

Shading in column indicates SDL values that exceed the Applicable MSC.

Concentration exceeds Applicable MSC.

[a] Value provided by the Texas Commission on Environmental Quality (TCEQ) as updated through March 2006 available on the TCEQ website at http://www.tceq.state.tx.us/remediation/rrr.html.

[b] Lower of surface and subsurface soil background concentrations used in these comparisons

[c] Shading in column indicates Applicable MSC equal to MQL for the chemical as provided in 30TAC§335.

[d] Where Applicable MSC is equal to MQL, value equals the SDL, which is the MDL adjusted for sample specific analytical factors.

[e] MSC value shown is for m-xylene, the more conservative of m- and p-xylene isomers.

95% UPL - 95% Upper Prediction Limit of background concentration calculated as described in TCEQ correspondence.
FD - field duplicate sample
Ft - feet
H - estimate is high
J - Estimated value. Chemical was detected above the method detection limit but below the MQL.
L - Estimate is low
NE - value not established
R - data rejected
REG - regular sample
U - Compound validated as not detected above MDL shown.

Table 3-2
Upper Prediction Limits for Soil Background Data

	Surface Soil (0 - 0.5 Feet bgs)		Subsurface Soil (1.5 - 2.5 Feet bgs)	
Metal	Distribution Type	95% UPL Concentration (mg/kg)	Distribution Type	95% UPL Concentration (mg/kg)
Aluminum	Nonparametric	16300.00	Lognormal	20767.06
Antimony	Nonparametric	0.94	Nonparametric	1.60
Arsenic	Lognormal	4.81	Normal	5.54
Barium	Lognormal	151.83	Lognormal	85.45
Cadmium	Nonparametric	1.40	Nonparametric	0.40
Chromium	Lognormal	26.56	Lognormal	30.06
Cobalt	Normal	7.23	Lognormal	5.61
Copper	Lognormal	5.55	Lognormal	9.25
Lead	Lognormal	22.59	Lognormal	11.41
Manganese	Lognormal	1249.70	Lognormal	201.11
Mercury	Lognormal	0.08	Nonparametric	0.36
Selenium	Lognormal	3.48	Normal	5.56
Silver	Nonparametric	0.31	Nonparametric	0.37
Strontium	Lognormal	19.83	Lognormal	29.05
Zinc	Nonparametric	61.60	Lognormal	20.20

Abbreviations:

95% UPL The concentration that will be above the next single measurement with 95 percent confidence.
bgs below ground surface
mg/kg milligrams per kilogram

Table 3-3
Analysis of the Total SPLP Soil Sample

Test Group	Parameter	Units	Method Detection Limit (MDL) [a,b]	Method Quantitation Limit (MQL) [a,b]	TCEQ Risk-Based MSC GWP-Ind [a]	Background Concentrations in Soil (95% UPL, mg/kg) [b] Surface 0 - 0.5 ft	Background Concentrations in Soil (95% UPL, mg/kg) [b] Subsurface 1.5 - 2.5 ft	Applicable TCEQ Risk-Based MSC Industrial [a]	03SB03-01 03SB03-01-Total 4-May-07 Result [a]	DIL	Qual
METALS	Antimony	mg/kg	0.05	0.1	6.0E-01	9.40E-01	1.60E+00	9.4E-01	0.0462	1	J
METALS	Arsenic	mg/kg	0.075	0.3	1.0E+00	4.81E+00	5.54E+00	4.8E+00	1.01	1	
METALS	Beryllium	mg/kg	0.012	0.5	4.0E-01	6.45E-01	7.66E-01	6.5E-01	0.16	1	
METALS	Cadmium	mg/kg	0.025	0.1	5.0E-01	1.40E+00	4.00E-01	5.0E-01	0.0284		U
METALS	Chromium	mg/kg	0.1	0.4	1.0E+01	2.66E+01	3.01E+01	2.7E+01	3.92	1	
METALS	Copper	mg/kg	0.15	0.6	1.3E+02	5.5E+00	9.2E+00	1.3E+02	1.41	1	
METALS	Lead	mg/kg	0.1	0.2	1.5E+00	2.26E+01	1.14E+01	1.1E+01	5.05	1	
METALS	Mercury	mg/kg	0.01	0.25	2.0E-01	8.19E-02	3.60E-01	2.5E-01	0.0165	1	J
METALS	Silver	mg/kg	0.05	0.2	5.1E+01	3.1E-01	3.7E-01	5.1E+01	0.0619	1	J
SVOCS	2,4,6-Trichlorophenol	ug/kg	82.5	165	2.6E+03	NA	NA	2.6E+03	106.0	1	U
SVOCS	2,4-Dinitrotoluene	ug/kg	82.5	165	4.2E+01	NA	NA	1.7E+02	97.4	1	U
SVOCS	2,6-Dinitrotoluene	ug/kg	82.5	165	4.2E+01	NA	NA	1.7E+02	97.4	1	U
SVOCS	2-Nitroaniline	ug/kg	330	825	3.1E+03	NA	NA	3.1E+03	423	1	U
SVOCS	2-Nitrophenol	ug/kg	82.5	165	3.1E+03	NA	NA	3.1E+03	106.0	1	U
SVOCS	3,3'-Dichlorobenzidine	ug/kg	165	330	6.4E+01	NA	NA	3.3E+02	194.8	1	U
SVOCS	3-Nitroaniline	ug/kg	330	825	3.1E+03	NA	NA	3.1E+03	423	1	U
SVOCS	4-Bromophenyl phenyl ether	ug/kg	82.5	165	1.9E+01	NA	NA	1.7E+02	97.4	1	U
SVOCS	4-Chlorophenyl phenyl ether	ug/kg	82.5	165	1.9E+01	NA	NA	1.7E+02	97.4	1	U
SVOCS	4-Nitroaniline	ug/kg	330	825	7.5E+03	NA	NA	7.5E+03	423	1	U
SVOCS	Atrazine	ug/kg	NA	NA	NA	NA	NA	--	NA	1	U
SVOCS	Benzo(a)anthracene	ug/kg	82.5	165	3.9E+01	NA	NA	1.7E+02	97.4	1	U
SVOCS	Benzo(a)pyrene	ug/kg	82.5	165	2.0E+01	NA	NA	1.7E+02	97.4	1	U
SVOCS	Benzo(b)fluoranthene	ug/kg	82.5	165	3.9E+01	NA	NA	1.7E+02	97.4	1	U
SVOCS	Benzo(k)fluoranthene	ug/kg	82.5	165	3.9E+02	NA	NA	3.9E+02	106.0	1	U
SVOCS	bis(2-Chloroethoxy)methane	ug/kg	82.5	165	2.6E+01	NA	NA	1.7E+02	97.4	1	U
SVOCS	bis(2-Chloroethyl)ether	ug/kg	82.5	165	2.6E+01	NA	NA	1.7E+02	97.4	1	U
SVOCS	bis(2-Ethylhexyl)phthalate	ug/kg	82.5	165	6.0E+02	NA	NA	6.0E+02	106.0	1	U
SVOCS	Dibenzo(a,h)anthracene	ug/kg	82.5	165	2.0E+01	NA	NA	1.7E+02	97.4	1	U
SVOCS	Hexachlorobenzene	ug/kg	82.5	165	1.0E+02	NA	NA	1.7E+02	97.4	1	U
SVOCS	Hexachlorobutadiene	ug/kg	82.5	165	2.0E+03	NA	NA	2.0E+03	106.0	1	U
SVOCS	Indeno(1,2,3-cd)pyrene	ug/kg	82.5	165	3.9E+01	NA	NA	1.7E+02	97.4	1	U
SVOCS	n-Nitroso-di-n-propylamine	ug/kg	82.5	165	4.1E+00	NA	NA	1.7E+02	97.4	1	U
SVOCS	Pentachlorophenol	ug/kg	330	825	1.0E+02	NA	NA	8.3E+02	390	1	U
SOLIDS	Percent Solids	NA	NA	NA	NA	NA	NA	--	84.7		

Notes and Abbreviations:

Total metal results for 03SB07 and 03SB08 are in Table 3-1a.

[a] Concentrations of metals are reported in mg/kg units; concentrations of organic compounds are reported in ug/kg units.

[b] Analysis of soil for total chemical concentrations by SW-846 Methods: lead by 6010B, other metals by 6020, PCBs by 8082, SVOCs by 8270C

Shading indicates applicable MSC equal to MQL for the chemical as provided in 30TAC§335

ft - feet

NA - sample not analyzed for this chemical

PCBS - polychlorinated biphenyls

SPLP - Synthetic Precipitation Leaching Procedure

SVOCs - semivolatile organic compounds

Table 3-4
Concentrations of Chemicals in Leachate from Synthetic Precipitation Leaching Procedure Analysis
LHAAP-03

Parameter	LOCATION_CODE SAMPLE_NO SAMPLE_DATE Units	Method Detection Limit (MDL)	Method Quantitation Limit (MQL)	TCEQ Risk-Based MSC GW-Ind [a]	Applicable TCEQ Risk-Based MSC Industrial [b]	03SB03-01 03SB03-01-SPLP 3-May-07 Result [c]	DIL	Qual	03SB07 03SB07(0-0.5)R 23-Oct-07 REG	DIL	Qual	03SB08 03SB08(0-0.5)R 23-Oct-07 REG	DIL	Qual
Antimony	mg/L	0.00025	0.00100	6.0E-03	0.006	0.00194	1		0.00664	1		0.01990	1	
Arsenic	mg/L	0.00025	0.00100	1.0E-02	0.010	0.0562	1		0.6300	1		0.0048	1	
Beryllium	mg/L	0.00050	0.00200	4.0E-03	0.004	NA			0.0005	1	U	0.0005	1	U
Cadmium	mg/L	0.000125	0.000500	5.0E-03	0.005	0.0005	1	U	0.0025	1	U	0.0025	1	U
Chromium	mg/L	0.00050	0.00200	1.0E-01	0.100	0.00635	1		0.04200	1		0.10600	1	
Copper	mg/L	0.00050	0.00200	1.3E+00	1.300	0.00586	1		0.00500	1	U	0.00500	1	U
Lead	mg/L	0.00025	0.00100	1.5E-02	0.015	0.0112	1		0.0427	1		0.1770	1	
Mercury	mg/L	0.00010	0.00020	2.0E-03	0.002	0.0002	1	U	0.0001	1	U	0.0001	1	U
Silver	mg/L	0.00025	0.00100	5.1E-01	0.511	NA			0.0050	1	U	0.0050	1	U
2,4,6-Trichlorophenol	µg/L	2.5	5.0	2.6E+01	2.6E+01	5	1	U						
2,4-Dinitrotoluene	µg/L	2.5	5.0	4.2E-01	5.0E+00	2.5	1	U						
2,6-Dinitrotoluene	µg/L	2.5	5.0	4.2E-01	5.0E+00	2.5	1	U						
2-Nitroaniline	µg/L	12.5	25.0	3.1E+01	3.1E+01	25	1	U						
2-Nitrophenol	µg/L	2.5	5.0	2.0E+02	2.0E+02	5	1	U						
3,3'-Dichlorobenzidine	µg/L	2.5	10.0	6.4E-01	1.0E+01	2.5	1	U						
3-Nitroaniline	µg/L	12.5	25.0	3.1E+01	3.1E+01	25	1	U						
4-Bromophenyl phenyl ether	µg/L	2.5	5.0	1.9E-01	5.0E+00	2.5	1	U						
4-Chlorophenyl phenyl ether	µg/L	2.5	5.0	1.9E-01	5.0E+00	2.5	1	U						
4-Nitroaniline	µg/L	12.5	25.0	7.5E+01	7.5E+01	25	1	U						
Atrazine	µg/L	10.0	20.0	3.0E+00	2.0E+01	10	1	U						
Benzo(a)anthracene	µg/L	2.5	5.0	3.9E-01	5.0E+00	2.5	1	U						
Benzo(a)pyrene	µg/L	2.5	5.0	2.0E-01	5.0E+00	2.5	1	U						
Benzo(b)fluoranthene	µg/L	2.5	5.0	3.9E-01	5.0E+00	2.5	1	U						
Benzo(k)fluoranthene	µg/L	2.5	5.0	3.9E+00	5.0E+00	2.5	1	U						
bis(2-Chloroethoxy)methane	µg/L	2.5	5.0	2.6E-01	5.0E+00	2.5	1	U						
bis(2-Chloroethyl)ether	µg/L	2.5	5.0	2.6E-01	5.0E+00	2.5	1	U						
bis(2-Ethylhexyl)phthalate	µg/L	3.0	10.0	6.0E+00	1.0E+01	3	1	U						
Dibenzo(a,h)anthracene	µg/L	2.5	5.0	2.0E-01	5.0E+00	2.5	1	U						
Hexachlorobenzene	µg/L	2.5	5.0	1.0E+00	5.0E+00	2.5	1	U						
Hexachlorobutadiene	µg/L	2.5	5.0	2.0E+01	2.0E+01	5	1	U						
Indeno(1,2,3-cd)pyrene	µg/L	2.5	5.0	3.9E-01	5.0E+00	2.5	1	U						
n-Nitroso-di-n-propylamine	µg/L	2.5	5.0	4.1E-02	5.0E+00	2.5	1	U						
Pentachlorophenol	µg/L	12.5	25.0	1.0E+00	2.5E+01	12.5	1	U						

Notes and Abbreviations:

[a] Value provided by the Texas Commission on Environmental Quality (TCEQ) as updated through March 2006 available on the TCEQ website at http://www.tceq.state.tx.us/remediation/rrr.html, corrected to correspond to units shown.

[b] Shading indicates Applicable MSC equal to MQL for the chemical as provided in 30TAC§335

[c] Where Applicable MSC is equal to MQL, value equals the is the SDL, which is the MDL adjusted for sample specific analytical factors

DIL - diltution factor

NA - sample not analyzed for this chemical

Qual - data validation qualifier

Qual - data qualifier provided by laboratory

SPLP - Synthetic Precipitation Leaching Procedure, SW846 Method 1312.

U - undetected

Table 3-5a
Comparison of Chemical Concentrations in Soil to Standard 3 MSCs
LHAAP-03

	LOCATION_CODE		03SB01				03SB01				03SB01				03SB02				03SB02				03SB03				03SB03				03SB04				03SB05				03SB06				03SB07				03SB07			
	SAMPLE_NO		03SB01-01				03SB01-01-QC				03SB01-02				03SB02-01				03SB02-02				03SB03-01				03SB03-02				03SB04-01				03SB05-01				03SB06-01				03SB07 (0-0_5)				03SB07(0-0.5)R			
	SAMPLE_DATE	Applicable	8/29/2006				8/29/2006				8/29/2006				8/29/2006				8/29/2006				8/29/2006				8/29/2006				12/19/2006				12/19/2006				12/19/2006				10/23/2007				10/23/2007			
	DEPTH	TCEQ	0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				3 - 4 Ft				0 - 0.5 Ft				3 - 4 Ft				3 - 4 Ft				3 - 4 Ft				3 - 4 Ft				0-0.5 Ft				0-0.5 Ft			
	SAMPLE_PURPOSE	Risk-Based	REG				FD				REG				REG				REG				REG				REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	MSC [a]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
METALS	Antimony	1.6E+00	0.148	1		JL	0.092	1	J	JL	0.115	1	U	UJL	0.063	1	J	JL	0.102	1	U	UJL	8.550	1		JL	0.112	1	U	UJL																	0.062	1	J	J
METALS	Arsenic	5.9E+00	1.830	1			1.650	1			0.883	1			1.440	1			0.845	1			6.090	1			1.110	1																			6.98	1		
METALS	Barium	3.3E+02	70.20	1			69.40	1		JH	47.40	1		JH	35.20	1		JH	23.80	1		JH	167.00	1		JH	57.40	1		JH																	57.20	25		
METALS	Cadmium	1.4E+00	0.20	1	J	J	0.21	1	J	J	0.43	1	U	U	0.09	1	J	J	0.40	1	U	U	1.43	1			0.42	1	U	U																	0.21	1		
METALS	Chromium	2.7E+05	31.20	1			25.70	1			12.80	1			15.90	1			9.11	1			267.00	1			14.80	1																			50	25		
METALS	Copper	2.4E+01	6.16	1			5.46	1			3.32	1			2.31	1			2.18	1			269	1			2.92	1																			4.08	1		
METALS	Lead	1.3E+02	24.70	1			22.50	1			7.20	1			19.50	1			4.66	1			5830	200			19.90	1			108.00	1		J	54.20	1		J	28.20	1		J	95.80	10			505	25		
METALS	Mercury	2.1E-01	0.0448	1	J		0.0490	1	J	J	0.0126	1	J	J	0.0252	1	J	J	0.0121	1	J	J	0.4830	1			0.0290	1	J	J																				

Notes and Abbreviations:

Concentration exceeds Applicable MSC

[a] Standard 3 MSC value calculated as described in Appendix B

DIL - dilution factor
FD - field duplicate sample
H - estimate is high
J - Estimated value. Chemical was detected above the method detection limit (MDL) but below the method quantitation limit (MQL) shown in Table 3-1.
L - estimate is low
LQ - laboratory data qualifier
MSC - medium-specific concentration
REG - regular sample
U - Compound validated as not detected above MDL shown in Table 3-1.
VQ - data validation qualifier

Table 3-5a
Comparison of Chemical Concentrations in Soil to Standard 3 MSCs
LHAAP-03

	LOCATION_CODE		03SB08				03SB08				03SB09				03SB09				03SB10				03SB10				03SB10				03SB11				03SB11				03SB11				03SB12			
	SAMPLE_NO		03SB08 (0-0_5)				03SB08(0-0.5)R				03SB09 (0-0_5)				03SB09(0-0_5)R				03SB10-(0-0_5)				03SB10-(3-4)				03SB10-(6-7)				03SB11-(0-0_5)				03SB11-(3-4)				03SB11-(6-7)				03SB12-(0-0_5)			
	SAMPLE_DATE	Applicable	23-Oct-07				23-Oct-07				23-Oct-07				23-Oct-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	TCEQ	0-0.5 Ft				0-0.5 Ft				0-0.5 FT				0-0.5 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft			
	SAMPLE_PURPOSE	Risk-Based	REG				REG				REG				REG				REG				REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	MSC [a]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
METALS	Antimony	1.6E+00					0.121	1		JL					0.054	1	U	U	0.574	10	U	U	0.630	10	U	U	0.601	10	U	U	0.632	10	U	U	0.595	10	U	U	0.579	10	U	U	0.586	10	U	U
METALS	Arsenic	5.9E+00					10.800	1							6.120	1			3.480	10			2.070	10	J	J	1.290	10	J	J	1.010	10	J	J	1.580	10	J	J	32.7	10			1.840	10	J	J
METALS	Barium	3.3E+02					48.80	1							57.60	1			100.00	1			66.90	1			54.80	1			229.00	1			119.00	1			106.00	1			53.30	1		
METALS	Cadmium	1.4E+00					0.17	1	J	J					1.44	1			0.29	10	U	U	0.32	10	U	U	0.30	10	U	U	0.32	10	U	U	0.30	10	U	U	0.68	10	J	J	0.29	10	U	U
METALS	Chromium	2.7E+05					28.00	1							62.70	1			11.80	10			9.41	10			7.23	10			5.10	10			12.00	10			591	1000			6.86	10		
METALS	Copper	2.4E+01					2.95	1							11.50	1			4.08	1			4.42	1			2.83	1			3.53	1			3.35	1			8.63	1			2.14	1		
METALS	Lead	1.3E+02	2320	100			701.00	100			57.7	10			75.40	10			18.90	10			11.30	10			9.17	10			8.76	10			36.30	10			6760	1000			19.60	10		
METALS	Mercury	2.1E-01					0.1170	1	J	J					0.0241	1	J	J	0.0242	1	J	J	0.0119	1	U	U	0.0125	1	U	U	0.0134	1	U	U	0.0122	1	U	U	0.276	1			0.0341	1	J	J

Notes and Abbreviations:

Concentration exceeds Applicable MSC

[a] Standard 3 MSC value calculated as described in Appendix B

DIL - dilution factor
FD - field duplicate sample
H - estimate is high
J - Estimated value. Chemical was detected above the method detecti
L - estimate is low
LQ - laboratory data qualifier
MSC - medium-specific concentration
REG - regular sample
U - Compound validated as not detected above MDL shown in Table 3
VQ - data validation qualifier

Table 3-5a
Comparison of Chemical Concentrations in Soil to Standard 3 MSCs
LHAAP-03

	LOCATION _CODE		03SB12				03SB12				03SB13				03SB13				03SB13				03SB14				03SB14				03SB14				03SB15				03SB15				03SB15			
	SAMPLE_NO		03SB12-(3-4)				03SB12-(6-7)				03SB13-(0-0_5)				03SB13-(3-4)				03SB13-(6-7)				03SB14-(0-0_5)				03SB14-(3-4)				03SB14-(6-7)				03SB15-(0-0_5)				03SB15-(3-4)				03SB15-(6-7)			
	SAMPLE_DATE	Applicable	17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	TCEQ	3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft			
	SAMPLE_PURPOSE	Risk-Based	REG				REG				REG				REG				REG				REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	MSC [a]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
METALS	Antimony	1.6E+00	3.060	50	U	U	0.555	10	U	UJL	0.597	10	U	U	0.596	10	U	U	0.621	10	U	U	0.588	10	U	U	0.60	10	U	U	0.622	10	U	U	0.571	10	U	U	0.599	10	U	U	0.572	10	U	U
METALS	Arsenic	5.9E+00	4.730	50	J	J	1.410	10	J	J	2.700	10	J	J	2.090	10	J	J	1.440	10	J	J	4.45	10			2.52	10	J	J	4.8	10			3.8	10			1.770	10	J	J	7.620	10		
METALS	Barium	3.3E+02	45.50	1			32.00	1			72.10	1			51.60	1			61.90	1			49	1			25.70	1			52.6	1			54.4	1			83.40	1			82.70	1		
METALS	Cadmium	1.4E+00	1.53	50	U	U	0.28	10	U	U	0.30	10	U	U	0.30	10	U	U	0.31	10	U	U	1	10	J	J	0.30	10	U	U	0.3	10	U	U	0.7	10	J	J	0.30	10	U	U	0.29	10	U	U
METALS	Chromium	2.7E+05	13.70	50	J	J	6.40	10			13.40	10			7.77	10		J	6.73	10		J	32.8	10		J	9.26	10		J	21.6	10		J	25.7	10		J	8.20	10		J	11.90	10		J
METALS	Copper	2.4E+01	4.10	1			2.03	1			3.11	1			3.00	1			3.30	1			3.18	1			1.96	1			6.640	1			2.460	1			3.78	1			2.43	1		
METALS	Lead	1.3E+02	10.60	50	J	J	5.17	10			19.20	10			8.36	10			8.61	10			259	10			5.52	10			17.6	10			150.0	10			14.10	10			60.00	10		
METALS	Mercury	2.1E-01	0.0407	1	J	J	0.0138	1	J	J	0.0329	1	J	J	0.0204	1	J	J	0.0119	1	U	U	0.175	1			0.01	1	U	U	0.040	1	J	J	0.043	1	J	J	0.0282	1	J	J	0.0106	1	U	U

Notes and Abbreviations:

Concentration exceeds Applicable MSC

[a] Standard 3 MSC value calculated as described in Appendix B

DIL - dilution factor
FD - field duplicate sample
H - estimate is high
J - Estimated value. Chemical was detected above the method detecti
L - estimate is low
LQ - laboratory data qualifier
MSC - medium-specific concentration
REG - regular sample
U - Compound validated as not detected above MDL shown in Table 3
VQ - data validation qualifier

Table 3-5b
Comparison of Chemical Concentration in Soil to Standard 3 MSC
LHAAP-03

	LOCATION _CODE		03SB16				03SB16				03SB16				03SB16				03SB16				03SB17				03SB17				03SB17				03SB11-(10-11)				03SB11-(BOTTOM)			
	SAMPLE_NO		03SB16-(0-0_5)				03SB16-(0-0_5)-QA				03SB16-(3-4)				03SB16-(6-7)				03SB16-(6-7)-QA				03SB17-(0-0.5)				03SB17-(3-4)				03SB17-(6-7)				03SB11-111808				03SB11-111808			
	SAMPLE_DATE	Applicable	12/17/2007				12/17/2007				12/17/2007				12/17/2007				12/17/2007				12/17/2007				12/17/2007				12/17/2007				11/18/2008				11/18/2008			
	DEPTH	TCEQ	0-.5 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				10-11				14-15			
	SAMPLE_PURPOSE	Risk-Based	REG				FD				REG				REG				FD				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	MSC [a]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
METALS	Antimony	1.6E+00	0.626	10		U	0.593	10	U	U	0.604	10	U	U	0.620	10	U	U	0.591	10	U	U	0.587	10	U	U	0.712	10	U	U	0.592	10	U	U	0.414	1	U	U	0.427	1	U	U
METALS	Arsenic	5.9E+00	2.030	10	U	J	4.340	10			1.510	10	J	J	2.650	10	J	J	2.840	10	J	J	2.250	10	J	J	1.960	10	J	J	0.887	10	U	U	2.190	1			0.219	1	J	J
METALS	Barium	3.3E+02	81.30	1	J		77.50	1			88.70	1			27.90	1			29.30	1			67.60	1			31.60	1			50.60	1			29.40	1			32.80	1		
METALS	Cadmium	1.4E+00	0.31	10		U	0.30	10	U	U	0.30	10	U	U	0.31	10	U	U	0.30	10	U	U	0.29	10	U	U	0.36	10	U	U	0.30	10	U	U	0.04	1	U	U	0.13	1	J	J
METALS	Chromium	2.7E+05	8.23	10		J	17.70	10			7.58	10		J	7.44	10			10.80	10			13.10	10			12.20	10			5.73	10			9.11	1			6.00	1		
METALS	Copper	2.4E+01	3.16	1			3.84	1			3.36	1			2.39	1			3.19	1			3.08	1			3.56	1			3.05	1			3.91	1			3.09	1		
METALS	Lead	1.3E+02	7.31	10			8.83	10			5.76	10			6.20	10			7.39	10			42.20	10			18	10			8.40	10			4.15	1			4.39	1		
METALS	Mercury	2.1E-01	0.0128	1		J	0.0146	1	J	J	0.0131	1	J	J	0.0164	1	J	J	0.0140	1	J	J	0.0402	1	J	J	0.0144	1	U	U	0.0112	1	U	U	0.0112	1	U	U	0.0118	1	U	U

Notes and Abbreviations:

Concentration exceeds Applicable MSC

[a] Standard 3 MSC value calculated as described in Appendix B

DIL - dilution factor
FD - field duplicate sample
J - Estimated value. Chemical was detected above the method detection limit (MDL) but below the method quantitation limit (MQL) shown in Table 3-1.
LQ - laboratory data qualifier
MSC - medium-specific concentration
REG - regular sample
U - Compound validated as not detected above MDL shown in Table 3-1.
VQ - data validation qualifier

Table 3-6
Comparison of Chemical Concentrations in Groundwater to TCEQ MSCs for Groundwater
LHAAP-03

		LOCATION_CODE	Applicable	03WW01			
		SAMPLE_NO	TCEQ	03WW01-112408			
		SAMPLE_DATE	Risk-Based	24-Nov-08			
Test Group	Parameter	Units	MSC [a]	Result	DIL	Qual	ValQual
METALS	Antimony	mg/L	6.0E-03	0.00131	1		
METALS	Arsenic	mg/L	1.0E-02	0.0414	1		
METALS	Barium	mg/L	2.0E+00	0.0699	1		
METALS	Cadmium	mg/L	5.0E-03	0.000486	1	J	J
METALS	Chromium	mg/L	1.0E-01	0.00523	1		
METALS	Copper	mg/L	1.3E+00	0.00404	1		
METALS	Lead	mg/L	1.5E-02	0.00575	1		
METALS	Mercury	mg/L	2.0E-03	0.0001	1	U	U

Notes and Abbreviations:

Concentration exceeds Applicable MSC

[a] Medium Specific Concentration (MSC) for groundwater use (GW-Ind) provided in 30 TAC 335, as updated through March 2006.

DIL - dilution factor

J - present but below reporting limit

LQ - laboratory data qualifier

MSC - medium-specific concentration

U - undetected

VQ - data validation qualifier

Appendix B

SAM Model

Development of TCEQ Risk Reduction Rules Standard 3 Medium-Specific Concentrations for Soil at the LHAAP-03 Site

Appendix B
Development of TCEQ Risk Reduction Rules Standard 3 Medium-Specific Concentrations for Soil at the LHAAP-03 Site

This appendix describes development of Standard 3 Medium-Specific Concentrations (MSCs) for chemicals in soil that are protective of groundwater at the former Waste Site at Building 722-P, Paint Shop, LHAAP-03. The MSC values were developed according to the Texas Commission on Environmental Quality [TCEQ] Texas Risk Reduction Rules, Title 30 Texas Administrative Code (TAC) Chapter 335 (30 TAC §335 and updates).

The chemicals of concern (COCs) at LHAAP-03 for soil are antimony, arsenic, barium, cadmium, chromium, copper, lead, and mercury (see revised Table 3-1). This appendix describes the calculation of Standard 3 MSCs for these COCs that are protective of groundwater using the Soil Attenuation Model (SAM).

The SAM model was selected to predict impacts of soil contamination on groundwater quality. The SAM model is an extension of the Soil Screening Level calculations EPA (1996) guidance and is based on calculating total mass (liquid phase, solid phase, and gas phase) in the soil column:

$$M_T = V(\rho_b C_s + \theta_w C_w + \theta_a C_g) \qquad \text{Eq. 1}$$

Where

M_T = total mass of chemical
V = volume of the soil column
ρ_b = bulk density
C_s = concentration in soil (dry weight basis)
θ_w = water filled porosity
C_w = concentration in pore water
θ_a = air filled porosity
C_g = gas phase concentration.

Total mass is then redistributed using equilibrium conditions based on the adsorption coefficient and Henry's Law constant. The equilibrium equations are:

$$C_s = K_d C_w \qquad \text{Eq. 2}$$

$$C_g = H^1 C_w \qquad \text{Eq. 3}$$

Where Kd is the distribution coefficient or adsorption coefficient, and H^1 is dimensionless Henry's Law constant.

The SAM model enhancement over EPA's Soil Screening Levels is that the SAM model assumes a zone of contaminated soils overlying a zone of clean soil (zero contaminant concentration). The SAM

simulates mixing of contamination through the contaminated and clean soil zones based on equilibrium conditions, and predicts leachate concentration at the bottom of the soil column. The SAM model calculates the leachate concentration according to the equation:

$$C_w = C_s \left(\frac{\rho_b}{\theta_w + (K_d \rho_b) + H'\theta_a} \right) \left(\frac{L_1}{L_2} \right) \qquad \text{Eq. 4}$$

The concentration in the contaminated soil zone that will produce a given leachate concentration can be calculated as:

$$C_s = C_w \left(\frac{\theta_w + (K_d \rho_b) + H'\theta_a}{\rho_b} \right) \left(\frac{L_2}{L_1} \right) \qquad \text{Eq. 5}$$

Where L_1 is the thickness of the total soil column and L_2 is the thickness of the contaminated zone. The factor (L_2/L_1) is an enhancement in the SAM model over the Soil Screening Level Model by EPA. A further dilution factor for leachate mixing with groundwater can be incorporated by using leachate dilution factor:

$$LDF = 1 + \frac{Kid}{IL} \qquad \text{Eq. 6}$$

Where

K = aquifer hydraulic conductivity
i = hydraulic gradient in aquifer
d = groundwater mixing zone depth
I = infiltration rate
L = source length parallel to groundwater flow.

The groundwater protective Standard 3 MSC is the soil concentration (C_s) described by Eq. 7 where the groundwater concentration (C_w) is limited by the TCEQ risk-based drinking water concentration (GW-Ind) modified by the LDF as follows:

$$\text{Standard 3 } MSC = C_w \left(\frac{\theta_w + (K_d \rho_b) + H'\theta_a}{\rho_b} \right) \left(\frac{L_2}{L_1} \right) x\ LDF \qquad \text{Eq. 7}$$

The model further calculates the soil saturation concentration (C_{sat}), which corresponds to the contaminant concentration in soil at which the absorptive capacity of soil particles, the solubility limits of soil pore water, and saturation of soil pore air have been reached. Concentrations above C_{sat} are assumed to be in free phase. The C_{sat} concentration is calculated in the SAM model according to Eq. 8.

$$C_{sat} = S\left(\frac{\theta_w + (K_d \rho_b) + H'\theta_a}{\rho_b}\right) \qquad \text{Eq. 8}$$

Input parameters to the SAM model that are either specific to LHAAP-03 or are default TCEQ values are shown in attached **Table B-1**. Physical properties of chemicals addressed in the SAM model are shown in **Table B-2**. Calculation of C_{sat} concentrations of each chemical is shown in **Table B-3**. Calculated Standard 3 MSC values that are based on the TCEQ MSC for groundwater (GW-Ind) are shown in **Table B-4**. As shown in **Tables B-3** and B-**4**, none of the calculated Standard 3 MSC exceeds the C_{sat} concentration for COCs.

The Applicable Standard 3 MSC (**Table B-5**) for each COC was developed as the larger of the Standard 3 MSC value and the background soil concentrations (Shaw, 2004). The background concentration represents the Applicable MSC for antimony, arsenic, and cadmium at LHAAP-03.

COCs that were measured at concentrations above the Applicable Commercial/Industrial Soil MSCs are shown in **Table B-5**. Concentrations above MSCs were measured at 03SB03 for antimony, arsenic, cadmium, copper, and lead. Concentrations above MSCs were measured at 03SB07 (arsenic and lead), 03SB08 (arsenic and lead), 03SB09 (arsenic and cadmium), 03SB10 (arsenic and cadmium), 03SB11 (arsenic, lead, and mercury), and 03SB15 (arsenic, and lead). COC concentrations were confined to surface soil (<0.5 feet below ground surface [bgs]) except at borings 03SB11 and 03SB15. Boring 03SB11 contained arsenic, lead, and mercury above MSCs at 6 to 7 feet bgs. Boring 03SB15 contained elevated lead concentrations 0.5 feet bgs and arsenic concentrations at 6 to 7 feet bgs.

These comparisons are shown in Table 3-5 of the revised document. Soil borings with COC concentrations above Applicable Standard 3 MSC values within the upper 0.5 feet bgs (03SB03, 03SB07, 03SB08, 03SB09, 03SB10, and 03SB15) lie within an oval area of approximately 40 feet in its largest dimension and is located south of LHAAP-03 (**Figure 2-1**).

Background concentrations shown in **Table B-5** represent the 95% Upper Prediction Limits (UPL) for both surface and subsurface soil concentrations reported in previously (Shaw, 2004) and are applied here as the most appropriate value to serve as the cleanup level for both surface and subsurface soil. These values differ slightly from the separate surface and subsurface soil background values shown in Table 3-1 of the main text, the lower of which was used to provide a conservative identification of COCs. When the lower of surface and subsurface background concentrations is applied to develop Applicable Standard 3 MSCs in **Table B-5**, the resulting comparison of COC concentrations to Applicable Standard 3 MSCs shown in the attached Table 3-5 of the main text is the same, and the conclusions based on the comparison remain the same.

References

Shaw, 2004, *Final Background Soil Study Report, Longhorn Army Ammunition Plant, Karnack*, Texas, July.

U.S. Environmental Protection Agency (EPA), 1996, *Soil Screening Guidance: User's Guide*, Second Edition.

Table B-1
Input Values for Parameters Used to Calculate Risk Reduction Standard 3 Groundwater-Protective MSCs for Soil
LHAAP-03 Waste Site at Building 722-P, Paint Shop

Parameter		Value	Units	Comment	Reference
Soil Dry Bulk Density	ρ_b	1.6	g/cm^3	Dry bulk density was assumed to be 100 pounds per cubic feet and is a typical value for silty clayey sands.	Shaw, 2006b
Particle Density	$\rho_{particle}$	2.65	g/cm^3	TCEQ default value	30 TAC §350.75 (c) and (d)
Total Porosity	n	0.40	unitless	n = 1-(rb/rparticle) = 1-(1.6 g/cc/2.65 g/cc)	EPA, 1996, pg. 38.
Volumetric Water Content of Soil	q_{ws}	0.16	unitless	Mean value calculated from Percent Solids measurements excluding quality control samples (Table 3-1, this document)	Table 3-1, Shaw, 2007a
Soil Fraction Organic Carbon	f_{oc}	0.02	unitless	TCEQ default value	30 TAC §335.567. Appendix I. (p. 26)
Net Infiltration Rate through soil	I	38.10	cm/yr	15 inches/yr estimated for LHAAP	Shaw, 2008
Thickness of affected soil	L_1	457	cm	Samples taken 0 to 7 ft bgs. 7 ft assumed all chemicals (Table 3-1, this document)	Shaw, 2007a
Distance from top of affected soils to top of water bearing unit.	L_2	722	cm	Median depth to groundwater at LHAAP-03 wells sampled = 24 ft	Shaw, 2007a
Groundwater Darcy Velocity	V_{gw}	299.88	cm/yr	= K*i*31500000 sec/yr	EPA, 1996, pg. 42.
Hydraulic conductivity in groundwater bearing unit	K	3.40E-04	cm/sec	Median of values	Jacobs 2002, Table 5-1.
Hydraulic gradient in groundwater bearing unit	i	0.03	unitless	Value calculated from potentiometric map scale: 13.1ft elevation/480ft horizontal	Shaw, 2007b, Fig. 1-3
Width of soil source area parallel to groundwater flow direction	W	1219	cm	Affected area dimension, 40 ft (Figure 2-1)	Shaw, 2007b, Fig. 1-3
Groundwater mixing zone (δ_{gw})	d_{gw}	305	cm	Median of screen intervals, 10 ft	Shaw, 2007a
Soil Air Filled Porosity (q_{as})	q_{as}	0.23	unitless	n - qws	EPA, 1996, pg. 38.
Henry's Law Constant	H'	Chemical specific property	unitless	See Table 3	TCEQ, 2008
Organic Carbon Partition Coefficient	K_{oc}	Chemical specific property	unitless	See Table 3	TCEQ, 2008
Soil Water Partition Coefficient	K_d	Chemical specific property	unitless	See Table 3	TCEQ, 2008

$$LDF = 1 + \frac{V_{gw} \times d_{gw}}{I \times W}$$

LDF = 2.969E+00

Notes:

EPA, 1996. *Soil Screening Guidance: Technical Background Document* , EPA/540/R-95/128018, U. S. Environmental Protection Agency, Office of Emergency and Remedial Response, July.

Jacobs Engineering Group, Inc., 2002: *Final Remedial Investigation Report, Vol. 1: Report for the Group 4 Sites, Sites 35A, 35B, 35C, 46,47,48,50,60, and Goose Prarie Creek, Longhorn Army Ammunition Plant, Karnack, Texas* , Oak Ridge, Tennessee, January.

Shaw, 2006b, *Draft Final Addendum 9, Soil Sampling at LHAAP-03 (Former Site of 55-Gallon Drum Stored on Gravel Pad) and LHAAP-06 (Former Site of 55-Gallon Drum Formerly Stored in Shed), LonghornArmy Ammunition Plant, Karnack, Texas, Houston, Texas, May.*

Shaw, 2007a, *Draft Final Site Investigation Report, LHAAP-03 (Waste Site at Building 722-P. Paint Shop),* September.

Shaw, 2007b, *Draft Final Focused Feasibility Study, LHAAP-35A(58), Shop Area Group 4, Longhorn Army Ammunition Plant, Karnack, Texas,* September.

Shaw, 2008 LHAAP-49 Site Evaluation Report, Longhorn Army Ammunition Plant, Karnack, Texas, Appendix E, May.

Texas Commission on Environmental Quality (TCEQ), *Risk Reduction Rules* , 30 TAC §335.567. Appendix I.

TCEQ, 2008: Texas Risk Reduction Program Physical Chemical Properties Tables, April, accessed at http://www.tceq.state.tx.us/remediation/trrp/trrppcls.html

Table B-2
Physical Chemical Properties of Chemicals of Concern [a]
LHAAP-03 Waste Site at Building 722-P, Paint Shop

Chemical of Concern	Henry's Law Constant (H') (unitless)	Organic Carbon Partition Coefficient (Koc, unitless)	Soil Water Partition Coefficient (Kd, unitless) [b]	pH Dependent Partition Coefficient at pH 6.3 Soil Kd	Solubility in Water (S, mg/L)
Antimony	0.00E+00	NA	c	4.90E+01	0.00E+00
Arsenic	0.00E+00	NA	c	2.80E+01	0.00E+00
Barium	0.00E+00	NA	c	3.50E+01	0.00E+00
Cadmium	0.00E+00	NA	c	4.40E+01	0.00E+00
Chromium (average Cr(III)Cr(IV) = 70:1)	0.00E+00	NA	c	5.80E+05	0.00E+00
Copper	0.00E+00	NA	d	3.98E+01	0.00E+00
Lead	0.00E+00	NA	c	1.8E+03	0.00E+00
Mercury	4.7E-01	NA	c	2.2E+01	3.00E-02

Notes:

pH data provided in the LHAAP-35A(58) Feasibility Study, in preparation.

[a] Annual TCEQ update of chemical/physical properties table [(Figure: 30 TAC §350.73(e)], April 2008.

[b] value calculated from log (Kd) value from chemphys TRRP table, April 2008 unless stated otherwise.

[c] pH-dependent Kd value obtained from Figure 30TAC§350.73(e)(1)(C), April 2008

[d] value calculated from log (Kd) value from chemphys TRRP table, April 2008 unless stated otherwise.

Table B-3
Calculation of Soil Saturation Concentration (Csat) Values for Chemicals in Soil

$$K_{sw} = \frac{\rho_b}{\theta_{ws}+K_d\rho_b+H'\theta_{as}} \qquad C_{sat} = S\,\frac{(\theta_{ws}+K_d\rho_b+H'\theta_{as})}{\rho_b}$$

Chemical of Concern (COC)	ρ_b	θ_{ws}	F_{oc}	K_{oc}	K_d	H'	q_{as}	S	K_{sw}	C_{sat}
Antimony	1.60	0.16	0.020	NA	4.90E+01	0.00E+00	0.23	0.00E+00	2.04E-02	NA
Arsenic	1.60	0.16	0.020	NA	2.80E+01	0.00E+00	0.23	0.00E+00	3.56E-02	NA
Barium	1.60	0.16	0.020	NA	3.50E+01	0.00E+00	0.23	0.00E+00	2.85E-02	NA
Cadmium	1.60	0.16	0.020	NA	4.40E+01	0.00E+00	0.23	0.00E+00	2.27E-02	NA
Chromium	1.60	0.16	0.020	NA	5.80E+05	0.00E+00	0.23	0.00E+00	1.72E-06	NA
Copper	1.60	0.16	0.020	NA	3.98E+01	0.00E+00	0.23	0.00E+00	2.51E-02	NA
Lead	1.60	0.16	0.020	NA	1.83E+03	0.00E+00	0.23	0.00E+00	5.46E-04	NA
Mercury	1.60	0.16	0.020	NA	2.20E+01	4.74E-01	0.23	3.00E-02	4.51E-02	6.65E-01

Abbreviation:

NA - not applicable

Table B-4
Calculation of Standard 3 Commercial/Industrial Medium Specific Concentration (MSC) for Chemicals in Soil

$$\text{Standard 3 Soil MSC} = \frac{\text{GW-Ind} \times \text{LDF} \times (L_2/L_1)}{\text{Ksw}}$$

Chemical of Concern (COC)	GW-Ind MSC [a] (mg/L)	LDF	K_{sw}	L_2	L_1	Standard 3 Commercial/Industrial Soil MSC (mg/kg)	
						Calculated	Corrected [b]
Antimony	6.0E-03	2.97E+00	0.020	721.78	457.00	**1.4E+00**	**1.4E+00**
Arsenic	1.0E-02	2.97E+00	0.036	721.78	457.00	**1.3E+00**	**1.3E+00**
Barium	2.0E+00	2.97E+00	0.028	721.78	457.00	**3.3E+02**	**3.3E+02**
Cadmium	5.0E-03	2.97E+00	0.023	721.78	457.00	**1.0E+00**	**1.0E+00**
Chromium	1.0E-01	2.97E+00	0.000	721.78	457.00	**2.7E+05**	**2.7E+05**
Copper	1.3E+00	2.97E+00	0.025	721.78	457.00	**2.4E+02**	**2.4E+02**
Lead	1.5E-02	2.97E+00	0.001	721.78	457.00	**1.3E+02**	**1.3E+02**
Mercury	2.0E-03	2.97E+00	0.045	721.78	457.00	**2.1E-01**	**2.1E-01**

Notes and Abbreviations:

[a] GW-Inc MSC value from TCEQ 2006 MSC table.

[b] Corrected MSC = C_{sat} concentration shown on Table 3.

NA - not applicable

Table B-5
Applicable Standard 3 Commercial/Industrial Medium Specific Concentration (MSC) for Chemicals in Soil at the LHAAP-03 Waste Site at Building 722-P, Paint Shop

Chemical of Concern (COC)	Calculated Standard 3 Commercial/Industrial Soil MSC [a] (mg/kg)	Background Concentration [b]	Applicable Commercial/Industrial Soil MSC [c] (mg/kg)
Antimony	1.4E+00	1.6E+00	1.6E+00
Arsenic	1.3E+00	5.9E+00	5.9E+00
Barium	3.3E+02	1.2E+02	3.3E+02
Cadmium	1.0E+00	1.4E+00	1.4E+00
Chromium	2.7E+05	2.9E+01	2.7E+05
Copper	2.4E+02	8.4E+00	2.4E+02
Lead	1.3E+02	1.8E+01	1.3E+02
Mercury	2.1E-01	1.1E-01	T

Notes:

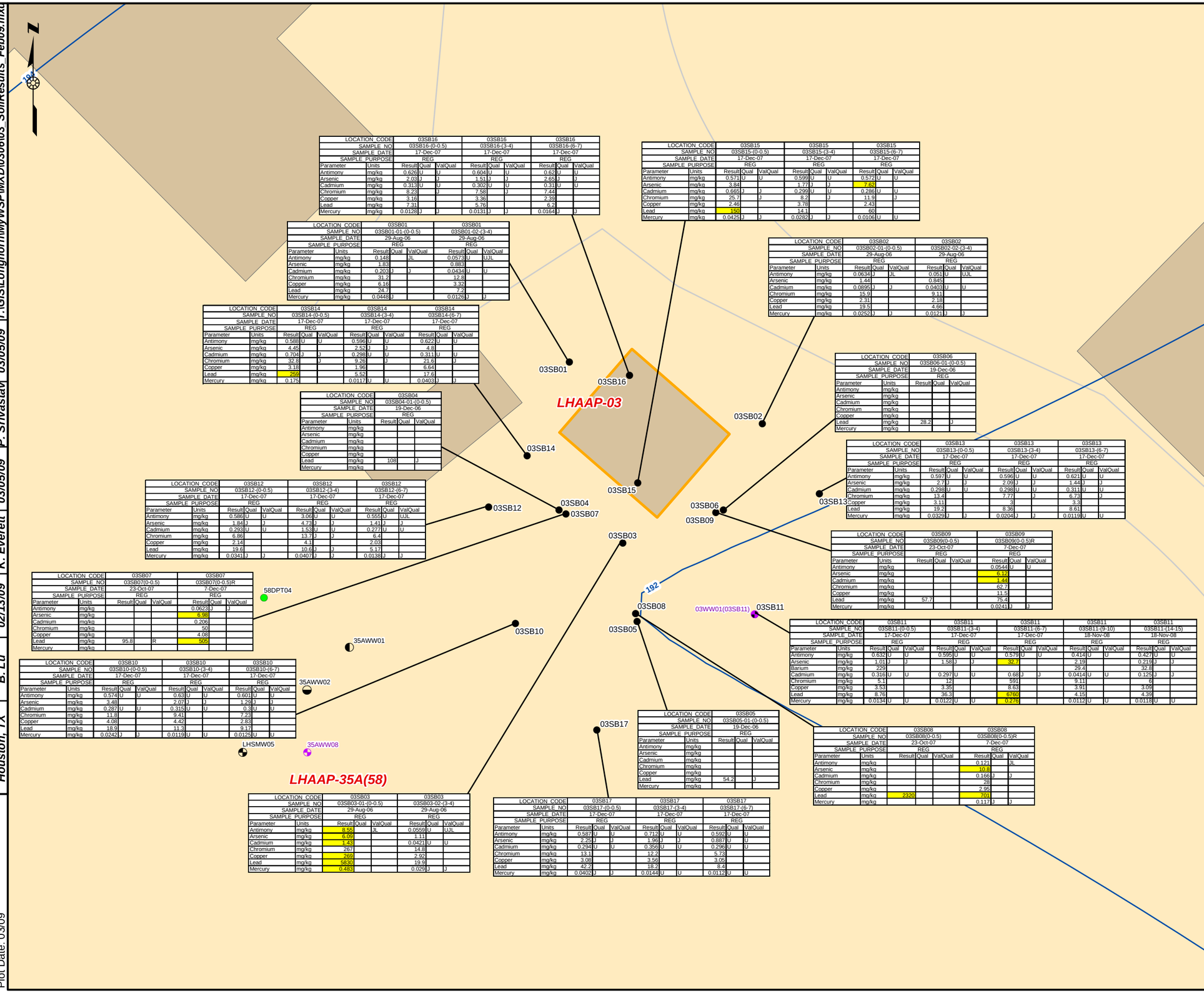
Shading indicates above the MSC

[a] Value equals the lower of the calculated MSC or C_{sat} values (Table 4).

[b] Background concentration calculated as the 95% UPL of soil background concentrations (*Final Background Soil Study Report, Longhorn Army Ammunition Plant, Karnack, Texas, July (Shaw, 2004).*

[c] Applicable Commercial/Industrial Soil MSC equals largest of Calculated Standard 3 MSC and background values. Shading indicates value equals background.

Figures



LOCATION_CODE	03SB16			03SB16			03SB16		
SAMPLE_NO	03SB16-(0-0.5)			03SB16-(3-4)			03SB16-(6-7)		
SAMPLE_DATE	17-Dec-07			17-Dec-07			17-Dec-07		
SAMPLE_PURPOSE	REG			REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg	0.626	U	U	0.604	U	U	0.62	U	U
Arsenic	mg/kg	2.03	J	J	1.51	J	J	2.65	J	J
Cadmium	mg/kg	0.313	U	U	0.302	U	U	0.31	U	U
Chromium	mg/kg	8.23		J	7.58		J	7.44		
Copper	mg/kg	3.16			3.36			2.39		
Lead	mg/kg	7.31			5.76			6.2		
Mercury	mg/kg	0.0128	J	J	0.0131	J	J	0.0164	J	J

LOCATION_CODE	03SB15			03SB15			03SB15		
SAMPLE_NO	03SB15-(0-0.5)			03SB15-(3-4)			03SB15-(6-7)		
SAMPLE_DATE	17-Dec-07			17-Dec-07			17-Dec-07		
SAMPLE_PURPOSE	REG			REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg	0.571	U	U	0.599	U	U	0.572	U	U
Arsenic	mg/kg	3.84			1.77	J	J	7.62		
Cadmium	mg/kg	0.665	J	J	0.299	U	U	0.286	U	U
Chromium	mg/kg	25.7		J	8.2		J	11.9		J
Copper	mg/kg	2.46			3.78			2.43		
Lead	mg/kg	150			14.1			60		
Mercury	mg/kg	0.0425	J	J	0.0282	J	J	0.0106	U	U

LOCATION_CODE	03SB01			03SB01		
SAMPLE_NO	03SB01-01-(0-0.5)			03SB01-02-(3-4)		
SAMPLE_DATE	29-Aug-06			29-Aug-06		
SAMPLE_PURPOSE	REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg	0.148		JL	0.0573	U	UJL
Arsenic	mg/kg	1.83			0.883		
Cadmium	mg/kg	0.203	J	J	0.0434	U	U
Chromium	mg/kg	31.2			12.8		
Copper	mg/kg	6.16			3.32		
Lead	mg/kg	24.7			7.2		
Mercury	mg/kg	0.0448	J		0.0126	J	J

LOCATION_CODE	03SB02			03SB02		
SAMPLE_NO	03SB02-01-(0-0.5)			03SB02-02-(3-4)		
SAMPLE_DATE	29-Aug-06			29-Aug-06		
SAMPLE_PURPOSE	REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg	0.0634	J	JL	0.051	U	UJL
Arsenic	mg/kg	1.44			0.845		
Cadmium	mg/kg	0.0895	J	J	0.0403	U	U
Chromium	mg/kg	15.9			9.11		
Copper	mg/kg	2.31			2.18		
Lead	mg/kg	19.5			4.66		
Mercury	mg/kg	0.0252	J	J	0.0121	J	J

LOCATION_CODE	03SB14			03SB14			03SB14		
SAMPLE_NO	03SB14-(0-0.5)			03SB14-(3-4)			03SB14-(6-7)		
SAMPLE_DATE	17-Dec-07			17-Dec-07			17-Dec-07		
SAMPLE_PURPOSE	REG			REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg	0.588	U	U	0.596	U	U	0.622	U	U
Arsenic	mg/kg	4.45			2.52	J	J	4.8		
Cadmium	mg/kg	0.704	J	J	0.298	U	U	0.311	U	U
Chromium	mg/kg	32.8		J	9.26		J	21.6		J
Copper	mg/kg	3.18			1.96			6.64		
Lead	mg/kg	259			5.52			17.6		
Mercury	mg/kg	0.175			0.0117	U	U	0.0403	J	J

LOCATION_CODE	03SB06		
SAMPLE_NO	03SB06-01-(0-0.5)		
SAMPLE_DATE	19-Dec-06		
SAMPLE_PURPOSE	REG		
Parameter	Units	Result	Qual	ValQual
Antimony	mg/kg			
Arsenic	mg/kg			
Cadmium	mg/kg			
Chromium	mg/kg			
Copper	mg/kg			
Lead	mg/kg	28.2		J
Mercury	mg/kg			

LOCATION_CODE	03SB04		
SAMPLE_NO	03SB04-01-(0-0.5)		
SAMPLE_DATE	19-Dec-06		
SAMPLE_PURPOSE	REG		
Parameter	Units	Result	Qual	ValQual
Antimony	mg/kg			
Arsenic	mg/kg			
Cadmium	mg/kg			
Chromium	mg/kg			
Copper	mg/kg			
Lead	mg/kg	108		J
Mercury	mg/kg			

LOCATION_CODE	03SB13			03SB13			03SB13		
SAMPLE_NO	03SB13-(0-0.5)			03SB13-(3-4)			03SB13-(6-7)		
SAMPLE_DATE	17-Dec-07			17-Dec-07			17-Dec-07		
SAMPLE_PURPOSE	REG			REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg	0.597	U	U	0.596	U	U	0.621	U	U
Arsenic	mg/kg	2.7	J	J	2.09	J	J	1.44	J	J
Cadmium	mg/kg	0.298	U	U	0.298	U	U	0.311	U	U
Chromium	mg/kg	13.4			7.77		J	6.73		J
Copper	mg/kg	3.11			3			3.3		
Lead	mg/kg	19.2			8.36			8.61		
Mercury	mg/kg	0.0329	J	J	0.0204	J	J	0.0119	U	U

LOCATION_CODE	03SB12			03SB12			03SB12		
SAMPLE_NO	03SB12-(0-0.5)			03SB12-(3-4)			03SB12-(6-7)		
SAMPLE_DATE	17-Dec-07			17-Dec-07			17-Dec-07		
SAMPLE_PURPOSE	REG			REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg	0.586	U	U	3.06	U	U	0.555	U	UJL
Arsenic	mg/kg	1.84	J	J	4.73	J	J	1.41	J	J
Cadmium	mg/kg	0.293	U	U	1.53	U	U	0.277	U	U
Chromium	mg/kg	6.86			13.7	J	J	6.4		
Copper	mg/kg	2.14			4.1			2.03		
Lead	mg/kg	19.6			10.6	J	J	5.17		
Mercury	mg/kg	0.0341	J	J	0.0407	J	J	0.0138	J	J

LOCATION_CODE	03SB09			03SB09		
SAMPLE_NO	03SB09-(0-0.5)			03SB09-(0-0.5)R		
SAMPLE_DATE	23-Oct-07			7-Dec-07		
SAMPLE_PURPOSE	REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg				0.0544	U	U
Arsenic	mg/kg				5.12		
Cadmium	mg/kg				1.44		
Chromium	mg/kg				62.7		
Copper	mg/kg				11.5		
Lead	mg/kg	57.7			75.4		
Mercury	mg/kg				0.0241	J	J

LOCATION_CODE	03SB07			03SB07		
SAMPLE_NO	03SB07(0-0.5)			03SB07(0-0.5)R		
SAMPLE_DATE	23-Oct-07			7-Dec-07		
SAMPLE_PURPOSE	REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg				0.0623	J	J
Arsenic	mg/kg				6.98		
Cadmium	mg/kg				0.206		
Chromium	mg/kg				50		
Copper	mg/kg				4.08		
Lead	mg/kg	95.8		R	505		
Mercury	mg/kg						

LOCATION_CODE	03SB11			03SB11			03SB11			03SB11			03SB11		
SAMPLE_NO	03SB11-(0-0.5)			03SB11-(3-4)			03SB11-(6-7)			03SB11-(9-10)			03SB11-(14-15)		
SAMPLE_DATE	17-Dec-07			17-Dec-07			17-Dec-07			18-Nov-08			18-Nov-08		
SAMPLE_PURPOSE	REG			REG			REG			REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg	0.632	U	U	0.595	U	U	0.579	U	U	0.414	U	U	0.427	U	U
Arsenic	mg/kg	1.01	J	J	1.58	J	J	32.7			2.19			0.219	U	U
Barium	mg/kg	229									29.4			32.8		
Cadmium	mg/kg	0.316	U	U	0.297	U	U	0.68	J	J	0.0414	U	U	0.125	J	J
Chromium	mg/kg	5.1			12			591			9.11			9		
Copper	mg/kg	3.53			3.35			8.63			3.91			3.09		
Lead	mg/kg	8.76			36.3			6760			4.15			4.39		
Mercury	mg/kg	0.0134	U	U	0.0122	U	U	0.276			0.0112	U	U	0.0118	U	U

LOCATION_CODE	03SB10			03SB10			03SB10		
SAMPLE_NO	03SB10-(0-0.5)			03SB10-(3-4)			03SB10-(6-7)		
SAMPLE_DATE	17-Dec-07			17-Dec-07			17-Dec-07		
SAMPLE_PURPOSE	REG			REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg	0.574	U	U	0.63	U	U	0.601	U	U
Arsenic	mg/kg	3.48			2.07	J	J	1.29	J	J
Cadmium	mg/kg	0.287	U	U	0.315	U	U	0.3	U	U
Chromium	mg/kg	11.8			9.41			7.23		
Copper	mg/kg	4.08			4.42			2.83		
Lead	mg/kg	18.9			11.3			9.17		
Mercury	mg/kg	0.0242	J	J	0.0119	U	U	0.0125	U	U

LOCATION_CODE	03SB05		
SAMPLE_NO	03SB05-01-(0-0.5)		
SAMPLE_DATE	19-Dec-06		
SAMPLE_PURPOSE	REG		
Parameter	Units	Result	Qual	ValQual
Antimony	mg/kg			
Arsenic	mg/kg			
Cadmium	mg/kg			
Chromium	mg/kg			
Copper	mg/kg			
Lead	mg/kg	54.2		J
Mercury	mg/kg			

LOCATION_CODE	03SB08			03SB08		
SAMPLE_NO	03SB08-(0-0.5)			03SB08-(0-0.5)R		
SAMPLE_DATE	23-Oct-07			7-Dec-07		
SAMPLE_PURPOSE	REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg				0.121		JL
Arsenic	mg/kg				10.8		
Cadmium	mg/kg				0.166	J	J
Chromium	mg/kg				28		
Copper	mg/kg				2.95		
Lead	mg/kg	2320			701		
Mercury	mg/kg				0.117	J	J

LOCATION_CODE	03SB03			03SB03		
SAMPLE_NO	03SB03-01-(0-0.5)			03SB03-02-(3-4)		
SAMPLE_DATE	29-Aug-06			29-Aug-06		
SAMPLE_PURPOSE	REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg	8.55		JL	0.0559	U	UJL
Arsenic	mg/kg	6.09			1.11		
Cadmium	mg/kg	1.43			0.0421	U	U
Chromium	mg/kg	267			14.8		
Copper	mg/kg	269			2.92		
Lead	mg/kg	5830			19.9		
Mercury	mg/kg	0.483			0.029	J	J

LOCATION_CODE	03SB17			03SB17			03SB17		
SAMPLE_NO	03SB17-(0-0.5)			03SB17-(3-4)			03SB17-(6-7)		
SAMPLE_DATE	17-Dec-07			17-Dec-07			17-Dec-07		
SAMPLE_PURPOSE	REG			REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg	0.587	U	U	0.712	U	U	0.592	U	U
Arsenic	mg/kg	2.25	J	J	1.96	J	J	0.887	U	U
Cadmium	mg/kg	0.294	U	U	0.356	U	U	0.296	U	U
Chromium	mg/kg	13.1			12.2			5.73		
Copper	mg/kg	3.08			3.56			3.05		
Lead	mg/kg	42.2			18.2			8.4		
Mercury	mg/kg	0.0402	J	J	0.0144	U	U	0.0112	U	U

LEGEND

- New Shallow Monitoring Well (Installed Nov. 2008)
- Shallow Monitoring Well
- Intermediate Monitoring Well
- Deep Monitoring Well
- Soil Boring
- DPT Location
- Groundwater Elevation Contour
- Inferred Groundwater Elevation Contour
- Road
- Former Building or Concrete Slab
- Site

NOTES:

1. mg/kg is milligrams per kilogram.
2. U -- less than laboratory detection limits.
3. J -- estimated concentration.
4. Yellow highlights indicate exceedance of applicable medium-specific concentration for chemical in soil.
   Antimony: 1.6 mg/kg
   Arsenic 5.9 mg/kg
   Cadmium 1.4 mg/kg
   Copper: 240 mg/kg
   Lead: 130 mg/kg
   Mercury: 0.21 mg/kg

0 6 12 24 Feet

Shaw®

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

FIGURE 2-1

SOIL SAMPLING RESULTS
LHAAP-03

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	FILE PATH
Houston, TX	B. Lu 02/13/09	K. Everett 03/05/09	P. Srivastav 03/05/09	T:\GIS\LonghornMyWSP\MXD\0306\03_SoilResults_Feb09.mxd

Plot Date: 03/09

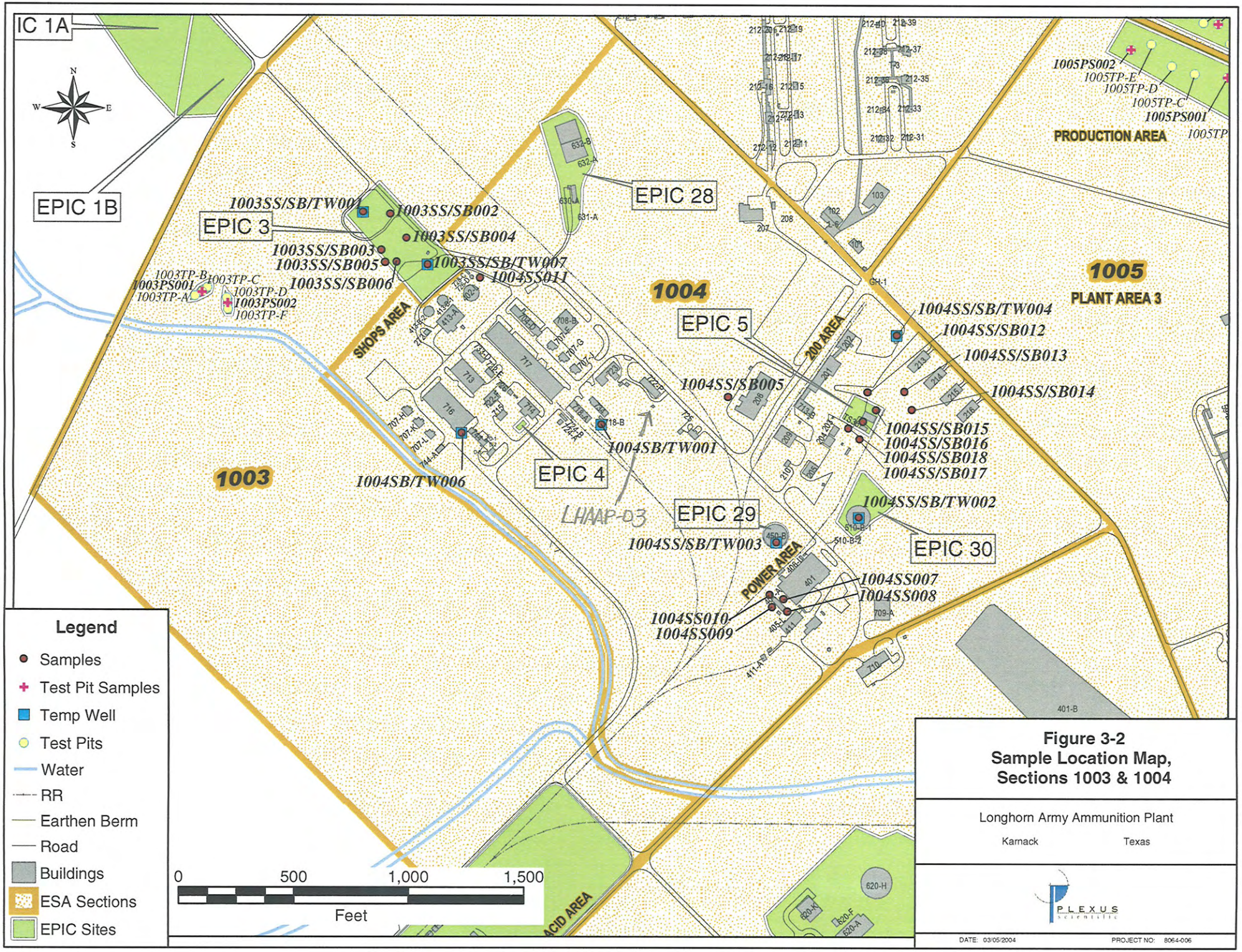


Figure 3-2
Sample Location Map, Sections 1003 & 1004

Longhorn Army Ammunition Plant

Karnack Texas

PLEXUS scientific

DATE: 03/05/2004 PROJECT NO: 8064-006

00076271

FINAL

SITE INVESTIGATION REPORT
LHAAP-03
(WASTE COLLECTION PAD NEAR BUILDING 722-P, PAINT SHOP)
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 No. W912QR-04-D-0027, Shaw Project No. 117591
Task Order No. DS02

August 2009

SITE INVESTIGATION REPORT
LHAAP-03
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
AUGUST 2009

PRAVEEN SRIVASTAV
Name of Texas Professional Geoscientist

1696
License Number

SHAW ENVIRONMENTAL, INC.
Company

3010 BRIARPARK DRIVE, SUITE 400, HOUSTON, TX 77042
Address

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

Signature

8/17/09
Date Signed

STATE OF TEXAS
PRAVEEN SRIVASTAV
GEOLOGY
1696
LICENSED
PROFESSIONAL GEOSCIENTIST

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Acronyms and Abbreviations

bgs	below ground surface
COC	chemical of concern
COPC	chemical of potential concern
DCS	detectability check sample
GWP-Ind	Groundwater Protection Standard for Industrial Use
kg	kilograms
LHAAP	Longhorn Army Ammunition Plant
MARC	Multiple Award Remediation Contract
MCL	Maximum Contaminant Level
MDL	method detection limit
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MQL	method quantitation limit
MSC	medium-specific concentration
Plexus	Plexus Scientific Corp.
PQL	practical quantitation limit
RRR	Risk Reduction Rules
SAI-Ind	Soil Ingestion, Inhalation, and Dermal Contact MSC for Industrial Use
SAM	Soil Attenuation Model
SDL	sample detection limit
Shaw	Shaw Environmental, Inc.
SPLP	Synthetic Precipitation Leaching Procedure
SQL	sample quantitation limit
SVOC	semivolatile organic compound
TAC	Texas Administrative Code
TCEQ	Texas Commission on Environmental Quality
TO	task order
UPL	upper prediction limit
USAEHA	U.S. Army Environmental Hygiene Agency
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compounds

1.0 Introduction

The U.S. Army Corps of Engineers, Tulsa District, contracted Shaw Environmental, Inc. (Shaw) under the Louisville District's Multiple Award Remediation Contract (MARC) Number W912QR-04-D-0027, Task Order (TO) No. DS02 to perform a site investigation at selected sites at the former Longhorn Army Ammunition Plant (LHAAP) in Karnack, Texas. The sites were used for a variety of purposes in support of the LHAAP mission. This site investigation report presents results of soil sampling activities conducted at LHAAP-03 by Shaw in August 2006, and results of the screening of results against Texas Commission on Environmental Quality (TCEQ) regulatory values.

1.1 Project Objective

The objective of the investigation at these LHAAP sites was to determine whether contaminants have been released during site operations.

1.2 Site Description and Operational History

LHAAP is a former Army installation that occupied nearly 8,500 acres between State Highway 43, in Karnack, Texas, and the southwestern shore of Caddo Lake. The sites investigated are shown on **Figure 1-1**, Site Location Map. The nearest cities are Marshall, Texas, approximately 14 miles to the southwest, and Shreveport, Louisiana, approximately 40 miles to the southeast. Caddo Lake, a large freshwater lake situated on the Texas-Louisiana border, bounds LHAAP to the north and east.

1.2.1 LHAAP-03

LHAAP-03 was a waste collection site outside of the paint shop at Building 722-P, which was at the Maintenance Shop Area within the boundary of LHAAP-35A(58) (**Figure 1-2**). Building 722-P was used for paint spraying and polyurethane spray coating of various items. Heavy metal-based primers, other waste paint, waste solvents and contaminated rags were collected in a 55-gallon drum on a gravel pad in an open-sided shed. Full drums were taken to Building 31-W for disposal (Plexus Scientific Corp. [Plexus], 2005). Building 722-P has been demolished (Plexus, 2005). Potential site-related chemicals at LHAAP-03 are metals, volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs) (Plexus, 2005).

2.0 Field Investigations

Previous descriptions of the wastes collected at LHAAP-03 near the Paint Shop (Building 722-P) included inventories of the types and quantities of wastes generated, including waste paint thinner and other non-halogenated solvents (95 kilograms [kg] in 1985 and 200 kg in 1986), and urethanes (606 kg in 1985 and 400 kg in 1986) (USAEHA, 1987). Approximately 130 gallons of waste paint thinner was generated circa 1990 (Day & Zimmerman, 1991).

Building 722-P was the Paint Shop located in the shop area, which mainly consists of the maintenance shops and power area (Plexus, 2003), and was located within Section 1004, a roughly rectangular parcel in the northwest quarter of LHAAP.

The shop area is designated LHAAP-58. This area also includes the vacuum truck parking (LHAAP-02), Building 722-P waste collection (LHAAP-03), the Pilot Wastewater Treatment Plant (PWTP, LHAAP-04), vehicle wash rack and oil/water separator (LHAAP-56), Building 725 (LHAAP-59), former pesticide storage buildings (LHAAP-60), water treatment plant effluent settling ponds (LHAAP-61), Building 209 (LHAAP-65), Building 401 transformer (LHAAP-66), mobile storage tank parking (LHAAP-68), and service station (underground storage tanks, LHAAP-69). Because LHAAP-03 is included within the LHAAP-35A(58) site, data from previous investigations of soil and groundwater near LHAAP-03 were included in the investigation of LHAAP-35A(58) (Shop Area) (Jacobs, 2002), and subsequent investigation results were summarized in the Plexus (2005) report.

All sampling activities and analytical methods used to provide data for this report are described in the Installation-Wide Work Plan (Shaw, 2006a). At LHAAP-03, Shaw advanced six soil borings denoted 03SB01, 03SB02, 03SB03, 03SB04, 03SB05, and 03SB06 at locations shown in **Figure 1-2**. Borings 03SB01, 03SB02, and 03SB03 were sampled in August 2006, and a second sample (03SB01-01-R) was collected in September 2006 for reanalysis of SVOCs. Borings 03SB04, 03SB05, and 03SB06 were sampled in December 2006 for further investigation of lead in soil. Soil borings were advanced using a hand auger and two samples were collected from each boring at 0 to 0.5 feet below ground surface (bgs) and 3 to 4 feet bgs.

In October 2007, surface soil samples were collected offset from the original soil samples (03SB04 through 03SB06) and identified as 03SB07 (offset from 03SB04), 03SB08 (offset from 03SB05), and 03SB09 (offset from 03SB06) as shown on **Figure 2-1**. Soil samples were collected from the 0 to 0.5 foot bgs interval and analyzed for metals. Maximum lead results were 505, 2320, and 75.4 milligrams per kilogram (mg/kg) respectively. The samples collected from 03SB07 and 03SB08 were also subjected to leaching tests.

In December 2007, additional soil borings (03SB10 through 03SB17) were installed and soil samples analyzed for metals. Samples were collected from the 0 to 0.5 feet bgs interval, the 3 to 4 feet bgs interval and the 6 to 7 feet bgs interval surface. The sample collected at 03SB11-(6-7) exceeded the applicable medium-specific concentrations (MSCs) for arsenic, lead, and mercury. (See **Table 3-5a**).

In November 2008, a soil boring offset from 03SB11 was advanced using a hollow stem auger. Soil samples were collected at subsurface intervals 10 to 11 feet bgs and 14 to 15 feet bgs for vertical delineation. Total lead results were 4.15 and 4.39 mg/kg respectively. The boring was converted to monitoring well 03WW01 and groundwater sample was collected and analyzed for total metals.

Samples were analyzed by SW846 Methods (U.S. Environmental Protection Agency [USEPA], 1997) for:

- Metals – Methods 6010B/6020/7471A
- SVOCs – Method 8270
- VOCs – Method 8260.

Sample 03SB03-01-SPLP was collected on May 4, 2007 at a location within 6 inches of the original sample location 03SB03-01 and subjected to the Synthetic Precipitation Leaching Procedure (SPLP) Method 1312 and total soil analyses. The samples collected from 03SB07 and 03SB08 in October 2007 were also subjected to leaching tests and total soil analysis. The SPLP leachate and the total sample were analyzed for metals and SVOCs by the above methods. Results of total soil and leachate analyses are described in **Sections 3.2** and **3.3**. Detailed sample collection and handling procedures are described in the Work Plan Addendum (Shaw, 2006b). Soil boring logs are attached in **Appendix A**.

3.0 Evaluation and Interpretation of Analytical Results

Decisions related to further action at LHAAP-03 will be made according to the requirements of the Risk Reduction Rules (RRR) as described in Chapter 335 of Title 30 of the Texas Administrative Code (30 TAC §335) as updated by the TCEQ Consistency Memorandum (TCEQ, 1998). Terms used in this report to describe concentrations at or near the detection limit are defined in TCEQ guidance as follows:

- **Practical quantitation limit (PQL)** is the concentration of the lowest non-zero standard in the laboratory's calibration curve adjusted for laboratory reagent matrix type and sample size. The PQL is analogous to the method quantitation limit (MQL) reported by the laboratory and described in Section 7 of SW846-Method 8000B. The PQL is used under the 30 TAC §335 rule to evaluate the capability of the analytical method used by the laboratory to quantitate the chemicals at concentrations below the regulatory level, e.g., the MSCs.

  When the PQL of the most sensitive standard available method is greater than the regulatory level, the PQL from that method is used as the regulatory limit in lieu of the MSC as allowed in 30 TAC §335. Upon TCEQ concurrence, that PQL remains the MSC for the life of the work related to the site being investigated if no extenuating circumstance arises and warrants investigating the chemical to lower levels.

- **Sample quantitation limit (SQL)** is the PQL adjusted for sample-specific factors affecting the quantitation of the chemical measured in an environmental sample, such as dilution or moisture content, and flagged with a "U" qualifier to indicate the chemical was not detected in the in the sample.

- **Method detection limit (MDL)** is the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from the analysis of a sample in a given matrix type containing the analyte (TCEQ, 1998, Appendix B.1.1.2).

  The laboratory establishes the MDL for the chemical and verifies the value on at least a quarterly basis using a detectability check sample (DCS) to demonstrate that the laboratory can detect the chemical at that MDL. The DCS is a laboratory reagent grade matrix sample spiked with the chemical at or within two times the laboratory's MDL and carried through the entire sample preparation and analysis procedures.

- **Sample detection limit (SDL)** is the laboratory's MDL for the chemical adjusted for sample-specific factors affecting the detection of the chemical measured in an environmental sample, such as dilution or percent moisture, and flagged or qualified with a "U" or "<" to indicate the chemical was not detected in the sample. The SDL is used in this document to report nondetected results for chemicals only when the PQL is being used as the regulatory limit in lieu of the MSC for the chemical (TCEQ, 2007).

3.1 Identification of Chemicals of Potential Concern

Concentrations of chemicals analyzed in soil samples described in **Section 2.0** are shown in **Table 3-1**.

Analytical data were evaluated as follows:

- Samples with all validation qualifiers were included in the data evaluation except for "R"-qualified data, which were rejected from the data set.
- "H" – estimate is high
- "J" – qualified data indicate estimated concentrations detected with concentrations measured between the MDL and the MQL values shown
- "L" – estimate is low
- "U" – qualified data indicate undetected concentrations below the MDL shown.

The first step in the data evaluation was the selection of chemicals of potential concern (COPC). The COPCs are chemicals that are detected in site media at concentrations that fail one or more conservative criteria designed to eliminate chemicals from further evaluation that are unlikely to cause adverse effects. The COPCs for the evaluation were identified using the following criteria:

Essential Nutrients. Calcium, chloride, iron, magnesium, phosphorus, potassium, and sodium are considered as essential nutrients and were eliminated as COPCs (TCEQ, 2001, 2003).

Background. For metals, a comparison to site-specific background concentrations was used to determine whether detected concentrations might be related to LHAAP operations or naturally occurring background levels. The LHAAP-specific background concentrations for soil were developed using data that represent background concentrations for surface (0 to 0.5 feet bgs) and subsurface (1.5 to 2.5 feet bgs) soil (Shaw, 2004). Because the samples collected at the LHAAP sites evaluated in this report were taken at depths varying between 0 and 4 feet bgs, the depth interval of surface and subsurface samples for the LHAAP-sites evaluated in this report and background soil data do not correspond to each other exactly. Therefore, the LHAAP-03 site concentrations were compared to the lower of surface and subsurface background concentrations. This approach provides a conservative evaluation.

Based on TCEQ recommendations, 95 percent upper prediction limits (UPLs) of the background data sets (Shaw, 2004) were calculated and used in this evaluation (**Table 3-2**). The 95 percent UPL value represents the concentration that will be above the next single measurement with 95 percent confidence, and was calculated as follows.

The distributions of background concentrations are shown in the Final Background Soil Study Report (Shaw, 2004) and are repeated in **Table 3-2**. If the background data have either the normal or lognormal distribution, the 95 percent UPL was calculated according to the equation (USEPA, 1992):

$$UPL_{0.95} = X + t_{n-1,0.95} \times S \times (1+1/n)^{1/2} \qquad \textbf{Equation 1}$$

where:

$UPL_{0.95}$	=	the 95 percent UPL
X	=	mean background concentration
$t_{n-1,0.95}$	=	Student's t value for n-1 degrees of freedom and 95 percent confidence
S	=	standard deviation of the mean
n	=	number of samples

If the data were shown to be both normally and lognormally distributed, the distribution having the higher p value above 0.05 was used for the 95 percent UPL calculation. If the data were lognormally distributed, the 95 percent UPL value used (**Table 3-2**) is the antilogarithm of the value calculated by **Equation 1**.

Nonparametric methods were used if the data do not have either the normal or lognormal distribution. The 95 percent UPL concentration was determined by ranking the data from highest to lowest and calculating the 95th percentile rank according to the equation:

$$UPL_{0.95} = 95^{th} \text{ percentile} = 0.95(n+1) \qquad \textbf{Equation 2}$$

where:

$UPL_{0.95}$	=	concentration occupying the 95th percentile rank
95th percentile	=	the 95th percentile rank of the of the data set
n	=	number of samples

This 95th percentile is the same as the 95 percent UPL according to the assumptions made in **Equation 1**.

3.1.1 Comparison of Chemical Concentrations to Medium-Specific Concentrations

Under the TCEQ RRR, future use of LHAAP as a wildlife refuge corresponds to commercial/industrial land-use standards. Therefore, the MSC concentrations used in the identification of soil COPCs are the Risk Reduction Standard 2 Soil Ingestion, Inhalation, and Dermal Contact for Industrial Use (SAI-Ind) and Groundwater Protection Standard for Industrial

Use (GWP-Ind) values (TCEQ, 2006). The MSC values are protective at a target risk level of 1E-06 for carcinogens and a target hazard quotient of 1 for noncarcinogens. In cases where contaminants have both carcinogenic and noncancer toxicity factors, the MSC represents the lower (more conservative) value.

The SAI-Ind MSC values are risk-based soil concentrations developed to protect human health from exposure via ingestion, inhalation, and dermal absorption pathways under commercial/industrial land-use assumptions. The GWP-Ind MSC values were developed to protect groundwater resources from leaching of chemicals from soil, and correspond to potential use of groundwater under commercial/industrial land use assumptions. As with SAI-Ind MSCs, the GWP-Ind values provided in TCEQ (2006) tables are the more conservative MSC if the chemical acts as both a carcinogen and a noncarcinogen.

3.2 Results of Comparisons to Regulatory Concentrations

The TCEQ risk-based MSCs used for COPC identification are given in TCEQ (1998) guidance and in current tables (TCEQ, 2006). The applicable MSCs (**Table 3-1a** and **3-1b**) represent the lower of the SAI-Ind and the GWP-Ind MSC values unless the MQL, or the lower of the surface and subsurface soil background concentrations is greater, in accordance with TCEQ guidance [30TAC§335.559(g)].

No VOCs were detected at concentrations above applicable MSCs (**Table 3-1a** and **3-1b**) in any sample analyzed, and are of no further concern at LHAAP-03. Fifteen SVOCs have SDL concentrations identified for diluted samples (03SB01-01-QC, 03SB02-01, and 03SB03-01), and were not detected in any of the undiluted samples (**Table 3-1a**). Results of reanalysis of sample 03SB01-01 without dilution (see sample 03SB01-01-R, **Table 3-1a**) showed that the soil at 03SB01-1 did not contain detectable SVOCs. A soil sample from location 03SB03-01 was also analyzed by the SPLP method as described in **Section 3.3**.

These SVOCs were identified as COPCs only as a result of the sample dilution, which raised the SQL above the Texas applicable MSC, and were not detected in undiluted samples from the same location (03SB01-01-R and 03SB01-02). Further, these SVOC are not related to LHAAP-03 processes, and thus, are considered to be of no further concern at LHAAP-03. Aluminum, beryllium, cobalt, manganese, nickel, selenium, silver, thallium, vanadium, and zinc were not detected with concentrations above applicable MSCs in any of the samples (**Table 3-1a** and **3-1b**). No metals were detected with concentrations above the MSCs in boring 03SB16.

Antimony, arsenic, barium, cadmium, chromium, copper, lead, and mercury were detected in one or more samples from 03SB01 through 03SB15, and 03SB17 with concentrations above applicable MSCs values. Sample 03SB03-01 contained the greatest number of metals with concentrations above applicable MSCs (**Table 3-1a**). Samples from 03SB11 contained the

second greatest number of metals above applicable MSCs (arsenic, barium, cadmium, chromium, lead, and mercury). Samples from 03SB09 contained arsenic, cadmium, chromium, and lead above applicable MSCs. Samples from 03SB14 contained cadmium, chromium, and lead above applicable MSCs. Samples from 03SB15 contained arsenic, cadmium, and lead above applicable MSCs. Samples from 03SB02, 03SB04, 03SB05, 03SB06, 03SB10, 03SB12, 03SB13, and 03SB17 contained only lead above the applicable MSC.

Samples from 03SB07 and 03SB08 contained arsenic, chromium, and lead above applicable MSCs. Because the samples from 03SB07 and 03SB08 collected in October 2007 contained lead at 95.8 mg/kg and 2,320 mg/kg, respectively, samples 03SB07(0-0.5)R and 03SB08(0-0.5)R were collected from these locations and were subjected to SPLP tests as described below.

3.3 Synthetic Precipitation Leaching Procedure Analysis

The SPLP analyses were conducted to determine if constituents in the soil could potentially impact groundwater via leaching. Three samples from locations 03SB03, 03SB07, and 03SB08 were subjected to SPLP analysis. Sample 03SB03-01 contained all the metals that were detected above applicable MSCs, and had elevated SDL values above applicable MSCs for 15 SVOCs as a result of sample dilution (**Table 3-1a**). An additional sample (03SB03-01-Total) was taken from the original sample 03SB03-01 location and subjected to the SPLP test as provided in 30 TAC §335.559(g)(2)(B). The portion of sample 03SB03-01-Total that was subjected to SPLP analysis is designated as 03SB03-01-SPLP. SVOCs that were not detected in the original sample 03SB03-01, but which were identified as having SDL concentrations above applicable MSCs only because of dilution (**Table 3-1a**), are chemicals that have MQL values above the MSC values (GWP-Ind), and have MDL and MQL values that are within a factor of two. Results of the 03SB03-01-Total analysis are shown in **Table 3-3**. Results of SPLP analysis for 03SB03-01-SPLP are shown in **Table 3-4**. All SVOC compounds were nondetected in sample 030SB03-01-SPLP. All detected concentrations of metals in leachate from sample 030SB03-01-SPLP were below the applicable MSC for groundwater (GW-Ind) except arsenic, which exceeds the GW-Ind (**Table 3-4**). The arsenic concentration that exceeds the GW-Ind MSC in this sample suggests that leaching of arsenic from soil may threaten groundwater at LHAAP-03, although the arsenic concentration in the corresponding soil sample (03SB03-01-Total) is below applicable MSC levels (**Table 3-3**). However, the total concentrations of the chemicals of concern (COCs) in the 03SB03-01-Total sample (**Table 3-3**) were significantly lower than the total concentrations in the original sample 03SB03-01. The SPLP results were, therefore, inconclusive and it was decided to repeat the SPLP analysis at two other locations.

Samples 03SB07(0-0.5)R and 03SB08(0-0.5)R contained lead concentrations of 505 mg/kg and 2,320 mg/kg, respectively. Results of SPLP test leachate analysis of samples 03SB07(0-0.5)R and 03SB08(0-0.5)R are shown in **Table 3-4**. Concentrations of antimony, arsenic, lead, and

zinc exceed GW-Ind values in leachate from sample 03SB07(0-0.5)R, and antimony, chromium, lead, and zinc exceed GW-Ind values in leachate from sample 03SB08(0-0.5)R suggesting that leaching of these metals from soil may threaten groundwater (**Table 3-4**). However, antimony and zinc concentrations in the corresponding soil samples 03SB07(0-0.5)R and 03SB08(0-0.5)R are below applicable MSC levels (**Table 3-1a** and **3-1b**). The concentrations of arsenic, chromium, and lead in both soil samples exceed applicable MSC levels.

3.4 Standard 3 Medium-Specific Concentrations for Soil

Because soil concentrations and SPLP leachate concentrations of selected metals exceed screening values (**Tables 3-1a**, **3-1b, 3-3**, and **3-4**), and published MSCs and SPLP test are considered conservative, Standard 3 MSCs were developed for all COCs in soil at LHAAP-03 (antimony, arsenic, barium, cadmium, chromium, copper, lead, and mercury, see **Section 2**). Standard 3 MSC values that are protective of groundwater were developed using the Soil Attenuation Model (SAM) according to the TCEQ Risk Reduction Rules (30 TAC §335 and updates). The development of Applicable Standard 3 Commercial/Industrial Soil MSCs using the SAM model is described in **Appendix B**.

Concentrations of COCs in soil were compared to Applicable Standard 3 Commercial/Industrial Soil MSCs developed using SAM calculations as shown in **Table 3-5a** and **3-5b**. Soil borings where COC concentrations exceed their Applicable Standard 3 Commercial/Industrial Soil MSCs are shown in **Figure 2-1**.

Concentrations above MSCs were measured at 03SB03 (antimony, arsenic, cadmium, copper, lead, and mercury), 03SB07 (arsenic and lead), 03SB08 (arsenic and lead), 03SB09 (arsenic and cadmium), 03SB11 (arsenic, lead, and mercury), 03SB12 (arsenic and cadmium), and 03SB15 (arsenic and lead). COC concentrations were confined to surface soil (<0.5 feet bgs) except at 03SB11 and 03SB15.

Boring 03SB11 contained arsenic, lead, and mercury above MSCs at 6 to 7 feet bgs.

Boring 03SB15 contained elevated lead concentrations at 0.5 feet bgs and arsenic concentrations at 6-7 feet bgs (**Table 3-5a** and **3-5b**). Soil at Boring 03SB15 contained lead concentrations in the upper 0.5 feet bgs (150 mg/kg) above the Applicable Standard 3 MSC (130 mg/kg) (**Figure 2-1**). However, the lead concentrations in soil at 3 to 4 feet bgs (14.1 mg/kg) and at 6 to 7 feet bgs (60 mg/kg) are below the MSC at this boring. Arsenic concentrations at all three elevations in this boring (3.84 mg/kg, 1.77 mg/kg, and 7.62 mg/kg) are similar to the background concentration (5.9 mg/kg, **Appendix B**, Table B-5).

3.5 COC Concentrations in Groundwater

Groundwater data from the new well 03WW01 installed at LHAAP-03 in 2008 (**Figure 2-1**) was further evaluated for the potential transport of COC concentrations to groundwater at LHAAP-03. Groundwater samples from well 03WW01 were analyzed for all COCs identified in soil at LHAAP-03 (antimony, arsenic, barium, cadmium, chromium, copper, lead, and mercury, see **Section 3**).

Results of analysis of groundwater samples collected from well 03WW01 in November 2008 for metals (**Table 3-6**) indicate that arsenic was detected at a concentration of 0.0414 milligrams per liter (mg/L), which exceeds the maximum contaminant level (MCL) concentration of 0.010 mg/L. All other metals were either not detected or were detected with concentrations below their respective GW-Ind values (**Table 3-6**). These comparisons indicate that the Applicable Standard 3 MSCs developed in **Appendix B** are consistent with protection of groundwater for antimony, barium, cadmium, chromium, copper, lead, and mercury.

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations, LHAAP-03

Table 3-1b
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations, LHAAP-03

Table 3-2
Upper Prediction Limits for Soil Background Data

Table 3-3
Analysis of the Total SPLP Soil Sample

Table 3-4
Concentrations of Chemicals in Leachate from Synthetic Precipitation Leaching Procedure Analysis, LHAAP-03

Table 3-5a
Comparison of Chemical Concentrations in Soil to Standard 3 MSCs, LHAAP-03

Table 3-5b
Comparison of Chemical Concentrations in Soil to Standard 3 MSCs, LHAAP-03

Table 3-6
Comparison of Chemical Concentrations in Groundwater to TCEQ Medium-Specific Concentrations for Groundwater, LHAAP-03

4.0 Results and Conclusions

All concentrations of chemicals are below SAI-Ind MSC values for soil at all sampling locations, except where the Applicable TCEQ Risk-Based MSC equals the MQL or the background concentration for a chemical (**Table 3-1a** and **3-1b**). No VOCs were detected at concentrations above applicable MSCs (**Table 3-1a** and **3-1b**) in any sample analyzed, and are of no further concern at LHAAP-03.

Concentrations of 15 SVOCs exceed SDL values for diluted samples (03SB01-01-QC, 03SB02-01, and 03SB03-01), but were not detected in any of the undiluted samples. Subsequent reanalysis of one sample without dilution (03SB01-01-R) showed that soil at this location did not contain detectable SVOCs.

The results of SPLP tests and SAM modeling efforts indicate the potential for transport of metals from soil to groundwater. The results of SPLP tests suggest that arsenic from soil at the 03SB03-01 location may threaten groundwater (**Table 3-4**) although the arsenic concentration in the corresponding soil sample (03SB03-01-Total) is below applicable MSC levels, which corresponds to background (**Table 3-3**).

Concentrations of antimony, arsenic, lead, and zinc exceed GW-Ind values in SPLP leachate from samples 03SB07(0-0.5)R and 03SB08(0-0.5)R and indicate potential leaching to groundwater (**Table 3-4**), but only arsenic and lead concentrations measured in these soil samples exceed soil MSCs developed by the SAM model (**Table 3-5a** and **3-5b**). All of these exceedances occur in samples from the upper 0.5 feet bgs of soil.

Arsenic was detected at a concentration slightly above the MCL concentration at 03WW01 (0.010 mg/L). All other metals were either not detected in groundwater, or were detected with concentrations below their regulatory limits.

The COCs identified based on comparison of soil sampling data to Applicable Standard 3 MSCs (soil to groundwater pathway) are antimony, arsenic, cadmium, copper, lead, and mercury. Soil borings with COC concentrations above Applicable Standard 3 MSC values in the upper 0.5 feet bgs (03SB03, 03SB07, 03SB08, 03SB09, 03SB10, and 03SB15) lie within an oval area of approximately 40 feet in its largest dimension and located south of LHAAP-03 (**Figure 2-1**).

Note that background concentrations serve as Applicable Standard 3 MSCs for antimony, arsenic, and cadmium (**Appendix B**, Table B-5) and represent the 95% UPL for both surface and subsurface soil concentrations reported previously (Shaw, 2004). These values are applied in **Table 3-5a** and **3-5b** as the most appropriate value to serve as the cleanup level for both surface

and subsurface soil at LHAAP-03, and differ slightly from the separate surface and subsurface soil background values shown in **Table 3-1a** and **3-1b**, the lower of which was used to provide a conservative identification of COCs. When the lower of surface and subsurface background concentrations is applied to develop Applicable Standard 3 MSCs in **Table 3-5a** and **3-5b**, the resulting comparison of COC concentrations to Applicable Standard 3 MSCs is the same, and the above conclusions based on the comparison remain the same. Soil at boring 03SB15 contained lead concentrations in the upper 0.5 feet bgs (150 mg/kg) above the Applicable Standard 3 MSC (130 mg/kg) (**Figure 2-1**). However, the lead concentrations in soil in the vertical profile, at 3 to 4 feet bgs (14.1 mg/kg) and at 6 to 7 feet bgs (60 mg/kg), are below the MSC at this boring. This indicates that lead has not migrated downward in excess of the Applicable Standard 3 MSCs and thus the soil at this location is not likely to threaten groundwater (**Table 3-6**). Arsenic concentrations in all three samples from this boring are similar to the background concentration.

Arsenic, lead, and mercury concentrations that were measured above their MSC concentrations at boring 03SB11 were located at 6 to 7 feet bgs. The concentration of arsenic measured in groundwater at monitoring well 03WW01, which was converted from boring 03SB11, was 0.0414 mg/L (**Table 3-6**), above the MCL value for arsenic (0.010 mg/L), indicating that the Applicable Standard 3 MSC for arsenic predicts groundwater impact as expected. The concentrations of lead and mercury measured in monitoring well 03WW01 groundwater are below their respective MCL values (**Table 3-6**) indicating that the groundwater protective soil MSCs developed for these lead and mercury metals (**Appendix B**) conservatively over predict the impact of these metals on groundwater. Likewise, groundwater analysis results showing undetected or low concentrations of antimony, barium, cadmium, chromium, copper, lead, and mercury that are below MCLs, (**Table 3-6**) also indicate that Applicable Standard 3 MSCs developed for these metals in soil at LHAAP-03 are conservatively protective of groundwater.

5.0 References

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Tables

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION_CODE								03SB01				03SB01				03SB01				03SB01				03SB02				03SB02				03SB03			
	SAMPLE_NO					Background			03SB01-01				03SB01-01-QC				03SB01-01-R				03SB01-02				03SB02-01				03SB02-02				03SB03-01			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	8/29/2006				8/29/2006				9/20/2006				8/29/2006				8/29/2006				8/29/2006				8/29/2006			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				3 - 4 Ft				0 - 0.5 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG[d]				FD[d]				REG				REG[d]				REG[d]				REG				REG[d]			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
METALS	Aluminum	1.0E+06	1.0E+04	10	20	1.63E+04	2.08E+04	1.6E+04	6510	1		JH	5840	1							12500	1			4570	1			5630	1			3030	1		
METALS	Antimony	4.9E+02	6.0E-01	0.05	0.1	9.40E-01	1.60E+00	9.4E-01	0.148	1		JL	0.092	1	J	JL					0.115	1	U	UJL	0.063	1	J	JL	0.102	1	U	UJL	8.550	1		JL
METALS	Arsenic	2.0E+02	1.0E+00	0.075	0.3	4.81E+00	5.54E+00	4.8E+00	1.830	1			1.650	1							0.883	1			1.440	1			0.845	1			6.090	1		
METALS	Barium	1.7E+05	2.0E+02	0.1	0.5	1.52E+02	8.55E+01	2.0E+02	70.20	1			69.40	1		JH					47.40	1		JH	35.20	1		JH	23.80	1		JH	167.00	1		JH
METALS	Beryllium	2.7E+02	4.0E-01	0.012	0.5	6.45E-01	7.66E-01	6.5E-01	0.437	1	J	J	0.422	1	J	J					0.392	1	J	J	0.352	1	J	J	0.111	1	J	J	0.217	1	J	J
METALS	Cadmium	1.5E+03	5.0E-01	0.05	0.5	1.40E+00	4.00E-01	5.0E-01	0.203	1	J	J	0.210	1	J	J					0.057	1	U	U	0.090	1	J	J	0.054	1	U	U	1.430	1		
METALS	Calcium	NE	NE	NA	NA	NA	NA	--	20100	1			16800	1							387	1			774	1			33	1			98400	10		
METALS	Chromium	3.5E+05	1.0E+01	0.12	1	2.66E+01	3.01E+01	2.7E+01	31.20	1			25.70	1							12.80	1			15.90	1			9.11	1			267.00	1		
METALS	Cobalt	1.1E+05	6.1E+02	0.12	1	7.23E+00	5.61E+00	6.1E+02	3.130	1			2.930	1							2.400	1			2.920	1			0.884	1			7.220	1		
METALS	Copper	7.4E+04	1.3E+02	0.5	1	5.55E+00	9.25E+00	1.3E+02	6.16	1			5.46	1							3.32	1			2.31	1			2.18	1			269.00	1		
METALS	Iron	NE	NE	NA	NA	NA	NA	--	10600	1			11400	1							9530	1			23500	1			6350	1			14700	1		
METALS	Lead	1.0E+03	1.5E+00	0.1	0.2	2.26E+01	1.14E+01	1.1E+01	24.70	1.00			22.50	1							7.20	1			19.50	1			4.66	1			5830	200		
METALS	Magnesium	NE	NE	NA	NA	NA	NA	--	519	1		JH	411	1		JH					610	1		JH	200	1		JH	240	1		JH	2980	1		JH
METALS	Manganese	1.1E+05	1.4E+03	0.1	0.5	1.25E+03	2.01E+02	1.4E+03	844	10			810	10							26	1			175	1			22	1			92	1		
METALS	Mercury	1.5E-01	2.0E-01	0.01	0.25	8.19E-02	3.60E-01	2.5E-01	0.0448	1	J		0.0490	1	J	J					0.0126	1	J	J	0.0252	1	J	J	0.0121	1	J	J	0.4830	1		
METALS	Nickel	1.2E+04	2.0E+02	0.5	2	6.98E+00	1.16E+01	2.0E+02	5.75	1			5.10	1							4.11	1			3.04	1			1.92	1			7.43	1		
METALS	Potassium	NE	NE	NA	NA	NA	NA	--	276	1			249	1							376	1			153	1			253	1			195	1		
METALS	Selenium	9.3E+03	5.0E+00	0.1	0.2	3.48E+00	5.57E+00	5.0E+00	0.252	1		JL	0.228	1	J	JL					0.204	1	J	JL	0.152	1	J	JL	0.198	1	J	JL	0.322	1		JL
METALS	Silver	2.9E+03	5.1E+01	0.25	2	3.10E-01	3.70E-01	5.1E+01	1.780	1	U	U	0.232	1	J	J					1.740	1	U	U	1.670	1	U	U	1.610	1	U	U	2.190	1		
METALS	Sodium	NE	NE	NA	NA	NA	NA	--	32.4	1			31.4	1							148.0	1			16.8	1	J	J	14.4	1	J	J	25.1	1		
METALS	Thallium	1.5E+02	2.0E-01	0.01	0.02	4.70E-01	NE	4.7E-01	0.0411	1			0.0306	1							0.2070	1			0.0863	1			0.1090	1			0.0317	1		
METALS	Vanadium	3.0E+03	7.2E+01	0.25	0.5	3.21E+01	4.46E+01	7.2E+01	23.7	1		JH	21.7	1		JH					18.9	1		JH	30.9	1		JH	16.2	1		JH	18.5	1		JH
METALS	Zinc	4.1E+05	3.1E+03	0.5	1	6.16E+01	2.02E+01	3.1E+03	44.50	1		JH	40.60	1		JH					14.60	1		JH	26.30	1		JH	7.18	1		JH	2310.00	10		JH
SEMIVOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.083	0.165	NE	NE	7.0E+00				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.083	0.165	NE	NE	6.0E+01				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.083	0.165	NE	NE	7.1E+01				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.083	0.165	NE	NE	7.5E+00				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	2,4,5-Trichlorophenol	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	2,4,6-Trichlorophenol	2.6E+02	2.6E+00	0.083	0.165	NE	NE	2.6E+00				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	2,4-Dichlorophenol	3.1E+03	3.1E+01	0.083	0.165	NE	NE	3.1E+01				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	2,4-Dimethylphenol	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	2,4-Dinitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01				R	4.630	5	U	U	1.050	1	U	U	0.935	1	U	U	4.530	5	U	U	0.868	1	U	U	8.500	10	U	U
SEMIVOLATILES	2,4-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01				R	0.484	5	U	U	0.109	1	U	U	0.095	1	U	U	0.453	5	U	U	0.089	1	U	U	0.851	10	U	U
SEMIVOLATILES	2,6-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01				R	0.484	5	U	U	0.109	1	U	U	0.095	1	U	U	0.453	5	U	U	0.089	1	U	U	0.851	10	U	U
SEMIVOLATILES	2-Chloronaphthalene	7.1E+04	8.2E+02	0.083	0.165	NE	NE	8.2E+02				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	2-Chlorophenol	4.0E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	2-Methylnaphthalene	3.6E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	2-Methylphenol	5.1E+04	5.1E+02	0.083	0.165	NE	NE	5.1E+02				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	2-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00				R	4.630	5	U	U	1.050	1	U	U	0.935	1	U	U	4.530	5	U	U	0.868	1	U	U	8.500	10	U	U
SEMIVOLATILES	2-Nitrophenol	2.0E+03	3.1E+00	0.083	0.165	NE	NE	3.1E+00				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	3,3'-Dichlorobenzidine	6.4E+00	6.4E-02	0.165	0.330	NE	NE	3.3E-01				R	0.968	5	U	U	0.217	1	U	U	0.189	1	U	U	0.907	5	U	U	0.178	1	U	U	1.701	10	U	U
SEMIVOLATILES	3-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00				R	4.630	5	U	U	1.050	1	U	U	0.935	1	U	U	4.530	5	U	U	0.868	1	U	U	8.500	10	U	U
SEMIVOLATILES	4,6-Dinitro-2-methylphenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01				R	4.630	5	U	U	1.050	1	U	U	0.935	1	U	U	4.530	5	U	U	0.868	1	U	U	8.500	10	U	U
SEMIVOLATILES	4-Bromophenyl phenyl ethe	1.6E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01				R	0.484	5	U	U	0.109	1	U	U	0.095	1	U	U	0.453	5	U	U	0.089	1	U	U	0.851	10	U	U
SEMIVOLATILES	4-Chloro-3-methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	4-Chloroaniline	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	4-Chlorophenyl phenyl ethe	1.2E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01				R	0.484	5	U	U	0.109	1	U	U	0.095	1	U	U	0.453	5	U	U	0.089	1	U	U	0.851	10	U	U
SEMIVOLATILES	4-Methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	4-Nitroaniline	7.5E+02	7.5E+00	0.330	0.825	NE	NE	7.5E+00				R	4.630	5	U	U	1.050	1	U	U	0.935	1	U	U	4.530	5	U	U	0.868	1	U	U	8.500	10	U	U
SEMIVOLATILES	4-Nitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01				R	4.630	5	U	U	1.050	1	U	U	0.935	1	U	U	4.530	5	U	U	0.868	1	U	U	8.500	10	U	U
SEMIVOLATILES	Acenaphthene	3.0E+01	6.1E+02	0.083	0.165	NE	NE	3.0E+01				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION_CODE								03SB01				03SB01				03SB01				03SB01				03SB02				03SB02				03SB03			
	SAMPLE_NO					Background			03SB01-01				03SB01-01-QC				03SB01-01-R				03SB01-02				03SB02-01				03SB02-02				03SB03-01			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	8/29/2006				8/29/2006				9/20/2006				8/29/2006				8/29/2006				8/29/2006				8/29/2006			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				3 - 4 Ft				0 - 0.5 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG[d]				FD[d]				REG				REG[d]				REG[d]				REG				REG[d]			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
SEMIVOLATILES	Acenaphthylene	5.3E+04	6.1E+02	0.083	0.165	NE	NE	6.1E+02				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Anthracene	2.7E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Benzo(a)anthracene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01				R	0.484	5	U	U	0.109	1	U	U	0.095	1	U	U	0.453	5	U	U	0.089	1	U	U	0.851	10	U	U
SEMIVOLATILES	Benzo(a)pyrene	3.4E-01	2.0E-02	0.083	0.165	1.54E-02	NE	1.7E-01				R	0.484	5	U	U	0.109	1	U	U	0.095	1	U	U	0.453	5	U	U	0.089	1	U	U	0.851	10	U	U
SEMIVOLATILES	Benzo(b)fluoranthene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01				R	0.484	5	U	U	0.109	1	U	U	0.095	1	U	U	0.453	5	U	U	0.089	1	U	U	0.851	10	U	U
SEMIVOLATILES	Benzo(ghi)perylene	2.7E+04	3.1E+02	0.083	0.165	1.23E-02	NE	3.1E+02				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Benzo(k)fluoranthene	3.4E+01	3.9E-01	0.083	0.165	1.30E-02	NE	3.9E-01				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Benzoic Acid	4.1E+06	4.1E+04	0.330	0.825	NE	NE	4.1E+04				R	4.630	5	U	U	1.050	1	U	U	0.935	1	U	U	4.530	5	U	U	0.868	1	U	U	8.500	10	U	U
SEMIVOLATILES	Benzyl Alcohol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03	1.920	10	U	R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	bis(2-Chloroethoxy)methane	9.0E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01				R	0.484	5	U	U	0.109	1	U	U	0.095	1	U	U	0.453	5	U	U	0.089	1	U	U	0.851	10	U	U
SEMIVOLATILES	bis(2-Chloroethyl)ether	3.2E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01				R	0.484	5	U	U	0.109	1	U	U	0.095	1	U	U	0.453	5	U	U	0.089	1	U	U	0.851	10	U	U
SEMIVOLATILES	bis(2-Chloroisopropyl)ether	1.5E+02	4.1E+00	0.083	0.165	NE	NE	4.1E+00				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	bis(2-Ethylhexyl)phthalate	6.5E+01	6.0E-01	0.083	0.165	NE	NE	6.0E-01				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Butyl benzyl phthalate	2.0E+05	2.0E+03	0.083	0.165	NE	NE	2.0E+03				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Chrysene	3.4E+02	3.9E+00	0.083	0.165	1.51E-02	NE	3.9E+00				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Dibenzo(a,h)anthracene	3.4E-01	2.0E-02	0.083	0.165	NE	NE	1.7E-01				R	0.484	5	U	U	0.109	1	U	U	0.095	1	U	U	0.453	5	U	U	0.089	1	U	U	0.851	10	U	U
SEMIVOLATILES	Dibenzofuran	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Diethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Dimethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	di-n-Butyl phthalate	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	di-n-Octyl phthalate	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Fluoranthene	3.6E+04	4.1E+02	0.083	0.165	2.29E-02	NE	4.1E+02				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Fluorene	3.6E+04	4.1E+02	0.083	0.165	NE	NE	4.1E+02				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Hexachlorobenzene	1.0E+00	1.0E-01	0.083	0.165	NE	NE	1.7E-01				R	0.484	5	U	U	0.109	1	U	U	0.095	1	U	U	0.453	5	U	U	0.089	1	U	U	0.851	10	U	U
SEMIVOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.083	0.165	NE	NE	2.0E+00				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Hexachlorocyclopentadiene	1.4E+01	5.0E+00	0.083	0.165	NE	NE	5.0E+00				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Hexachloroethane	7.5E+02	1.0E+01	0.083	0.165	NE	NE	1.0E+01				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Indeno(1,2,3-cd)pyrene	3.4E+00	3.9E-02	0.083	0.165	1.43E-02	NE	1.7E-01				R	0.484	5	U	U	0.109	1	U	U	0.095	1	U	U	0.453	5	U	U	0.089	1	U	U	0.851	10	U	U
SEMIVOLATILES	Isophorone	3.0E+04	3.0E+02	0.083	0.165	NE	NE	3.0E+02				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Naphthalene	2.7E+02	2.0E+02	0.083	0.165	NE	NE	2.0E+02				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Nitrobenzene	2.7E+02	5.1E+00	0.083	0.165	NE	NE	5.1E+00				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	n-Nitroso-di-n-propylamine	1.6E-01	4.1E-03	0.083	0.165	NE	NE	1.7E-01				R	0.484	5	U	U	0.109	1	U	U	0.095	1	U	U	0.453	5	U	U	0.089	1	U	U	0.851	10	U	U
SEMIVOLATILES	n-Nitrosodiphenylamine	2.3E+02	5.8E+00	0.083	0.165	NE	NE	5.8E+00				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Pentachlorophenol	1.4E+01	1.0E-01	0.330	0.825	NE	NE	8.3E-01				R	1.937	5	U	U	0.435	1	U	U	0.378	1	U	U	1.813	5	U	U	0.356	1	U	U	3.402	10	U	U
SEMIVOLATILES	Phenanthrene	2.7E+04	3.1E+02	0.083	0.165	NE	NE	3.1E+02				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Phenol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SEMIVOLATILES	Pyrene	2.7E+04	3.1E+02	0.083	0.165	1.94E-02	NE	3.1E+02				R	0.927	5	U	U	0.210	1	U	U	0.187	1	U	U	0.907	5	U	U	0.174	1	U	U	1.700	10	U	U
SOLIDS	Percent Solids	NE	NE	NE	NE	NE	NE	--	85.1	1			85.2	1			75.9	1			87.2	1			91.0	1			92.7	1			97.0	1		
VOLATILES	1,1,1,2-Tetrachloroethane	1.1E+02	1.1E+01	0.0005	0.005	NE	NE	1.1E+01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,1,1-Trichloroethane	3.4E+03	2.0E+01	0.0005	0.005	NE	NE	2.0E+01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,1,2,2-Tetrachloroethane	9.8E+00	1.4E+00	0.0005	0.005	NE	NE	1.4E+00	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,1,2-Trichloroethane	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,1-Dichloroethane	1.3E+03	1.0E+03	0.0010	0.005	NE	NE	1.0E+03	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,1-Dichloroethene	3.8E+02	7.0E-01	0.0005	0.005	NE	NE	7.0E-01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,1-Dichloropropene	1.9E+00	2.9E-01	0.0005	0.005	NE	NE	2.9E-01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,2,3-Trichlorobenzene	2.0E+03	3.1E+01	0.0005	0.005	NE	NE	3.1E+01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,2,3-Trichloropropane	8.2E-01	4.1E-03	0.0010	0.005	NE	NE	5.0E-03	0.0012	1	U	U	0.0012	1	U	U					0.0011	1	U	U	0.0011	1	U	U	0.0011	1	U	U	0.0010	1	U	U
VOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,2,4-Trimethylbenzene	1.4E+02	5.1E+02	0.0005	0.005	NE	NE	1.4E+02	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,2-Dibromo-3-chloropropan	2.0E+00	2.0E-02	0.0020	0.005	NE	NE	2.0E-02	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,2-Dibromoethane	1.0E-01	5.0E-03	0.0005	0.005	NE	NE	5.0E-03	0.0006	1	U	U	0.0006	1	U	U					0.0006	1	U	U	0.0005	1	U	U	0.0005	1	U	U	0.0005	1	U	U

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION_CODE					Background		Applicable	03SB01				03SB01				03SB01				03SB01				03SB02				03SB02				03SB03			
	SAMPLE_NO								03SB01-01				03SB01-01-QC				03SB01-01-R				03SB01-02				03SB02-01				03SB02-02				03SB03-01			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		TCEQ	8/29/2006				8/29/2006				9/20/2006				8/29/2006				8/29/2006				8/29/2006				8/29/2006			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		Risk-Based	0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				3 - 4 Ft				0 - 0.5 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	MSC [c]	REG[d]				FD[d]				REG				REG[d]				REG[d]				REG				REG[d]			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft		Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
VOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.0005	0.005	NE	NE	6.0E+01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,2-Dichloroethane	4.7E-01	5.0E-01	0.0005	0.005	NE	NE	4.7E-01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,2-Dichloropropane	2.5E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,2-Dimethylbenzene (o-X	4.8E+04	1.0E+03	0.0005	0.005	NE	NE	1.0E+03	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,3,5-Trimethylbenzene	1.2E+02	5.1E+02	0.0005	0.005	NE	NE	1.2E+02	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.0005	0.005	NE	NE	7.1E+01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,3-Dichloropropane	8.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.0005	0.005	NE	NE	7.5E+00	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	2,2-Dichloropropane	2.4E+01	4.2E+00	0.0005	0.005	NE	NE	4.2E+00	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	2-Butanone	4.2E+04	6.1E+03	0.0025	0.010	NE	NE	6.1E+03	0.0129	1	U	U	0.0112	1	U	U					0.0104	1	U	U	0.0111	1	U	U	0.0125	1	U	U	0.0101	1	U	U
VOLATILES	2-Chloroethyl vinyl ether	3.0E+00	2.6E-01	0.0020	0.010	NE	NE	2.6E-01	0.0129	1	U	U	0.0112	1	U	U					0.0104	1	U	U	0.0111	1	U	U	0.0125	1	U	U	0.0101	1	U	U
VOLATILES	2-Chlorotoluene	3.5E+03	2.0E+02	0.0005	0.005	NE	NE	2.0E+02	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	2-Hexanone	8.7E+01	6.1E+02	0.0025	0.010	NE	NE	8.7E+01	0.0129	1	U	U	0.0112	1	U	U					0.0104	1	U	U	0.0111	1	U	U	0.0125	1	U	U	0.0101	1	U	U
VOLATILES	4-Chlorotoluene	4.8E+00	2.0E+02	0.0005	0.005	NE	NE	4.8E+00	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Acetone	2.5E+03	9.2E+03	0.0050	0.010	NE	NE	2.5E+03	0.0129	1	U	U	0.0112	1	U	U					0.0104	1	U	U	0.0133	1			0.0125	1	U	U	0.0101	1	U	U
VOLATILES	Benzene	1.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Bromobenzene	1.6E+02	2.0E+02	0.0005	0.005	NE	NE	1.6E+02	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Bromochloromethane	3.4E+02	4.1E+02	0.0005	0.005	NE	NE	3.4E+02	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Bromodichloromethane	9.2E+01	4.6E-01	0.0005	0.005	NE	NE	4.6E-01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Bromoform	8.5E+01	3.6E+00	0.0005	0.005	NE	NE	3.6E+00	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Bromomethane	4.9E+00	1.4E+01	0.0010	0.010	NE	NE	4.9E+00	0.0129	1	U	U	0.0112	1	U	U					0.0104	1	U	U	0.0111	1	U	U	0.0125	1	U	U	0.0101	1	U	U
VOLATILES	Carbon disulfide	1.5E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Carbon tetrachloride	6.3E-01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Chlorobenzene	5.9E+02	1.0E+01	0.0005	0.005	NE	NE	1.0E+01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Chloroethane	1.7E+04	4.1E+03	0.0010	0.010	NE	NE	4.1E+03	0.0129	1	U	U	0.0112	1	U	U					0.0104	1	U	U	0.0111	1	U	U	0.0125	1	U	U	0.0101	1	U	U
VOLATILES	Chloroform	5.2E-01	1.0E+02	0.0005	0.005	NE	NE	5.2E-01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Chloromethane	3.8E+00	2.2E+01	0.0020	0.010	NE	NE	3.8E+00	0.0129	1	U	U	0.0112	1	U	U					0.0104	1	U	U	0.0111	1	U	U	0.0125	1	U	U	0.0101	1	U	U
VOLATILES	cis-1,2-Dichloroethene	2.5E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	cis-1,3-Dichloropropene	3.4E+01	5.3E-01	0.0005	0.005	NE	NE	5.3E-01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Dibromochloromethane	6.8E+02	3.4E+00	0.0005	0.005	NE	NE	3.4E+00	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Dibromomethane	2.7E+02	3.8E+01	0.0005	0.005	NE	NE	3.8E+01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Dichlorodifluoromethane	3.1E+03	2.0E+03	0.0010	0.010	NE	NE	2.0E+03	0.0129	1	U	U	0.0112	1	U	U					0.0104	1	U	U	0.0111	1	U	U	0.0125	1	U	U	0.0101	1	U	U
VOLATILES	Ethylbenzene	6.9E+03	7.0E+01	0.0005	0.005	NE	NE	7.0E+01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.0005	0.005	NE	NE	2.0E+00	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Isopropylbenzene	9.0E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	m,p-Xylenes [e]	3.3E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0008	1	J	J
VOLATILES	Methyl isobutyl ketone	3.5E+04	8.2E+02	0.0025	0.010	NE	NE	8.2E+02	0.0129	1	U	U	0.0112	1	U	U					0.0104	1	U	U	0.0111	1	U	U	0.0125	1	U	U	0.0101	1	U	U
VOLATILES	Methylene chloride	1.6E+01	5.0E-01	0.0010	0.005	NE	NE	5.0E-01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Naphthalene	2.7E+02	2.0E+02	0.0005	0.010	NE	NE	2.0E+02	0.0129	1	U	U	0.0112	1	U	U					0.0104	1	U	U	0.0111	1	U	U	0.0125	1	U	U	0.0101	1	U	U
VOLATILES	n-BUTYLBENZENE	5.7E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	n-PROPYLBENZENE	5.9E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	p-ISOPROPYLTOLUENE	6.7E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	sec-BUTYLBENZENE	5.4E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Styrene	2.3E+04	1.0E+01	0.0005	0.005	NE	NE	1.0E+01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	tert-BUTYLBENZENE	4.5E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Tetrachloroethene	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01	0.0065	1	U	U	0.0056	1	U	U					0.0041	1	J	J	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Toluene	2.5E+04	1.0E+02	0.0005	0.005	NE	NE	1.0E+02	0.0013	1	J	J	0.0016	1	J	J					0.0010	1	J	J	0.0056	1	U	U	0.0018	1	J	J	0.0020	1	J	J
VOLATILES	trans-1,2-Dichloroethene	2.4E+03	1.0E+01	0.0005	0.005	NE	NE	1.0E+01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	trans-1,3-Dichloropropene	4.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Trichloroethene	6.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01	0.0065	1	U	U	0.0056	1	U	U					0.0052	1	U	U	0.0056	1	U	U	0.0063	1	U	U	0.0050	1	U	U
VOLATILES	Trichlorofluoromethane	3.8E+03	3.1E+03	0.0010	0.010	NE	NE	3.1E+03	0.0129	1	U	U	0.0112	1	U	U					0.0104	1	U	U	0.0111	1	U	U	0.0125	1	U	U	0.0101	1	U	U

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE					Background		Applicable	03SB01				03SB01				03SB01				03SB01				03SB02				03SB02				03SB03			
	SAMPLE_NO								03SB01-01				03SB01-01-QC				03SB01-01-R				03SB01-02				03SB02-01				03SB02-02				03SB03-01			
	SAMPLE_DATE	TCEQ				Concentrations in Soil			8/29/2006				8/29/2006				9/20/2006				8/29/2006				8/29/2006				8/29/2006				8/29/2006			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				3 - 4 Ft				0 - 0.5 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG[d]				FD[d]				REG				REG[d]				REG[d]				REG				REG[d]			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
VOLATILES	Vinyl acetate	8.0E+02	1.0E+04	0.0010	0.010	NE	NE	8.0E+02	0.0129	1	U	U	0.0112	1	U	U					0.0104	1	U	U	0.0111	1	U	U	0.0125	1	U	U	0.0101	1	U	U
VOLATILES	Vinyl chloride	6.6E-02	2.0E-01	0.0010	0.010	NE	NE	6.6E-02	0.0129	1	U	U	0.0112	1	U	U					0.0104	1	U	U	0.0111	1	U	U	0.0125	1	U	U	0.0101	1	U	U

Notes and Abbreviations:

Shading in column indicates SDL values that exceed the Applicable MSC.

Concentration exceeds Applicable MSC.

[a] Value provided by the Texas Commission on Environmental Quality (TCEQ) as updated through March 2006 available on the TCEQ website at http://www.tceq.state.tx.us/remediation/rrr.html.

[b] Lower of surface and subsurface soil background concentrations used in these comparisons

[c] Shading in column indicates Applicable MSC equal to MQL for the chemical as provided in 30TAC§335.

[d] Where Applicable MSC is equal to MQL, value equals the SDL, which is the MDL adjusted for sample specific analytical factors.

[e] MSC value shown is for m-xylene, the more conservative of m- and p-xylene isomers.

95% UPL - 95% Upper Prediction Limit of background concentration calculated as described in TCEQ correspondence.
FD - field duplicate sample
H - estimate is high
J - Estimated value. Chemical was detected above the method detection limit but below the MQL.
L - estimate is low
NE - value not established
R - data rejected
REG - regular sample
U - compound validated as not detected above MDL shown

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE					Background		Applicable	03SB03				03SB04				03SB05				03SB06				03SB07				03SB07				03SB08			
	SAMPLE_NO					Concentrations in Soil			03SB03-02				03SB04-01				03SB05-01				03SB06-01				03SB07 (0-0_5)				03SB07(0-0.5)R				03SB08 (0-0_5)			
	SAMPLE_DATE	TCEQ							8/29/2006				12/19/2006				12/19/2006				12/19/2006				10/23/2007				23-Oct-07				23-Oct-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	3 - 4 Ft				3 - 4 Ft				3 - 4 Ft				3 - 4 Ft				0-0.5 Ft				0-0.5				0-0.5 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG[d]				REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
METALS	Aluminum	1.0E+06	1.0E+04	10	20	1.63E+04	2.08E+04	1.6E+04	10600	1																										
METALS	Antimony	4.9E+02	6.0E-01	0.05	0.1	9.40E-01	1.60E+00	9.4E-01	0.112	1	U	UJL																	0.062	1	J	J				
METALS	Arsenic	2.0E+02	1.0E+00	0.075	0.3	4.81E+00	5.54E+00	4.8E+00	1.110	1																			6.98	1						
METALS	Barium	1.7E+05	2.0E+02	0.1	0.5	1.52E+02	8.55E+01	2.0E+02	57.40	1		JH																	57.20	25						
METALS	Beryllium	2.7E+02	4.0E-01	0.012	0.5	6.45E-01	7.66E-01	6.5E-01	0.349	1	J	J																								
METALS	Cadmium	1.5E+03	5.0E-01	0.05	0.5	1.40E+00	4.00E-01	5.0E-01	0.057	1	U	U																	0.206	1						
METALS	Calcium	NE	NE	NA	NA	NA	NA	--	319	1																										
METALS	Chromium	3.5E+05	1.0E+01	0.12	1	2.66E+01	3.01E+01	2.7E+01	14.80	1																			50	25						
METALS	Cobalt	1.1E+05	6.1E+02	0.12	1	7.23E+00	5.61E+00	6.1E+02	4.650	1																			7.090	1						
METALS	Copper	7.4E+04	1.3E+02	0.5	1	5.55E+00	9.25E+00	1.3E+02	2.92	1																			4.08	1						
METALS	Iron	NE	NE	NA	NA	NA	NA	--	11500	1																										
METALS	Lead	1.0E+03	1.5E+00	0.1	0.2	2.26E+01	1.14E+01	1.1E+01	19.90	1			108.00	1		J	54.20	1		J	28.20	1		J	95.80	10			505	25			2320	100		
METALS	Magnesium	NE	NE	NA	NA	NA	NA	--	530	1		JH																								
METALS	Manganese	1.1E+05	1.4E+03	0.1	0.5	1.25E+03	2.01E+02	1.4E+03	178	1																			213.0	25						
METALS	Mercury	1.5E-01	2.0E-01	0.01	0.25	8.19E-02	3.60E-01	2.5E-01	0.0290	1	J	J																								
METALS	Nickel	1.2E+04	2.0E+02	0.5	2	6.98E+00	1.16E+01	2.0E+02	3.98	1																			4.54	1						
METALS	Potassium	NE	NE	NA	NA	NA	NA	--	347	1																										
METALS	Selenium	9.3E+03	5.0E+00	0.1	0.2	3.48E+00	5.57E+00	5.0E+00	0.388	1		JL																	0.376	1						
METALS	Silver	2.9E+03	5.1E+01	0.25	2	3.10E-01	3.70E-01	5.1E+01	1.680	1	U	U																	0.073	1	J	J				
METALS	Sodium	NE	NE	NA	NA	NA	NA	--	70.8	1																										
METALS	Thallium	1.5E+02	2.0E-01	0.01	0.02	4.70E-01	NE	4.7E-01	0.0520	1																			0.0792	1						
METALS	Vanadium	3.0E+03	7.2E+01	0.25	0.5	3.21E+01	4.46E+01	7.2E+01	29.8	1		JH																	26.0	1						
METALS	Zinc	4.1E+05	3.1E+03	0.5	1	6.16E+01	2.02E+01	3.1E+03	25.20	1		JH																	424.00	25						
SEMIVOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.083	0.165	NE	NE	7.0E+00	0.189	1	U	U																								
SEMIVOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.083	0.165	NE	NE	6.0E+01	0.189	1	U	U																								
SEMIVOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.083	0.165	NE	NE	7.1E+01	0.189	1	U	U																								
SEMIVOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.083	0.165	NE	NE	7.5E+00	0.189	1	U	U																								
SEMIVOLATILES	2,4,5-Trichlorophenol	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03	0.189	1	U	U																								
SEMIVOLATILES	2,4,6-Trichlorophenol	2.6E+02	2.6E+00	0.083	0.165	NE	NE	2.6E+00	0.189	1	U	U																								
SEMIVOLATILES	2,4-Dichlorophenol	3.1E+03	3.1E+01	0.083	0.165	NE	NE	3.1E+01	0.189	1	U	U																								
SEMIVOLATILES	2,4-Dimethylphenol	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02	0.189	1	U	U																								
SEMIVOLATILES	2,4-Dinitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01	0.944	1	U	U																								
SEMIVOLATILES	2,4-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01	0.095	1	U	U																								
SEMIVOLATILES	2,6-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01	0.095	1	U	U																								
SEMIVOLATILES	2-Chloronaphthalene	7.1E+04	8.2E+02	0.083	0.165	NE	NE	8.2E+02	0.189	1	U	U																								
SEMIVOLATILES	2-Chlorophenol	4.0E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01	0.189	1	U	U																								
SEMIVOLATILES	2-Methylnaphthalene	3.6E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01	0.189	1	U	U																								
SEMIVOLATILES	2-Methylphenol	5.1E+04	5.1E+02	0.083	0.165	NE	NE	5.1E+02	0.189	1	U	U																								
SEMIVOLATILES	2-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00	0.944	1	U	U																								
SEMIVOLATILES	2-Nitrophenol	2.0E+03	3.1E+00	0.083	0.165	NE	NE	3.1E+00	0.189	1	U	U																								
SEMIVOLATILES	3,3'-Dichlorobenzidine	6.4E+00	6.4E-02	0.165	0.330	NE	NE	3.3E-01	0.189	1	U	U																								
SEMIVOLATILES	3-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00	0.944	1	U	U																								
SEMIVOLATILES	4,6-Dinitro-2-methylphenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01	0.944	1	U	U																								
SEMIVOLATILES	4-Bromophenyl phenyl ethe	1.6E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01	0.095	1	U	U																								
SEMIVOLATILES	4-Chloro-3-methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01	0.189	1	U	U																								
SEMIVOLATILES	4-Chloroaniline	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01	0.189	1	U	U																								
SEMIVOLATILES	4-Chlorophenyl phenyl ethe	1.2E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01	0.095	1	U	U																								
SEMIVOLATILES	4-Methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01	0.189	1	U	U																								
SEMIVOLATILES	4-Nitroaniline	7.5E+02	7.5E+00	0.330	0.825	NE	NE	7.5E+00	0.944	1	U	U																								
SEMIVOLATILES	4-Nitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01	0.944	1	U	U																								
SEMIVOLATILES	Acenaphthene	3.0E+01	6.1E+02	0.083	0.165	NE	NE	3.0E+01	0.189	1	U	U																								

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB03				03SB04				03SB05				03SB06				03SB07				03SB07				03SB08			
	SAMPLE_NO					Background			03SB03-02				03SB04-01				03SB05-01				03SB06-01				03SB07 (0-0_5)				03SB07(0-0.5)R				03SB08 (0-0_5)			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	8/29/2006				12/19/2006				12/19/2006				12/19/2006				10/23/2007				23-Oct-07				23-Oct-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	3 - 4 Ft				3 - 4 Ft				3 - 4 Ft				3 - 4 Ft				0-0.5 Ft				0-0.5				0-0.5 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG[d]				REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
SEMIVOLATILES	Acenaphthylene	5.3E+04	6.1E+02	0.083	0.165	NE	NE	6.1E+02	0.189	1	U	U																								
SEMIVOLATILES	Anthracene	2.7E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03	0.189	1	U	U																								
SEMIVOLATILES	Benzo(a)anthracene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01	0.095	1	U	U																								
SEMIVOLATILES	Benzo(a)pyrene	3.4E-01	2.0E-02	0.083	0.165	1.54E-02	NE	1.7E-01	0.095	1	U	U																								
SEMIVOLATILES	Benzo(b)fluoranthene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01	0.095	1	U	U																								
SEMIVOLATILES	Benzo(ghi)perylene	2.7E+04	3.1E+02	0.083	0.165	1.23E-02	NE	3.1E+02	0.189	1	U	U																								
SEMIVOLATILES	Benzo(k)fluoranthene	3.4E+01	3.9E-01	0.083	0.165	1.30E-02	NE	3.9E-01	0.189	1	U	U																								
SEMIVOLATILES	Benzoic Acid	4.1E+06	4.1E+04	0.330	0.825	NE	NE	4.1E+04	0.944	1	U	U																								
SEMIVOLATILES	Benzyl Alcohol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03	0.189	1	U	U																								
SEMIVOLATILES	bis(2-Chloroethoxy)methane	9.0E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01	0.095	1	U	U																								
SEMIVOLATILES	bis(2-Chloroethyl)ether	3.2E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01	0.095	1	U	U																								
SEMIVOLATILES	bis(2-Chloroisopropyl)ether	1.5E+02	4.1E+00	0.083	0.165	NE	NE	4.1E+00	0.189	1	U	U																								
SEMIVOLATILES	bis(2-Ethylhexyl)phthalate	6.5E+01	6.0E-01	0.083	0.165	NE	NE	6.0E-01	0.347	1																										
SEMIVOLATILES	Butyl benzyl phthalate	2.0E+05	2.0E+03	0.083	0.165	NE	NE	2.0E+03	0.189	1	U	U																								
SEMIVOLATILES	Chrysene	3.4E+02	3.9E+00	0.083	0.165	1.51E-02	NE	3.9E+00	0.189	1	U	U																								
SEMIVOLATILES	Dibenzo(a,h)anthracene	3.4E-01	2.0E-02	0.083	0.165	NE	NE	1.7E-01	0.095	1	U	U																								
SEMIVOLATILES	Dibenzofuran	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01	0.189	1	U	U																								
SEMIVOLATILES	Diethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03	0.189	1	U	U																								
SEMIVOLATILES	Dimethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03	0.189	1	U	U																								
SEMIVOLATILES	di-n-Butyl phthalate	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03	0.189	1	U	U																								
SEMIVOLATILES	di-n-Octyl phthalate	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02	0.189	1	U	U																								
SEMIVOLATILES	Fluoranthene	3.6E+04	4.1E+02	0.083	0.165	2.29E-02	NE	4.1E+02	0.189	1	U	U																								
SEMIVOLATILES	Fluorene	3.6E+04	4.1E+02	0.083	0.165	NE	NE	4.1E+02	0.189	1	U	U																								
SEMIVOLATILES	Hexachlorobenzene	1.0E+00	1.0E-01	0.083	0.165	NE	NE	1.7E-01	0.095	1	U	U																								
SEMIVOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.083	0.165	NE	NE	2.0E+00	0.189	1	U	U																								
SEMIVOLATILES	Hexachlorocyclopentadiene	1.4E+01	5.0E+00	0.083	0.165	NE	NE	5.0E+00	0.189	1	U	U																								
SEMIVOLATILES	Hexachloroethane	7.5E+02	1.0E+01	0.083	0.165	NE	NE	1.0E+01	0.189	1	U	U																								
SEMIVOLATILES	Indeno(1,2,3-cd)pyrene	3.4E+00	3.9E-02	0.083	0.165	1.43E-02	NE	1.7E-01	0.095	1	U	U																								
SEMIVOLATILES	Isophorone	3.0E+04	3.0E+02	0.083	0.165	NE	NE	3.0E+02	0.189	1	U	U																								
SEMIVOLATILES	Naphthalene	2.7E+02	2.0E+02	0.083	0.165	NE	NE	2.0E+02	0.189	1	U	U																								
SEMIVOLATILES	Nitrobenzene	2.7E+02	5.1E+00	0.083	0.165	NE	NE	5.1E+00	0.189	1	U	U																								
SEMIVOLATILES	n-Nitroso-di-n-propylamine	1.6E-01	4.1E-03	0.083	0.165	NE	NE	1.7E-01	0.095	1	U	U																								
SEMIVOLATILES	n-Nitrosodiphenylamine	2.3E+02	5.8E+00	0.083	0.165	NE	NE	5.8E+00	0.189	1	U	U																								
SEMIVOLATILES	Pentachlorophenol	1.4E+01	1.0E-01	0.330	0.825	NE	NE	8.3E-01	0.378	1	U	U																								
SEMIVOLATILES	Phenanthrene	2.7E+04	3.1E+02	0.083	0.165	NE	NE	3.1E+02	0.189	1	U	U																								
SEMIVOLATILES	Phenol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03	0.189	1	U	U																								
SEMIVOLATILES	Pyrene	2.7E+04	3.1E+02	0.083	0.165	1.94E-02	NE	3.1E+02	0.189	1	U	U																								
SOLIDS	Percent Solids	NE	NE	NE	NE	NE	NE	--	87.3	1			76.1	1			81.3	1			81.5	1			90.7				90.7	1			90.8			
VOLATILES	1,1,1,2-Tetrachloroethane	1.1E+02	1.1E+01	0.0005	0.005	NE	NE	1.1E+01	0.0046	1	U	U																								
VOLATILES	1,1,1-Trichloroethane	3.4E+03	2.0E+01	0.0005	0.005	NE	NE	2.0E+01	0.0046	1	U	U																								
VOLATILES	1,1,2,2-Tetrachloroethane	9.8E+00	1.4E+00	0.0005	0.005	NE	NE	1.4E+00	0.0046	1	U	U																								
VOLATILES	1,1,2-Trichloroethane	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01	0.0046	1	U	U																								
VOLATILES	1,1-Dichloroethane	1.3E+03	1.0E+03	0.0010	0.005	NE	NE	1.0E+03	0.0046	1	U	U																								
VOLATILES	1,1-Dichloroethene	3.8E+02	7.0E-01	0.0005	0.005	NE	NE	7.0E-01	0.0046	1	U	U																								
VOLATILES	1,1-Dichloropropene	1.9E+00	2.9E-01	0.0005	0.005	NE	NE	2.9E-01	0.0046	1	U	U																								
VOLATILES	1,2,3-Trichlorobenzene	2.0E+03	3.1E+01	0.0005	0.005	NE	NE	3.1E+01	0.0046	1	U	U																								
VOLATILES	1,2,3-Trichloropropane	8.2E-01	4.1E-03	0.0010	0.005	NE	NE	5.0E-03	0.0011	1	U	U																								
VOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00	0.0046	1	U	U																								
VOLATILES	1,2,4-Trimethylbenzene	1.4E+02	5.1E+02	0.0005	0.005	NE	NE	1.4E+02	0.0046	1	U	U																								
VOLATILES	1,2-Dibromo-3-chloropropan	2.0E+00	2.0E-02	0.0020	0.005	NE	NE	2.0E-02	0.0046	1	U	U																								
VOLATILES	1,2-Dibromoethane	1.0E-01	5.0E-03	0.0005	0.005	NE	NE	5.0E-03	0.0006	1	U	U																								

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB03				03SB04				03SB05				03SB06				03SB07				03SB07				03SB08			
	SAMPLE_NO					Background			03SB03-02				03SB04-01				03SB05-01				03SB06-01				03SB07 (0-0_5)				03SB07(0-0.5)R				03SB08 (0-0_5)			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	8/29/2006				12/19/2006				12/19/2006				12/19/2006				10/23/2007				23-Oct-07				23-Oct-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	3 - 4 Ft				3 - 4 Ft				3 - 4 Ft				3 - 4 Ft				0-0.5 Ft				0-0.5				0-0.5 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG[d]				REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
VOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.0005	0.005	NE	NE	6.0E+01	0.0046	1	U	U																								
VOLATILES	1,2-Dichloroethane	4.7E-01	5.0E-01	0.0005	0.005	NE	NE	4.7E-01	0.0046	1	U	U																								
VOLATILES	1,2-Dichloropropane	2.5E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01	0.0046	1	U	U																								
VOLATILES	1,2-Dimethylbenzene (o-X	4.8E+04	1.0E+03	0.0005	0.005	NE	NE	1.0E+03	0.0046	1	U	U																								
VOLATILES	1,3,5-Trimethylbenzene	1.2E+02	5.1E+02	0.0005	0.005	NE	NE	1.2E+02	0.0046	1	U	U																								
VOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.0005	0.005	NE	NE	7.1E+01	0.0046	1	U	U																								
VOLATILES	1,3-Dichloropropane	8.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00	0.0046	1	U	U																								
VOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.0005	0.005	NE	NE	7.5E+00	0.0046	1	U	U																								
VOLATILES	2,2-Dichloropropane	2.4E+01	4.2E+00	0.0005	0.005	NE	NE	4.2E+00	0.0046	1	U	U																								
VOLATILES	2-Butanone	4.2E+04	6.1E+03	0.0025	0.010	NE	NE	6.1E+03	0.0304	1																										
VOLATILES	2-Chloroethyl vinyl ether	3.0E+00	2.6E-01	0.0020	0.010	NE	NE	2.6E-01	0.0092	1	U	U																								
VOLATILES	2-Chlorotoluene	3.5E+03	2.0E+02	0.0005	0.005	NE	NE	2.0E+02	0.0046	1	U	U																								
VOLATILES	2-Hexanone	8.7E+01	6.1E+02	0.0025	0.010	NE	NE	8.7E+01	0.0092	1	U	U																								
VOLATILES	4-Chlorotoluene	4.8E+00	2.0E+02	0.0005	0.005	NE	NE	4.8E+00	0.0046	1	U	U																								
VOLATILES	Acetone	2.5E+03	9.2E+03	0.0050	0.010	NE	NE	2.5E+03	0.9080	50	J	J																								
VOLATILES	Benzene	1.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01	0.0046	1	U	U																								
VOLATILES	Bromobenzene	1.6E+02	2.0E+02	0.0005	0.005	NE	NE	1.6E+02	0.0046	1	U	U																								
VOLATILES	Bromochloromethane	3.4E+02	4.1E+02	0.0005	0.005	NE	NE	3.4E+02	0.0046	1	U	U																								
VOLATILES	Bromodichloromethane	9.2E+01	4.6E-01	0.0005	0.005	NE	NE	4.6E-01	0.0046	1	U	U																								
VOLATILES	Bromoform	8.5E+01	3.6E+00	0.0005	0.005	NE	NE	3.6E+00	0.0046	1	U	U																								
VOLATILES	Bromomethane	4.9E+00	1.4E+01	0.0010	0.010	NE	NE	4.9E+00	0.0092	1	U	U																								
VOLATILES	Carbon disulfide	1.5E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03	0.0046	1	U	U																								
VOLATILES	Carbon tetrachloride	6.3E-01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01	0.0046	1	U	U																								
VOLATILES	Chlorobenzene	5.9E+02	1.0E+01	0.0005	0.005	NE	NE	1.0E+01	0.0046	1	U	U																								
VOLATILES	Chloroethane	1.7E+04	4.1E+03	0.0010	0.010	NE	NE	4.1E+03	0.0092	1	U	U																								
VOLATILES	Chloroform	5.2E-01	1.0E+02	0.0005	0.005	NE	NE	5.2E-01	0.0046	1	U	U																								
VOLATILES	Chloromethane	3.8E+00	2.2E+01	0.0020	0.010	NE	NE	3.8E+00	0.0092	1	U	U																								
VOLATILES	cis-1,2-Dichloroethene	2.5E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00	0.0046	1	U	U																								
VOLATILES	cis-1,3-Dichloropropene	3.4E+01	5.3E-01	0.0005	0.005	NE	NE	5.3E-01	0.0046	1	U	U																								
VOLATILES	Dibromochloromethane	6.8E+02	3.4E+00	0.0005	0.005	NE	NE	3.4E+00	0.0046	1	U	U																								
VOLATILES	Dibromomethane	2.7E+02	3.8E+01	0.0005	0.005	NE	NE	3.8E+01	0.0046	1	U	U																								
VOLATILES	Dichlorodifluoromethane	3.1E+03	2.0E+03	0.0010	0.010	NE	NE	2.0E+03	0.0092	1	U	U																								
VOLATILES	Ethylbenzene	6.9E+03	7.0E+01	0.0005	0.005	NE	NE	7.0E+01	0.0046	1	U	U																								
VOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.0005	0.005	NE	NE	2.0E+00	0.0046	1	U	U																								
VOLATILES	Isopropylbenzene	9.0E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03	0.0046	1	U	U																								
VOLATILES	m,p-Xylenes [e]	3.3E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03	0.0046	1	U	U																								
VOLATILES	Methyl isobutyl ketone	3.5E+04	8.2E+02	0.0025	0.010	NE	NE	8.2E+02	0.0092	1	U	U																								
VOLATILES	Methylene chloride	1.6E+01	5.0E-01	0.0010	0.005	NE	NE	5.0E-01	0.0046	1	U	U																								
VOLATILES	Naphthalene	2.7E+02	2.0E+02	0.0005	0.010	NE	NE	2.0E+02	0.0048	1	J	J																								
VOLATILES	n-BUTYLBENZENE	5.7E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02	0.0046	1	U	U																								
VOLATILES	n-PROPYLBENZENE	5.9E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02	0.0046	1	U	U																								
VOLATILES	p-ISOPROPYLTOLUENE	6.7E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03	0.0046	1	U	U																								
VOLATILES	sec-BUTYLBENZENE	5.4E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02	0.0046	1	U	U																								
VOLATILES	Styrene	2.3E+04	1.0E+01	0.0005	0.005	NE	NE	1.0E+01	0.0046	1	U	U																								
VOLATILES	tert-BUTYLBENZENE	4.5E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02	0.0046	1	U	U																								
VOLATILES	Tetrachloroethene	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01	0.0046	1	U	U																								
VOLATILES	Toluene	2.5E+04	1.0E+02	0.0005	0.005	NE	NE	1.0E+02	0.0046	1	U	U																								
VOLATILES	trans-1,2-Dichloroethene	2.4E+03	1.0E+01	0.0005	0.005	NE	NE	1.0E+01	0.0046	1	U	U																								
VOLATILES	trans-1,3-Dichloropropene	4.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00	0.0046	1	U	U																								
VOLATILES	Trichloroethene	6.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01	0.0046	1	U	U																								
VOLATILES	Trichlorofluoromethane	3.8E+03	3.1E+03	0.0010	0.010	NE	NE	3.1E+03	0.0092	1	U	U																								

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB03				03SB04				03SB05				03SB06				03SB07				03SB07				03SB08			
	SAMPLE_NO					Background			03SB03-02				03SB04-01				03SB05-01				03SB06-01				03SB07 (0-0_5)				03SB07(0-0.5)R				03SB08 (0-0_5)			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	8/29/2006				12/19/2006				12/19/2006				12/19/2006				10/23/2007				23-Oct-07				23-Oct-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	3 - 4 Ft				3 - 4 Ft				3 - 4 Ft				3 - 4 Ft				0-0.5 Ft				0-0.5				0-0.5 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG[d]				REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
VOLATILES	Vinyl acetate	8.0E+02	1.0E+04	0.0010	0.010	NE	NE	8.0E+02	0.0092	1	U	U																								
VOLATILES	Vinyl chloride	6.6E-02	2.0E-01	0.0010	0.010	NE	NE	6.6E-02	0.0092	1	U	U																								

Notes and Abbreviations:

Shading in column indicates SDL values that exceed the Applicable MSC.

Concentration exceeds Applicable MSC.

[a] Value provided by the Texas Commission on Environmental Quality (TCEQ) as updated through March 2006 available on the TCEQ website at http://www.tceq.state.tx.us/remediation/rrr.html.

[b] Lower of surface and subsurface soil background concentrations used in these comparisons

[c] Shading in column indicates Applicable MSC equal to MQL for the chemical as provided in 30TAC§335.

[d] Where Applicable MSC is equal to MQL, value equals the SDL, which is the MDL adjusted for sample specific analytical factors.

[e] MSC value shown is for m-xylene, the more conservative of m- and p-xylene isomers.

95% UPL - 95% Upper Prediction Limit of background concentration calculated as described in TCEQ correspondence.
FD - field duplicate sample
H - estimate is high
J - Estimated value. Chemical was detected above the method detection limit but below the MQL.
L - estimate is low
NE - value not established
R - data rejected
REG - regular sample
U - compound validated as not detected above MDL shown

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION_CODE	TCEQ Medium-Specific Concentration (MSC)		Method Detection Limit (MDL)	Method Quantitation Limit (MQL)	Background Concentrations in Soil (95% UPL, mg/kg) [b]		Applicable TCEQ Risk-Based MSC [c]	03SB08				03SB09				03SB09				03SB10				03SB10				03SB10				03SB11			
	SAMPLE_NO								03SB08(0-0.5)R				03SB09 (0-0_5)				03SB09(0-0_5)R				03SB10-(0-0_5)				03SB10-(3-4)				03SB10-(6-7)				03SB11-(0-0_5)			
	SAMPLE_DATE								23-Oct-07				23-Oct-07				23-Oct-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH								0-0.5 Ft				0-0.5 FT				0-0.5 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft			
	SAMPLE_PURPOSE								REG				REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]			Surface 0 - 0.5 Ft	Subsurface 1.5 - 2.5 Ft		Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
METALS	Aluminum	1.0E+06	1.0E+04	10	20	1.63E+04	2.08E+04	1.6E+04	5180	1							7790	1			6710	1		J	13700	1			8510	1			8370	1		
METALS	Antimony	4.9E+02	6.0E-01	0.05	0.1	9.40E-01	1.60E+00	9.4E-01	0.121	1		JL					0.054	1	U	U	0.574	10	U	U	0.630	10	U	U	0.601	10	U	U	0.632	10	U	U
METALS	Arsenic	2.0E+02	1.0E+00	0.075	0.3	4.81E+00	5.54E+00	4.8E+00	10.800	1							6.120	1			3.480	10			2.070	10	J	J	1.290	10	J	J	1.010	10	J	J
METALS	Barium	1.7E+05	2.0E+02	0.1	0.5	1.52E+02	8.55E+01	2.0E+02	48.80	1							57.60	1			100.00	1			66.90	1			54.80	1			229.00	1		
METALS	Beryllium	2.7E+02	4.0E-01	0.012	0.5	6.45E-01	7.66E-01	6.5E-01	0.347	1	J	J					0.259	1	J	J	0.492	1			0.494	1			0.423	1	J	J	0.475	1	J	J
METALS	Cadmium	1.5E+03	5.0E-01	0.05	0.5	1.40E+00	4.00E-01	5.0E-01	0.166	1	J	J					1.440	1			0.592	10	U	U	0.631	10	U	U	0.637	10	U	U	0.668	10	U	U
METALS	Calcium	NE	NE	NA	NA	NA	NA	--	3520	1							56000	10			2110	1			814	1			737	1			1150	1		
METALS	Chromium	3.5E+05	1.0E+01	0.12	1	2.66E+01	3.01E+01	2.7E+01	28.00	1							62.70	1			11.80	10			9.41	10			7.23	10			5.10	10		
METALS	Cobalt	1.1E+05	6.1E+02	0.12	1	7.23E+00	5.61E+00	6.1E+02	3.160	1							3.740	1			6.160	1		JL	3.180	1			3.090	1			3.460	1		
METALS	Copper	7.4E+04	1.3E+02	0.5	1	5.55E+00	9.25E+00	1.3E+02	2.95	1							11.50	1			4.08	1			4.42	1			2.83	1			3.53	1		
METALS	Iron	NE	NE	NA	NA	NA	NA	--	16400	1							23900	1			13800	1		J	12800	1		J	8860	1		J	8970	1		J
METALS	Lead	1.0E+03	1.5E+00	0.1	0.2	2.26E+01	1.14E+01	1.1E+01	701.00	100			57.7	10			75.40	10			18.90	10			11.30	10			9.17	10			8.76	10		
METALS	Magnesium	NE	NE	NA	NA	NA	NA	--	167	1							22800	1			471	1		J	813	1			610	1			769	1		
METALS	Manganese	1.1E+05	1.4E+03	0.1	0.5	1.25E+03	2.01E+02	1.4E+03	161	1							66	1			579	1			51	1			33	1			43	1		
METALS	Mercury	1.5E-01	2.0E-01	0.01	0.25	8.19E-02	3.60E-01	2.5E-01	0.1170	1	J	J					0.0241	1	J	J	0.0242	1	J	J	0.0126	1	U	U	0.0127	1	U	U	0.0134	1	U	U
METALS	Nickel	1.2E+04	2.0E+02	0.5	2	6.98E+00	1.16E+01	2.0E+02	2.68	1							4.12	1			5.56	1			5.44	1			4.10	1			4.85	1		
METALS	Potassium	NE	NE	NA	NA	NA	NA	--	180	1							350	1			264	1			406	1			234	1			220	1		
METALS	Selenium	9.3E+03	5.0E+00	0.1	0.2	3.48E+00	5.57E+00	5.0E+00	0.397	1							0.356	1			1.150	10	U	U	1.260	10	U	U	1.200	10	U	U	1.260	10	U	U
METALS	Silver	2.9E+03	5.1E+01	0.25	2	3.10E-01	3.70E-01	5.1E+01	0.246	1	J	J					0.689	1	J	J	0.224	1	U	U	0.273	1	J	J	0.238	1	U	U	0.246	1	U	U
METALS	Sodium	NE	NE	NA	NA	NA	NA	--	13.3	1	J	J					79.8	1			31.2	1			268.0	1			282.0	1			326.0	1		
METALS	Thallium	1.5E+02	2.0E-01	0.01	0.02	4.70E-01	NE	4.7E-01	0.0707	1							0.0815	1			0.1230	10	J	J	0.1660	10	J	J	0.1200	10	U	U	0.1260	10	U	U
METALS	Vanadium	3.0E+03	7.2E+01	0.25	0.5	3.21E+01	4.46E+01	7.2E+01	24.7	1							39.1	1			19.6	1			23.3	1			17.6	1			13.1	1		
METALS	Zinc	4.1E+05	3.1E+03	0.5	1	6.16E+01	2.02E+01	3.1E+03	70.50	1							1640	10			27.50	1			18.60	1			12.10	1			10.70	1		
SEMIVOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.083	0.165	NE	NE	7.0E+00																												
SEMIVOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.083	0.165	NE	NE	6.0E+01																												
SEMIVOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.083	0.165	NE	NE	7.1E+01																												
SEMIVOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.083	0.165	NE	NE	7.5E+00																												
SEMIVOLATILES	2,4,5-Trichlorophenol	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03																												
SEMIVOLATILES	2,4,6-Trichlorophenol	2.6E+02	2.6E+00	0.083	0.165	NE	NE	2.6E+00																												
SEMIVOLATILES	2,4-Dichlorophenol	3.1E+03	3.1E+01	0.083	0.165	NE	NE	3.1E+01																												
SEMIVOLATILES	2,4-Dimethylphenol	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02																												
SEMIVOLATILES	2,4-Dinitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																												
SEMIVOLATILES	2,4-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01																												
SEMIVOLATILES	2,6-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01																												
SEMIVOLATILES	2-Chloronaphthalene	7.1E+04	8.2E+02	0.083	0.165	NE	NE	8.2E+02																												
SEMIVOLATILES	2-Chlorophenol	4.0E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																												
SEMIVOLATILES	2-Methylnaphthalene	3.6E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																												
SEMIVOLATILES	2-Methylphenol	5.1E+04	5.1E+02	0.083	0.165	NE	NE	5.1E+02																												
SEMIVOLATILES	2-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00																												
SEMIVOLATILES	2-Nitrophenol	2.0E+03	3.1E+00	0.083	0.165	NE	NE	3.1E+00																												
SEMIVOLATILES	3,3'-Dichlorobenzidine	6.4E+00	6.4E-02	0.165	0.330	NE	NE	3.3E-01																												
SEMIVOLATILES	3-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00																												
SEMIVOLATILES	4,6-Dinitro-2-methylphenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																												
SEMIVOLATILES	4-Bromophenyl phenyl ethe	1.6E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01																												
SEMIVOLATILES	4-Chloro-3-methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																												
SEMIVOLATILES	4-Chloroaniline	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																												
SEMIVOLATILES	4-Chlorophenyl phenyl ethe	1.2E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01																												
SEMIVOLATILES	4-Methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																												
SEMIVOLATILES	4-Nitroaniline	7.5E+02	7.5E+00	0.330	0.825	NE	NE	7.5E+00																												
SEMIVOLATILES	4-Nitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																												
SEMIVOLATILES	Acenaphthene	3.0E+01	6.1E+02	0.083	0.165	NE	NE	3.0E+01																												

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB08				03SB09				03SB09				03SB10				03SB10				03SB10				03SB11			
	SAMPLE_NO					Background			03SB08(0-0.5)R				03SB09 (0-0_5)				03SB09(0-0_5)R				03SB10-(0-0_5)				03SB10-(3-4)				03SB10-(6-7)				03SB11-(0-0_5)			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	23-Oct-07				23-Oct-07				23-Oct-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-0.5 Ft				0-0.5 FT				0-0.5 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based		REG				REG				REG				REG				REG				REG				REG		
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
SEMIVOLATILES	Acenaphthylene	5.3E+04	6.1E+02	0.083	0.165	NE	NE	6.1E+02																												
SEMIVOLATILES	Anthracene	2.7E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																												
SEMIVOLATILES	Benzo(a)anthracene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01																												
SEMIVOLATILES	Benzo(a)pyrene	3.4E-01	2.0E-02	0.083	0.165	1.54E-02	NE	1.7E-01																												
SEMIVOLATILES	Benzo(b)fluoranthene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01																												
SEMIVOLATILES	Benzo(ghi)perylene	2.7E+04	3.1E+02	0.083	0.165	1.23E-02	NE	3.1E+02																												
SEMIVOLATILES	Benzo(k)fluoranthene	3.4E+01	3.9E-01	0.083	0.165	1.30E-02	NE	3.9E-01																												
SEMIVOLATILES	Benzoic Acid	4.1E+06	4.1E+04	0.330	0.825	NE	NE	4.1E+04																												
SEMIVOLATILES	Benzyl Alcohol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																												
SEMIVOLATILES	bis(2-Chloroethoxy)methane	9.0E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01																												
SEMIVOLATILES	bis(2-Chloroethyl)ether	3.2E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01																												
SEMIVOLATILES	bis(2-Chloroisopropyl)ether	1.5E+02	4.1E+00	0.083	0.165	NE	NE	4.1E+00																												
SEMIVOLATILES	bis(2-Ethylhexyl)phthalate	6.5E+01	6.0E-01	0.083	0.165	NE	NE	6.0E-01																												
SEMIVOLATILES	Butyl benzyl phthalate	2.0E+05	2.0E+03	0.083	0.165	NE	NE	2.0E+03																												
SEMIVOLATILES	Chrysene	3.4E+02	3.9E+00	0.083	0.165	1.51E-02	NE	3.9E+00																												
SEMIVOLATILES	Dibenzo(a,h)anthracene	3.4E-01	2.0E-02	0.083	0.165	NE	NE	1.7E-01																												
SEMIVOLATILES	Dibenzofuran	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																												
SEMIVOLATILES	Diethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03																												
SEMIVOLATILES	Dimethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03																												
SEMIVOLATILES	di-n-Butyl phthalate	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03																												
SEMIVOLATILES	di-n-Octyl phthalate	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02																												
SEMIVOLATILES	Fluoranthene	3.6E+04	4.1E+02	0.083	0.165	2.29E-02	NE	4.1E+02																												
SEMIVOLATILES	Fluorene	3.6E+04	4.1E+02	0.083	0.165	NE	NE	4.1E+02																												
SEMIVOLATILES	Hexachlorobenzene	1.0E+00	1.0E-01	0.083	0.165	NE	NE	1.7E-01																												
SEMIVOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.083	0.165	NE	NE	2.0E+00																												
SEMIVOLATILES	Hexachlorocyclopentadiene	1.4E+01	5.0E+00	0.083	0.165	NE	NE	5.0E+00																												
SEMIVOLATILES	Hexachloroethane	7.5E+02	1.0E+01	0.083	0.165	NE	NE	1.0E+01																												
SEMIVOLATILES	Indeno(1,2,3-cd)pyrene	3.4E+00	3.9E-02	0.083	0.165	1.43E-02	NE	1.7E-01																												
SEMIVOLATILES	Isophorone	3.0E+04	3.0E+02	0.083	0.165	NE	NE	3.0E+02																												
SEMIVOLATILES	Naphthalene	2.7E+02	2.0E+02	0.083	0.165	NE	NE	2.0E+02																												
SEMIVOLATILES	Nitrobenzene	2.7E+02	5.1E+00	0.083	0.165	NE	NE	5.1E+00																												
SEMIVOLATILES	n-Nitroso-di-n-propylamine	1.6E-01	4.1E-03	0.083	0.165	NE	NE	1.7E-01																												
SEMIVOLATILES	n-Nitrosodiphenylamine	2.3E+02	5.8E+00	0.083	0.165	NE	NE	5.8E+00																												
SEMIVOLATILES	Pentachlorophenol	1.4E+01	1.0E-01	0.330	0.825	NE	NE	8.3E-01																												
SEMIVOLATILES	Phenanthrene	2.7E+04	3.1E+02	0.083	0.165	NE	NE	3.1E+02																												
SEMIVOLATILES	Phenol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																												
SEMIVOLATILES	Pyrene	2.7E+04	3.1E+02	0.083	0.165	1.94E-02	NE	3.1E+02																												
SOLIDS	Percent Solids	NE	NE	NE	NE	NE	NE	--	90.8		1		91.3		1		91.3		1		84.4		1		79.3		1		78.5		1		74.8		1	
VOLATILES	1,1,1,2-Tetrachloroethane	1.1E+02	1.1E+01	0.0005	0.005	NE	NE	1.1E+01																												
VOLATILES	1,1,1-Trichloroethane	3.4E+03	2.0E+01	0.0005	0.005	NE	NE	2.0E+01																												
VOLATILES	1,1,2,2-Tetrachloroethane	9.8E+00	1.4E+00	0.0005	0.005	NE	NE	1.4E+00																												
VOLATILES	1,1,2-Trichloroethane	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																												
VOLATILES	1,1-Dichloroethane	1.3E+03	1.0E+03	0.0010	0.005	NE	NE	1.0E+03																												
VOLATILES	1,1-Dichloroethene	3.8E+02	7.0E-01	0.0005	0.005	NE	NE	7.0E-01																												
VOLATILES	1,1-Dichloropropene	1.9E+00	2.9E-01	0.0005	0.005	NE	NE	2.9E-01																												
VOLATILES	1,2,3-Trichlorobenzene	2.0E+03	3.1E+01	0.0005	0.005	NE	NE	3.1E+01																												
VOLATILES	1,2,3-Trichloropropane	8.2E-01	4.1E-03	0.0010	0.005	NE	NE	5.0E-03																												
VOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00																												
VOLATILES	1,2,4-Trimethylbenzene	1.4E+02	5.1E+02	0.0005	0.005	NE	NE	1.4E+02																												
VOLATILES	1,2-Dibromo-3-chloropropar	2.0E+00	2.0E-02	0.0020	0.005	NE	NE	2.0E-02																												
VOLATILES	1,2-Dibromoethane	1.0E-01	5.0E-03	0.0005	0.005	NE	NE	5.0E-03																												

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION_CODE								03SB08				03SB09				03SB09				03SB10				03SB10				03SB10				03SB11			
	SAMPLE_NO					Background			03SB08(0-0.5)R				03SB09 (0-0_5)				03SB09(0-0_5)R				03SB10-(0-0_5)				03SB10-(3-4)				03SB10-(6-7)				03SB11-(0-0_5)			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	23-Oct-07				23-Oct-07				23-Oct-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-0.5 Ft				0-0.5 FT				0-0.5 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based			REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
VOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.0005	0.005	NE	NE	6.0E+01																												
VOLATILES	1,2-Dichloroethane	4.7E-01	5.0E-01	0.0005	0.005	NE	NE	4.7E-01																												
VOLATILES	1,2-Dichloropropane	2.5E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																												
VOLATILES	1,2-Dimethylbenzene (o-X	4.8E+04	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																												
VOLATILES	1,3,5-Trimethylbenzene	1.2E+02	5.1E+02	0.0005	0.005	NE	NE	1.2E+02																												
VOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.0005	0.005	NE	NE	7.1E+01																												
VOLATILES	1,3-Dichloropropane	8.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00																												
VOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.0005	0.005	NE	NE	7.5E+00																												
VOLATILES	2,2-Dichloropropane	2.4E+01	4.2E+00	0.0005	0.005	NE	NE	4.2E+00																												
VOLATILES	2-Butanone	4.2E+04	6.1E+03	0.0025	0.010	NE	NE	6.1E+03																												
VOLATILES	2-Chloroethyl vinyl ether	3.0E+00	2.6E-01	0.0020	0.010	NE	NE	2.6E-01																												
VOLATILES	2-Chlorotoluene	3.5E+03	2.0E+02	0.0005	0.005	NE	NE	2.0E+02																												
VOLATILES	2-Hexanone	8.7E+01	6.1E+02	0.0025	0.010	NE	NE	8.7E+01																												
VOLATILES	4-Chlorotoluene	4.8E+00	2.0E+02	0.0005	0.005	NE	NE	4.8E+00																												
VOLATILES	Acetone	2.5E+03	9.2E+03	0.0050	0.010	NE	NE	2.5E+03																												
VOLATILES	Benzene	1.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																												
VOLATILES	Bromobenzene	1.6E+02	2.0E+02	0.0005	0.005	NE	NE	1.6E+02																												
VOLATILES	Bromochloromethane	3.4E+02	4.1E+02	0.0005	0.005	NE	NE	3.4E+02																												
VOLATILES	Bromodichloromethane	9.2E+01	4.6E-01	0.0005	0.005	NE	NE	4.6E-01																												
VOLATILES	Bromoform	8.5E+01	3.6E+00	0.0005	0.005	NE	NE	3.6E+00																												
VOLATILES	Bromomethane	4.9E+00	1.4E+01	0.0010	0.010	NE	NE	4.9E+00																												
VOLATILES	Carbon disulfide	1.5E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																												
VOLATILES	Carbon tetrachloride	6.3E-01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																												
VOLATILES	Chlorobenzene	5.9E+02	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																												
VOLATILES	Chloroethane	1.7E+04	4.1E+03	0.0010	0.010	NE	NE	4.1E+03																												
VOLATILES	Chloroform	5.2E-01	1.0E+02	0.0005	0.005	NE	NE	5.2E-01																												
VOLATILES	Chloromethane	3.8E+00	2.2E+01	0.0020	0.010	NE	NE	3.8E+00																												
VOLATILES	cis-1,2-Dichloroethene	2.5E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00																												
VOLATILES	cis-1,3-Dichloropropene	3.4E+01	5.3E-01	0.0005	0.005	NE	NE	5.3E-01																												
VOLATILES	Dibromochloromethane	6.8E+02	3.4E+00	0.0005	0.005	NE	NE	3.4E+00																												
VOLATILES	Dibromomethane	2.7E+02	3.8E+01	0.0005	0.005	NE	NE	3.8E+01																												
VOLATILES	Dichlorodifluoromethane	3.1E+03	2.0E+03	0.0010	0.010	NE	NE	2.0E+03																												
VOLATILES	Ethylbenzene	6.9E+03	7.0E+01	0.0005	0.005	NE	NE	7.0E+01																												
VOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.0005	0.005	NE	NE	2.0E+00																												
VOLATILES	Isopropylbenzene	9.0E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																												
VOLATILES	m,p-Xylenes [e]	3.3E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																												
VOLATILES	Methyl isobutyl ketone	3.5E+04	8.2E+02	0.0025	0.010	NE	NE	8.2E+02																												
VOLATILES	Methylene chloride	1.6E+01	5.0E-01	0.0010	0.005	NE	NE	5.0E-01																												
VOLATILES	Naphthalene	2.7E+02	2.0E+02	0.0005	0.010	NE	NE	2.0E+02																												
VOLATILES	n-BUTYLBENZENE	5.7E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																												
VOLATILES	n-PROPYLBENZENE	5.9E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																												
VOLATILES	p-ISOPROPYLTOLUENE	6.7E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																												
VOLATILES	sec-BUTYLBENZENE	5.4E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																												
VOLATILES	Styrene	2.3E+04	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																												
VOLATILES	tert-BUTYLBENZENE	4.5E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																												
VOLATILES	Tetrachloroethene	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																												
VOLATILES	Toluene	2.5E+04	1.0E+02	0.0005	0.005	NE	NE	1.0E+02																												
VOLATILES	trans-1,2-Dichloroethene	2.4E+03	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																												
VOLATILES	trans-1,3-Dichloropropene	4.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00																												
VOLATILES	Trichloroethene	6.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																												
VOLATILES	Trichlorofluoromethane	3.8E+03	3.1E+03	0.0010	0.010	NE	NE	3.1E+03																												

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB08				03SB09				03SB09				03SB10				03SB10				03SB10				03SB11			
	SAMPLE_NO					Background			03SB08(0-0.5)R				03SB09 (0-0_5)				03SB09(0-0_5)R				03SB10-(0-0_5)				03SB10-(3-4)				03SB10-(6-7)				03SB11-(0-0_5)			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	23-Oct-07				23-Oct-07				23-Oct-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-0.5 Ft				0-0.5 FT				0-0.5 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based					REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
VOLATILES	Vinyl acetate	8.0E+02	1.0E+04	0.0010	0.010	NE	NE	8.0E+02																												
VOLATILES	Vinyl chloride	6.6E-02	2.0E-01	0.0010	0.010	NE	NE	6.6E-02																												

Notes and Abbreviations:

Shading in column indicates SDL values that exceed the Applicable MSC.

Concentration exceeds Applicable MSC.

[a] Value provided by the Texas Commission on Environmental Quality (TCEQ) as updated through March 2006 available on the TCEQ website at http://www.tceq.state.tx.us/remediation/rrr.html.

[b] Lower of surface and subsurface soil background concentrations used in these comparisons

[c] Shading in column indicates Applicable MSC equal to MQL for the chemical as provided in 30TAC§335.

[d] Where Applicable MSC is equal to MQL, value equals the SDL, which is the MDL adjusted for sample specific analytical factors.

[e] MSC value shown is for m-xylene, the more conservative of m- and p-xylene isomers.

95% UPL - 95% Upper Prediction Limit of background concentration calculated as described in TCEQ correspondence.
FD - field duplicate sample
H - estimate is high
J - Estimated value. Chemical was detected above the method detection limit but below the MQL.
L - estimate is low
NE - value not established
R - data rejected
REG - regular sample
U - compound validated as not detected above MDL shown

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION_CODE					Background		Applicable	03SB11				03SB11				03SB12				03SB12				03SB12				03SB13				03SB13				03SB13			
	SAMPLE_NO					Concentrations in Soil			03SB11-(3-4)				03SB11-(6-7)				03SB12-(0-0_5)				03SB12-(3-4)				03SB12-(6-7)				03SB13-(0-0_5)				03SB13-(3-4)				03SB13-(6-7)			
	SAMPLE_DATE	TCEQ				(95% UPL, mg/kg) [b]		TCEQ	17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method			Risk-Based	3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface		REG				REG				REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
METALS	Aluminum	1.0E+06	1.0E+04	10	20	1.63E+04	2.08E+04	1.6E+04	7420	1			7180	1			4580	1			12100	1			7030	1			6250	1			4720	1			5640	1		
METALS	Antimony	4.9E+02	6.0E-01	0.05	0.1	9.40E-01	1.60E+00	9.4E-01	0.595	10	U	U	0.579	10	U	U	0.586	10	U	U	3.060	50	U	U	0.555	10	U	UJL	0.597	10	U	U	0.596	10	U	U	0.621	10	U	U
METALS	Arsenic	2.0E+02	1.0E+00	0.075	0.3	4.81E+00	5.54E+00	4.8E+00	1.580	10	J	J	32.7	10			1.840	10	J	J	4.730	50	J	J	1.410	10	J	J	2.700	10	J	J	2.090	10	J	J	1.440	10	J	J
METALS	Barium	1.7E+05	2.0E+02	0.1	0.5	1.52E+02	8.55E+01	2.0E+02	119.00	1			106.00	1			53.30	1			45.50	1			32.00	1			72.10	1			51.60	1			61.90	1		
METALS	Beryllium	2.7E+02	4.0E-01	0.012	0.5	6.45E-01	7.66E-01	6.5E-01	0.368	1	J	J	0.370	1	J	J	0.418	1	J	J	0.399	1	J	J	0.213	1	J	J	0.461	1			0.283	1	J	J	0.323	1	J	J
METALS	Cadmium	1.5E+03	5.0E-01	0.05	0.5	1.40E+00	4.00E-01	5.0E-01	0.631	10	U	U	0.680	10	J	J	0.619	10	U	U	3.060	50	U	U	0.554	10	U	U	0.597	10	U	U	0.603	10	U	U	0.621	10	U	U
METALS	Calcium	NE	NE	NA	NA	NA	NA	--	972	1			4260	1			1030	1			1550	1			337	1			1420	1			804	1		J	1190	1		J
METALS	Chromium	3.5E+05	1.0E+01	0.12	1	2.66E+01	3.01E+01	2.7E+01	12.00	10			591	1000			6.86	10			13.70	50	J	J	6.40	10			13.40	10			7.77	10		J	6.73	10		J
METALS	Cobalt	1.1E+05	6.1E+02	0.12	1	7.23E+00	5.61E+00	6.1E+02	2.150	1			6.930	1			3.900	1			2.830	1			1.360	1			4.070	1			1.470	1			2.100	1		
METALS	Copper	7.4E+04	1.3E+02	0.5	1	5.55E+00	9.25E+00	1.3E+02	3.35	1			8.63	1			2.14	1			4.10	1			2.03	1			3.11	1			3.00	1			3.30	1		
METALS	Iron	NE	NE	NA	NA	NA	NA	--	8430	1		J	15000	1		J	8610	1		J	19800	1		J	6990	1		J	9510	1		J	5990	1			7550	1		
METALS	Lead	1.0E+03	1.5E+00	0.1	0.2	2.26E+01	1.14E+01	1.1E+01	36.30	10			6760	1000			19.60	10			10.60	50	J	J	5.17	10			19.20	10			8.36	10			8.61	10		
METALS	Magnesium	NE	NE	NA	NA	NA	NA	--	543	1			812	1			355	1			522	1			294	1			274	1			334	1			469	1		
METALS	Manganese	1.1E+05	1.4E+03	0.1	0.5	1.25E+03	2.01E+02	1.4E+03	55	1			175	1			382	1			69	1			76	1			274	5			66	1		J	192	1		J
METALS	Mercury	1.5E-01	2.0E-01	0.01	0.25	8.19E-02	3.60E-01	2.5E-01	0.0126	1	U	U	0.276	1			0.0341	1	J	J	0.0407	1	J	J	0.0138	1	J	J	0.0329	1	J	J	0.0204	1	J	J	0.0124	1	U	U
METALS	Nickel	1.2E+04	2.0E+02	0.5	2	6.98E+00	1.16E+01	2.0E+02	3.44	1			5.87	1			3.07	1			4.33	1			2.84	1			4.59	1			2.33	1			3.48	1		
METALS	Potassium	NE	NE	NA	NA	NA	NA	--	247	1			296	1			187	1			323	1			306	1			289	1			155	1			161	1		
METALS	Selenium	9.3E+03	5.0E+00	0.1	0.2	3.48E+00	5.57E+00	5.0E+00	1.190	10	U	U	1.160	10	U	U	1.170	10	U	U	6.120	50	U	U	1.110	10	U	U	1.190	10	U	U	1.190	10	U	U	1.240	10	U	U
METALS	Silver	2.9E+03	5.1E+01	0.25	2	3.10E-01	3.70E-01	5.1E+01	0.237	1	U	U	0.430	1			0.226	1	U	U	0.299	1	J	J	0.195	1	U	U	0.244	1	J	J	0.232	1	U	U	0.234	1	U	U
METALS	Sodium	NE	NE	NA	NA	NA	NA	--	202.0	1			38.0	1			30.2	1			120.0	1			28.2	1			50.7	1			102.0	1			164.0	1		
METALS	Thallium	1.5E+02	2.0E-01	0.01	0.02	4.70E-01	NE	4.7E-01	0.1190	10	U	U	0.1160	10	U	U	0.1170	10	U	U	0.6120	50	U	U	0.1110	10	U	U	0.1190	10	U	U	0.1190	10	U	U	0.1240	10	U	U
METALS	Vanadium	3.0E+03	7.2E+01	0.25	0.5	3.21E+01	4.46E+01	7.2E+01	17.5	1			21.6	1			19.3	1			33.9	1			22.2	1			19.0	1			15.0	1			12.3	1		
METALS	Zinc	4.1E+05	3.1E+03	0.5	1	6.16E+01	2.02E+01	3.1E+03	16.80	1			588	1			24.60	1			15.40	1			9.37	1			18.90	1			6.64	1			7.75	1		
SEMIVOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.083	0.165	NE	NE	7.0E+00																																
SEMIVOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.083	0.165	NE	NE	6.0E+01																																
SEMIVOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.083	0.165	NE	NE	7.1E+01																																
SEMIVOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.083	0.165	NE	NE	7.5E+00																																
SEMIVOLATILES	2,4,5-Trichlorophenol	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03																																
SEMIVOLATILES	2,4,6-Trichlorophenol	2.6E+02	2.6E+00	0.083	0.165	NE	NE	2.6E+00																																
SEMIVOLATILES	2,4-Dichlorophenol	3.1E+03	3.1E+01	0.083	0.165	NE	NE	3.1E+01																																
SEMIVOLATILES	2,4-Dimethylphenol	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02																																
SEMIVOLATILES	2,4-Dinitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																																
SEMIVOLATILES	2,4-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01																																
SEMIVOLATILES	2,6-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01																																
SEMIVOLATILES	2-Chloronaphthalene	7.1E+04	8.2E+02	0.083	0.165	NE	NE	8.2E+02																																
SEMIVOLATILES	2-Chlorophenol	4.0E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																																
SEMIVOLATILES	2-Methylnaphthalene	3.6E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																																
SEMIVOLATILES	2-Methylphenol	5.1E+04	5.1E+02	0.083	0.165	NE	NE	5.1E+02																																
SEMIVOLATILES	2-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00																																
SEMIVOLATILES	2-Nitrophenol	2.0E+03	3.1E+00	0.083	0.165	NE	NE	3.1E+00																																
SEMIVOLATILES	3,3'-Dichlorobenzidine	6.4E+00	6.4E-02	0.165	0.330	NE	NE	3.3E-01																																
SEMIVOLATILES	3-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00																																
SEMIVOLATILES	4,6-Dinitro-2-methylphenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																																
SEMIVOLATILES	4-Bromophenyl phenyl ethe	1.6E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01																																
SEMIVOLATILES	4-Chloro-3-methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																																
SEMIVOLATILES	4-Chloroaniline	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																																
SEMIVOLATILES	4-Chlorophenyl phenyl ethe	1.2E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01																																
SEMIVOLATILES	4-Methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																																
SEMIVOLATILES	4-Nitroaniline	7.5E+02	7.5E+00	0.330	0.825	NE	NE	7.5E+00																																
SEMIVOLATILES	4-Nitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																																
SEMIVOLATILES	Acenaphthene	3.0E+01	6.1E+02	0.083	0.165	NE	NE	3.0E+01																																

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION_CODE					Background		Applicable	03SB11				03SB11				03SB12				03SB12				03SB12				03SB13				03SB13				03SB13			
	SAMPLE_NO					Concentrations in Soil			03SB11-(3-4)				03SB11-(6-7)				03SB12-(0-0_5)				03SB12-(3-4)				03SB12-(6-7)				03SB13-(0-0_5)				03SB13-(3-4)				03SB13-(6-7)			
	SAMPLE_DATE	TCEQ							17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				REG				REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
SEMIVOLATILES	Acenaphthylene	5.3E+04	6.1E+02	0.083	0.165	NE	NE	6.1E+02																																
SEMIVOLATILES	Anthracene	2.7E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																																
SEMIVOLATILES	Benzo(a)anthracene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01																																
SEMIVOLATILES	Benzo(a)pyrene	3.4E-01	2.0E-02	0.083	0.165	1.54E-02	NE	1.7E-01																																
SEMIVOLATILES	Benzo(b)fluoranthene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01																																
SEMIVOLATILES	Benzo(ghi)perylene	2.7E+04	3.1E+02	0.083	0.165	1.23E-02	NE	3.1E+02																																
SEMIVOLATILES	Benzo(k)fluoranthene	3.4E+01	3.9E-01	0.083	0.165	1.30E-02	NE	3.9E-01																																
SEMIVOLATILES	Benzoic Acid	4.1E+06	4.1E+04	0.330	0.825	NE	NE	4.1E+04																																
SEMIVOLATILES	Benzyl Alcohol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																																
SEMIVOLATILES	bis(2-Chloroethoxy)methane	9.0E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01																																
SEMIVOLATILES	bis(2-Chloroethyl)ether	3.2E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01																																
SEMIVOLATILES	bis(2-Chloroisopropyl)ether	1.5E+02	4.1E+00	0.083	0.165	NE	NE	4.1E+00																																
SEMIVOLATILES	bis(2-Ethylhexyl)phthalate	6.5E+01	6.0E-01	0.083	0.165	NE	NE	6.0E-01																																
SEMIVOLATILES	Butyl benzyl phthalate	2.0E+05	2.0E+03	0.083	0.165	NE	NE	2.0E+03																																
SEMIVOLATILES	Chrysene	3.4E+02	3.9E+00	0.083	0.165	1.51E-02	NE	3.9E+00																																
SEMIVOLATILES	Dibenzo(a,h)anthracene	3.4E-01	2.0E-02	0.083	0.165	NE	NE	1.7E-01																																
SEMIVOLATILES	Dibenzofuran	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																																
SEMIVOLATILES	Diethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03																																
SEMIVOLATILES	Dimethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03																																
SEMIVOLATILES	di-n-Butyl phthalate	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03																																
SEMIVOLATILES	di-n-Octyl phthalate	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02																																
SEMIVOLATILES	Fluoranthene	3.6E+04	4.1E+02	0.083	0.165	2.29E-02	NE	4.1E+02																																
SEMIVOLATILES	Fluorene	3.6E+04	4.1E+02	0.083	0.165	NE	NE	4.1E+02																																
SEMIVOLATILES	Hexachlorobenzene	1.0E+00	1.0E-01	0.083	0.165	NE	NE	1.7E-01																																
SEMIVOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.083	0.165	NE	NE	2.0E+00																																
SEMIVOLATILES	Hexachlorocyclopentadiene	1.4E+01	5.0E+00	0.083	0.165	NE	NE	5.0E+00																																
SEMIVOLATILES	Hexachloroethane	7.5E+02	1.0E+01	0.083	0.165	NE	NE	1.0E+01																																
SEMIVOLATILES	Indeno(1,2,3-cd)pyrene	3.4E+00	3.9E-02	0.083	0.165	1.43E-02	NE	1.7E-01																																
SEMIVOLATILES	Isophorone	3.0E+04	3.0E+02	0.083	0.165	NE	NE	3.0E+02																																
SEMIVOLATILES	Naphthalene	2.7E+02	2.0E+02	0.083	0.165	NE	NE	2.0E+02																																
SEMIVOLATILES	Nitrobenzene	2.7E+02	5.1E+00	0.083	0.165	NE	NE	5.1E+00																																
SEMIVOLATILES	n-Nitroso-di-n-propylamine	1.6E-01	4.1E-03	0.083	0.165	NE	NE	1.7E-01																																
SEMIVOLATILES	n-Nitrosodiphenylamine	2.3E+02	5.8E+00	0.083	0.165	NE	NE	5.8E+00																																
SEMIVOLATILES	Pentachlorophenol	1.4E+01	1.0E-01	0.330	0.825	NE	NE	8.3E-01																																
SEMIVOLATILES	Phenanthrene	2.7E+04	3.1E+02	0.083	0.165	NE	NE	3.1E+02																																
SEMIVOLATILES	Phenol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																																
SEMIVOLATILES	Pyrene	2.7E+04	3.1E+02	0.083	0.165	1.94E-02	NE	3.1E+02																																
SOLIDS	Percent Solids	NE	NE	NE	NE	NE	NE	--	79.3	1			86.3	1			80.8	1			81.7	1			90.2	1			83.8	1			82.9	1			80.5	1		
VOLATILES	1,1,1,2-Tetrachloroethane	1.1E+02	1.1E+01	0.0005	0.005	NE	NE	1.1E+01																																
VOLATILES	1,1,1-Trichloroethane	3.4E+03	2.0E+01	0.0005	0.005	NE	NE	2.0E+01																																
VOLATILES	1,1,2,2-Tetrachloroethane	9.8E+00	1.4E+00	0.0005	0.005	NE	NE	1.4E+00																																
VOLATILES	1,1,2-Trichloroethane	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																																
VOLATILES	1,1-Dichloroethane	1.3E+03	1.0E+03	0.0010	0.005	NE	NE	1.0E+03																																
VOLATILES	1,1-Dichloroethene	3.8E+02	7.0E-01	0.0005	0.005	NE	NE	7.0E-01																																
VOLATILES	1,1-Dichloropropene	1.9E+00	2.9E-01	0.0005	0.005	NE	NE	2.9E-01																																
VOLATILES	1,2,3-Trichlorobenzene	2.0E+03	3.1E+01	0.0005	0.005	NE	NE	3.1E+01																																
VOLATILES	1,2,3-Trichloropropane	8.2E-01	4.1E-03	0.0010	0.005	NE	NE	5.0E-03																																
VOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00																																
VOLATILES	1,2,4-Trimethylbenzene	1.4E+02	5.1E+02	0.0005	0.005	NE	NE	1.4E+02																																
VOLATILES	1,2-Dibromo-3-chloropropan	2.0E+00	2.0E-02	0.0020	0.005	NE	NE	2.0E-02																																
VOLATILES	1,2-Dibromoethane	1.0E-01	5.0E-03	0.0005	0.005	NE	NE	5.0E-03																																

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION_CODE					Background		Applicable	03SB11				03SB11				03SB12				03SB12				03SB12				03SB13				03SB13				03SB13			
	SAMPLE_NO					Concentrations in Soil			03SB11-(3-4)				03SB11-(6-7)				03SB12-(0-0_5)				03SB12-(3-4)				03SB12-(6-7)				03SB13-(0-0_5)				03SB13-(3-4)				03SB13-(6-7)			
	SAMPLE_DATE	TCEQ							17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				REG				REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
VOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.0005	0.005	NE	NE	6.0E+01																																
VOLATILES	1,2-Dichloroethane	4.7E-01	5.0E-01	0.0005	0.005	NE	NE	4.7E-01																																
VOLATILES	1,2-Dichloropropane	2.5E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																																
VOLATILES	1,2-Dimethylbenzene (o-X	4.8E+04	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																																
VOLATILES	1,3,5-Trimethylbenzene	1.2E+02	5.1E+02	0.0005	0.005	NE	NE	1.2E+02																																
VOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.0005	0.005	NE	NE	7.1E+01																																
VOLATILES	1,3-Dichloropropane	8.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00																																
VOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.0005	0.005	NE	NE	7.5E+00																																
VOLATILES	2,2-Dichloropropane	2.4E+01	4.2E+00	0.0005	0.005	NE	NE	4.2E+00																																
VOLATILES	2-Butanone	4.2E+04	6.1E+03	0.0025	0.010	NE	NE	6.1E+03																																
VOLATILES	2-Chloroethyl vinyl ether	3.0E+00	2.6E-01	0.0020	0.010	NE	NE	2.6E-01																																
VOLATILES	2-Chlorotoluene	3.5E+03	2.0E+02	0.0005	0.005	NE	NE	2.0E+02																																
VOLATILES	2-Hexanone	8.7E+01	6.1E+02	0.0025	0.010	NE	NE	8.7E+01																																
VOLATILES	4-Chlorotoluene	4.8E+00	2.0E+02	0.0005	0.005	NE	NE	4.8E+00																																
VOLATILES	Acetone	2.5E+03	9.2E+03	0.0050	0.010	NE	NE	2.5E+03																																
VOLATILES	Benzene	1.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																																
VOLATILES	Bromobenzene	1.6E+02	2.0E+02	0.0005	0.005	NE	NE	1.6E+02																																
VOLATILES	Bromochloromethane	3.4E+02	4.1E+02	0.0005	0.005	NE	NE	3.4E+02																																
VOLATILES	Bromodichloromethane	9.2E+01	4.6E-01	0.0005	0.005	NE	NE	4.6E-01																																
VOLATILES	Bromoform	8.5E+01	3.6E+00	0.0005	0.005	NE	NE	3.6E+00																																
VOLATILES	Bromomethane	4.9E+00	1.4E+01	0.0010	0.010	NE	NE	4.9E+00																																
VOLATILES	Carbon disulfide	1.5E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																																
VOLATILES	Carbon tetrachloride	6.3E-01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																																
VOLATILES	Chlorobenzene	5.9E+02	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																																
VOLATILES	Chloroethane	1.7E+04	4.1E+03	0.0010	0.010	NE	NE	4.1E+03																																
VOLATILES	Chloroform	5.2E-01	1.0E+02	0.0005	0.005	NE	NE	5.2E-01																																
VOLATILES	Chloromethane	3.8E+00	2.2E+01	0.0020	0.010	NE	NE	3.8E+00																																
VOLATILES	cis-1,2-Dichloroethene	2.5E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00																																
VOLATILES	cis-1,3-Dichloropropene	3.4E+01	5.3E-01	0.0005	0.005	NE	NE	5.3E-01																																
VOLATILES	Dibromochloromethane	6.8E+02	3.4E+00	0.0005	0.005	NE	NE	3.4E+00																																
VOLATILES	Dibromomethane	2.7E+02	3.8E+01	0.0005	0.005	NE	NE	3.8E+01																																
VOLATILES	Dichlorodifluoromethane	3.1E+03	2.0E+03	0.0010	0.010	NE	NE	2.0E+03																																
VOLATILES	Ethylbenzene	6.9E+03	7.0E+01	0.0005	0.005	NE	NE	7.0E+01																																
VOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.0005	0.005	NE	NE	2.0E+00																																
VOLATILES	Isopropylbenzene	9.0E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																																
VOLATILES	m,p-Xylenes [e]	3.3E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																																
VOLATILES	Methyl isobutyl ketone	3.5E+04	8.2E+02	0.0025	0.010	NE	NE	8.2E+02																																
VOLATILES	Methylene chloride	1.6E+01	5.0E-01	0.0010	0.005	NE	NE	5.0E-01																																
VOLATILES	Naphthalene	2.7E+02	2.0E+02	0.0005	0.010	NE	NE	2.0E+02																																
VOLATILES	n-BUTYLBENZENE	5.7E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																																
VOLATILES	n-PROPYLBENZENE	5.9E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																																
VOLATILES	p-ISOPROPYLTOLUENE	6.7E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																																
VOLATILES	sec-BUTYLBENZENE	5.4E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																																
VOLATILES	Styrene	2.3E+04	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																																
VOLATILES	tert-BUTYLBENZENE	4.5E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																																
VOLATILES	Tetrachloroethene	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																																
VOLATILES	Toluene	2.5E+04	1.0E+02	0.0005	0.005	NE	NE	1.0E+02																																
VOLATILES	trans-1,2-Dichloroethene	2.4E+03	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																																
VOLATILES	trans-1,3-Dichloropropene	4.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00																																
VOLATILES	Trichloroethene	6.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																																
VOLATILES	Trichlorofluoromethane	3.8E+03	3.1E+03	0.0010	0.010	NE	NE	3.1E+03																																

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB11				03SB11				03SB12				03SB12				03SB12				03SB13				03SB13				03SB13			
	SAMPLE_NO					Background			03SB11-(3-4)				03SB11-(6-7)				03SB12-(0-0_5)				03SB12-(3-4)				03SB12-(6-7)				03SB13-(0-0_5)				03SB13-(3-4)				03SB13-(6-7)			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				REG				REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
VOLATILES	Vinyl acetate	8.0E+02	1.0E+04	0.0010	0.010	NE	NE	8.0E+02																																
VOLATILES	Vinyl chloride	6.6E-02	2.0E-01	0.0010	0.010	NE	NE	6.6E-02																																

Notes and Abbreviations:

Shading in column indicates SDL values that exceed the Applicable MSC.

Concentration exceeds Applicable MSC.

[a] Value provided by the Texas Commission on Environmental Quality (TCEQ) as updated through March 2006 available on the TCEQ website at http://www.tceq.state.tx.us/remediation/rrr.html.

[b] Lower of surface and subsurface soil background concentrations used in these comparisons

[c] Shading in column indicates Applicable MSC equal to MQL for the chemical as provided in 30TAC§335.

[d] Where Applicable MSC is equal to MQL, value equals the SDL, which is the MDL adjusted for sample specific analytical factors.

[e] MSC value shown is for m-xylene, the more conservative of m- and p-xylene isomers.

95% UPL - 95% Upper Prediction Limit of background concentration calculated as described in TCEQ correspondence.
FD - field duplicate sample
H - estimate is high
J - Estimated value. Chemical was detected above the method detection limit but below the MQL.
L - estimate is low
NE - value not established
R - data rejected
REG - regular sample
U - compound validated as not detected above MDL shown

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE					Background		Applicable	03SB14				03SB14				03SB14				03SB15				03SB15				03SB15			
	SAMPLE_NO								03SB14-(0-0_5)				03SB14-(3-4)				03SB14-(6-7)				03SB15-(0-0_5)				03SB15-(3-4)				03SB15-(6-7)			
	SAMPLE_DATE	TCEQ				Concentrations in Soil			17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
METALS	Aluminum	1.0E+06	1.0E+04	10	20	1.63E+04	2.08E+04	1.6E+04	3580	1			5470	1			15100	1			5180	1			10100	1			5280	1		
METALS	Antimony	4.9E+02	6.0E-01	0.05	0.1	9.40E-01	1.60E+00	9.4E-01	0.588	10	U	U	0.60	10	U	U	0.622	10	U	U	0.571	10	U	U	0.599	10	U	U	0.572	10	U	U
METALS	Arsenic	2.0E+02	1.0E+00	0.075	0.3	4.81E+00	5.54E+00	4.8E+00	4.45	10			2.52	10	J	J	4.8	10			3.8	10			1.770	10	J	J	7.620	10		
METALS	Barium	1.7E+05	2.0E+02	0.1	0.5	1.52E+02	8.55E+01	2.0E+02	49	1			25.70	1			52.6	1			54.4	1			83.40	1			82.70	1		
METALS	Beryllium	2.7E+02	4.0E-01	0.012	0.5	6.45E-01	7.66E-01	6.5E-01	0.288	1	J	J	0.16	1	J	J	0.607	1			0.444	1			0.497	1			0.341	1	J	J
METALS	Cadmium	1.5E+03	5.0E-01	0.05	0.5	1.40E+00	4.00E-01	5.0E-01	0.70	10	J	J	0.60	10	U	U	0.623	10	U	U	0.665	10	J	J	0.608	10	U	U	0.574	10	U	U
METALS	Calcium	NE	NE	NA	NA	NA	NA	--	26300	10		J	371.00	1		J	609	1		J	1010	1		J	881	1		J	573	1		J
METALS	Chromium	3.5E+05	1.0E+01	0.12	1	2.66E+01	3.01E+01	2.7E+01	32.8	10		J	9.26	10		J	21.6	10		J	25.7	10		J	8.20	10		J	11.90	10		J
METALS	Cobalt	1.1E+05	6.1E+02	0.12	1	7.23E+00	5.61E+00	6.1E+02	6.86	1			1.70	1			5.310	1			3.270	1			3.710	1			2.600	1		
METALS	Copper	7.4E+04	1.3E+02	0.5	1	5.55E+00	9.25E+00	1.3E+02	3.18	1			1.96	1			6.640	1			2.460	1			3.78	1			2.43	1		
METALS	Iron	NE	NE	NA	NA	NA	NA	--	5380	1			9990	1			20400.0	1			6610.0	1			12300	1			6910	1		
METALS	Lead	1.0E+03	1.5E+00	0.1	0.2	2.26E+01	1.14E+01	1.1E+01	259	10			5.52	10			17.6	10			150.0	10			14.10	10			60.00	10		
METALS	Magnesium	NE	NE	NA	NA	NA	NA	--	13800	1			219.00	1			640	1			212	1			559	1			350	1		
METALS	Manganese	1.1E+05	1.4E+03	0.1	0.5	1.25E+03	2.01E+02	1.4E+03	374	1		J	39	1		J	25.1	1		J	79.4	1		J	200	1		J	81	1		J
METALS	Mercury	1.5E-01	2.0E-01	0.01	0.25	8.19E-02	3.60E-01	2.5E-01	0.175	1			0.01	1	U	U	0.040	1	J	J	0.043	1	J	J	0.0282	1	J	J	0.0115	1	U	U
METALS	Nickel	1.2E+04	2.0E+02	0.5	2	6.98E+00	1.16E+01	2.0E+02	3.04	1			2.92	1			5.160	1			3.560	1			3.88	1			2.60	1		
METALS	Potassium	NE	NE	NA	NA	NA	NA	--	153	1			212	1			308	1			213	1			297	1			189	1		
METALS	Selenium	9.3E+03	5.0E+00	0.1	0.2	3.48E+00	5.57E+00	5.0E+00	1.21	10	J	J	1.19	10	U	U	1.600	10	J	J	1.140	10	U	U	1.200	10	U	U	1.800	10	J	J
METALS	Silver	2.9E+03	5.1E+01	0.25	2	3.10E-01	3.70E-01	5.1E+01	0.353	1	J	J	0.22	1	U	U	0.302	1	J	J	0.210	1	U	U	0.220	1	U	U	0.213	1	U	U
METALS	Sodium	NE	NE	NA	NA	NA	NA	--	85.50	1			33.40	1			363	1			58	1			169.0	1			130.0	1		
METALS	Thallium	1.5E+02	2.0E-01	0.01	0.02	4.70E-01	NE	4.7E-01	0.118	10	U	U	0.12	10	U	U	0.173	10	J	J	0.114	10	U	U	0.1200	10	U	U	0.1140	10	U	U
METALS	Vanadium	3.0E+03	7.2E+01	0.25	0.5	3.21E+01	4.46E+01	7.2E+01	12.60	1			22.20	1			36.4	1			15.9	1			23.9	1			17.4	1		
METALS	Zinc	4.1E+05	3.1E+03	0.5	1	6.16E+01	2.02E+01	3.1E+03	228	1			12.90	1			15.6	1			44.8	1			13.90	1			167.00	1		
SEMIVOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.083	0.165	NE	NE	7.0E+00																								
SEMIVOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.083	0.165	NE	NE	6.0E+01																								
SEMIVOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.083	0.165	NE	NE	7.1E+01																								
SEMIVOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.083	0.165	NE	NE	7.5E+00																								
SEMIVOLATILES	2,4,5-Trichlorophenol	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03																								
SEMIVOLATILES	2,4,6-Trichlorophenol	2.6E+02	2.6E+00	0.083	0.165	NE	NE	2.6E+00																								
SEMIVOLATILES	2,4-Dichlorophenol	3.1E+03	3.1E+01	0.083	0.165	NE	NE	3.1E+01																								
SEMIVOLATILES	2,4-Dimethylphenol	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02																								
SEMIVOLATILES	2,4-Dinitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																								
SEMIVOLATILES	2,4-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01																								
SEMIVOLATILES	2,6-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01																								
SEMIVOLATILES	2-Chloronaphthalene	7.1E+04	8.2E+02	0.083	0.165	NE	NE	8.2E+02																								
SEMIVOLATILES	2-Chlorophenol	4.0E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																								
SEMIVOLATILES	2-Methylnaphthalene	3.6E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																								
SEMIVOLATILES	2-Methylphenol	5.1E+04	5.1E+02	0.083	0.165	NE	NE	5.1E+02																								
SEMIVOLATILES	2-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00																								
SEMIVOLATILES	2-Nitrophenol	2.0E+03	3.1E+00	0.083	0.165	NE	NE	3.1E+00																								
SEMIVOLATILES	3,3'-Dichlorobenzidine	6.4E+00	6.4E-02	0.165	0.330	NE	NE	3.3E-01																								
SEMIVOLATILES	3-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00																								
SEMIVOLATILES	4,6-Dinitro-2-methylphenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																								
SEMIVOLATILES	4-Bromophenyl phenyl ethe	1.6E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01																								
SEMIVOLATILES	4-Chloro-3-methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																								
SEMIVOLATILES	4-Chloroaniline	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																								
SEMIVOLATILES	4-Chlorophenyl phenyl ethe	1.2E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01																								
SEMIVOLATILES	4-Methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																								
SEMIVOLATILES	4-Nitroaniline	7.5E+02	7.5E+00	0.330	0.825	NE	NE	7.5E+00																								
SEMIVOLATILES	4-Nitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																								
SEMIVOLATILES	Acenaphthene	3.0E+01	6.1E+02	0.083	0.165	NE	NE	3.0E+01																								

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB14				03SB14				03SB14				03SB15				03SB15				03SB15			
	SAMPLE_NO					Background		Applicable	03SB14-(0-0_5)				03SB14-(3-4)				03SB14-(6-7)				03SB15-(0-0_5)				03SB15-(3-4)				03SB15-(6-7)			
	SAMPLE_DATE	TCEQ				Concentrations in Soil			17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
SEMIVOLATILES	Acenaphthylene	5.3E+04	6.1E+02	0.083	0.165	NE	NE	6.1E+02																								
SEMIVOLATILES	Anthracene	2.7E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																								
SEMIVOLATILES	Benzo(a)anthracene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01																								
SEMIVOLATILES	Benzo(a)pyrene	3.4E-01	2.0E-02	0.083	0.165	1.54E-02	NE	1.7E-01																								
SEMIVOLATILES	Benzo(b)fluoranthene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01																								
SEMIVOLATILES	Benzo(ghi)perylene	2.7E+04	3.1E+02	0.083	0.165	1.23E-02	NE	3.1E+02																								
SEMIVOLATILES	Benzo(k)fluoranthene	3.4E+01	3.9E-01	0.083	0.165	1.30E-02	NE	3.9E-01																								
SEMIVOLATILES	Benzoic Acid	4.1E+06	4.1E+04	0.330	0.825	NE	NE	4.1E+04																								
SEMIVOLATILES	Benzyl Alcohol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																								
SEMIVOLATILES	bis(2-Chloroethoxy)methane	9.0E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01																								
SEMIVOLATILES	bis(2-Chloroethyl)ether	3.2E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01																								
SEMIVOLATILES	bis(2-Chloroisopropyl)ether	1.5E+02	4.1E+00	0.083	0.165	NE	NE	4.1E+00																								
SEMIVOLATILES	bis(2-Ethylhexyl)phthalate	6.5E+01	6.0E-01	0.083	0.165	NE	NE	6.0E-01																								
SEMIVOLATILES	Butyl benzyl phthalate	2.0E+05	2.0E+03	0.083	0.165	NE	NE	2.0E+03																								
SEMIVOLATILES	Chrysene	3.4E+02	3.9E+00	0.083	0.165	1.51E-02	NE	3.9E+00																								
SEMIVOLATILES	Dibenzo(a,h)anthracene	3.4E-01	2.0E-02	0.083	0.165	NE	NE	1.7E-01																								
SEMIVOLATILES	Dibenzofuran	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																								
SEMIVOLATILES	Diethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03																								
SEMIVOLATILES	Dimethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03																								
SEMIVOLATILES	di-n-Butyl phthalate	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03																								
SEMIVOLATILES	di-n-Octyl phthalate	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02																								
SEMIVOLATILES	Fluoranthene	3.6E+04	4.1E+02	0.083	0.165	2.29E-02	NE	4.1E+02																								
SEMIVOLATILES	Fluorene	3.6E+04	4.1E+02	0.083	0.165	NE	NE	4.1E+02																								
SEMIVOLATILES	Hexachlorobenzene	1.0E+00	1.0E-01	0.083	0.165	NE	NE	1.7E-01																								
SEMIVOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.083	0.165	NE	NE	2.0E+00																								
SEMIVOLATILES	Hexachlorocyclopentadiene	1.4E+01	5.0E+00	0.083	0.165	NE	NE	5.0E+00																								
SEMIVOLATILES	Hexachloroethane	7.5E+02	1.0E+01	0.083	0.165	NE	NE	1.0E+01																								
SEMIVOLATILES	Indeno(1,2,3-cd)pyrene	3.4E+00	3.9E-02	0.083	0.165	1.43E-02	NE	1.7E-01																								
SEMIVOLATILES	Isophorone	3.0E+04	3.0E+02	0.083	0.165	NE	NE	3.0E+02																								
SEMIVOLATILES	Naphthalene	2.7E+02	2.0E+02	0.083	0.165	NE	NE	2.0E+02																								
SEMIVOLATILES	Nitrobenzene	2.7E+02	5.1E+00	0.083	0.165	NE	NE	5.1E+00																								
SEMIVOLATILES	n-Nitroso-di-n-propylamine	1.6E-01	4.1E-03	0.083	0.165	NE	NE	1.7E-01																								
SEMIVOLATILES	n-Nitrosodiphenylamine	2.3E+02	5.8E+00	0.083	0.165	NE	NE	5.8E+00																								
SEMIVOLATILES	Pentachlorophenol	1.4E+01	1.0E-01	0.330	0.825	NE	NE	8.3E-01																								
SEMIVOLATILES	Phenanthrene	2.7E+04	3.1E+02	0.083	0.165	NE	NE	3.1E+02																								
SEMIVOLATILES	Phenol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																								
SEMIVOLATILES	Pyrene	2.7E+04	3.1E+02	0.083	0.165	1.94E-02	NE	3.1E+02																								
SOLIDS	Percent Solids	NE	NE	NE	NE	NE	NE	--	83.6	1			83.4	1			80.3	1			87.5	1			82.2	1			87.1	1		
VOLATILES	1,1,1,2-Tetrachloroethane	1.1E+02	1.1E+01	0.0005	0.005	NE	NE	1.1E+01																								
VOLATILES	1,1,1-Trichloroethane	3.4E+03	2.0E+01	0.0005	0.005	NE	NE	2.0E+01																								
VOLATILES	1,1,2,2-Tetrachloroethane	9.8E+00	1.4E+00	0.0005	0.005	NE	NE	1.4E+00																								
VOLATILES	1,1,2-Trichloroethane	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																								
VOLATILES	1,1-Dichloroethane	1.3E+03	1.0E+03	0.0010	0.005	NE	NE	1.0E+03																								
VOLATILES	1,1-Dichloroethene	3.8E+02	7.0E-01	0.0005	0.005	NE	NE	7.0E-01																								
VOLATILES	1,1-Dichloropropene	1.9E+00	2.9E-01	0.0005	0.005	NE	NE	2.9E-01																								
VOLATILES	1,2,3-Trichlorobenzene	2.0E+03	3.1E+01	0.0005	0.005	NE	NE	3.1E+01																								
VOLATILES	1,2,3-Trichloropropane	8.2E-01	4.1E-03	0.0010	0.005	NE	NE	5.0E-03																								
VOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00																								
VOLATILES	1,2,4-Trimethylbenzene	1.4E+02	5.1E+02	0.0005	0.005	NE	NE	1.4E+02																								
VOLATILES	1,2-Dibromo-3-chloropropan	2.0E+00	2.0E-02	0.0020	0.005	NE	NE	2.0E-02																								
VOLATILES	1,2-Dibromoethane	1.0E-01	5.0E-03	0.0005	0.005	NE	NE	5.0E-03																								

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION_CODE								03SB14				03SB14				03SB14				03SB15				03SB15				03SB15			
	SAMPLE_NO					Background			03SB14-(0-0_5)				03SB14-(3-4)				03SB14-(6-7)				03SB15-(0-0_5)				03SB15-(3-4)				03SB15-(6-7)			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
VOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.0005	0.005	NE	NE	6.0E+01																								
VOLATILES	1,2-Dichloroethane	4.7E-01	5.0E-01	0.0005	0.005	NE	NE	4.7E-01																								
VOLATILES	1,2-Dichloropropane	2.5E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																								
VOLATILES	1,2-Dimethylbenzene (o-X	4.8E+04	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																								
VOLATILES	1,3,5-Trimethylbenzene	1.2E+02	5.1E+02	0.0005	0.005	NE	NE	1.2E+02																								
VOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.0005	0.005	NE	NE	7.1E+01																								
VOLATILES	1,3-Dichloropropane	8.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00																								
VOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.0005	0.005	NE	NE	7.5E+00																								
VOLATILES	2,2-Dichloropropane	2.4E+01	4.2E+00	0.0005	0.005	NE	NE	4.2E+00																								
VOLATILES	2-Butanone	4.2E+04	6.1E+03	0.0025	0.010	NE	NE	6.1E+03																								
VOLATILES	2-Chloroethyl vinyl ether	3.0E+00	2.6E-01	0.0020	0.010	NE	NE	2.6E-01																								
VOLATILES	2-Chlorotoluene	3.5E+03	2.0E+02	0.0005	0.005	NE	NE	2.0E+02																								
VOLATILES	2-Hexanone	8.7E+01	6.1E+02	0.0025	0.010	NE	NE	8.7E+01																								
VOLATILES	4-Chlorotoluene	4.8E+00	2.0E+02	0.0005	0.005	NE	NE	4.8E+00																								
VOLATILES	Acetone	2.5E+03	9.2E+03	0.0050	0.010	NE	NE	2.5E+03																								
VOLATILES	Benzene	1.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																								
VOLATILES	Bromobenzene	1.6E+02	2.0E+02	0.0005	0.005	NE	NE	1.6E+02																								
VOLATILES	Bromochloromethane	3.4E+02	4.1E+02	0.0005	0.005	NE	NE	3.4E+02																								
VOLATILES	Bromodichloromethane	9.2E+01	4.6E-01	0.0005	0.005	NE	NE	4.6E-01																								
VOLATILES	Bromoform	8.5E+01	3.6E+00	0.0005	0.005	NE	NE	3.6E+00																								
VOLATILES	Bromomethane	4.9E+00	1.4E+01	0.0010	0.010	NE	NE	4.9E+00																								
VOLATILES	Carbon disulfide	1.5E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																								
VOLATILES	Carbon tetrachloride	6.3E-01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																								
VOLATILES	Chlorobenzene	5.9E+02	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																								
VOLATILES	Chloroethane	1.7E+04	4.1E+03	0.0010	0.010	NE	NE	4.1E+03																								
VOLATILES	Chloroform	5.2E-01	1.0E+02	0.0005	0.005	NE	NE	5.2E-01																								
VOLATILES	Chloromethane	3.8E+00	2.2E+01	0.0020	0.010	NE	NE	3.8E+00																								
VOLATILES	cis-1,2-Dichloroethene	2.5E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00																								
VOLATILES	cis-1,3-Dichloropropene	3.4E+01	5.3E-01	0.0005	0.005	NE	NE	5.3E-01																								
VOLATILES	Dibromochloromethane	6.8E+02	3.4E+00	0.0005	0.005	NE	NE	3.4E+00																								
VOLATILES	Dibromomethane	2.7E+02	3.8E+01	0.0005	0.005	NE	NE	3.8E+01																								
VOLATILES	Dichlorodifluoromethane	3.1E+03	2.0E+03	0.0010	0.010	NE	NE	2.0E+03																								
VOLATILES	Ethylbenzene	6.9E+03	7.0E+01	0.0005	0.005	NE	NE	7.0E+01																								
VOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.0005	0.005	NE	NE	2.0E+00																								
VOLATILES	Isopropylbenzene	9.0E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																								
VOLATILES	m,p-Xylenes [e]	3.3E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																								
VOLATILES	Methyl isobutyl ketone	3.5E+04	8.2E+02	0.0025	0.010	NE	NE	8.2E+02																								
VOLATILES	Methylene chloride	1.6E+01	5.0E-01	0.0010	0.005	NE	NE	5.0E-01																								
VOLATILES	Naphthalene	2.7E+02	2.0E+02	0.0005	0.010	NE	NE	2.0E+02																								
VOLATILES	n-BUTYLBENZENE	5.7E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																								
VOLATILES	n-PROPYLBENZENE	5.9E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																								
VOLATILES	p-ISOPROPYLTOLUENE	6.7E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																								
VOLATILES	sec-BUTYLBENZENE	5.4E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																								
VOLATILES	Styrene	2.3E+04	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																								
VOLATILES	tert-BUTYLBENZENE	4.5E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																								
VOLATILES	Tetrachloroethene	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																								
VOLATILES	Toluene	2.5E+04	1.0E+02	0.0005	0.005	NE	NE	1.0E+02																								
VOLATILES	trans-1,2-Dichloroethene	2.4E+03	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																								
VOLATILES	trans-1,3-Dichloropropene	4.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00																								
VOLATILES	Trichloroethene	6.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																								
VOLATILES	Trichlorofluoromethane	3.8E+03	3.1E+03	0.0010	0.010	NE	NE	3.1E+03																								

Table 3-1a
Comparison of Chemical Concentrations in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB14				03SB14				03SB14				03SB15				03SB15				03SB15			
	SAMPLE_NO					Background			03SB14-(0-0_5)				03SB14-(3-4)				03SB14-(6-7)				03SB15-(0-0_5)				03SB15-(3-4)				03SB15-(6-7)			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
VOLATILES	Vinyl acetate	8.0E+02	1.0E+04	0.0010	0.010	NE	NE	8.0E+02																								
VOLATILES	Vinyl chloride	6.6E-02	2.0E-01	0.0010	0.010	NE	NE	6.6E-02																								

Notes and Abbreviations:

Shading in column indicates SDL values that exceed the Applicable MSC.

Concentration exceeds Applicable MSC.

[a] Value provided by the Texas Commission on Environmental Quality (TCEQ) as updated through March 2006 available on the TCEQ website at http://www.tceq.state.tx.us/remediation/rrr.html.

[b] Lower of surface and subsurface soil background concentrations used in these comparisons

[c] Shading in column indicates Applicable MSC equal to MQL for the chemical as provided in 30TAC§335.

[d] Where Applicable MSC is equal to MQL, value equals the SDL, which is the MDL adjusted for sample specific analytical factors.

[e] MSC value shown is for m-xylene, the more conservative of m- and p-xylene isomers.

95% UPL - 95% Upper Prediction Limit of background concentration calculated as described in TCEQ correspondence.
FD - field duplicate sample
H - estimate is high
J - Estimated value. Chemical was detected above the method detection limit but below the MQL.
L - estimate is low
NE - value not established
R - data rejected
REG - regular sample
U - compound validated as not detected above MDL shown

Table 3-1b
Comparison of Chemical Concentration in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB16			03SB16			03SB16			03SB16			03SB16		
	SAMPLE_NO					Background			03SB16-(0-0_5)			03SB16-(0-0_5)-QA			03SB16-(3-4)			03SB16-(6-7)			03SB16-(6-7)-QA		
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	17-Dec-07			17-Dec-07			17-Dec-07			17-Dec-07			17-Dec-07		
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-.5 Ft			0-.5 Ft			3-4 Ft			6-7 Ft			6-7 Ft		
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG			FD			REG			REG			FD		
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result DF	LQ	VQ	Result DF	LQ	VQ	Result DF	LQ	VQ	Result DF	LQ	VQ	Result DF	LQ	VQ
METALS	Aluminum	1.0E+06	1.0E+04	10	20	1.63E+04	2.08E+04	1.6E+04	6840 1			9580 1			6760 1			7170 1			9680 1		
METALS	Antimony	4.9E+02	6.0E-01	0.05	0.1	9.40E-01	1.60E+00	9.4E-01	0.626 10		U	0.593 10	U	U	0.604 10	U	U	0.620 10	U	U	0.591 10	U	U
METALS	Arsenic	2.0E+02	1.0E+00	0.075	0.3	4.81E+00	5.54E+00	4.8E+00	2.030 10	U	J	4.340 10			1.510 10	J	J	2.650 10	J	J	2.840 10	J	J
METALS	Barium	1.7E+05	2.0E+02	0.1	0.5	1.52E+02	8.55E+01	2.0E+02	81.30 1	J		77.50 1			88.70 1			27.9 1			29.30 1		
METALS	Beryllium	2.7E+02	4.0E-01	0.012	0.5	6.45E-01	7.66E-01	6.5E-01	0.500 1			0.486 1			0.452 1			0.161 1	J	J	0.261 1	J	J
METALS	Cadmium	1.5E+03	5.0E-01	0.05	0.5	1.40E+00	4.00E-01	5.0E-01	0.313 10		U	0.593 10	U	U	0.614 10	U	U	0.639 10	U	U	0.592 10	U	U
METALS	Calcium	NE	NE	NA	NA	NA	NA	--	1110 1	U	J	1920 1			968 1		J	357 1			445 1		
METALS	Chromium	3.5E+05	1.0E+01	0.12	1	2.66E+01	3.01E+01	2.7E+01	8.23 10		J	17.70 10			7.58 10		J	7.440 10			10.80 10		
METALS	Cobalt	1.1E+05	6.1E+02	0.12	1	7.23E+00	5.61E+00	6.1E+02	4.630 1			4.760 1			4.470 1			1.330 1			1.580 1		
METALS	Copper	7.4E+04	1.3E+02	0.5	1	5.55E+00	9.25E+00	1.3E+02	3.16 1			3.84 1			3.36 1			2.390 1			3.19 1		
METALS	Iron	NE	NE	NA	NA	NA	NA	--	7330 1			8800 1			7890 1			9140 1		J	15400 1		J
METALS	Lead	1.0E+03	1.5E+00	0.1	0.2	2.26E+01	1.14E+01	1.1E+01	7.31 10			8.83 10			5.76 10			6.200 10			7.39 10		
METALS	Magnesium	NE	NE	NA	NA	NA	NA	--	291 1			436 1			284 1			281 1			365 1		
METALS	Manganese	1.1E+05	1.4E+03	0.1	0.5	1.25E+03	2.01E+02	1.4E+03	102 1		J	197 1			162 1		J	37.90 1			33 1		
METALS	Mercury	1.5E-01	2.0E-01	0.01	0.25	8.19E-02	3.60E-01	2.5E-01	0.0128 1		J	0.0146 1	J	J	0.0131 1	J	J	0.016 1	J	J	0.0140 1	J	J
METALS	Nickel	1.2E+04	2.0E+02	0.5	2	6.98E+00	1.16E+01	2.0E+02	4.64 1	J		5.79 1			4.59 1			2.550 1			3.87 1		
METALS	Potassium	NE	NE	NA	NA	NA	NA	--	309 1			476 1			301 1			280 1			399 1		
METALS	Selenium	9.3E+03	5.0E+00	0.1	0.2	3.48E+00	5.57E+00	5.0E+00	1.250 10		U	1.190 10	U	U	1.210 10	U	U	1.240 10	U	U	1.180 10	U	U
METALS	Silver	2.9E+03	5.1E+01	0.25	2	3.10E-01	3.70E-01	5.1E+01	0.239 1	U	U	0.225 1	U	U	0.221 1	U	U	0.242 1	J	J	0.227 1	J	J
METALS	Sodium	NE	NE	NA	NA	NA	NA	--	28.9 1	U		45.1 1			39.4 1			43.50 1			46.6 1		
METALS	Thallium	1.5E+02	2.0E-01	0.01	0.02	4.70E-01	NE	4.7E-01	0.1250 10		U	0.1190 10	U	U	0.1210 10	U	U	0.124 10	U	U	0.1180 10	U	U
METALS	Vanadium	3.0E+03	7.2E+01	0.25	0.5	3.21E+01	4.46E+01	7.2E+01	15.3 1	U		18.5 1			17.7 1			19.70 1			32.1 1		
METALS	Zinc	4.1E+05	3.1E+03	0.5	1	6.16E+01	2.02E+01	3.1E+03	9.85 1			13.60 1			10.40 1			9.11 1			13.80 1		
SEMIVOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.083	0.165	NE	NE	7.0E+00															
SEMIVOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.083	0.165	NE	NE	6.0E+01															
SEMIVOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.083	0.165	NE	NE	7.1E+01															
SEMIVOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.083	0.165	NE	NE	7.5E+00															
SEMIVOLATILES	2,4,5-Trichlorophenol	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03															
SEMIVOLATILES	2,4,6-Trichlorophenol	2.6E+02	2.6E+00	0.083	0.165	NE	NE	2.6E+00															
SEMIVOLATILES	2,4-Dichlorophenol	3.1E+03	3.1E+01	0.083	0.165	NE	NE	3.1E+01															
SEMIVOLATILES	2,4-Dimethylphenol	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02															
SEMIVOLATILES	2,4-Dinitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01															
SEMIVOLATILES	2,4-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01															
SEMIVOLATILES	2,6-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01															
SEMIVOLATILES	2-Chloronaphthalene	7.1E+04	8.2E+02	0.083	0.165	NE	NE	8.2E+02															
SEMIVOLATILES	2-Chlorophenol	4.0E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01															
SEMIVOLATILES	2-Methylnaphthalene	3.6E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01															
SEMIVOLATILES	2-Methylphenol	5.1E+04	5.1E+02	0.083	0.165	NE	NE	5.1E+02															
SEMIVOLATILES	2-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00															
SEMIVOLATILES	2-Nitrophenol	2.0E+03	3.1E+00	0.083	0.165	NE	NE	3.1E+00															
SEMIVOLATILES	3,3'-Dichlorobenzidine	6.4E+00	6.4E-02	0.165	0.330	NE	NE	3.3E-01															
SEMIVOLATILES	3-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00															
SEMIVOLATILES	4,6-Dinitro-2-methylphenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01															
SEMIVOLATILES	4-Bromophenyl phenyl ether	1.6E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01															
SEMIVOLATILES	4-Chloro-3-methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01															
SEMIVOLATILES	4-Chloroaniline	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01															
SEMIVOLATILES	4-Chlorophenyl phenyl ether	1.2E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01															
SEMIVOLATILES	4-Methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01															
SEMIVOLATILES	4-Nitroaniline	7.5E+02	7.5E+00	0.330	0.825	NE	NE	7.5E+00															
SEMIVOLATILES	4-Nitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01															

Table 3-1b
Comparison of Chemical Concentration in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB17				03SB17				03SB17				03SB11-(10-11)				03SB11-(BOTTOM)			
	SAMPLE_NO					Background			03SB17-(0-0_5)				03SB17-(3-4)				03SB17-(6-7)				03SB11-111808				03SB11-111808			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	17-Dec-07				17-Dec-07				17-Dec-07				18-Nov-08				18-Nov-08			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-.5 Ft				3-4 Ft				6-7 Ft				10-11				14-15			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ
METALS	Aluminum	1.0E+06	1.0E+04	10	20	1.63E+04	2.08E+04	1.6E+04	4770	1			7480	1			6610	1			7080	1			4740	1		
METALS	Antimony	4.9E+02	6.0E-01	0.05	0.1	9.40E-01	1.60E+00	9.4E-01	0.587	10	U	U	0.712	10	U	U	0.592	10	U	U	0.414	1	U	U	0.427	1	U	U
METALS	Arsenic	2.0E+02	1.0E+00	0.075	0.3	4.81E+00	5.54E+00	4.8E+00	2.250	10	J	J	1.960	10	J	J	0.887	10	U	U	2.190	1			0.219	1	J	J
METALS	Barium	1.7E+05	2.0E+02	0.1	0.5	1.52E+02	8.55E+01	2.0E+02	67.60	1			31.60	1			50.60	1			29.40	1			32.80	1		
METALS	Beryllium	2.7E+02	4.0E-01	0.012	0.5	6.45E-01	7.66E-01	6.5E-01	0.390	1	J	J	0.466	1	J	J	0.378	1	J	J	0.341	1	J	J	0.226	1	J	J
METALS	Cadmium	1.5E+03	5.0E-01	0.05	0.5	1.40E+00	4.00E-01	5.0E-01	0.597	10	U	U	0.725	10	U	U	0.602	10	U	U	0.050	1	U	U	0.125	1	J	J
METALS	Calcium	NE	NE	NA	NA	NA	NA	--	1330	1			1280	1			1060	1			718	1			1830	1		
METALS	Chromium	3.5E+05	1.0E+01	0.12	1	2.66E+01	3.01E+01	2.7E+01	13.10	10			12.20	10			5.73	10			9.11	1			6.00	1		
METALS	Cobalt	1.1E+05	6.1E+02	0.12	1	7.23E+00	5.61E+00	6.1E+02	3.270	1			2.840	1			2.300	1			1.500	1			13.100	1		
METALS	Copper	7.4E+04	1.3E+02	0.5	1	5.55E+00	9.25E+00	1.3E+02	3.08	1			3.56	1			3.05	1			3.91	1			3.09	1		
METALS	Iron	NE	NE	NA	NA	NA	NA	--	8870	1		J	7780	1		J	6090	1		J	7800	1			2090	1		
METALS	Lead	1.0E+03	1.5E+00	0.1	0.2	2.26E+01	1.14E+01	1.1E+01	42.20	10			18.20	10			8.40	10			4.15	1			4.39	1		
METALS	Magnesium	NE	NE	NA	NA	NA	NA	--	265	1			748	1			646	1			862	1			1680	1		
METALS	Manganese	1.1E+05	1.4E+03	0.1	0.5	1.25E+03	2.01E+02	1.4E+03	238	1			18	1			13	1			33	1			24	1		
METALS	Mercury	1.5E-01	2.0E-01	0.01	0.25	8.19E-02	3.60E-01	2.5E-01	0.0402	1	J	J	0.0145	1	U	U	0.0120	1	U	U	0.0100	1	U	U	0.0100	1	U	U
METALS	Nickel	1.2E+04	2.0E+02	0.5	2	6.98E+00	1.16E+01	2.0E+02	3.55	1			4.10	1			3.36	1			7.22	1			14.80	1		
METALS	Potassium	NE	NE	NA	NA	NA	NA	--	184	1			174	1			171	1			588	1			364	1		
METALS	Selenium	9.3E+03	5.0E+00	0.1	0.2	3.48E+00	5.57E+00	5.0E+00	1.310	10	J	J	1.420	10	U	U	1.180	10	U	U	0.206	1	J	J	0.209	1	J	J
METALS	Silver	2.9E+03	5.1E+01	0.25	2	3.10E-01	3.70E-01	5.1E+01	0.292	1	J	J	0.255	1	U	U	0.228	1	U	U	0.209	1	J	J	0.213	1	U	U
METALS	Sodium	NE	NE	NA	NA	NA	NA	--	53.9	1			351.0	1			348.0	1			331.0	1			418.0	1		
METALS	Thallium	1.5E+02	2.0E-01	0.01	0.02	4.70E-01	NE	4.7E-01	0.1170	10	U	U	0.1420	10	U	U	0.1180	10	U	U	0.0730	1			0.1230	1		
METALS	Vanadium	3.0E+03	7.2E+01	0.25	0.5	3.21E+01	4.46E+01	7.2E+01	21.8	1			11.9	1			9.2	1			14.3	1			3.1	1		
METALS	Zinc	4.1E+05	3.1E+03	0.5	1	6.16E+01	2.02E+01	3.1E+03	38.70	1			9.55	1			8.51	1			16.70	1			22.00	1		
SEMIVOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.083	0.165	NE	NE	7.0E+00																				
SEMIVOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.083	0.165	NE	NE	6.0E+01																				
SEMIVOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.083	0.165	NE	NE	7.1E+01																				
SEMIVOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.083	0.165	NE	NE	7.5E+00																				
SEMIVOLATILES	2,4,5-Trichlorophenol	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03																				
SEMIVOLATILES	2,4,6-Trichlorophenol	2.6E+02	2.6E+00	0.083	0.165	NE	NE	2.6E+00																				
SEMIVOLATILES	2,4-Dichlorophenol	3.1E+03	3.1E+01	0.083	0.165	NE	NE	3.1E+01																				
SEMIVOLATILES	2,4-Dimethylphenol	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02																				
SEMIVOLATILES	2,4-Dinitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																				
SEMIVOLATILES	2,4-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	2,6-Dinitrotoluene	4.2E+00	4.2E-02	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	2-Chloronaphthalene	7.1E+04	8.2E+02	0.083	0.165	NE	NE	8.2E+02																				
SEMIVOLATILES	2-Chlorophenol	4.0E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																				
SEMIVOLATILES	2-Methylnaphthalene	3.6E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																				
SEMIVOLATILES	2-Methylphenol	5.1E+04	5.1E+02	0.083	0.165	NE	NE	5.1E+02																				
SEMIVOLATILES	2-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00																				
SEMIVOLATILES	2-Nitrophenol	2.0E+03	3.1E+00	0.083	0.165	NE	NE	3.1E+00																				
SEMIVOLATILES	3,3'-Dichlorobenzidine	6.4E+00	6.4E-02	0.165	0.330	NE	NE	3.3E-01																				
SEMIVOLATILES	3-Nitroaniline	3.1E+02	3.1E+00	0.330	0.825	NE	NE	3.1E+00																				
SEMIVOLATILES	4,6-Dinitro-2-methylphenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																				
SEMIVOLATILES	4-Bromophenyl phenyl ether	1.6E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	4-Chloro-3-methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																				
SEMIVOLATILES	4-Chloroaniline	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																				
SEMIVOLATILES	4-Chlorophenyl phenyl ether	1.2E+00	1.9E-02	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	4-Methylphenol	5.1E+03	5.1E+01	0.083	0.165	NE	NE	5.1E+01																				
SEMIVOLATILES	4-Nitroaniline	7.5E+02	7.5E+00	0.330	0.825	NE	NE	7.5E+00																				
SEMIVOLATILES	4-Nitrophenol	2.0E+03	2.0E+01	0.330	0.825	NE	NE	2.0E+01																				

Table 3-1b
Comparison of Chemical Concentration in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB16			03SB16			03SB16			03SB16			03SB16		
	SAMPLE_NO					Background			03SB16-(0-0_5)			03SB16-(0-0_5)-QA			03SB16-(3-4)			03SB16-(6-7)			03SB16-(6-7)-QA		
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	17-Dec-07			17-Dec-07			17-Dec-07			17-Dec-07			17-Dec-07		
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-.5 Ft			0-.5 Ft			3-4 Ft			6-7 Ft			6-7 Ft		
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG			FD			REG			REG			FD		
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ
SEMIVOLATILES	Acenaphthene	3.0E+01	6.1E+02	0.083	0.165	NE	NE	3.0E+01																				
SEMIVOLATILES	Acenaphthylene	5.3E+04	6.1E+02	0.083	0.165	NE	NE	6.1E+02																				
SEMIVOLATILES	Anthracene	2.7E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																				
SEMIVOLATILES	Benzo(a)anthracene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01																				
SEMIVOLATILES	Benzo(a)pyrene	3.4E-01	2.0E-02	0.083	0.165	1.54E-02	NE	1.7E-01																				
SEMIVOLATILES	Benzo(b)fluoranthene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01																				
SEMIVOLATILES	Benzo(ghi)perylene	2.7E+04	3.1E+02	0.083	0.165	1.23E-02	NE	3.1E+02																				
SEMIVOLATILES	Benzo(k)fluoranthene	3.4E+01	3.9E-01	0.083	0.165	1.30E-02	NE	3.9E-01																				
SEMIVOLATILES	Benzoic Acid	4.1E+06	4.1E+04	0.330	0.825	NE	NE	4.1E+04																				
SEMIVOLATILES	Benzyl Alcohol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																				
SEMIVOLATILES	bis(2-Chloroethoxy)methane	9.0E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	bis(2-Chloroethyl)ether	3.2E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	bis(2-Chloroisopropyl)ether	1.5E+02	4.1E+00	0.083	0.165	NE	NE	4.1E+00																				
SEMIVOLATILES	bis(2-Ethylhexyl)phthalate	6.5E+01	6.0E-01	0.083	0.165	NE	NE	6.0E-01																				
SEMIVOLATILES	Butyl benzyl phthalate	2.0E+05	2.0E+03	0.083	0.165	NE	NE	2.0E+03																				
SEMIVOLATILES	Chrysene	3.4E+02	3.9E+00	0.083	0.165	1.51E-02	NE	3.9E+00																				
SEMIVOLATILES	Dibenzo(a,h)anthracene	3.4E-01	2.0E-02	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	Dibenzofuran	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																				
SEMIVOLATILES	Diethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03																				
SEMIVOLATILES	Dimethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03																				
SEMIVOLATILES	di-n-Butyl phthalate	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03																				
SEMIVOLATILES	di-n-Octyl phthalate	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02																				
SEMIVOLATILES	Fluoranthene	3.6E+04	4.1E+02	0.083	0.165	2.29E-02	NE	4.1E+02																				
SEMIVOLATILES	Fluorene	3.6E+04	4.1E+02	0.083	0.165	NE	NE	4.1E+02																				
SEMIVOLATILES	Hexachlorobenzene	1.0E+00	1.0E-01	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.083	0.165	NE	NE	2.0E+00																				
SEMIVOLATILES	Hexachlorocyclopentadiene	1.4E+01	5.0E+00	0.083	0.165	NE	NE	5.0E+00																				
SEMIVOLATILES	Hexachloroethane	7.5E+02	1.0E+01	0.083	0.165	NE	NE	1.0E+01																				
SEMIVOLATILES	Indeno(1,2,3-cd)pyrene	3.4E+00	3.9E-02	0.083	0.165	1.43E-02	NE	1.7E-01																				
SEMIVOLATILES	Isophorone	3.0E+04	3.0E+02	0.083	0.165	NE	NE	3.0E+02																				
SEMIVOLATILES	Naphthalene	2.7E+02	2.0E+02	0.083	0.165	NE	NE	2.0E+02																				
SEMIVOLATILES	Nitrobenzene	2.7E+02	5.1E+00	0.083	0.165	NE	NE	5.1E+00																				
SEMIVOLATILES	n-Nitroso-di-n-propylamine	1.6E-01	4.1E-03	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	n-Nitrosodiphenylamine	2.3E+02	5.8E+00	0.083	0.165	NE	NE	5.8E+00																				
SEMIVOLATILES	Pentachlorophenol	1.4E+01	1.0E-01	0.330	0.825	NE	NE	8.3E-01																				
SEMIVOLATILES	Phenanthrene	2.7E+04	3.1E+02	0.083	0.165	NE	NE	3.1E+02																				
SEMIVOLATILES	Phenol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																				
SEMIVOLATILES	Pyrene	2.7E+04	3.1E+02	0.083	0.165	1.94E-02	NE	3.1E+02																				
SOLIDS	Percent Solids	NE	NE	NE	NE	NE	NE	--	79.9	1			84.3	1			81.4	1			78.2	1			84.5	1		
VOLATILES	1,1,1,2-Tetrachloroethane	1.1E+02	1.1E+01	0.0005	0.005	NE	NE	1.1E+01																				
VOLATILES	1,1,1-Trichloroethane	3.4E+03	2.0E+01	0.0005	0.005	NE	NE	2.0E+01																				
VOLATILES	1,1,2,2-Tetrachloroethane	9.8E+00	1.4E+00	0.0005	0.005	NE	NE	1.4E+00																				
VOLATILES	1,1,2-Trichloroethane	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																				
VOLATILES	1,1-Dichloroethane	1.3E+03	1.0E+03	0.0010	0.005	NE	NE	1.0E+03																				
VOLATILES	1,1-Dichloroethene	3.8E+02	7.0E-01	0.0005	0.005	NE	NE	7.0E-01																				
VOLATILES	1,1-Dichloropropene	1.9E+00	2.9E-01	0.0005	0.005	NE	NE	2.9E-01																				
VOLATILES	1,2,3-Trichlorobenzene	2.0E+03	3.1E+01	0.0005	0.005	NE	NE	3.1E+01																				
VOLATILES	1,2,3-Trichloropropane	8.2E-01	4.1E-03	0.0010	0.005	NE	NE	5.0E-03																				
VOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00																				
VOLATILES	1,2,4-Trimethylbenzene	1.4E+02	5.1E+02	0.0005	0.005	NE	NE	1.4E+02																				

Table 3-1b
Comparison of Chemical Concentration in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB17				03SB17				03SB17				03SB11-(10-11)				03SB11-(BOTTOM)			
	SAMPLE_NO					Background			03SB17-(0-0_5)				03SB17-(3-4)				03SB17-(6-7)				03SB11-111808				03SB11-111808			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	17-Dec-07				17-Dec-07				17-Dec-07				18-Nov-08				18-Nov-08			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-.5 Ft				3-4 Ft				6-7 Ft				10-11				14-15			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ
SEMIVOLATILES	Acenaphthene	3.0E+01	6.1E+02	0.083	0.165	NE	NE	3.0E+01																				
SEMIVOLATILES	Acenaphthylene	5.3E+04	6.1E+02	0.083	0.165	NE	NE	6.1E+02																				
SEMIVOLATILES	Anthracene	2.7E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																				
SEMIVOLATILES	Benzo(a)anthracene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01																				
SEMIVOLATILES	Benzo(a)pyrene	3.4E-01	2.0E-02	0.083	0.165	1.54E-02	NE	1.7E-01																				
SEMIVOLATILES	Benzo(b)fluoranthene	3.4E+00	3.9E-02	0.083	0.165	1.53E-02	NE	1.7E-01																				
SEMIVOLATILES	Benzo(ghi)perylene	2.7E+04	3.1E+02	0.083	0.165	1.23E-02	NE	3.1E+02																				
SEMIVOLATILES	Benzo(k)fluoranthene	3.4E+01	3.9E-01	0.083	0.165	1.30E-02	NE	3.9E-01																				
SEMIVOLATILES	Benzoic Acid	4.1E+06	4.1E+04	0.330	0.825	NE	NE	4.1E+04																				
SEMIVOLATILES	Benzyl Alcohol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																				
SEMIVOLATILES	bis(2-Chloroethoxy)methane	9.0E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	bis(2-Chloroethyl)ether	3.2E-01	2.6E-02	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	bis(2-Chloroisopropyl)ether	1.5E+02	4.1E+00	0.083	0.165	NE	NE	4.1E+00																				
SEMIVOLATILES	bis(2-Ethylhexyl)phthalate	6.5E+01	6.0E-01	0.083	0.165	NE	NE	6.0E-01																				
SEMIVOLATILES	Butyl benzyl phthalate	2.0E+05	2.0E+03	0.083	0.165	NE	NE	2.0E+03																				
SEMIVOLATILES	Chrysene	3.4E+02	3.9E+00	0.083	0.165	1.51E-02	NE	3.9E+00																				
SEMIVOLATILES	Dibenzo(a,h)anthracene	3.4E-01	2.0E-02	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	Dibenzofuran	4.1E+03	4.1E+01	0.083	0.165	NE	NE	4.1E+01																				
SEMIVOLATILES	Diethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03																				
SEMIVOLATILES	Dimethyl phthalate	8.2E+05	8.2E+03	0.083	0.165	NE	NE	8.2E+03																				
SEMIVOLATILES	di-n-Butyl phthalate	1.0E+05	1.0E+03	0.083	0.165	NE	NE	1.0E+03																				
SEMIVOLATILES	di-n-Octyl phthalate	2.0E+04	2.0E+02	0.083	0.165	NE	NE	2.0E+02																				
SEMIVOLATILES	Fluoranthene	3.6E+04	4.1E+02	0.083	0.165	2.29E-02	NE	4.1E+02																				
SEMIVOLATILES	Fluorene	3.6E+04	4.1E+02	0.083	0.165	NE	NE	4.1E+02																				
SEMIVOLATILES	Hexachlorobenzene	1.0E+00	1.0E-01	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.083	0.165	NE	NE	2.0E+00																				
SEMIVOLATILES	Hexachlorocyclopentadiene	1.4E+01	5.0E+00	0.083	0.165	NE	NE	5.0E+00																				
SEMIVOLATILES	Hexachloroethane	7.5E+02	1.0E+01	0.083	0.165	NE	NE	1.0E+01																				
SEMIVOLATILES	Indeno(1,2,3-cd)pyrene	3.4E+00	3.9E-02	0.083	0.165	1.43E-02	NE	1.7E-01																				
SEMIVOLATILES	Isophorone	3.0E+04	3.0E+02	0.083	0.165	NE	NE	3.0E+02																				
SEMIVOLATILES	Naphthalene	2.7E+02	2.0E+02	0.083	0.165	NE	NE	2.0E+02																				
SEMIVOLATILES	Nitrobenzene	2.7E+02	5.1E+00	0.083	0.165	NE	NE	5.1E+00																				
SEMIVOLATILES	n-Nitroso-di-n-propylamine	1.6E-01	4.1E-03	0.083	0.165	NE	NE	1.7E-01																				
SEMIVOLATILES	n-Nitrosodiphenylamine	2.3E+02	5.8E+00	0.083	0.165	NE	NE	5.8E+00																				
SEMIVOLATILES	Pentachlorophenol	1.4E+01	1.0E-01	0.330	0.825	NE	NE	8.3E-01																				
SEMIVOLATILES	Phenanthrene	2.7E+04	3.1E+02	0.083	0.165	NE	NE	3.1E+02																				
SEMIVOLATILES	Phenol	3.1E+05	3.1E+03	0.083	0.165	NE	NE	3.1E+03																				
SEMIVOLATILES	Pyrene	2.7E+04	3.1E+02	0.083	0.165	1.94E-02	NE	3.1E+02																				
SOLIDS	Percent Solids	NE	NE	NE	NE	NE	NE	--	83.8	1			69	1			83	1		1	100	1			100	1		
VOLATILES	1,1,1,2-Tetrachloroethane	1.1E+02	1.1E+01	0.0005	0.005	NE	NE	1.1E+01																				
VOLATILES	1,1,1-Trichloroethane	3.4E+03	2.0E+01	0.0005	0.005	NE	NE	2.0E+01																				
VOLATILES	1,1,2,2-Tetrachloroethane	9.8E+00	1.4E+00	0.0005	0.005	NE	NE	1.4E+00																				
VOLATILES	1,1,2-Trichloroethane	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																				
VOLATILES	1,1-Dichloroethane	1.3E+03	1.0E+03	0.0010	0.005	NE	NE	1.0E+03																				
VOLATILES	1,1-Dichloroethene	3.8E+02	7.0E-01	0.0005	0.005	NE	NE	7.0E-01																				
VOLATILES	1,1-Dichloropropene	1.9E+00	2.9E-01	0.0005	0.005	NE	NE	2.9E-01																				
VOLATILES	1,2,3-Trichlorobenzene	2.0E+03	3.1E+01	0.0005	0.005	NE	NE	3.1E+01																				
VOLATILES	1,2,3-Trichloropropane	8.2E-01	4.1E-03	0.0010	0.005	NE	NE	5.0E-03																				
VOLATILES	1,2,4-Trichlorobenzene	6.1E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00																				
VOLATILES	1,2,4-Trimethylbenzene	1.4E+02	5.1E+02	0.0005	0.005	NE	NE	1.4E+02																				

Table 3-1b
Comparison of Chemical Concentration in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB16				03SB16				03SB16				03SB16				03SB16			
	SAMPLE_NO					Background			03SB16-(0-0_5)				03SB16-(0-0_5)-QA				03SB16-(3-4)				03SB16-(6-7)				03SB16-(6-7)-QA			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-.5 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				6-7 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				FD				REG				REG				FD			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ
VOLATILES	1,2-Dibromo-3-chloropropane	2.0E+00	2.0E-02	0.0020	0.005	NE	NE	2.0E-02																				
VOLATILES	1,2-Dibromoethane	1.0E-01	5.0E-03	0.0005	0.005	NE	NE	5.0E-03																				
VOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.0005	0.005	NE	NE	6.0E+01																				
VOLATILES	1,2-Dichloroethane	4.7E-01	5.0E-01	0.0005	0.005	NE	NE	4.7E-01																				
VOLATILES	1,2-Dichloropropane	2.5E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																				
VOLATILES	1,2-Dimethylbenzene (o-Xylene	4.8E+04	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																				
VOLATILES	1,3,5-Trimethylbenzene	1.2E+02	5.1E+02	0.0005	0.005	NE	NE	1.2E+02																				
VOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.0005	0.005	NE	NE	7.1E+01																				
VOLATILES	1,3-Dichloropropane	8.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00																				
VOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.0005	0.005	NE	NE	7.5E+00																				
VOLATILES	2,2-Dichloropropane	2.4E+01	4.2E+00	0.0005	0.005	NE	NE	4.2E+00																				
VOLATILES	2-Butanone	4.2E+04	6.1E+03	0.0025	0.010	NE	NE	6.1E+03																				
VOLATILES	2-Chloroethyl vinyl ether	3.0E+00	2.6E-01	0.0020	0.010	NE	NE	2.6E-01																				
VOLATILES	2-Chlorotoluene	3.5E+03	2.0E+02	0.0005	0.005	NE	NE	2.0E+02																				
VOLATILES	2-Hexanone	8.7E+01	6.1E+02	0.0025	0.010	NE	NE	8.7E+01																				
VOLATILES	4-Chlorotoluene	4.8E+00	2.0E+02	0.0005	0.005	NE	NE	4.8E+00																				
VOLATILES	Acetone	2.5E+03	9.2E+03	0.0050	0.010	NE	NE	2.5E+03																				
VOLATILES	Benzene	1.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																				
VOLATILES	Bromobenzene	1.6E+02	2.0E+02	0.0005	0.005	NE	NE	1.6E+02																				
VOLATILES	Bromochloromethane	3.4E+02	4.1E+02	0.0005	0.005	NE	NE	3.4E+02																				
VOLATILES	Bromodichloromethane	9.2E+01	4.6E-01	0.0005	0.005	NE	NE	4.6E-01																				
VOLATILES	Bromoform	8.5E+01	3.6E+00	0.0005	0.005	NE	NE	3.6E+00																				
VOLATILES	Bromomethane	4.9E+00	1.4E+01	0.0010	0.010	NE	NE	4.9E+00																				
VOLATILES	Carbon disulfide	1.5E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																				
VOLATILES	Carbon tetrachloride	6.3E-01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																				
VOLATILES	Chlorobenzene	5.9E+02	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																				
VOLATILES	Chloroethane	1.7E+04	4.1E+03	0.0010	0.010	NE	NE	4.1E+03																				
VOLATILES	Chloroform	5.2E-01	1.0E+02	0.0005	0.005	NE	NE	5.2E-01																				
VOLATILES	Chloromethane	3.8E+00	2.2E+01	0.0020	0.010	NE	NE	3.8E+00																				
VOLATILES	cis-1,2-Dichloroethene	2.5E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00																				
VOLATILES	cis-1,3-Dichloropropene	3.4E+01	5.3E-01	0.0005	0.005	NE	NE	5.3E-01																				
VOLATILES	Dibromochloromethane	6.8E+02	3.4E+00	0.0005	0.005	NE	NE	3.4E+00																				
VOLATILES	Dibromomethane	2.7E+02	3.8E+01	0.0005	0.005	NE	NE	3.8E+01																				
VOLATILES	Dichlorodifluoromethane	3.1E+03	2.0E+03	0.0010	0.010	NE	NE	2.0E+03																				
VOLATILES	Ethylbenzene	6.9E+03	7.0E+01	0.0005	0.005	NE	NE	7.0E+01																				
VOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.0005	0.005	NE	NE	2.0E+00																				
VOLATILES	Isopropylbenzene	9.0E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																				
VOLATILES	m,p-Xylenes [e]	3.3E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																				
VOLATILES	Methyl isobutyl ketone	3.5E+04	8.2E+02	0.0025	0.010	NE	NE	8.2E+02																				
VOLATILES	Methylene chloride	1.6E+01	5.0E-01	0.0010	0.005	NE	NE	5.0E-01																				
VOLATILES	Naphthalene	2.7E+02	2.0E+02	0.0005	0.010	NE	NE	2.0E+02																				
VOLATILES	n-BUTYLBENZENE	5.7E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																				
VOLATILES	n-PROPYLBENZENE	5.9E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																				
VOLATILES	p-ISOPROPYLTOLUENE	6.7E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																				
VOLATILES	sec-BUTYLBENZENE	5.4E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																				
VOLATILES	Styrene	2.3E+04	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																				
VOLATILES	tert-BUTYLBENZENE	4.5E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																				
VOLATILES	Tetrachloroethene	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																				
VOLATILES	Toluene	2.5E+04	1.0E+02	0.0005	0.005	NE	NE	1.0E+02																				
VOLATILES	trans-1,2-Dichloroethene	2.4E+03	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																				
VOLATILES	trans-1,3-Dichloropropene	4.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00																				

Table 3-1b
Comparison of Chemical Concentration in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB17				03SB17				03SB17				03SB11-(10-11)				03SB11-(BOTTOM)			
	SAMPLE_NO					Background			03SB17-(0-0_5)				03SB17-(3-4)				03SB17-(6-7)				03SB11-111808				03SB11-111808			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	17-Dec-07				17-Dec-07				17-Dec-07				18-Nov-08				18-Nov-08			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-.5 Ft				3-4 Ft				6-7 Ft				10-11				14-15			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ
VOLATILES	1,2-Dibromo-3-chloropropane	2.0E+00	2.0E-02	0.0020	0.005	NE	NE	2.0E-02																				
VOLATILES	1,2-Dibromoethane	1.0E-01	5.0E-03	0.0005	0.005	NE	NE	5.0E-03																				
VOLATILES	1,2-Dichlorobenzene	8.0E+02	6.0E+01	0.0005	0.005	NE	NE	6.0E+01																				
VOLATILES	1,2-Dichloroethane	4.7E-01	5.0E-01	0.0005	0.005	NE	NE	4.7E-01																				
VOLATILES	1,2-Dichloropropane	2.5E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																				
VOLATILES	1,2-Dimethylbenzene (o-Xylene	4.8E+04	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																				
VOLATILES	1,3,5-Trimethylbenzene	1.2E+02	5.1E+02	0.0005	0.005	NE	NE	1.2E+02																				
VOLATILES	1,3-Dichlorobenzene	7.1E+01	3.1E+02	0.0005	0.005	NE	NE	7.1E+01																				
VOLATILES	1,3-Dichloropropane	8.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00																				
VOLATILES	1,4-Dichlorobenzene	2.4E+03	7.5E+00	0.0005	0.005	NE	NE	7.5E+00																				
VOLATILES	2,2-Dichloropropane	2.4E+01	4.2E+00	0.0005	0.005	NE	NE	4.2E+00																				
VOLATILES	2-Butanone	4.2E+04	6.1E+03	0.0025	0.010	NE	NE	6.1E+03																				
VOLATILES	2-Chloroethyl vinyl ether	3.0E+00	2.6E-01	0.0020	0.010	NE	NE	2.6E-01																				
VOLATILES	2-Chlorotoluene	3.5E+03	2.0E+02	0.0005	0.005	NE	NE	2.0E+02																				
VOLATILES	2-Hexanone	8.7E+01	6.1E+02	0.0025	0.010	NE	NE	8.7E+01																				
VOLATILES	4-Chlorotoluene	4.8E+00	2.0E+02	0.0005	0.005	NE	NE	4.8E+00																				
VOLATILES	Acetone	2.5E+03	9.2E+03	0.0050	0.010	NE	NE	2.5E+03																				
VOLATILES	Benzene	1.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																				
VOLATILES	Bromobenzene	1.6E+02	2.0E+02	0.0005	0.005	NE	NE	1.6E+02																				
VOLATILES	Bromochloromethane	3.4E+02	4.1E+02	0.0005	0.005	NE	NE	3.4E+02																				
VOLATILES	Bromodichloromethane	9.2E+01	4.6E-01	0.0005	0.005	NE	NE	4.6E-01																				
VOLATILES	Bromoform	8.5E+01	3.6E+00	0.0005	0.005	NE	NE	3.6E+00																				
VOLATILES	Bromomethane	4.9E+00	1.4E+01	0.0010	0.010	NE	NE	4.9E+00																				
VOLATILES	Carbon disulfide	1.5E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																				
VOLATILES	Carbon tetrachloride	6.3E-01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																				
VOLATILES	Chlorobenzene	5.9E+02	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																				
VOLATILES	Chloroethane	1.7E+04	4.1E+03	0.0010	0.010	NE	NE	4.1E+03																				
VOLATILES	Chloroform	5.2E-01	1.0E+02	0.0005	0.005	NE	NE	5.2E-01																				
VOLATILES	Chloromethane	3.8E+00	2.2E+01	0.0020	0.010	NE	NE	3.8E+00																				
VOLATILES	cis-1,2-Dichloroethene	2.5E+03	7.0E+00	0.0005	0.005	NE	NE	7.0E+00																				
VOLATILES	cis-1,3-Dichloropropene	3.4E+01	5.3E-01	0.0005	0.005	NE	NE	5.3E-01																				
VOLATILES	Dibromochloromethane	6.8E+02	3.4E+00	0.0005	0.005	NE	NE	3.4E+00																				
VOLATILES	Dibromomethane	2.7E+02	3.8E+01	0.0005	0.005	NE	NE	3.8E+01																				
VOLATILES	Dichlorodifluoromethane	3.1E+03	2.0E+03	0.0010	0.010	NE	NE	2.0E+03																				
VOLATILES	Ethylbenzene	6.9E+03	7.0E+01	0.0005	0.005	NE	NE	7.0E+01																				
VOLATILES	Hexachlorobutadiene	3.2E+01	2.0E+00	0.0005	0.005	NE	NE	2.0E+00																				
VOLATILES	Isopropylbenzene	9.0E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																				
VOLATILES	m,p-Xylenes [e]	3.3E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																				
VOLATILES	Methyl isobutyl ketone	3.5E+04	8.2E+02	0.0025	0.010	NE	NE	8.2E+02																				
VOLATILES	Methylene chloride	1.6E+01	5.0E-01	0.0010	0.005	NE	NE	5.0E-01																				
VOLATILES	Naphthalene	2.7E+02	2.0E+02	0.0005	0.010	NE	NE	2.0E+02																				
VOLATILES	n-BUTYLBENZENE	5.7E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																				
VOLATILES	n-PROPYLBENZENE	5.9E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																				
VOLATILES	p-ISOPROPYLTOLUENE	6.7E+03	1.0E+03	0.0005	0.005	NE	NE	1.0E+03																				
VOLATILES	sec-BUTYLBENZENE	5.4E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																				
VOLATILES	Styrene	2.3E+04	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																				
VOLATILES	tert-BUTYLBENZENE	4.5E+03	4.1E+02	0.0005	0.005	NE	NE	4.1E+02																				
VOLATILES	Tetrachloroethene	1.7E+01	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																				
VOLATILES	Toluene	2.5E+04	1.0E+02	0.0005	0.005	NE	NE	1.0E+02																				
VOLATILES	trans-1,2-Dichloroethene	2.4E+03	1.0E+01	0.0005	0.005	NE	NE	1.0E+01																				
VOLATILES	trans-1,3-Dichloropropene	4.0E+01	2.9E+00	0.0005	0.005	NE	NE	2.9E+00																				

Table 3-1b
Comparison of Chemical Concentration in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB16				03SB16				03SB16				03SB16				03SB16			
	SAMPLE_NO					Background			03SB16-(0-0_5)				03SB16-(0-0_5)-QA				03SB16-(3-4)				03SB16-(6-7)				03SB16-(6-7)-QA			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-.5 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				6-7 Ft			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				FD				REG				REG				FD			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ
VOLATILES	Trichloroethene	6.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																				
VOLATILES	Trichlorofluoromethane	3.8E+03	3.1E+03	0.0010	0.010	NE	NE	3.1E+03																				
VOLATILES	Vinyl acetate	8.0E+02	1.0E+04	0.0010	0.010	NE	NE	8.0E+02																				
VOLATILES	Vinyl chloride	6.6E-02	2.0E-01	0.0010	0.010	NE	NE	6.6E-02																				

Notes and Abbreviations:

Shading in column indicates SDL values that exceed the Applicable MSC.

Concentration exceeds Applicable MSC.

[a] Value provided by the Texas Commission on Environmental Quality (TCEQ) as updated through March 2006 available on the TCEQ website at http://www.tceq.state.tx.us/remediation/rrr.html.

[b] Lower of surface and subsurface soil background concentrations used in these comparisons

[c] Shading in column indicates Applicable MSC equal to MQL for the chemical as provided in 30TAC§335.

[d] Where Applicable MSC is equal to MQL, value equals the SDL, which is the MDL adjusted for sample specific analytical factors.

[e] MSC value shown is for m-xylene, the more conservative of m- and p-xylene isomers.

95% UPL - 95% Upper Prediction Limit of background concentration calculated as described in TCEQ correspondence.

FD - field duplicate sample

Ft - feet

H - estimate is high

J - Estimated value. Chemical was detected above the method detection limit but below the MQL.

L - Estimate is low

NE - value not established

R - data rejected

REG - regular sample

U - Compound validated as not detected above MDL shown.

Table 3-1b
Comparison of Chemical Concentration in Soil to Medium-Specific Concentrations
LHAAP-03

	LOCATION _CODE								03SB17				03SB17				03SB17				03SB11-(10-11)				03SB11-(BOTTOM)			
	SAMPLE_NO					Background			03SB17-(0-0_5)				03SB17-(3-4)				03SB17-(6-7)				03SB11-111808				03SB11-111808			
	SAMPLE_DATE	TCEQ				Concentrations in Soil		Applicable	17-Dec-07				17-Dec-07				17-Dec-07				18-Nov-08				18-Nov-08			
	DEPTH	Medium-Specific		Method	Method	(95% UPL, mg/kg) [b]		TCEQ	0-.5 Ft				3-4 Ft				6-7 Ft				10-11				14-15			
	SAMPLE_PURPOSE	Concentration (MSC)		Detection	Quantitation	Surface	Subsurface	Risk-Based	REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	SAI-Ind [a]	GWP-Ind [a]	Limit (MDL)	Limit (MQL)	0 - 0.5 Ft	1.5 - 2.5 Ft	MSC [c]	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ	Result	DF	LQ	VQ
VOLATILES	Trichloroethene	6.6E+00	5.0E-01	0.0005	0.005	NE	NE	5.0E-01																				
VOLATILES	Trichlorofluoromethane	3.8E+03	3.1E+03	0.0010	0.010	NE	NE	3.1E+03																				
VOLATILES	Vinyl acetate	8.0E+02	1.0E+04	0.0010	0.010	NE	NE	8.0E+02																				
VOLATILES	Vinyl chloride	6.6E-02	2.0E-01	0.0010	0.010	NE	NE	6.6E-02																				

Notes and Abbreviations:

Shading in column indicates SDL values that exceed the Applicable MSC.

Concentration exceeds Applicable MSC.

[a] Value provided by the Texas Commission on Environmental Quality (TCEQ) as updated through March 2006 available on the TCEQ website at http://www.tceq.state.tx.us/remediation/rrr.html.

[b] Lower of surface and subsurface soil background concentrations used in these comparisons

[c] Shading in column indicates Applicable MSC equal to MQL for the chemical as provided in 30TAC§335.

[d] Where Applicable MSC is equal to MQL, value equals the SDL, which is the MDL adjusted for sample specific analytical factors.

[e] MSC value shown is for m-xylene, the more conservative of m- and p-xylene isomers.

95% UPL - 95% Upper Prediction Limit of background concentration calculated as described in TCEQ correspondence.
FD - field duplicate sample
Ft - feet
H - estimate is high
J - Estimated value. Chemical was detected above the method detection limit but below the MQL.
L - Estimate is low
NE - value not established
R - data rejected
REG - regular sample
U - Compound validated as not detected above MDL shown.

Table 3-2
Upper Prediction Limits for Soil Background Data

	Surface Soil (0 - 0.5 Feet bgs)		Subsurface Soil (1.5 - 2.5 Feet bgs)	
Metal	Distribution Type	95% UPL Concentration (mg/kg)	Distribution Type	95% UPL Concentration (mg/kg)
Aluminum	Nonparametric	16300.00	Lognormal	20767.06
Antimony	Nonparametric	0.94	Nonparametric	1.60
Arsenic	Lognormal	4.81	Normal	5.54
Barium	Lognormal	151.83	Lognormal	85.45
Cadmium	Nonparametric	1.40	Nonparametric	0.40
Chromium	Lognormal	26.56	Lognormal	30.06
Cobalt	Normal	7.23	Lognormal	5.61
Copper	Lognormal	5.55	Lognormal	9.25
Lead	Lognormal	22.59	Lognormal	11.41
Manganese	Lognormal	1249.70	Lognormal	201.11
Mercury	Lognormal	0.08	Nonparametric	0.36
Selenium	Lognormal	3.48	Normal	5.56
Silver	Nonparametric	0.31	Nonparametric	0.37
Strontium	Lognormal	19.83	Lognormal	29.05
Zinc	Nonparametric	61.60	Lognormal	20.20

Abbreviations:

95% UPL The concentration that will be above the next single measurement with 95 percent confidence.
bgs below ground surface
mg/kg milligrams per kilogram

Table 3-3
Analysis of the Total SPLP Soil Sample

Test Group	Parameter	Units	Method Detection Limit (MDL) [a,b]	Method Quantitation Limit (MQL) [a,b]	TCEQ Risk-Based MSC GWP-Ind [a]	Background Concentrations in Soil (95% UPL, mg/kg) [b] Surface 0 - 0.5 ft	Background Concentrations in Soil (95% UPL, mg/kg) [b] Subsurface 1.5 - 2.5 ft	Applicable TCEQ Risk-Based MSC Industrial [a]	03SB03-01 03SB03-01-Total 4-May-07 Result [a]	DIL	Qual
METALS	Antimony	mg/kg	0.05	0.1	6.0E-01	9.40E-01	1.60E+00	9.4E-01	0.0462	1	J
METALS	Arsenic	mg/kg	0.075	0.3	1.0E+00	4.81E+00	5.54E+00	4.8E+00	1.01	1	
METALS	Beryllium	mg/kg	0.012	0.5	4.0E-01	6.45E-01	7.66E-01	6.5E-01	0.16	1	
METALS	Cadmium	mg/kg	0.025	0.1	5.0E-01	1.40E+00	4.00E-01	5.0E-01	0.0284		U
METALS	Chromium	mg/kg	0.1	0.4	1.0E+01	2.66E+01	3.01E+01	2.7E+01	3.92	1	
METALS	Copper	mg/kg	0.15	0.6	1.3E+02	5.5E+00	9.2E+00	1.3E+02	1.41	1	
METALS	Lead	mg/kg	0.1	0.2	1.5E+00	2.26E+01	1.14E+01	1.1E+01	5.05	1	
METALS	Mercury	mg/kg	0.01	0.25	2.0E-01	8.19E-02	3.60E-01	2.5E-01	0.0165	1	J
METALS	Silver	mg/kg	0.05	0.2	5.1E+01	3.1E-01	3.7E-01	5.1E+01	0.0619	1	J
SVOCS	2,4,6-Trichlorophenol	ug/kg	82.5	165	2.6E+03	NA	NA	2.6E+03	106.0	1	U
SVOCS	2,4-Dinitrotoluene	ug/kg	82.5	165	4.2E+01	NA	NA	1.7E+02	97.4	1	U
SVOCS	2,6-Dinitrotoluene	ug/kg	82.5	165	4.2E+01	NA	NA	1.7E+02	97.4	1	U
SVOCS	2-Nitroaniline	ug/kg	330	825	3.1E+03	NA	NA	3.1E+03	423	1	U
SVOCS	2-Nitrophenol	ug/kg	82.5	165	3.1E+03	NA	NA	3.1E+03	106.0	1	U
SVOCS	3,3'-Dichlorobenzidine	ug/kg	165	330	6.4E+01	NA	NA	3.3E+02	194.8	1	U
SVOCS	3-Nitroaniline	ug/kg	330	825	3.1E+03	NA	NA	3.1E+03	423	1	U
SVOCS	4-Bromophenyl phenyl ether	ug/kg	82.5	165	1.9E+01	NA	NA	1.7E+02	97.4	1	U
SVOCS	4-Chlorophenyl phenyl ether	ug/kg	82.5	165	1.9E+01	NA	NA	1.7E+02	97.4	1	U
SVOCS	4-Nitroaniline	ug/kg	330	825	7.5E+03	NA	NA	7.5E+03	423	1	U
SVOCS	Atrazine	ug/kg	NA	NA	NA	NA	NA	--	NA	1	U
SVOCS	Benzo(a)anthracene	ug/kg	82.5	165	3.9E+01	NA	NA	1.7E+02	97.4	1	U
SVOCS	Benzo(a)pyrene	ug/kg	82.5	165	2.0E+01	NA	NA	1.7E+02	97.4	1	U
SVOCS	Benzo(b)fluoranthene	ug/kg	82.5	165	3.9E+01	NA	NA	1.7E+02	97.4	1	U
SVOCS	Benzo(k)fluoranthene	ug/kg	82.5	165	3.9E+02	NA	NA	3.9E+02	106.0	1	U
SVOCS	bis(2-Chloroethoxy)methane	ug/kg	82.5	165	2.6E+01	NA	NA	1.7E+02	97.4	1	U
SVOCS	bis(2-Chloroethyl)ether	ug/kg	82.5	165	2.6E+01	NA	NA	1.7E+02	97.4	1	U
SVOCS	bis(2-Ethylhexyl)phthalate	ug/kg	82.5	165	6.0E+02	NA	NA	6.0E+02	106.0	1	U
SVOCS	Dibenzo(a,h)anthracene	ug/kg	82.5	165	2.0E+01	NA	NA	1.7E+02	97.4	1	U
SVOCS	Hexachlorobenzene	ug/kg	82.5	165	1.0E+02	NA	NA	1.7E+02	97.4	1	U
SVOCS	Hexachlorobutadiene	ug/kg	82.5	165	2.0E+03	NA	NA	2.0E+03	106.0	1	U
SVOCS	Indeno(1,2,3-cd)pyrene	ug/kg	82.5	165	3.9E+01	NA	NA	1.7E+02	97.4	1	U
SVOCS	n-Nitroso-di-n-propylamine	ug/kg	82.5	165	4.1E+00	NA	NA	1.7E+02	97.4	1	U
SVOCS	Pentachlorophenol	ug/kg	330	825	1.0E+02	NA	NA	8.3E+02	390	1	U
SOLIDS	Percent Solids	NA	NA	NA	NA	NA	NA	--	84.7		

Notes and Abbreviations:

Total metal results for 03SB07 and 03SB08 are in Table 3-1a.

[a] Concentrations of metals are reported in mg/kg units; concentrations of organic compounds are reported in ug/kg units.

[b] Analysis of soil for total chemical concentrations by SW-846 Methods: lead by 6010B, other metals by 6020, PCBs by 8082, SVOCs by 8270C

Shading indicates applicable MSC equal to MQL for the chemical as provided in 30TAC§335

ft - feet

NA - sample not analyzed for this chemical

PCBS - polychlorinated biphenyls

SPLP - Synthetic Precipitation Leaching Procedure

SVOCs - semivolatile organic compounds

Table 3-4
Concentrations of Chemicals in Leachate from Synthetic Precipitation Leaching Procedure Analysis
LHAAP-03

Parameter	LOCATION_CODE SAMPLE_NO SAMPLE_DATE Units	Method Detection Limit (MDL)	Method Quantitation Limit (MQL)	TCEQ Risk-Based MSC GW-Ind [a]	Applicable TCEQ Risk-Based MSC Industrial [b]	03SB03-01 03SB03-01-SPLP 3-May-07 Result [c]	DIL	Qual	03SB07 03SB07(0-0.5)R 23-Oct-07 REG	DIL	Qual	03SB08 03SB08(0-0.5)R 23-Oct-07 REG	DIL	Qual
Antimony	mg/L	0.00025	0.00100	6.0E-03	0.006	0.00194	1		0.00664	1		0.01990	1	
Arsenic	mg/L	0.00025	0.00100	1.0E-02	0.010	0.0562	1		0.6300	1		0.0048	1	
Beryllium	mg/L	0.00050	0.00200	4.0E-03	0.004	NA			0.0005	1	U	0.0005	1	U
Cadmium	mg/L	0.000125	0.000500	5.0E-03	0.005	0.0005	1	U	0.0025	1	U	0.0025	1	U
Chromium	mg/L	0.00050	0.00200	1.0E-01	0.100	0.00635	1		0.04200	1		0.10600	1	
Copper	mg/L	0.00050	0.00200	1.3E+00	1.300	0.00586	1		0.00500	1	U	0.00500	1	U
Lead	mg/L	0.00025	0.00100	1.5E-02	0.015	0.0112	1		0.0427	1		0.1770	1	
Mercury	mg/L	0.00010	0.00020	2.0E-03	0.002	0.0002	1	U	0.0001	1	U	0.0001	1	U
Silver	mg/L	0.00025	0.00100	5.1E-01	0.511	NA			0.0050	1	U	0.0050	1	U
2,4,6-Trichlorophenol	µg/L	2.5	5.0	2.6E+01	2.6E+01	5	1	U						
2,4-Dinitrotoluene	µg/L	2.5	5.0	4.2E-01	5.0E+00	2.5	1	U						
2,6-Dinitrotoluene	µg/L	2.5	5.0	4.2E-01	5.0E+00	2.5	1	U						
2-Nitroaniline	µg/L	12.5	25.0	3.1E+01	3.1E+01	25	1	U						
2-Nitrophenol	µg/L	2.5	5.0	2.0E+02	2.0E+02	5	1	U						
3,3'-Dichlorobenzidine	µg/L	2.5	10.0	6.4E-01	1.0E+01	2.5	1	U						
3-Nitroaniline	µg/L	12.5	25.0	3.1E+01	3.1E+01	25	1	U						
4-Bromophenyl phenyl ether	µg/L	2.5	5.0	1.9E-01	5.0E+00	2.5	1	U						
4-Chlorophenyl phenyl ether	µg/L	2.5	5.0	1.9E-01	5.0E+00	2.5	1	U						
4-Nitroaniline	µg/L	12.5	25.0	7.5E+01	7.5E+01	25	1	U						
Atrazine	µg/L	10.0	20.0	3.0E+00	2.0E+01	10	1	U						
Benzo(a)anthracene	µg/L	2.5	5.0	3.9E-01	5.0E+00	2.5	1	U						
Benzo(a)pyrene	µg/L	2.5	5.0	2.0E-01	5.0E+00	2.5	1	U						
Benzo(b)fluoranthene	µg/L	2.5	5.0	3.9E-01	5.0E+00	2.5	1	U						
Benzo(k)fluoranthene	µg/L	2.5	5.0	3.9E+00	5.0E+00	2.5	1	U						
bis(2-Chloroethoxy)methane	µg/L	2.5	5.0	2.6E-01	5.0E+00	2.5	1	U						
bis(2-Chloroethyl)ether	µg/L	2.5	5.0	2.6E-01	5.0E+00	2.5	1	U						
bis(2-Ethylhexyl)phthalate	µg/L	3.0	10.0	6.0E+00	1.0E+01	3	1	U						
Dibenzo(a,h)anthracene	µg/L	2.5	5.0	2.0E-01	5.0E+00	2.5	1	U						
Hexachlorobenzene	µg/L	2.5	5.0	1.0E+00	5.0E+00	2.5	1	U						
Hexachlorobutadiene	µg/L	2.5	5.0	2.0E+01	2.0E+01	5	1	U						
Indeno(1,2,3-cd)pyrene	µg/L	2.5	5.0	3.9E-01	5.0E+00	2.5	1	U						
n-Nitroso-di-n-propylamine	µg/L	2.5	5.0	4.1E-02	5.0E+00	2.5	1	U						
Pentachlorophenol	µg/L	12.5	25.0	1.0E+00	2.5E+01	12.5	1	U						

Notes and Abbreviations:

[a] Value provided by the Texas Commission on Environmental Quality (TCEQ) as updated through March 2006 available on the TCEQ website at http://www.tceq.state.tx.us/remediation/rrr.html, corrected to correspond to units shown.

[b] Shading indicates Applicable MSC equal to MQL for the chemical as provided in 30TAC§335

[c] Where Applicable MSC is equal to MQL, value equals the is the SDL, which is the MDL adjusted for sample specific analytical factors

DIL - diltution factor

NA - sample not analyzed for this chemical

Qual - data validation qualifier

Qual - data qualifier provided by laboratory

SPLP - Synthetic Precipitation Leaching Procedure, SW846 Method 1312.

U - undetected

Table 3-5a
Comparison of Chemical Concentrations in Soil to Standard 3 MSCs
LHAAP-03

	LOCATION_CODE		03SB01				03SB01				03SB01				03SB02				03SB02				03SB03				03SB03				03SB04				03SB05				03SB06				03SB07				03SB07			
	SAMPLE_NO		03SB01-01				03SB01-01-QC				03SB01-02				03SB02-01				03SB02-02				03SB03-01				03SB03-02				03SB04-01				03SB05-01				03SB06-01				03SB07 (0-0_5)				03SB07(0-0.5)R			
	SAMPLE_DATE	Applicable	8/29/2006				8/29/2006				8/29/2006				8/29/2006				8/29/2006				8/29/2006				8/29/2006				12/19/2006				12/19/2006				12/19/2006				10/23/2007				10/23/2007			
	DEPTH	TCEQ	0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				0 - 0.5 Ft				3 - 4 Ft				0 - 0.5 Ft				3 - 4 Ft				3 - 4 Ft				3 - 4 Ft				3 - 4 Ft				0-0.5 Ft				0-0.5 Ft			
	SAMPLE_PURPOSE	Risk-Based	REG				FD				REG				REG				REG				REG				REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	MSC [a]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
METALS	Antimony	1.6E+00	0.148	1		JL	0.092	1	J	JL	0.115	1	U	UJL	0.063	1	J	JL	0.102	1	U	UJL	8.550	1		JL	0.112	1	U	UJL																	0.062	1	J	J
METALS	Arsenic	5.9E+00	1.830	1			1.650	1			0.883	1			1.440	1			0.845	1			6.090	1			1.110	1																			6.98	1		
METALS	Barium	3.3E+02	70.20	1			69.40	1		JH	47.40	1		JH	35.20	1		JH	23.80	1		JH	167.00	1		JH	57.40	1		JH																	57.20	25		
METALS	Cadmium	1.4E+00	0.20	1	J	J	0.21	1	J	J	0.43	1	U	U	0.09	1	J	J	0.40	1	U	U	1.43	1			0.42	1	U	U																	0.21	1		
METALS	Chromium	2.7E+05	31.20	1			25.70	1			12.80	1			15.90	1			9.11	1			267.00	1			14.80	1																			50	25		
METALS	Copper	2.4E+01	6.16	1			5.46	1			3.32	1			2.31	1			2.18	1			269	1			2.92	1																			4.08	1		
METALS	Lead	1.3E+02	24.70	1			22.50	1			7.20	1			19.50	1			4.66	1			5830	200			19.90	1			108.00	1		J	54.20	1		J	28.20	1		J	95.80	10			505	25		
METALS	Mercury	2.1E-01	0.0448	1	J		0.0490	1	J	J	0.0126	1	J	J	0.0252	1	J	J	0.0121	1	J	J	0.4830	1			0.0290	1	J	J																				

Notes and Abbreviations:

Concentration exceeds Applicable MSC

[a] Standard 3 MSC value calculated as described in Appendix B

DIL - dilution factor
FD - field duplicate sample
H - estimate is high
J - Estimated value. Chemical was detected above the method detection limit (MDL) but below the method quantitation limit (MQL) shown in Table 3-1.
L - estimate is low
LQ - laboratory data qualifier
MSC - medium-specific concentration
REG - regular sample
U - Compound validated as not detected above MDL shown in Table 3-1.
VQ - data validation qualifier

Table 3-5a
Comparison of Chemical Concentrations in Soil to Standard 3 MSCs
LHAAP-03

	LOCATION_CODE		03SB08				03SB08				03SB09				03SB09				03SB10				03SB10				03SB10				03SB11				03SB11				03SB11				03SB12			
	SAMPLE_NO		03SB08 (0-0_5)				03SB08(0-0.5)R				03SB09 (0-0_5)				03SB09(0-0_5)R				03SB10-(0-0_5)				03SB10-(3-4)				03SB10-(6-7)				03SB11-(0-0_5)				03SB11-(3-4)				03SB11-(6-7)				03SB12-(0-0_5)			
	SAMPLE_DATE	Applicable	23-Oct-07				23-Oct-07				23-Oct-07				23-Oct-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	TCEQ	0-0.5 Ft				0-0.5 Ft				0-0.5 FT				0-0.5 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft			
	SAMPLE_PURPOSE	Risk-Based	REG				REG				REG				REG				REG				REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	MSC [a]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
METALS	Antimony	1.6E+00					0.121	1		JL					0.054	1	U	U	0.574	10	U	U	0.630	10	U	U	0.601	10	U	U	0.632	10	U	U	0.595	10	U	U	0.579	10	U	U	0.586	10	U	U
METALS	Arsenic	5.9E+00					10.800	1							6.120	1			3.480	10			2.070	10	J	J	1.290	10	J	J	1.010	10	J	J	1.580	10	J	J	32.7	10			1.840	10	J	J
METALS	Barium	3.3E+02					48.80	1							57.60	1			100.00	1			66.90	1			54.80	1			229.00	1			119.00	1			106.00	1			53.30	1		
METALS	Cadmium	1.4E+00					0.17	1	J	J					1.44	1			0.29	10	U	U	0.32	10	U	U	0.30	10	U	U	0.32	10	U	U	0.30	10	U	U	0.68	10	J	J	0.29	10	U	U
METALS	Chromium	2.7E+05					28.00	1							62.70	1			11.80	10			9.41	10			7.23	10			5.10	10			12.00	10			591	1000			6.86	10		
METALS	Copper	2.4E+01					2.95	1							11.50	1			4.08	1			4.42	1			2.83	1			3.53	1			3.35	1			8.63	1			2.14	1		
METALS	Lead	1.3E+02	2320	100			701.00	100			57.7	10			75.40	10			18.90	10			11.30	10			9.17	10			8.76	10			36.30	10			6760	1000			19.60	10		
METALS	Mercury	2.1E-01					0.1170	1	J	J					0.0241	1	J	J	0.0242	1	J	J	0.0119	1	U	U	0.0125	1	U	U	0.0134	1	U	U	0.0122	1	U	U	0.276	1			0.0341	1	J	J

Notes and Abbreviations:

Concentration exceeds Applicable MSC

[a] Standard 3 MSC value calculated as described in Appendix B

DIL - dilution factor
FD - field duplicate sample
H - estimate is high
J - Estimated value. Chemical was detected above the method detecti
L - estimate is low
LQ - laboratory data qualifier
MSC - medium-specific concentration
REG - regular sample
U - Compound validated as not detected above MDL shown in Table 3
VQ - data validation qualifier

Table 3-5a
Comparison of Chemical Concentrations in Soil to Standard 3 MSCs
LHAAP-03

	LOCATION _CODE		03SB12				03SB12				03SB13				03SB13				03SB13				03SB14				03SB14				03SB14				03SB15				03SB15				03SB15			
	SAMPLE_NO		03SB12-(3-4)				03SB12-(6-7)				03SB13-(0-0_5)				03SB13-(3-4)				03SB13-(6-7)				03SB14-(0-0_5)				03SB14-(3-4)				03SB14-(6-7)				03SB15-(0-0_5)				03SB15-(3-4)				03SB15-(6-7)			
	SAMPLE_DATE	Applicable	17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07				17-Dec-07			
	DEPTH	TCEQ	3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft			
	SAMPLE_PURPOSE	Risk-Based	REG				REG				REG				REG				REG				REG				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	MSC [a]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
METALS	Antimony	1.6E+00	3.060	50	U	U	0.555	10	U	UJL	0.597	10	U	U	0.596	10	U	U	0.621	10	U	U	0.588	10	U	U	0.60	10	U	U	0.622	10	U	U	0.571	10	U	U	0.599	10	U	U	0.572	10	U	U
METALS	Arsenic	5.9E+00	4.730	50	J	J	1.410	10	J	J	2.700	10	J	J	2.090	10	J	J	1.440	10	J	J	4.45	10			2.52	10	J	J	4.8	10			3.8	10			1.770	10	J	J	7.620	10		
METALS	Barium	3.3E+02	45.50	1			32.00	1			72.10	1			51.60	1			61.90	1			49	1			25.70	1			52.6	1			54.4	1			83.40	1			82.70	1		
METALS	Cadmium	1.4E+00	1.53	50	U	U	0.28	10	U	U	0.30	10	U	U	0.30	10	U	U	0.31	10	U	U	1	10	J	J	0.30	10	U	U	0.3	10	U	U	0.7	10	J	J	0.30	10	U	U	0.29	10	U	U
METALS	Chromium	2.7E+05	13.70	50	J	J	6.40	10			13.40	10			7.77	10		J	6.73	10		J	32.8	10		J	9.26	10		J	21.6	10		J	25.7	10		J	8.20	10		J	11.90	10		J
METALS	Copper	2.4E+01	4.10	1			2.03	1			3.11	1			3.00	1			3.30	1			3.18	1			1.96	1			6.640	1			2.460	1			3.78	1			2.43	1		
METALS	Lead	1.3E+02	10.60	50	J	J	5.17	10			19.20	10			8.36	10			8.61	10			259	10			5.52	10			17.6	10			150.0	10			14.10	10			60.00	10		
METALS	Mercury	2.1E-01	0.0407	1	J	J	0.0138	1	J	J	0.0329	1	J	J	0.0204	1	J	J	0.0119	1	U	U	0.175	1			0.01	1	U	U	0.040	1	J	J	0.043	1	J	J	0.0282	1	J	J	0.0106	1	U	U

Notes and Abbreviations:

Concentration exceeds Applicable MSC

[a] Standard 3 MSC value calculated as described in Appendix B

DIL - dilution factor
FD - field duplicate sample
H - estimate is high
J - Estimated value. Chemical was detected above the method detecti
L - estimate is low
LQ - laboratory data qualifier
MSC - medium-specific concentration
REG - regular sample
U - Compound validated as not detected above MDL shown in Table 3
VQ - data validation qualifier

Table 3-5b
Comparison of Chemical Concentrations in Soil to Standard 3 MSCs
LHAAP-03

	LOCATION _CODE		03SB16				03SB16				03SB16				03SB16				03SB16				03SB17				03SB17				03SB17				03SB11-(10-11)				03SB11-(BOTTOM)			
	SAMPLE_NO		03SB16-(0-0_5)				03SB16-(0-0_5)-QA				03SB16-(3-4)				03SB16-(6-7)				03SB16-(6-7)-QA				03SB17-(0-0.5)				03SB17-(3-4)				03SB17-(6-7)				03SB11-111808				03SB11-111808			
	SAMPLE_DATE	Applicable	12/17/2007				12/17/2007				12/17/2007				12/17/2007				12/17/2007				12/17/2007				12/17/2007				12/17/2007				11/18/2008				11/18/2008			
	DEPTH	TCEQ	0-.5 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				6-7 Ft				0-.5 Ft				3-4 Ft				6-7 Ft				10-11				14-15			
	SAMPLE_PURPOSE	Risk-Based	REG				FD				REG				REG				FD				REG				REG				REG				REG				REG			
Test Group	Parameter (Units = mg/kg)	MSC [a]	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ	Result	DIL	LQ	VQ
METALS	Antimony	1.6E+00	0.626	10		U	0.593	10	U	U	0.604	10	U	U	0.620	10	U	U	0.591	10	U	U	0.587	10	U	U	0.712	10	U	U	0.592	10	U	U	0.414	1	U	U	0.427	1	U	U
METALS	Arsenic	5.9E+00	2.030	10	U	J	4.340	10			1.510	10	J	J	2.650	10	J	J	2.840	10	J	J	2.250	10	J	J	1.960	10	J	J	0.887	10	U	U	2.190	1			0.219	1	J	J
METALS	Barium	3.3E+02	81.30	1	J		77.50	1			88.70	1			27.90	1			29.30	1			67.60	1			31.60	1			50.60	1			29.40	1			32.80	1		
METALS	Cadmium	1.4E+00	0.31	10		U	0.30	10	U	U	0.30	10	U	U	0.31	10	U	U	0.30	10	U	U	0.29	10	U	U	0.36	10	U	U	0.30	10	U	U	0.04	1	U	U	0.13	1	J	J
METALS	Chromium	2.7E+05	8.23	10		J	17.70	10			7.58	10		J	7.44	10			10.80	10			13.10	10			12.20	10			5.73	10			9.11	1			6.00	1		
METALS	Copper	2.4E+01	3.16	1			3.84	1			3.36	1			2.39	1			3.19	1			3.08	1			3.56	1			3.05	1			3.91	1			3.09	1		
METALS	Lead	1.3E+02	7.31	10			8.83	10			5.76	10			6.20	10			7.39	10			42.20	10			18	10			8.40	10			4.15	1			4.39	1		
METALS	Mercury	2.1E-01	0.0128	1		J	0.0146	1	J	J	0.0131	1	J	J	0.0164	1	J	J	0.0140	1	J	J	0.0402	1	J	J	0.0144	1	U	U	0.0112	1	U	U	0.0112	1	U	U	0.0118	1	U	U

Notes and Abbreviations:

Concentration exceeds Applicable MSC

[a] Standard 3 MSC value calculated as described in Appendix B

DIL - dilution factor
FD - field duplicate sample
J - Estimated value. Chemical was detected above the method detection limit (MDL) but below the method quantitation limit (MQL) shown in Table 3-1.
LQ - laboratory data qualifier
MSC - medium-specific concentration
REG - regular sample
U - Compound validated as not detected above MDL shown in Table 3-1.
VQ - data validation qualifier

Table 3-6
Comparison of Chemical Concentrations in Groundwater to TCEQ Medium-Specific Concentrations for Groundwater
LHAAP-03

		LOCATION_CODE	Applicable	03WW01			
		SAMPLE_NO	TCEQ	03WW01-112408			
		SAMPLE_DATE	Risk-Based	24-Nov-08			
Test Group	Parameter	Units	MSC [a]	Result	DIL	Qual	ValQual
METALS	Antimony	mg/L	6.0E-03	0.00131	1		
METALS	Arsenic	mg/L	1.0E-02	0.0414	1		
METALS	Barium	mg/L	2.0E+00	0.0699	1		
METALS	Cadmium	mg/L	5.0E-03	0.000486	1	J	J
METALS	Chromium	mg/L	1.0E-01	0.00523	1		
METALS	Copper	mg/L	1.3E+00	0.00404	1		
METALS	Lead	mg/L	1.5E-02	0.00575	1		
METALS	Mercury	mg/L	2.0E-03	0.0001	1	U	U

Notes and Abbreviations:

Concentration exceeds Applicable MSC

[a] Medium Specific Concentration (MSC) for groundwater use (GW-Ind) provided in 30 TAC 335, as updated through March 2006.

DIL - dilution factor

J - present but below reporting limit

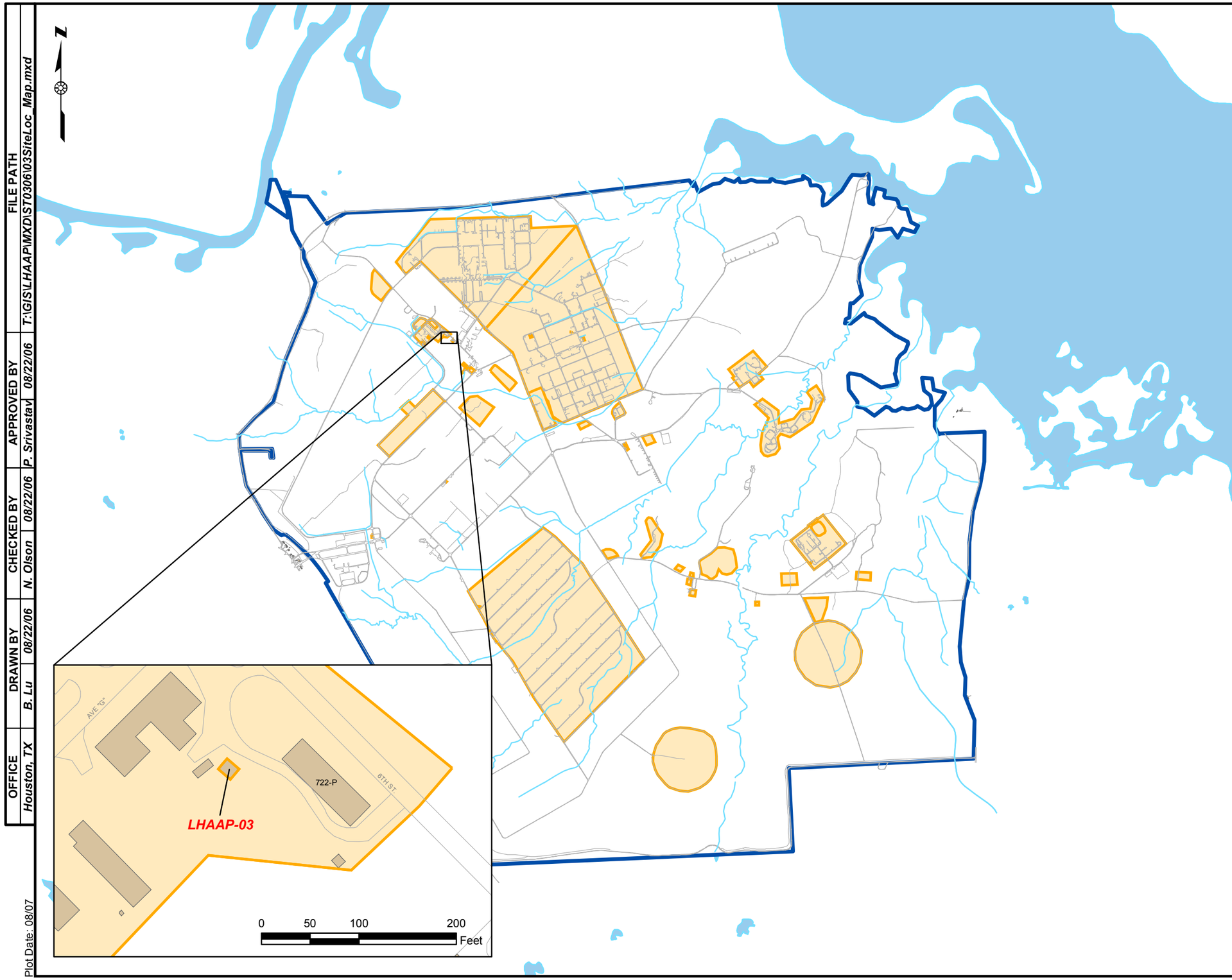
LQ - laboratory data qualifier

MSC - medium-specific concentration

U - undetected

VQ - data validation qualifier

Figures



Legend

- Stream
- Road
- Former Building or Tank Location
- Site
- Approximate LHAAP Boundary

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	FILE PATH
Houston, TX	B. Lu 08/22/06	N. Olson 08/22/06	P. Srivastav 08/22/06	T:\GIS\LHAAP\MXD\ST0306\03SiteLoc_Map.mxd

Plot Date: 08/07

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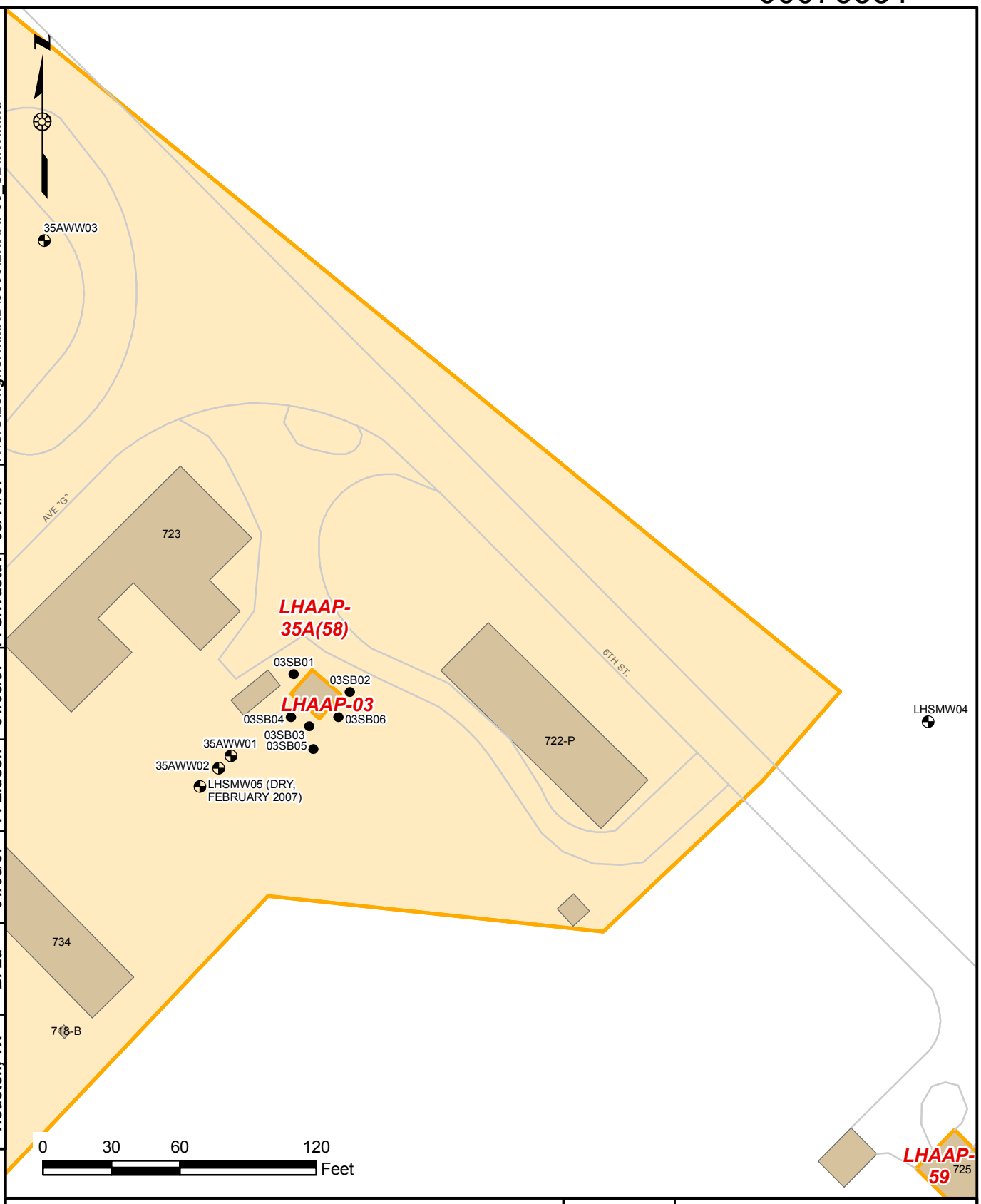
TULSA DISTRICT
TULSA, OKLAHOMA

FIGURE 1-1

SITE LOCATION MAP
LHAAP-03

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS



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Houston, TX	B. Lu	01/03/07	F. Eidson	01/03/07	P. Srivastav	08/14/07	T:\GIS\Longhorn\MXD\0306\LHAAP03_SBMW.mxd

Legend

- Monitoring Well
- Soil Boring
- Road
- Former Building or Concrete Slab
- Site

Plot Date: 08/07

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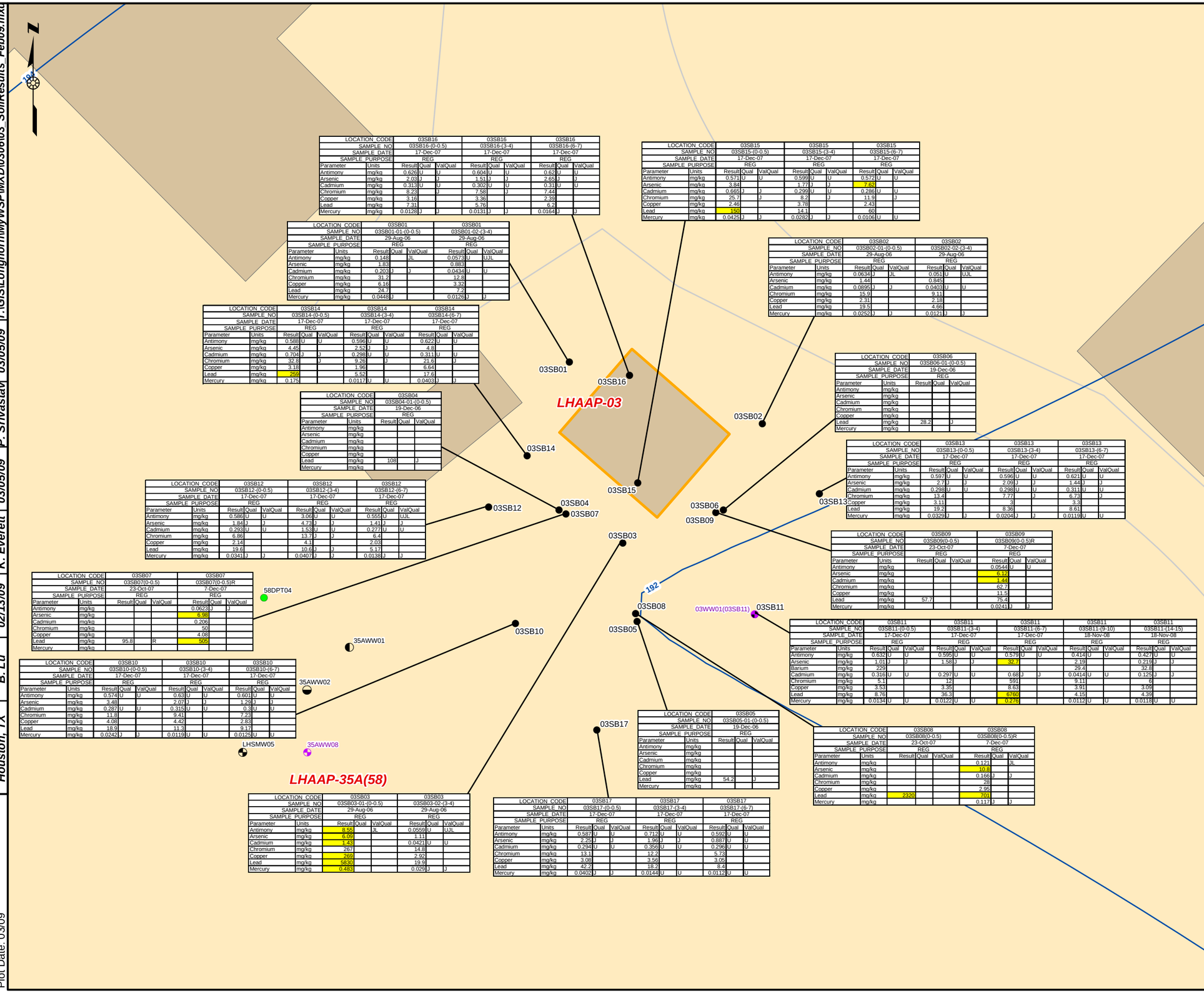
TULSA DISTRICT
TULSA, OKLAHOMA

FIGURE 1-2
SOIL BORING AND
MONITORING WELL LOCATION MAP
LHAAP-03

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS



LOCATION_CODE		03SB16			03SB16			03SB16		
SAMPLE_NO		03SB16-(0-0.5)			03SB16-(3-4)			03SB16-(6-7)		
SAMPLE_DATE		17-Dec-07			17-Dec-07			17-Dec-07		
SAMPLE_PURPOSE		REG			REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg	0.626	U	U	0.604	U	U	0.62	U	U
Arsenic	mg/kg	2.03	J	J	1.51	J	J	2.65	J	J
Cadmium	mg/kg	0.313	U	U	0.302	U	U	0.31	U	U
Chromium	mg/kg	8.23		J	7.58		J	7.44		
Copper	mg/kg	3.16			3.36			2.39		
Lead	mg/kg	7.31			5.76			6.2		
Mercury	mg/kg	0.0128	J	J	0.0131	J	J	0.0164	J	J

LOCATION_CODE		03SB15			03SB15			03SB15		
SAMPLE_NO		03SB15-(0-0.5)			03SB15-(3-4)			03SB15-(6-7)		
SAMPLE_DATE		17-Dec-07			17-Dec-07			17-Dec-07		
SAMPLE_PURPOSE		REG			REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg	0.571	U	U	0.599	U	U	0.572	U	U
Arsenic	mg/kg	3.84			1.77	J	J	7.62		
Cadmium	mg/kg	0.665	J	J	0.299	U	U	0.286	U	U
Chromium	mg/kg	25.7		J	8.2		J	11.9		J
Copper	mg/kg	2.46			3.78			2.43		
Lead	mg/kg	150			14.1			60		
Mercury	mg/kg	0.0425	J	J	0.0282	J	J	0.0106	U	U

LOCATION_CODE		03SB01			03SB01		
SAMPLE_NO		03SB01-01-(0-0.5)			03SB01-02-(3-4)		
SAMPLE_DATE		29-Aug-06			29-Aug-06		
SAMPLE_PURPOSE		REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg	0.148		JL	0.0573	U	UJL
Arsenic	mg/kg	1.83			0.883		
Cadmium	mg/kg	0.203	J	J	0.0434	U	U
Chromium	mg/kg	31.2			12.8		
Copper	mg/kg	6.16			3.32		
Lead	mg/kg	24.7			7.2		
Mercury	mg/kg	0.0448	J		0.0126	J	J

LOCATION_CODE		03SB02			03SB02		
SAMPLE_NO		03SB02-01-(0-0.5)			03SB02-02-(3-4)		
SAMPLE_DATE		29-Aug-06			29-Aug-06		
SAMPLE_PURPOSE		REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg	0.0634	J	JL	0.051	U	UJL
Arsenic	mg/kg	1.44			0.845		
Cadmium	mg/kg	0.0895	J	J	0.0403	U	U
Chromium	mg/kg	15.9			9.11		
Copper	mg/kg	2.31			2.18		
Lead	mg/kg	19.5			4.66		
Mercury	mg/kg	0.0252	J	J	0.0121	J	J

LOCATION_CODE		03SB14			03SB14			03SB14		
SAMPLE_NO		03SB14-(0-0.5)			03SB14-(3-4)			03SB14-(6-7)		
SAMPLE_DATE		17-Dec-07			17-Dec-07			17-Dec-07		
SAMPLE_PURPOSE		REG			REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg	0.588	U	U	0.596	U	U	0.622	U	U
Arsenic	mg/kg	4.45			2.52	J	J	4.8		
Cadmium	mg/kg	0.704	J	J	0.298	U	U	0.311	U	U
Chromium	mg/kg	32.8		J	9.26		J	21.6		J
Copper	mg/kg	3.18			1.96			6.64		
Lead	mg/kg	259			5.52			17.6		
Mercury	mg/kg	0.175			0.0117	U	U	0.0403	J	J

LOCATION_CODE		03SB06		
SAMPLE_NO		03SB06-01-(0-0.5)		
SAMPLE_DATE		19-Dec-06		
SAMPLE_PURPOSE		REG		
Parameter	Units	Result	Qual	ValQual
Antimony	mg/kg			
Arsenic	mg/kg			
Cadmium	mg/kg			
Chromium	mg/kg			
Copper	mg/kg			
Lead	mg/kg	28.2		J
Mercury	mg/kg			

LOCATION_CODE		03SB04		
SAMPLE_NO		03SB04-01-(0-0.5)		
SAMPLE_DATE		19-Dec-06		
SAMPLE_PURPOSE		REG		
Parameter	Units	Result	Qual	ValQual
Antimony	mg/kg			
Arsenic	mg/kg			
Cadmium	mg/kg			
Chromium	mg/kg			
Copper	mg/kg			
Lead	mg/kg	108		J
Mercury	mg/kg			

LOCATION_CODE		03SB13			03SB13			03SB13		
SAMPLE_NO		03SB13-(0-0.5)			03SB13-(3-4)			03SB13-(6-7)		
SAMPLE_DATE		17-Dec-07			17-Dec-07			17-Dec-07		
SAMPLE_PURPOSE		REG			REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg	0.597	U	U	0.596	U	U	0.621	U	U
Arsenic	mg/kg	2.7	J	J	2.09	J	J	1.44	J	J
Cadmium	mg/kg	0.298	U	U	0.298	U	U	0.311	U	U
Chromium	mg/kg	13.4			7.77		J	6.73		J
Copper	mg/kg	3.11			3			3.3		
Lead	mg/kg	19.2			8.36			8.61		
Mercury	mg/kg	0.0329	J	J	0.0204	J	J	0.0119	U	U

LOCATION_CODE		03SB12			03SB12			03SB12		
SAMPLE_NO		03SB12-(0-0.5)			03SB12-(3-4)			03SB12-(6-7)		
SAMPLE_DATE		17-Dec-07			17-Dec-07			17-Dec-07		
SAMPLE_PURPOSE		REG			REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg	0.586	U	U	3.06	U	U	0.555	U	UJL
Arsenic	mg/kg	1.84	J	J	4.73	J	J	1.41	J	J
Cadmium	mg/kg	0.293	U	U	1.53	U	U	0.277	U	U
Chromium	mg/kg	6.86			13.7	J	J	6.4		
Copper	mg/kg	2.14			4.1			2.03		
Lead	mg/kg	19.6			10.6	J	J	5.17		
Mercury	mg/kg	0.0341	J	J	0.0407	J	J	0.0138	J	J

LOCATION_CODE		03SB09			03SB09		
SAMPLE_NO		03SB09(0-0.5)			03SB09(0-0.5)R		
SAMPLE_DATE		23-Oct-07			7-Dec-07		
SAMPLE_PURPOSE		REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg				0.0544	U	U
Arsenic	mg/kg				5.12		
Cadmium	mg/kg				1.44		
Chromium	mg/kg				62.7		
Copper	mg/kg				11.5		
Lead	mg/kg	57.7			75.4		
Mercury	mg/kg				0.0241	J	J

LOCATION_CODE		03SB07			03SB07		
SAMPLE_NO		03SB07(0-0.5)			03SB07(0-0.5)R		
SAMPLE_DATE		23-Oct-07			7-Dec-07		
SAMPLE_PURPOSE		REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg				0.0623	J	J
Arsenic	mg/kg				6.98		
Cadmium	mg/kg				0.206		
Chromium	mg/kg				50		
Copper	mg/kg				4.08		
Lead	mg/kg	95.8		R	505		
Mercury	mg/kg						

LOCATION_CODE		03SB11			03SB11			03SB11			03SB11			03SB11		
SAMPLE_NO		03SB11-(0-0.5)			03SB11-(3-4)			03SB11-(6-7)			03SB11-(9-10)			03SB11-(14-15)		
SAMPLE_DATE		17-Dec-07			17-Dec-07			17-Dec-07			18-Nov-08			18-Nov-08		
SAMPLE_PURPOSE		REG			REG			REG			REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg	0.632	U	U	0.595	U	U	0.579	U	U	0.414	U	U	0.427	U	U
Arsenic	mg/kg	1.01	J	J	1.58	J	J	32.7			2.19			0.219	J	J
Barium	mg/kg	229									29.4			32.8		
Cadmium	mg/kg	0.316	U	U	0.297	U	U	0.68	J	J	0.0414	U	U	0.125	J	J
Chromium	mg/kg	5.1			12			591			9.11			9		
Copper	mg/kg	3.53			3.35			8.63			3.91			3.09		
Lead	mg/kg	8.76			36.3			6760			4.15			4.39		
Mercury	mg/kg	0.0134	U	U	0.0122	U	U	0.276			0.0112	U	U	0.0118	U	U

LOCATION_CODE		03SB10			03SB10			03SB10		
SAMPLE_NO		03SB10-(0-0.5)			03SB10-(3-4)			03SB10-(6-7)		
SAMPLE_DATE		17-Dec-07			17-Dec-07			17-Dec-07		
SAMPLE_PURPOSE		REG			REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg	0.574	U	U	0.63	U	U	0.601	U	U
Arsenic	mg/kg	3.48			2.07	J	J	1.29	J	J
Cadmium	mg/kg	0.287	U	U	0.315	U	U	0.3	U	U
Chromium	mg/kg	11.8			9.41			7.23		
Copper	mg/kg	4.08			4.42			2.83		
Lead	mg/kg	18.9			11.3			9.17		
Mercury	mg/kg	0.0242	J	J	0.0119	U	U	0.0125	U	U

LOCATION_CODE		03SB05		
SAMPLE_NO		03SB05-01-(0-0.5)		
SAMPLE_DATE		19-Dec-06		
SAMPLE_PURPOSE		REG		
Parameter	Units	Result	Qual	ValQual
Antimony	mg/kg			
Arsenic	mg/kg			
Cadmium	mg/kg			
Chromium	mg/kg			
Copper	mg/kg			
Lead	mg/kg	54.2		J
Mercury	mg/kg			

LOCATION_CODE		03SB08			03SB08		
SAMPLE_NO		03SB08(0-0.5)			03SB08(0-0.5)R		
SAMPLE_DATE		23-Oct-07			7-Dec-07		
SAMPLE_PURPOSE		REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg				0.121		JL
Arsenic	mg/kg				10.8		
Cadmium	mg/kg				0.166	J	J
Chromium	mg/kg				28		
Copper	mg/kg				2.95		
Lead	mg/kg	2320			701		
Mercury	mg/kg				0.117	J	J

LOCATION_CODE		03SB03			03SB03		
SAMPLE_NO		03SB03-01-(0-0.5)			03SB03-02-(3-4)		
SAMPLE_DATE		29-Aug-06			29-Aug-06		
SAMPLE_PURPOSE		REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg	8.55		JL	0.0559	U	UJL
Arsenic	mg/kg	6.09			1.11		
Cadmium	mg/kg	1.43			0.0421	U	U
Chromium	mg/kg	267			14.8		
Copper	mg/kg	269			2.92		
Lead	mg/kg	5830			19.9		
Mercury	mg/kg	0.483			0.029	J	J

LOCATION_CODE		03SB17			03SB17			03SB17		
SAMPLE_NO		03SB17-(0-0.5)			03SB17-(3-4)			03SB17-(6-7)		
SAMPLE_DATE		17-Dec-07			17-Dec-07			17-Dec-07		
SAMPLE_PURPOSE		REG			REG			REG		
Parameter	Units	Result	Qual	ValQual	Result	Qual	ValQual	Result	Qual	ValQual
Antimony	mg/kg	0.587	U	U	0.712	U	U	0.592	U	U
Arsenic	mg/kg	2.25	J	J	1.96	J	J	0.887	U	U
Cadmium	mg/kg	0.294	U	U	0.356	U	U	0.296	U	U
Chromium	mg/kg	13.1			12.2			5.73		
Copper	mg/kg	3.08			3.56			3.05		
Lead	mg/kg	42.2			18.2			8.4		
Mercury	mg/kg	0.0402	J	J	0.0144	U	U	0.0112	U	U

LEGEND

- New Shallow Monitoring Well (Installed Nov. 2008)
- Shallow Monitoring Well
- Intermediate Monitoring Well
- Deep Monitoring Well
- Soil Boring
- DPT Location
- Groundwater Elevation Contour
- Inferred Groundwater Elevation Contour
- Road
- Former Building or Concrete Slab
- Site

NOTES:

1. mg/kg is milligrams per kilogram.
2. U -- less than laboratory detection limits.
3. J -- estimated concentration.
4. Yellow highlights indicate exceedance of applicable medium-specific concentration for chemical in soil.
   Antimony: 1.6 mg/kg
   Arsenic 5.9 mg/kg
   Cadmium 1.4 mg/kg
   Copper: 240 mg/kg
   Lead: 130 mg/kg
   Mercury: 0.21 mg/kg

0 6 12 24 Feet

Shaw®

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

FIGURE 2-1

SOIL SAMPLING RESULTS
LHAAP-03

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	FILE PATH
Houston, TX	B. Lu 02/13/09	K. Everett 03/05/09	P. Srivastav 03/05/09	T:\GIS\Longhorn\MyWSP\MXD\0306\03_SoilResults_Feb09.mxd

Plot Date: 03/09

Appendix A

Boring Logs and Field Forms

Photocopies of boring logs and field forms are best available.

00076335

HOLE NO. 03SB01

DRILLING LOG	DIVISION Longhorn PBC	INSTALLATION LONGHORN AAP	SHEET 1 OF 1 SHEETS

1. PROJECT 117591	10. SIZE AND TYPE OF BIT 2" Stainless Steel
2. LOCATION (Coordinates or Station) Site 03	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) — NA
3. DRILLING AGENCY Shaw	12. MANUFACTURER'S DESIGNATION OF DRILL — NA
4. HOLE NO. (As shown on drawing title and file number) 03SB01	13. OVERBURDEN SAMPLES DISTURBED — NA UNDISTURBED NA
5. NAME OF DRILLER S. Oller	14. TOTAL NUMBER CORE BOXES — NA
	15. ELEVATION GROUND WATER — NA
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED — NA DEG. FROM VERT.	16. DATE HOLE STARTED 8/29/06 COMPLETED 8/29/06
7. THICKNESS OF OVERBURDEN — NA	17. ELEVATION TOP OF HOLE NA
8. DEPTH DRILLED INTO ROCK — NA	18. TOTAL CORE RECOVERY FOR BORING NA %
9. TOTAL DEPTH OF HOLE 4 ft	INSPECTOR

ELEVATION PID a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
0.0	.5		Topsoil	100%	X	Hand Augered 0-4' 03 SB01-01 13:20
0.0	1	SC	Sand, Clayey, med to fine grained, moderately sorted, dry, brown	100%		
0.0				100%		
0.0	2			100%		
0.0			Clay, sandy, dense, no plasticity, dry, brown	100%		
0.0	3	CL		100%		
0.0				100%	X	03 SB01-02 13:05
0.0	4			100%		
			End of Boring			

00076336

HOLE NO. 03SB02

DRILLING LOG	DIVISION Longhorn PBC	INSTALLATION LONGHORN AAP	SHEET 1 OF 1 SHEETS

1. PROJECT	117591
2. LOCATION (Coordinates or Station)	Site 03
3. DRILLING AGENCY	Shaw
4. HOLE NO. (As shown on drawing title and file number)	03SB02
5. NAME OF DRILLER	S. Oller
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED	— NA DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	— NA
8. DEPTH DRILLED INTO ROCK	— NA
9. TOTAL DEPTH OF HOLE	4 ft
10. SIZE AND TYPE OF BIT	2" Stainless Steel
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	— NA
12. MANUFACTURER'S DESIGNATION OF DRILL	— NA
13. OVERBURDEN SAMPLES	DISTURBED NA / UNDISTURBED NA
14. TOTAL NUMBER CORE BOXES	— NA
15. ELEVATION GROUND WATER	— NA
16. DATE HOLE	STARTED 8/29/06 COMPLETED 8/29/06
17. ELEVATION TOP OF HOLE	NA
18. TOTAL CORE RECOVERY FOR BORING	NA %
INSPECTOR	

ELEVATION a (PID)	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
0.0			Topsoil	100%	X	Hand Augered 0-4' 03SB02-01 12:30
0.0	.5	SC	Sand, clayey, medium grained, moderately sorted, dry, brown	100%		
0.0	1			100%		
0.0				100%		
0.0	2		Clay, sandy, dense, no plasticity, dry, brown	100%		
0.0		CL		100%		
0.0	3			100%	X	03SB02-02 12:50
0.0				100%		
	4		End of Boring			

00076337

HOLE NO. 03 SB 03

DRILLING LOG	DIVISION Longhorn PBC	INSTALLATION LONGHORN AAP	SHEET 1 OF 1 SHEETS

1. PROJECT 117591	10. SIZE AND TYPE OF BIT 2" Stainless Steel
2. LOCATION (Coordinates or Station) Site 03	11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NA
3. DRILLING AGENCY Shaw	12. MANUFACTURER'S DESIGNATION OF DRILL NA
4. HOLE NO. (As shown on drawing title and file number) 03 SB03	13. OVERBURDEN SAMPLES DISTURBED NA UNDISTURBED NA
5. NAME OF DRILLER S. Oller	14. TOTAL NUMBER CORE BOXES NA
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED NA DEG. FROM VERT.	15. ELEVATION GROUND WATER NA
	16. DATE HOLE STARTED 8/29/06 COMPLETED 8/29/06
7. THICKNESS OF OVERBURDEN NA	17. ELEVATION TOP OF HOLE NA
8. DEPTH DRILLED INTO ROCK NA	18. TOTAL CORE RECOVERY FOR BORING NA %
9. TOTAL DEPTH OF HOLE 4 ft	INSPECTOR

ELEVATION PD a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
0.0			Topsoil	100%	X	Hand Augered 0-4' 03SB03-01 13:00
0.0	.5	SC	Sand, clayey, medium grained, moderately sorted, dry, brown	100%		
0.0	1			100%		
0.0				100%		
0.0	2			100%		
0.0			Clay, sandy, dense, no plasticity, dry, brown	100%		
0.0	3	Cl		100%	X	03SB03-02 13:10
0.0				100%		
	4		End of Boring			

Appendix B

Soil Attenuation Model

Development of TCEQ Risk Reduction Rules Standard 3 Medium-Specific Concentrations for Soil at the LHAAP-03 Site

Appendix B
Development of TCEQ Risk Reduction Rules Standard 3 Medium-Specific Concentrations for Soil at the LHAAP-03 Site

This appendix describes development of Standard 3 Medium-Specific Concentrations (MSCs) for chemicals in soil that are protective of groundwater at the former Waste Collection Pad near at Building 722-P, Paint Shop, LHAAP-03. The MSC values were developed according to the Texas Commission on Environmental Quality [TCEQ] Texas Risk Reduction Rules, Title 30 Texas Administrative Code (TAC) Chapter 335 (30 TAC §335 and updates).

The chemicals of concern (COCs) at LHAAP-03 for soil are antimony, arsenic, barium, cadmium, chromium, copper, lead, and mercury (see Table 3-1a and Table 3-1b of the main document). This appendix describes the calculation of Standard 3 MSCs for these COCs that are protective of groundwater using the Soil Attenuation Model (SAM).

The SAM model was selected to predict impacts of soil contamination on groundwater quality. The SAM model is an extension of the Soil Screening Level calculations EPA (1996) guidance and is based on calculating total mass (liquid phase, solid phase, and gas phase) in the soil column:

$$M_T = V(\rho_b C_s + \theta_w C_w + \theta_a C_g) \qquad \text{Eq. 1}$$

Where

M_T = total mass of chemical
V = volume of the soil column
ρ_b = bulk density
C_s = concentration in soil (dry weight basis)
θ_w = water filled porosity
C_w = concentration in pore water
θ_a = air filled porosity
C_g = gas phase concentration.

Total mass is then redistributed using equilibrium conditions based on the adsorption coefficient and Henry's Law constant. The equilibrium equations are:

$$C_s = K_d C_w \qquad \text{Eq. 2}$$

$$C_g = H^1 C_w \qquad \text{Eq. 3}$$

Where Kd is the distribution coefficient or adsorption coefficient, and H^1 is dimensionless Henry's Law constant.

The SAM model enhancement over EPA's Soil Screening Levels is that the SAM model assumes a zone of contaminated soils overlying a zone of clean soil (zero contaminant concentration). The SAM

simulates mixing of contamination through the contaminated and clean soil zones based on equilibrium conditions, and predicts leachate concentration at the bottom of the soil column. The SAM model calculates the leachate concentration according to the equation:

$$C_w = C_s \left(\frac{\rho_b}{\theta_w + (K_d \rho_b) + H'\theta_a} \right) \left(\frac{L_1}{L_2} \right) \qquad \text{Eq. 4}$$

The concentration in the contaminated soil zone that will produce a given leachate concentration can be calculated as:

$$C_s = C_w \left(\frac{\theta_w + (K_d \rho_b) + H'\theta_a}{\rho_b} \right) \left(\frac{L_2}{L_1} \right) \qquad \text{Eq. 5}$$

Where L_1 is the thickness of the total soil column and L_2 is the thickness of the contaminated zone. The factor (L_2/L_1) is an enhancement in the SAM model over the Soil Screening Level Model by EPA. A further dilution factor for leachate mixing with groundwater can be incorporated by using leachate dilution factor:

$$LDF = 1 + \frac{Kid}{IL} \qquad \text{Eq. 6}$$

Where

K = aquifer hydraulic conductivity
i = hydraulic gradient in aquifer
d = groundwater mixing zone depth
I = infiltration rate
L = source length parallel to groundwater flow.

The groundwater protective Standard 3 MSC is the soil concentration (C_s) described by Eq. 7 where the groundwater concentration (C_w) is limited by the TCEQ risk-based drinking water concentration (GW-Ind) modified by the LDF as follows:

$$\text{Standard 3 } MSC = C_w \left(\frac{\theta_w + (K_d \rho_b) + H'\theta_a}{\rho_b} \right) \left(\frac{L_2}{L_1} \right) x\ LDF \qquad \text{Eq. 7}$$

The model further calculates the soil saturation concentration (C_{sat}), which corresponds to the contaminant concentration in soil at which the absorptive capacity of soil particles, the solubility limits of soil pore water, and saturation of soil pore air have been reached. Concentrations above C_{sat} are assumed to be in free phase. The C_{sat} concentration is calculated in the SAM model according to Eq. 8.

$$C_{sat} = S\left(\frac{\theta_w + (K_d \rho_b) + H'\theta_a}{\rho_b}\right) \qquad \text{Eq. 8}$$

Input parameters to the SAM model that are either specific to LHAAP-03 or are default TCEQ values are shown in attached **Table B-1**. Physical properties of chemicals addressed in the SAM model are shown in **Table B-2**. Calculation of C_{sat} concentrations of each chemical is shown in **Table B-3**. Calculated Standard 3 MSC values that are based on the TCEQ MSC for groundwater (GW-Ind) are shown in **Table B-4**. As shown in **Tables B-3** and B-**4**, none of the calculated Standard 3 MSC exceeds the C_{sat} concentration for COCs.

The Applicable Standard 3 MSC (**Table B-5**) for each COC was developed as the larger of the Standard 3 MSC value and the background soil concentrations (Shaw, 2004). The background concentration represents the Applicable MSC for antimony, arsenic, and cadmium at LHAAP-03.

COCs that were measured at concentrations above the Applicable Commercial/Industrial Soil MSCs are shown in **Table B-5**. Concentrations above MSCs were measured at 03SB03 for antimony, arsenic, cadmium, copper, and lead. Concentrations above MSCs were measured at 03SB07 (arsenic and lead), 03SB08 (arsenic and lead), 03SB09 (arsenic and cadmium), 03SB10 (arsenic and cadmium), 03SB11 (arsenic, lead, and mercury), and 03SB15 (arsenic, and lead). COC concentrations were confined to surface soil (<0.5 feet below ground surface [bgs]) except at borings 03SB11 and 03SB15. Boring 03SB11 contained arsenic, lead, and mercury above MSCs at 6 to 7 feet bgs. Boring 03SB15 contained elevated lead concentrations 0.5 feet bgs and arsenic concentrations at 6 to 7 feet bgs.

These comparisons are shown in tables of the main document. Soil borings with COC concentrations above Applicable Standard 3 MSC values within the upper 0.5 feet bgs (03SB03, 03SB07, 03SB08, 03SB09, 03SB10, and 03SB15) lie within an oval area of approximately 40 feet in its largest dimension and is located south of LHAAP-03 (**Figure 2-1**).

Background concentrations shown in **Table B-5** represent the 95% Upper Prediction Limits (UPL) for both surface and subsurface soil concentrations reported in previously (Shaw, 2004) and are applied here as the most appropriate value to serve as the cleanup level for both surface and subsurface soil. These values differ slightly from the separate surface and subsurface soil background values shown in Tables 3-1a and 3-1b of the main document, the lower of which was used to provide a conservative identification of COCs. When the lower of surface and subsurface background concentrations is applied to develop Applicable Standard 3 MSCs in **Table B-5**, the resulting comparison of COC concentrations to Applicable Standard 3 MSCs shown in the attached tables of the main document are the same, and the conclusions based on the comparison remain the same.

References

Shaw, 2004, *Final Background Soil Study Report, Longhorn Army Ammunition Plant, Karnack*, Texas, July.

U.S. Environmental Protection Agency (EPA), 1996, *Soil Screening Guidance: User's Guide*, Second Edition.

Table B-1
Input Values for Parameters Used to Calculate Risk Reduction Standard 3 Groundwater-Protective MSCs for Soil
LHAAP-03 Waste Collection Pad near Building 722-P, Paint Shop

Parameter		Value	Units	Comment	Reference
Soil Dry Bulk Density	ρ_b	1.6	g/cm^3	Dry bulk density was assumed to be 100 pounds per cubic feet and is a typical value for silty clayey sands.	Shaw, 2006b
Particle Density	$\rho_{particle}$	2.65	g/cm^3	TCEQ default value	30 TAC §350.75 (c) and (d)
Total Porosity	n	0.40	unitless	n = 1-(rb/rparticle) = 1-(1.6 g/cc/2.65 g/cc)	EPA, 1996, pg. 38.
Volumetric Water Content of Soil	q_{ws}	0.16	unitless	Mean value calculated from Percent Solids measurements excluding quality control samples (Table 3-1, this document)	Table 3-1, Shaw, 2007a
Soil Fraction Organic Carbon	f_{oc}	0.02	unitless	TCEQ default value	30 TAC §335.567. Appendix I. (p. 26)
Net Infiltration Rate through soil	I	38.10	cm/yr	15 inches/yr estimated for LHAAP	Shaw, 2008
Thickness of affected soil	L_1	457	cm	Samples taken 0 to 7 ft bgs. 7 ft assumed all chemicals (Table 3-1, this document)	Shaw, 2007a
Distance from top of affected soils to top of water bearing unit.	L_2	722	cm	Median depth to groundwater at LHAAP-03 wells sampled = 24 ft	Shaw, 2007a
Groundwater Darcy Velocity	V_{gw}	299.88	cm/yr	= K*i*31500000 sec/yr	EPA, 1996, pg. 42.
Hydraulic conductivity in groundwater bearing unit	K	3.40E-04	cm/sec	Median of values	Jacobs 2002, Table 5-1.
Hydraulic gradient in groundwater bearing unit	i	0.03	unitless	Value calculated from potentiometric map scale: 13.1ft elevation/480ft horizontal	Shaw, 2007b, Fig. 1-3
Width of soil source area parallel to groundwater flow direction	W	1219	cm	Affected area dimension, 40 ft (Figure 2-1)	Shaw, 2007b, Fig. 1-3
Groundwater mixing zone (δ_{gw})	d_{gw}	305	cm	Median of screen intervals, 10 ft	Shaw, 2007a
Soil Air Filled Porosity (q_{as})	q_{as}	0.23	unitless	n - qws	EPA, 1996, pg. 38.
Henry's Law Constant	H'	Chemical specific property	unitless	See Table 3	TCEQ, 2008
Organic Carbon Partition Coefficient	K_{oc}	Chemical specific property	unitless	See Table 3	TCEQ, 2008
Soil Water Partition Coefficient	K_d	Chemical specific property	unitless	See Table 3	TCEQ, 2008

$$LDF = 1 + \frac{V_{gw} \times d_{gw}}{I \times W}$$

LDF = 2.969E+00

Notes:

EPA, 1996. *Soil Screening Guidance: Technical Background Document* , EPA/540/R-95/128018, U. S. Environmental Protection Agency, Office of Emergency and Remedial Response, July.

Jacobs Engineering Group, Inc., 2002: *Final Remedial Investigation Report, Vol. 1: Report for the Group 4 Sites, Sites 35A, 35B, 35C, 46,47,48,50,60, and Goose Prarie Creek, Longhorn Army Ammunition Plant, Karnack, Texas* , Oak Ridge, Tennessee, January.

Shaw, 2006b, *Draft Final Addendum 9, Soil Sampling at LHAAP-03 (Former Site of 55-Gallon Drum Stored on Gravel Pad) and LHAAP-06 (Former Site of 55-Gallon Drum Formerly Stored in Shed), LonghornArmy Ammunition Plant, Karnack, Texas, Houston, Texas, May.*

Shaw, 2007a, *Draft Final Site Investigation Report, LHAAP-03 (Waste Site at Building 722-P. Paint Shop),* September.

Shaw, 2007b, *Draft Final Focused Feasibility Study, LHAAP-35A(58), Shop Area Group 4, Longhorn Army Ammunition Plant, Karnack, Texas,* September.

Shaw, 2008 LHAAP-49 Site Evaluation Report, Longhorn Army Ammunition Plant, Karnack, Texas, Appendix E, May.

Texas Commission on Environmental Quality (TCEQ), *Risk Reduction Rules* , 30 TAC §335.567. Appendix I.

TCEQ, 2008: Texas Risk Reduction Program Physical Chemical Properties Tables, April, accessed at http://www.tceq.state.tx.us/remediation/trrp/trrppcls.html

Table B-2
Physical Chemical Properties of Chemicals of Concern [a]
LHAAP-03 Waste Collection Pad near Building 722-P, Paint Shop

Chemical of Concern	Henry's Law Constant (H') (unitless)	Organic Carbon Partition Coefficient (Koc, unitless)	Soil Water Partition Coefficient (Kd, unitless) [b]	pH Dependent Partition Coefficient at pH 6.3 Soil Kd	Solubility in Water (S, mg/L)
Antimony	0.00E+00	NA	c	4.90E+01	0.00E+00
Arsenic	0.00E+00	NA	c	2.80E+01	0.00E+00
Barium	0.00E+00	NA	c	3.50E+01	0.00E+00
Cadmium	0.00E+00	NA	c	4.40E+01	0.00E+00
Chromium (average Cr(III)Cr(IV) = 70:1)	0.00E+00	NA	c	5.80E+05	0.00E+00
Copper	0.00E+00	NA	d	3.98E+01	0.00E+00
Lead	0.00E+00	NA	c	1.8E+03	0.00E+00
Mercury	4.7E-01	NA	c	2.2E+01	3.00E-02

Notes:

pH data provided in the LHAAP-35A(58) Feasibility Study, in preparation.

[a] Annual TCEQ update of chemical/physical properties table [(Figure: 30 TAC §350.73(e)], April 2008.

[b] value calculated from log (Kd) value from chemphys TRRP table, April 2008 unless stated otherwise.

[c] pH-dependent Kd value obtained from Figure 30TAC§350.73(e)(1)(C), April 2008

[d] value calculated from log (Kd) value from chemphys TRRP table, April 2008 unless stated otherwise.

Table B-3
Calculation of Soil Saturation Concentration (Csat) Values for Chemicals in Soil

$$K_{sw} = \frac{\rho_b}{\theta_{ws} + K_d\rho_b + H'\theta_{as}} \qquad C_{sat} = S\,\frac{(\theta_{ws} + K_d\rho_b + H'\theta_{as})}{\rho_b}$$

Chemical of Concern (COC)	ρ_b	θ_{ws}	F_{oc}	K_{oc}	K_d	H'	q_{as}	S	K_{sw}	C_{sat}
Antimony	1.60	0.16	0.020	NA	4.90E+01	0.00E+00	0.23	0.00E+00	2.04E-02	NA
Arsenic	1.60	0.16	0.020	NA	2.80E+01	0.00E+00	0.23	0.00E+00	3.56E-02	NA
Barium	1.60	0.16	0.020	NA	3.50E+01	0.00E+00	0.23	0.00E+00	2.85E-02	NA
Cadmium	1.60	0.16	0.020	NA	4.40E+01	0.00E+00	0.23	0.00E+00	2.27E-02	NA
Chromium	1.60	0.16	0.020	NA	5.80E+05	0.00E+00	0.23	0.00E+00	1.72E-06	NA
Copper	1.60	0.16	0.020	NA	3.98E+01	0.00E+00	0.23	0.00E+00	2.51E-02	NA
Lead	1.60	0.16	0.020	NA	1.83E+03	0.00E+00	0.23	0.00E+00	5.46E-04	NA
Mercury	1.60	0.16	0.020	NA	2.20E+01	4.74E-01	0.23	3.00E-02	4.51E-02	6.65E-01

Abbreviation:

NA - not applicable

Table B-4
Calculation of Standard 3 Commercial/Industrial Medium-Specific Concentration (MSC) for Chemicals in Soil

$$\text{Standard 3 Soil MSC} = \frac{\text{GW-Ind} \times \text{LDF} \times (L_2/L_1)}{\text{Ksw}}$$

Chemical of Concern (COC)	GW-Ind MSC [a] (mg/L)	LDF	K_{sw}	L_2	L_1	Standard 3 Commercial/Industrial Soil MSC (mg/kg)	
						Calculated	Corrected [b]
Antimony	6.0E-03	2.97E+00	0.020	721.78	457.00	**1.4E+00**	**1.4E+00**
Arsenic	1.0E-02	2.97E+00	0.036	721.78	457.00	**1.3E+00**	**1.3E+00**
Barium	2.0E+00	2.97E+00	0.028	721.78	457.00	**3.3E+02**	**3.3E+02**
Cadmium	5.0E-03	2.97E+00	0.023	721.78	457.00	**1.0E+00**	**1.0E+00**
Chromium	1.0E-01	2.97E+00	0.000	721.78	457.00	**2.7E+05**	**2.7E+05**
Copper	1.3E+00	2.97E+00	0.025	721.78	457.00	**2.4E+02**	**2.4E+02**
Lead	1.5E-02	2.97E+00	0.001	721.78	457.00	**1.3E+02**	**1.3E+02**
Mercury	2.0E-03	2.97E+00	0.045	721.78	457.00	**2.1E-01**	**2.1E-01**

Notes and Abbreviations:

[a] GW-Inc MSC value from TCEQ 2006 MSC table.

[b] Corrected MSC = C_{sat} concentration shown on Table 3.

NA - not applicable

Table B-5
Applicable Standard 3 Commercial/Industrial Medium-Specific Concentration (MSC) for Chemicals in Soil at the LHAAP-03 Waste Collection Pad near Building 722-P, Paint Shop

Chemical of Concern (COC)	Calculated Standard 3 Commercial/Industrial Soil MSC [a] (mg/kg)	Background Concentration [b]	Applicable Commercial/Industrial Soil MSC [c] (mg/kg)
Antimony	1.4E+00	1.6E+00	1.6E+00
Arsenic	1.3E+00	5.9E+00	5.9E+00
Barium	3.3E+02	1.2E+02	3.3E+02
Cadmium	1.0E+00	1.4E+00	1.4E+00
Chromium	2.7E+05	2.9E+01	2.7E+05
Copper	2.4E+02	8.4E+00	2.4E+02
Lead	1.3E+02	1.8E+01	1.3E+02
Mercury	2.1E-01	1.1E-01	T

Notes:

Shading indicates above the MSC

[a] Value equals the lower of the calculated MSC or C_{sat} values (Table 4).

[b] Background concentration calculated as the 95% UPL of soil background concentrations (*Final Background Soil Study Report, Longhorn Army Ammunition Plant, Karnack, Texas, July (Shaw, 2004).*

[c] Applicable Commercial/Industrial Soil MSC equals largest of Calculated Standard 3 MSC and background values. Shading indicates value equals background.

LONGHORN ARMY AMMUNITION PLANT,

Karnack, Texas

MONTHLY MANAGERS' MEETING

AGENDA

DATE:	Tuesday, 18 August 2009
TIME:	2:00 p.m.
PLACE:	Teleconference Call-In Number 866-797-9304, Passcode 4155734

Welcome **RMZ**

Action Items:

Army

- RMZ to forward MMRP LUC notification language to Fay Duke. Completed
- Follow up with AEC on the progress of the Action Memo concurrence and get back to Shaw as soon as possible. Completed
- Army and ECC will discuss road conditions, truck routes and handling (Haystack Road) and coordinate with USFWS in regards to the need for a SUP (special use permit). Completed
- Aaron will provide a copy of the draft final work plan to Dale Vodak on landfill demolition. Completed

EPA

- Steve will find out what EPA's role is on the ESD.

Shaw

- Shaw will meet with USFWS this week regarding site access (restricting gate access) during environmental work. Completed.
- Shaw will begin providing a two-week look-ahead schedule on a weekly basis. Ongoing.

Programmatic Issues

- Status of Technical Approach on FS Remedies **RMZ/ST**
- Restoration Discussions between Army and EPA

Defense Environmental Restoration Program (DERP) PBC Update **PS/GJ**

- Document Status/Environmental Sites (Table)
- Field update for LHAAP-04 and Pistol Range
- Groundwater Treatment Plant Update

DERP Total Environmental Restoration Contract Update

- LHAAP-37/67 – Draft Final ROD Status **RMZ**

BRAC-Funded Environmental Restoration

- LHAAP-19 – Demolition Landfill Progress **JRL/AW**

MMRP **JRL/AW**

- Status of regulatory review comment responses
    - DF MEC Removal Action Report
        - TCEQ review of notification recordation
    - DF MC Data Summary Report

Transfer Update **RMZ**

- ECOP VI
- LUCs
- Refuge Opening

Other Issues

- 2009 IAP Status
- Powerhouse Demolition Status
- LHAAP-18/24 ESD
- Groundwater Treatment Plant
    - Results of Creek Sampling from June downtime
    - Sand Filter Replacement

Adjourn

Shaw® Shaw Environmental, Inc.

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

Location of Meeting: **Teleconference**

Date of Meeting: **August 18, 2009; 2:00 PM – 03:30 PM**

Meeting Participants:

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

Previous Action Items

Army

- RMZ to forward MMRP LUC notification language to Fay Duke. *Completed.*
- Follow up with AEC on the progress of the Action Memo concurrence and get back to Shaw as soon as possible. *Completed.*
- Army and ECC will discuss road conditions, truck routes and handling (Haystack Road) and coordinate with USFWS in regards to the need for a SUP (special use permit). *Completed.*
- Aaron Williams will provide a copy of the draft final work plan to Dale Vodak on landfill demolition. *Completed.*

EPA

- Steve Tzhone will find out what EPA's role is on the ESD. *Completed.*

Shaw

- Shaw will meet with USFWS this week regarding site access (restricting gate access) during environmental work. *Completed.*
- Shaw will begin providing a two-week look-ahead schedule on a weekly basis. *Ongoing.*

<u>Programmatic Issues</u> **Rose M. Zeiler/John Lambert**

Technical approach on FS Remedies

John Lambert indicated that the Army approved the monitored natural attenuation (MNA) with contingent remedy concept, and that it was basically the same concept as that discussed during the April feasibility study meeting, but using different terminology. This applies to the Feasibility Studies (FSs) for sites LHAAP-46, LHAAP-50, and LHAAP-58. The MNA remedy will include a two-year data collection and evaluation period at the end of which a decision will be made as to whether or not the contingent remedy needs to be implemented. Shaw is in agreement with this resolution. Praveen Srivastav added that the difference in terminology went from a "two component remedy" to "MNA with contingent remedy". It was clarified that the MNA evaluation will utilize data collected during the two year evaluation period plus any historical data, going back at least 10 years, which are available and appropriate for MNA evaluation. Rose Zeiler stated that the Army would review the MNA evaluation before it goes to the regulators and that the Army may have more stringent criteria than what the regulators are requiring. Praveen indicated that Shaw will evaluate the effectiveness of MNA according to the EPA evaluation criteria and inquired whether Army had evaluation criteria other than those in EPA guidance. John Lambert clarified that the Army was interested in clear guidelines and wanted to remove as much subjectivity as possible.

Fay asked about the trigger for implementation of the remedy. Steve Tzhone and Terry Burton also added that the need for the contingent remedy would depend upon what the MNA data show. Praveen replied that the evaluation criteria and trigger language would be discussed and agreed upon prior to the finalization of the RODs for the sites. However, this does not affect the FS. The alternatives are already listed in the FSs and some modification to the text may have to be made to make sure that the two-component language is purged. Praveen suggested that we should move ahead with the finalization of the feasibility studies. Fay suggested that the recommendation portion in the FSs be removed to make them more neutral. Praveen agreed that the recommendation section will be removed.

Restoration Discussions between Army and EPA

Steve Tzhone mentioned that Longhorn was discussed during the EPA HQ quarterly meetings because of restoration issues related to the EPA's Groundwater Policy Clarification Memo. Steve outlined a couple of programmatic issues that EPA is working with Army nationwide for groundwater and MMRP Sites. DOD's new DERP manual (draft at this time) addresses groundwater, but policy-wise there is a discrepancy between EPA and DOD positions. Longhorn isn't the only facility affected by EPA's Groundwater Policy Clarification Memo.

EPA Legal department and Steve are going over the RTCs for LHAAP-37/67 ROD to see if they can agree. If so, then the issue can be resolved. If not, it will run through the usual channels: 1) enforcement; 2) EPA HQ with Army HQ; or 3) elevate to the EPA administrator and Secretary of Defense. EPA is considering certain legal nuances, but Steve does anticipate agreement.

Steve indicated that EPA has to meet certain GPRA goals. For federal facilities, EPA must meet certain environmental markers even though EPA is not the lead agency on those environmental markers. There has been an attempt to "harmonize" (GRPA) EPA goals with Army's schedule goals through matching up the CERCLIS schedule with the Army's schedule. For Region 6, all of the ROD GPRA goals for this fiscal year lie with Longhorn. Steve is counting on Army to look at the schedule realistically and communicate any necessary changes to meet those goals.

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

Document Status/Environmental Sites (Table)
Praveen Srivastav went over the document status/environmental sites table. Analytical data from LHAAP-02 is presently being reviewed, and the Draft Decision Document for LHAAP-02 is on hold pending the completion and submittal of those results. Comments were resolved on the Draft Final SI Report for LHAAP-03 and the final version is being prepared. The Final Action Memorandum for the Pistol Range and LHAAP-04 was submitted to the Army August 3, 2009, along with the Final Removal Action Work Plan for LHAAP-04 and the Pistol Range. The survey for sites LHAAP-06, -07, -51, -55, -64, -66, and -68 is being conducted. County notification will follow. RTC revision is in preparation for the Draft Final FS Addendum LHAAP-16. Additional comments are currently being resolved for the Draft Final FS LHAAP-17. Resolution is in progress for the Draft FS for LHAAP-18/24. RTC for the Draft Final FS for LHAAP-29 is in preparation. Resolution is in progress on comments received for the Draft Final Focused FS for LHAAP-46. Comments on the Draft Focused FS for LHAAP-47 are in preparation. The draft PP for LHAAP-49 is in Army review. The Draft Final FSs for LHAAP-50 and -58 are in comment resolution. The site survey is being conducted for LHAAP-60 to be followed by county notification to close this site. The final addendum to the Data Evaluation for LHAAP-35/36 and the Draft Final Decision Document for LHAAP-35/36 were submitted.

Field Update for LHAAP-04 and Pistol Range
Shaw is currently working at LHAAP-04 and has completed soil removal at the former Pistol Range. The excavated soil from the Pistol Range is in roll off boxes awaiting sampling results for disposal off site. At LHAAP-04, the concrete pad is being broken up for removal. The soils at LHAAP-04 will be stockpiled as will the concrete that is removed. Excavations will continue under the concrete. At 4 feet below ground surface, groundwater has not been encountered. A clay pipe, which was associated with LHAAP-04 operations, was found about 8 feet below ground surface. Praveen indicated that the field work would be completed in about two weeks. A detailed site sketch showing pipe locations will be provided with the excavation updates.

John Lambert indicated that ECC has completed their activities near the former Powerhouse site (adjacent to site LHAAP-04) and has removed its trailer. ECC is currently working at the demolition landfill near LHAAP-18/24.

Groundwater Treatment Plant Update
The Groundwater Treatment Plant (GWTP) had experienced power problems during the past month. Power was disrupted by a thunderstorm. SWEPCO repaired some lines, but did not turn on the transformer because of conditions at the site. This was resolved in 2½ weeks; and, during the interim, a generator was used to run the GWTP and to maintain recirculation of water at the perchlorate treatment unit. However, since there was no power to the wells, no water was extracted from sites LHAAP-16 or 18/24. Due to extraction downtime at LHAAP-18/24 in June due to the problems with the sand filter, samples were collected at several wells between 18/24 and Harrison Bayou as well as at the bayou itself. Results from that sampling indicated that there were no perchlorate or TCE detections in previously uncontaminated wells and no perchlorate detection at the bayou. The sand filter is scheduled to be replaced this week; this will allow normal GWTP operations to resume.

DERP Total Environmental Restoration Contract (TERC) Update **Rose M. Zeiler**

Rose indicated RTCs for LHAAP-37/67 were transmitted Monday. The RTCs are under review. She will be getting the surveys notarized and prepared for filing after ROD signature.

BRAC-Funded Environmental Restoration **John Lambert/Aaron Williams**

LHAAP-19-Demolition Landfill Progress
Aaron Williams is working with ECC on the landfill work plan, and he indicated the document should be finalized within the next couple of days. ECC has completed the first 6-inch lift at the demolition landfill and is currently working on the second lift. They'll probably have that completed by the middle of next week. All repair work will be done within the next 30 days.

Regarding the Powerhouse demolition, ECC expects to install the metal building to provide permanent cover for the switch gear within the next couple of weeks.

Paul Bruckwicki said that there are nine roll-off containers at the side of the road in a curve near the former Pistol Range site where Shaw had been working. Praveen indicated that preparations are underway for disposal of the excavated soil and that the roll-off containers should be removed in a few weeks. John Lambert said he would remind ECC to watch their speeds on installation roads and bridges.

Dale Vodak asked if there will be an inspection done for the landfill. John indicated that a PE will inspect the earth-filled cover and a closure report will be submitted. John indicated that all the usual criteria will be followed - earth-fill cover, verification of the thickness of the cap, compaction to 95% standard proctor, Quality Control elements, landfill investigation assessment, availability of waste records, and sign off from the PE. This will be in the final closure report.

Rose said that the scope of the landfill has expanded, and it is being treated as a DERA environmental site. Dale said they were near the end of their fiscal year, and he wanted to make

sure his managers were aware of the status of the landfill. He would like to visit the landfill and appreciated any advanced notification for scheduling a visit. Dale indicated that the region has been very interested in the landfill over the years, and added that the Army has been doing a good job managing the landfill and that he did not have any specific concerns. John said that the Army would provide status of the work at the landfill activities as far in advance as possible so that Dale or any other stakeholder can visit the site.

MMRP **John Lambert**

Status of Regulatory Review Comment Responses
Responses to the MC Data Summary Report are expected to be submitted later today or tomorrow. The Draft-Final MEC Removal Report is also expected to be submitted today or tomorrow.

Fay indicated she had not received the Decision Document for LHAAP-35/36 and asked that it be resent to her. She also requested that she always be sent a hardcopy.

Transfer Update **Rose M. Zeiler**

ECOP VI
This ECOP includes LHAAP-08, -32, -48, and -53. It is still moving forward.

LUCs
Rose indicated that the Army has received some guidance material from Fort Ord about the LUCs to develop a LUC MOA between Army and USFWS as preliminary to transfer of environmental sites with LUCs. Aaron Williams is taking a look at it.

Rose asked Paul if USFWS has had a chance to review the TCLP data from LHAAP-49. Paul indicated that he has not and said that he does not see a change in the USFWS stance.

Refuge Opening
The Refuge is scheduled to open to the public on September 26, 2009. Paul said the USFWS hired a temporary coordinator to manage the opening activities and provide information to the media.

Other Issues **Rose Zeiler**

2010 IAP Status
There is nothing new to discuss.

Powerhouse Demolition Status
The demolition work was completed at the Powerhouse. The status was discussed briefly above.

LHAAP-18/24 ESD
ESD is with the Army. Status was discussed briefly during earlier topics.

Groundwater Treatment Plant
GWTP issues, including results of sampling after the June 2009 downtime and the sand filter replacement, were addressed above under the DERP PBC update.

Miscellaneous
Paul Bruckwicki said that Senator Cornyn's aide, Gayle Green, is planning to be at Longhorn tomorrow. Paul said that there is stimulus money available, and they are hoping some will trickle down into Longhorn for road and bridge improvements.

Steve Tzhone asked about the scheduling spreadsheet. Aaron Williams said it should be out later today or in the morning.

The next monthly manager's meeting will be held at Longhorn Army Ammunition Plant on September 15, 2009 at 1 PM.

Meeting Adjourned

Action Items:

Army
- Provide additional language on LUCs after reviewing guidance material from another installation.

Shaw
- Provide field update with more detail and sketch showing where pipes were found in the LHAAP-04 excavation.
- Resend a hardcopy of the Draft Final Decision Document for LHAAP-35/36 to Fay.

USFWS
- Review LHAAP-49 TCLP data for acceptability of transfer.
- Provide the USFWS coordinator contact information to EPA/TCEQ in regards to Refuge opening activities.

Shaw Environmental, Inc.

Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
18 August 2009

No.	Document in Progress	Submittal Date	Army	Regulator	Next Submittal	Expected Date	Army	Regulator	Comment Resolution	Status	Remarks
1	Draft Decision Document, LHAAP-02	4/06/09	x		Draft Final DD	07/31/09	x	x		Evaluating how to address soil-to-groundwater COCs within LHAAP-02, without having to include monitoring within LHAAP-58.	Shaw collected 5 soil samples from LHAAP-02 for total and SPLP metals analysis
2	Draft Final SI Report for LHAAP-03, Rev 01	12/30/07	x	x	Final	08/17/09	x	x	Comments resolved.	RTCs submitted to TCEQ for review on 05/29/09; received concurrence from TCEQ 08/06/09.	Final SI report is in preparation.
3	Final Action Memorandum, LHAAP-04/Pistol Range	08/03/09	x		NA				Submitted.	Responses resolved. Final document submitted 08/03/09.	No regulatory review or signatures required
4	Final Removal Action Work Plan, LHAAP-04/Pistol Range	08/03/09	x	x	NA					Final document Submitted 8/3/09	
5	Final Decision Document, LHAAP-06, 07, 51, 55, 64, 66, 68	12/18/08	x		NA				NA	Final copies were distributed on 12/18/08.	Survey in progress; followed by County notification.
6	Draft Final Feasibility Study Addendum, Rev 01, LHAAP-16	7/3/08		x	RTC	07/31/09	x		In progress	EPA and TCEQ comments rec'd. RTCs reviewed by Army. RTC revision in progress	
7	Draft Final Feasibility Study, LHAAP-17	4/14/09	x	x	Final	07/31/09	x	x	In progress	Revised RTCs submitted to Army on 5/29/09. Resolving additional Army comments	
8	Draft Feasibility Study, LHAAP-18/24	3/3/09	x		Draft Final	07/31/09	x	x	In progress	Army comments received. Resolution in progress	

Shaw Environmental, Inc.

Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
18 August 2009

No.	Document in Progress	Submittal Date	Army	Regulator	Next Submittal	Expected Date	Army	Regulator	Comment Resolution	Status	Remarks
9	Draft Final Feasibility Study, LHAAP-29	03/11/09	x	x	Final	07/22/09	x	x	In progress	TCEQ and EPA comments received. EPA comments pending. New well installed and sampled week of 06/08/09 in groundwater below the intermediate zone. RTC prep in progress.	
10	Draft Final Focused Feasibility Study, LHAAP-46	1/30/09	x	x	Final	07/31/09	x	x	In progress	Responses for TCEQ and EPA comments submitted to Army for review on 05/13/09. Additional Army comments received. Resolution in progress.	
11	Draft Focused Feasibility Study, LHAAP-47	12/23/08	x		Draft Final	07/31/09	x	x	In progress	Army comments received. Conducted a new round of groundwater sampling. RTC in prep.	
12	Draft Final Site Evaluation Report for LHAAP-49	3/3/08	x	x	Final	6/16/09	x	x		Final report submitted 06/16/09.	
13	Draft Proposed Plan, LHAAP-49	7/2/09	x		Draft Final	7/31/09	x	x		In Army review	
14	Draft Final Feasibility Study, LHAAP-50	11/20/08	x	x	Final	06/30/09	X	x	In progress	Regulatory comments received. Revised responses submitted to Army for review on 05/13/09. Additional comments received. Resolution in progress.	
15	Draft Final Feasibility Study, LHAAP-58	9/20/07	x	x	Final	06/30/09	x	x	In progress	MNA evaluation submitted to regulators. Revised RTCs submitted to Army for review on 05/12/09. Resolution in progress.	
16	Final Decision Document, LHAAP-60	12/18/08	x						NA	Final copies were distributed on 12/18/08.	Survey in progress; followed by County notification.

Shaw Environmental, Inc.

Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
18 August 2009

No.	Document in Progress	Submittal Date	Army	Regulator	Next Submittal	Expected Date	Army	Regulator	Comment Resolution	Status	Remarks
17	Final Addendum, LHAAP-35/36	4/22/09	x	x					NA	Final document submitted.	
18	Draft Final Decision Document, LHAAP-35/36	7/15/09	x	x	Final	08/17/09	x	x		Draft Final Decision Document submitted 07/15/09.	

LONGHORN ARMY AMMUNITION PLANT,

Karnack, Texas

MONTHLY MANAGERS' MEETING

AGENDA

DATE:	Tuesday, 15 September 2009
TIME:	1:00 p.m.
PLACE:	Longhorn AAP @ Caddo Lake National Wildlife Refuge Office Conference Room Call-In Number 866-797-9304, Passcode 4155734

Welcome **RMZ**

Action Items:

Shaw

- Provide field update with more detail and sketch showing where pipes were found in the LHAAP-04 excavation. Completed
- Resend a hardcopy of the Draft Final Decision Document for LHAAP-35/36 to Fay. Complete

USFWS

- Provide the USFWS coordinator contact information to EPA/TCEQ in regards to Refuge opening activities.

Programmatic Issues

- Restoration Discussions between Army and EPA **RMZ/ST**
- Two new EPA policies regarding groundwater and the MMRP
- Enforceable schedule

Defense Environmental Restoration Program (DERP) PBC Update **PS/GJ**

- Document Status/Environmental Sites (Table)
- Field update for LHAAP-04 and Pistol Range
- Need for PP and ROD for Pistol Range
- Groundwater Treatment Plant
  - Results of Creek Sampling from June and August downtime
  - Sand Filter Replacement

DERP Total Environmental Restoration Contract Update

- LHAAP-37/67 – Draft Final ROD Status **RMZ**

BRAC-Funded Environmental Restoration

- LHAAP-19 – Demolition Landfill Progress **JRL/AW**

MMRP **JRL/AW**

- Status of regulatory review comment responses
  - DF MEC Removal Action Report
  - DF MC Data Summary Report

Transfer Update **RMZ**

- ECOP VI
- LUCs
- Refuge Opening

Other Issues

- 2009 IAP Status
- Powerhouse Demolition Status
- LHAAP-18/24 ESD

Adjourn

Shaw Environmental, Inc.

Subject: **Final Minutes, Monthly Managers Meeting**

Location of Meeting: **USFWS Administrative Building at Longhorn Army Ammunition Plant (LHAAP)**

Date of Meeting: **September 15, 2009; 1:00 PM – 04:45 PM**

Meeting Participants:

BRAC:	Rose M. Zeiler
USAEC:	Matthew Mechenes (phone)
USACE-Tulsa:	Aaron Williams, John Lambert
Shaw:	Praveen Srivastav, Kay Everett, Greg Jones, Van Vangala
USEPA Region 6:	Steve Tzhone, Terry Burton, Charles Faultry
TCEQ:	Fay Duke

Previous Action Items

Shaw

- Provide field update with more detail and sketch showing where pipes were found in the LHAAP-04 excavation. *Completed*
- Resend a hardcopy of the Draft Final Decision Document for LHAAP-35/36 to Fay. *Completed*

USFWS

- Provide the USFWS coordinator contact information to EPA/TCEQ in regards to Refuge opening activities. *Completed*.

Special EPA guest Charles Faultry was welcomed and introduced. Mr. Faultry is the Associate Director of the Superfund Remediation Branch of EPA Region 6. He came to the meeting to address the group to express the importance of adherence to schedule deadlines during the remediation program at Longhorn. Since many ROD dates were missed in the 2009 fiscal year, he is requesting an approach for getting the site into compliance with committed EPA GPRA goals. He indicated that when important deadlines are missed, the issues are elevated to EPA Headquarters in Washington D.C. He stressed that his appearance at the meeting was to

emphasize the importance that any slippage of schedules impacts Region (6) as well as on the national level and that a lot of justifications will have to be written to explain why all the RODs were missed this fiscal year. Mr. Faultry emphasized that policy disagreements may occur between the Army and EPA, and that such policy disagreements need to be identified as such and resolved at the Headquarter levels. He indicated that the schedule for FY2010 should actually be a schedule with realistic dates and that the schedule will be enforced by EPA in accordance with the FFA.

Mr. Faultry mentioned that the groundwater policy memo may also have caused some lost time. However, that is the time when any issues or "show stoppers" should be documented and bumped up to a higher level.

Mr. Faultry informed the group that a letter is being sent from the Region 6 Superfund Division director to the BRAC chief regarding the missed ROD deadlines and GPRA goals in Fiscal Year 2009 and informing that FY 2010 schedule will be enforced in accordance with the FFA. It was pointed out that the terminology used on the Army's scheduling spreadsheet is not consistent with EPA definitions and should be resolved before submitting the revised schedule.

Programmatic Issues **Rose M. Zeiler/Steve Tzhone**

Restoration Discussions between Army and EPA
Steve Tzhone pointed out that EPA's groundwater policy should be followed. If the Army disagrees with EPA policy, EPA Region 6 will issue enforcement letters to the BRAC Chief so that the issue pertaining to the disagreement is elevated to the highest level within Army and EPA.

EPA HQ liaisons involved in upcoming DoD DERP manual
EPA indicated that there are two EPA HQ liaisons who will be involved with the upcoming DoD DERP manual; one on groundwater issues and the other on MMRP issues.

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

Document Status/Environmental Sites (Table)
Praveen Srivastav went over the document status/environmental sites table. Analytical data from LHAAP-02 is presently being evaluated in regards to the soil-to-groundwater pathway. He indicated that the results of the recently conducted SPLP analysis exceeded GW-Ind MSCs. Fay Duke stated that the metals can be addressed by monitoring groundwater. Shaw will check the groundwater level in the well located within LHAAP-02. This well may be used for Long Term Monitoring or a new monitoring well will be installed if the existing well is dry or has insufficient water. The Final SI Report for LHAAP-03 was submitted, and a soil removal work plan is being prepared. The Final Action Memorandum for the Pistol Range and LHAAP-04 was submitted to the Army August 3, 2009, along with the Final Removal Action Work Plan for LHAAP-04 and the Pistol Range. The soil removal action has been completed at the pistol range and excavation activities are continuing at LHAAP-04. The survey for sites LHAAP-06, -07, -51, -55, -64, -66,

and -68 is being conducted. County notification will follow. Revised RTCs are with the Army for their review in regards to the Draft Final FS Addendum LHAAP-16. Additional comments are currently being resolved for the Draft Final FS LHAAP-17. Resolution is in progress for the Draft FS for LHAAP-18/24. Revised RTCs are with Army for their review regarding the Draft Final FS for LHAAP-29. RTCs for the Draft Final Focused FS for LHAAP-46 are in regulatory review. Comments from TCEQ have been received; EPA review is pending. Comments on the Draft Focused FS for LHAAP-47 are in preparation. The draft final PP for LHAAP-49 is in preparation. The Draft Final FSs for LHAAP-50 and -58 are in comment resolution. The site survey is being conducted for LHAAP-60 to be followed by county notification to close this site. The final addendum to the Data Evaluation for LHAAP-35/36 and the Draft Final Decision Document for LHAAP-35/36 were submitted and comment resolution for the draft final DD is in progress.

Field Update for LHAAP-04 and Pistol Range **Greg Jones**

Shaw has completed soil removal at the former Pistol Range and is currently working at LHAAP-04. The non-hazardous soil removed during excavation activities at the Pistol Range have been transported off site for proper disposal. Roll offs consisting of hazardous waste soil from the Pistol Range are awaiting the completion of waste profiling before being removed for disposal. Field work is continuing at LHAAP-04 as contaminated soils above clean up levels are encountered. Soils at LHAAP-04 are stockpiled or removed by truck for proper disposal. The excavation at LHAAP-04 has reached the top of the water table in a portion of the site. Greg Jones used a PowerPoint presentation of the soil removal actions at LHAAP-04 and the Pistol Range for the field update.

Need for PP and ROD for Pistol Range

The need for a proposed plan and ROD for the Pistol Range was discussed. Praveen inquired why a ROD was needed for the removal action at the Pistol Range since all contaminated soils above clean up levels have been removed from the site and there is no follow up action for groundwater. Steve Tzhone indicated that a no further action ROD will be necessary because this is an NPL site and to document a final decision.

Groundwater Treatment Plant Update

The Groundwater Treatment Plant (GWTP) is currently operating under normal conditions. The sand filter media has been replaced since the last meeting. Previously, during power disruptions, sampling of specific wells and a creek sample location was conducted on two occasions. The July sampling results indicated no detectable or J value results. In August, the latest results indicated concentrations less than laboratory detection limits were observed for samples collected from C-02, but that detected concentrations were observed in the sample collected from MW-16. Likewise, perchlorate above laboratory detection limits was observed in the creek sampling result.

<u>DERP Total Environmental Restoration Contract (TERC) Update</u> **Rose M. Zeiler**

LHAAP-37/67—Draft Final ROD Status

Rose indicated the RTCs for LHAAP-37/67 were annotated by EPA and are back at ELD for concurrence. Meanwhile the ROD is being prepared and will be presented to regulators soon.

BRAC-Funded Environmental Restoration **John Lambert/Aaron Williams**

LHAAP-19-Demolition Landfill Progress
Progress is continuing on the landfill cover work. Dale Vodak, TCEQ, was present during some of the activities. The landfill cover is almost complete. Testing of the cover for compaction, thickness, etc. has been completed. A discussion regarding the seeding procedures and type of seed for the landfill cover followed.

MMRP **John Lambert**

Status of Regulatory Review Comment Responses

DF MEC Removal Action Report: John stated the RTCs between Army and the regulators were resolved and the document is in final preparation.

DF MC Data Summary Report: Still awaiting comments. John indicated that they decoupled the perchlorate and the data gap constituent of white phosphorus and are answering other questions based on the 1998 ROD.

Transfer Update **Rose M. Zeiler**

ECOP VI
This ECOP includes LHAAP-08, -32, -48, and -53. It is still moving forward.

Refuge Opening
The Refuge is scheduled to open to the public on September 26, 2009.

Other Issues **Rose M. Zeiler**

2010 IAP Status
There is nothing new to discuss.

Powerhouse Demolition Status
The demolition work was completed at the Powerhouse.

LHAAP-18/24 ESD
ESD is with the Army. There is nothing new to report.

Meeting Adjourned

Action Items:

Army

- Provide additional language on LUC MOA with USFWS after reviewing guidance material from another installation.

Shaw

- Provide revised site schedule to Army for review and submission to EPA.

USFWS

- Review LHAAP-49 TCLP data for acceptability of transfer.

Shaw Environmental, Inc.

Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
15 September 2009

No.	Document in Progress	Submittal Date	Army	Regulator	Next Submittal	Expected Date	Army	Regulator	Comment Resolution	Status	Remarks
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4	Draft Final Feasibility Study Addendum, Rev 01, LHAAP-16	7/3/08		x	RTC	09/25/09	x		In progress	Revised RTCs in Army review as of 9/11/09.	
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Shaw Environmental, Inc.

Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
15 September 2009

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11	Draft Proposed Plan, LHAAP-49	7/2/09	x		Draft Final	9/18/09	x	x		Army comments resolved. DF proposed plan in progress.	
12	Draft Final Feasibility Study, LHAAP-50	11/20/08	x	x	RTC	09/18/09	x	x	In progress	Regulatory comments received. Revised responses submitted to Army for review on 05/13/09. Additional comments received from Army. Resolution in progress.	
13	Draft Final Feasibility Study, LHAAP-58	9/20/07	x	x	RTC	09/11/09	x	x	In progress	MNA evaluation submitted to regulators. Revised RTCs submitted to Army for review on 09/11/09	
14	County Notification, LHAAP-60	Nov 2009									
16	Draft Final Decision Document, LHAAP-35/36	7/15/09	x	x	Final	09/25/09	x	x		TCEQ comment received on DF DD. Resolution in progress.	

Shaw

LONGHORN ARMY AMMUNITION PLANT
MONTHLY MANAGERS' MEETING

Location	Longhorn Army Ammunition Plant, Karnack, Texas		
Date	15-Sep-2009	**Time**	1:00 PM

ATTENDEES

Name (printed)	Signature	Organization	Phone	E-mail
Longhorn Team Members				
Rose M. Zeiler		BRAC	(479) 635-0110	rose.zeiler@us.army.mil
Matthew Mechenes		USAEC	(410) 436-1505	matthew.mechenes@us.army.mil
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CHARLES FAULKY		US EPA	(214) 665-2731	FAULKY.CHARLES@EPA.GOV.

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

September 1, 2009

Distribution (one copy each)

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Dear LHAAP RAB Member,

The next Restoration Advisory Board (RAB) meeting will be held on Tuesday, September 15, 2009, from 6:30 to 7:30 p.m. at the Karnack Community Center, Highway 134 and Spur 449, Karnack, Texas 75661. We hope that you can attend this meeting. If you have any questions, please do not hesitate to contact me.

Shaw Environmental, Inc. (Shaw) is the contractor supporting the U.S. Army environmental restoration activities at the Longhorn Army Ammunition Plant (LHAAP), and will be coordinating the RAB meeting. A tentative agenda is attached.

Regards,

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

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

AGENDA

DATE:	Tuesday, September 15, 2009
TIME:	6:30 – 7:30 PM
PLACE:	Karnack Community Center, Karnack, Texas

06:30 Welcome {RMZ & PF}

06:35 Open items {RMZ}

06:40 Programmatic Issues
- Site Status Summary
- Other

06:50 Defense Environmental Restoration Program (DERP) Performance Based Contract (PBC) Update {Shaw}
- Groundwater Treatment Plant (GWTP) Update
- Documents Status/ Environmental Sites
- Community Questions About Groundwater Quality at Site Perimeter

07:05 DERP Total Environmental Restoration Contract Update {RMZ}
- ROD for LHAAP-37 and-67

07:10 Military Munitions Response Program (MMRP) Update {USACE}

07:15 Other Environmental Restoration Issues/Concerns {RMZ)
- Construction Debris Landfill

07:20 Transfer Update
- Powerhouse Demolition {USACE}
- Transfer status of Site 12
- ECOP VI

07:30 Adjourn {RMZ}

Shaw Environmental, Inc.

Subject:	**Draft Final Minutes, Quarterly Restoration Advisory Board (RAB) Meeting, Longhorn Army Ammunition Plant (LHAAP)**
Location of Meeting:	**Karnack Community Center, Karnack, Texas**
Date of Meeting:	**September 15, 2009, 6:30 – 07:30 PM**

Meeting Participants:

LHAAP/BRAC	Rose M. Zeiler
USACE-Tulsa:	John Lambert, Aaron Williams
Shaw Environmental:	Praveen Srivastav, Greg Jones, Kay Everett, Van Vangala
TCEQ:	Fay Duke
USEPA Region 6:	Steve Tzhone, Terry Burton
RAB:	Paul Fortune, Judith Johnson
Community:	Gary Endsley, Ron Mundey, Chris Parsons, Jeff Thompson

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

Welcome – Rose Zeiler and Paul Fortune
Paul Fortune called the meeting to order and introduced new participants to the meeting.

Open Items – Rose Zeiler
There were no open items discussed.

Programmatic Issues
Site Status Summary
Steve Tzhone indicated that there were two programmatic issues - groundwater and munitions. Steve indicated that EPA is working with the State on these issues. He said that at the end of June 2009, a memo was issued by EPA as a groundwater policy clarification so that facilities would be operating consistently under the same policy. To this end, two EPA liaisons are working with the Department of Defense, who is in the process of updating the DERP manual that the Army follows for environmental restoration. The other issue was regarding munitions.

Paul asked how these changes will affect Longhorn AAP. Steve said that the policy states that groundwater is to be restored to potential drinking water for beneficial use, using drinking

water standards. He indicated that there will be restoration activity goals set for groundwater through this policy.

Steve also is working with the Army on enforcement of document schedule and milestone schedule. That schedule is not available tonight, but will be available by the end of the month. Steve said he would have the groundwater policy memo sent to all attendees.

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

Document Status/Environmental Sites
Praveen Srivastav distributed copies of the document status table and discussed each site on the table. Praveen indicated LHAAP-02 is under evaluation regarding how to address the soil-to-groundwater COCs within LHAAP-02. A soil removal work plan for LHAAP-03 is being developed. Surveys for LHAAP-06, -07, -51, -55, -64, -66, and -68 are underway for the county notification. Completion of this stage is expected soon. Comment resolution is in progress for the LHAAP-16 and -17 DF FSs. The Draft FS for LHAAP-18/24 is in Army's review after revised RTCs were submitted. Regulatory responses have been addressed for the Draft Final FS for LHAAP-29 and are in Army review. The Draft Final FS for LHAAP-46 is in regulatory review with EPA comments pending. Comment resolution is in progress on the Draft FS for LHAAP-47. The Draft Final proposed plan for LHAAP-49 is in progress. Resolution to comments on the Draft Final FS for LHAAP-50 is in progress. The Draft Final FS for LHAAP-58 is in progress. Revised RTCs were submitted to Army for review. Resolution of comments on the Draft Final Decision Document for LHAAP-35/36 is in progress.

Groundwater Treatment Plant (GWTP) Update
The plant is operating normally. The sand filter issues and power problems during the past three months have been resolved.

Community Questions about Groundwater Quality at Site Perimeter
Praveen provided a presentation on the groundwater monitoring wells at LHAAP in response to a letter from Gary Endsley submitted to the RAB through Paul Fortune. Hydraulic connectivity and plume maps of contaminated groundwater were presented and discussed. One topic of special interest was the depths of the nearby water supply wells and how those wells might be impacted by the contamination in the groundwater at LHAAP. Based on well construction data, it was explained that the wells are screened at a much deeper groundwater zone than any of the LHAAP environmental monitoring wells, and that the contaminated groundwater zones are not hydraulically connected to the water supply wells offsite or onsite. A discussion occurred on analytical methods such as SW 846 and the target list of the parameters historically analyzed in samples from the LHAAP perimeter wells. Initially, a wide range of parameters was analyzed (e.g., volatile organics, semi-volatile organics, metals, dioxins, etc.). When perchlorate became an emerging contaminant, it was analyzed in samples from throughout LHAAP and continues to be analyzed in groundwater samples from perimeter wells at the present time. This was done as part of a dispute resolution between the Army and EPA. The others analytes were dropped because they were not present above laboratory detection limits for several rounds of sampling and were not required in the dispute resolution.

Mr. Endsley indicated that he was satisfied with the responses to his questions.

DERP Total Environmental Restoration Contract (TERC) Update – Rose Zeiler

ROD for Sites LHAAP-37 and -67
The issues have been recently resolved regarding this ROD, and it is expected to be submitted this calendar year.

Military Munitions Response Program (MMRP) Update – USACE
There are two documents being finalized under this program for the two MMRP sites. The areas of these sites are approximately 79 and 80 acres.

Other Environmental Restoration Issues/Concerns – USACE

Construction Debris Landfill
John Lambert indicated that the contractor is completing the work at the construction landfill (LHAAP-19). The clay cover was completed and tested. The next step is placement of top soil, but rain events have delayed this step. As soon as the cap dries, the top soil will be placed and the project completed. The work will be summarized in a landfill closure report.

Transfer Update

Powerhouse Demolition Progress
The demolition of the Powerhouse has been completed, although there is still some construction debris that is scheduled to be removed.

Transfer Status of Site 12
There has been no change to the transfer status of LHAAP-12.

ECOP VI
ECOP VI includes the static test firing area (LHAAP-53), the "Y" Area (LHAAP-48) which consists of about 14 acres, LHAAP-08, and LHAAP-32.

The next RAB meeting is December 8, 2009 at 6:30 PM.
[NOTE: The meeting was later rescheduled to December 1, 2009.]

Adjourn

September Meeting Attachments and Handouts:
- *Status of Technical Documents MARC PBC*
- *Meeting Agenda*
- *Creek and Perimeter Sampling Results*

Shaw Environmental, Inc.

Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
15 September 2009

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Shaw Environmental, Inc.

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August 6, 2009

RAB Advisory Board Questions for Shaw Engineering

Issue: Contamination of groundwater beyond the boundary of Caddo Lake National Wildlife Refuge

Concern: Public health risks associated with and resulting from contamination of public and private drinking water sources near CLNWR

Request of RAB Advisory Board Membership:

As a concerned citizen and President of the Friends of CLNWR, I must raise an issue, which I feel has not been properly addressed by the RAB proceedings or the scientific investigations/remediation recommendations of Shaw Engineering.

My premise is this: If we know there is groundwater contamination within the historic Longhorn Army Ammunition Plant site and if we know there is plume migration (which Shaw admits), then when can we expect toxins within the boundary of CLNWR to travel beyond the fence line. This scenario poses a real and direct public health risk to the general public living near CLNWR and Federal and state agency employees working at the Refuge as well as to all its future visitors.

Questions to be asked by RAB Advisory Board members to Shaw Engineering:

1. What contaminants are being found during peripheral well sampling that is periodically conducted by Shaw or its contractors?
    a. What is Shaw (or its contractors) sampling to detect and what is Shaw finding?
    b. What other substances should be sampled and what are laboratory analysis limits for each?
    c. What is the human toxicological response from exposures to these substances?
    d. What are the Federal and state drinking water standards associated with these specific substances?
2. At what rate is/are the underground contaminant plume(s) moving?
    a. The Advisory Board should ask for a map showing plume depth, rate of flow, direction of movement, and predicted timeline for movement beyond the boundary of CLNWR.
    b. Data should be correlated with common depth of local private drinking water wells and the City drinking water wells at Uncertain and Karnack.

Reports to ask Shaw Engineering to produce:

1. A report of peripheral well sampling analysis showing results over time (chronological findings for each well).
2. Human toxicological reports for all substances detected in groundwater samples to date.
3. Human toxicological reports on all substances, which may be added to the sampling list (like dioxins and heavy metals including the isomers of chromium).

4. Vector maps showing depth, direction of movement, and rate of movement of underground contaminants from their original sources to and beyond the fence line.
5. Recommendations for absolute prevention of contamination of off-site drinking water sources.

Thank you very much.

Gary Endsley
281 CR 3209
Atlanta, TX 75551
903.319.5312

02M062007D

The Shaw Group Inc.®

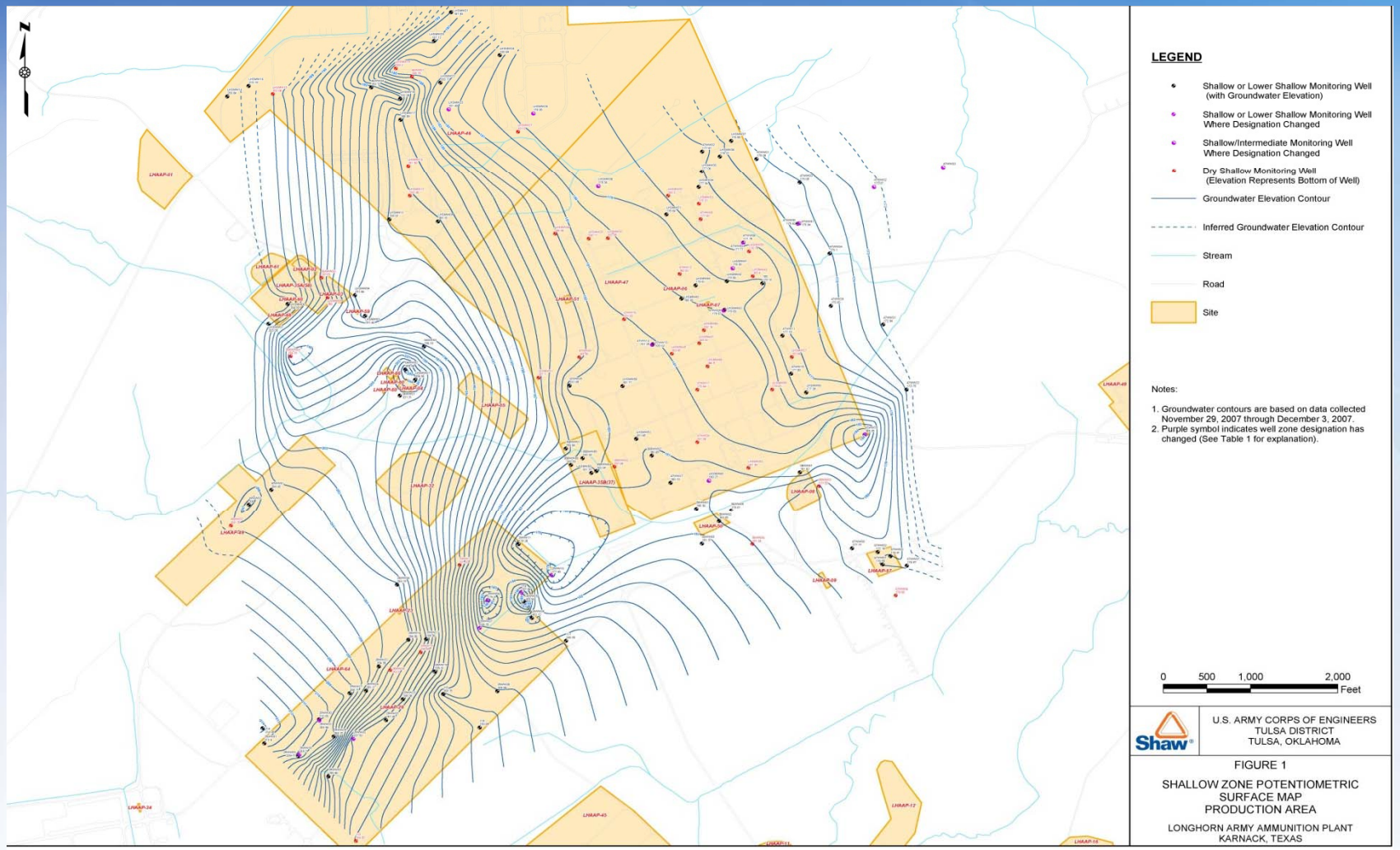

Longhorn Army Ammunition Plant
Karnack, Texas
Harrison Bayou

Groundwater and Contaminant Plumes at Longhorn AAP

Groundwater Depth and Flow

- Three groundwater zones at Longhorn: Shallow, intermediate, and deep
- Shallow zone – surface to approximately 30 feet deep
- Intermediate zone – 30 feet to 80 feet
- Deep zone – 80 feet to 150 feet
- Groundwater flow direction to the northeast towards the lake
- Groundwater flow rate – 0.04 ft/day (clay) to 4 (silty-sand) feet/day.

Groundwater Flow Map



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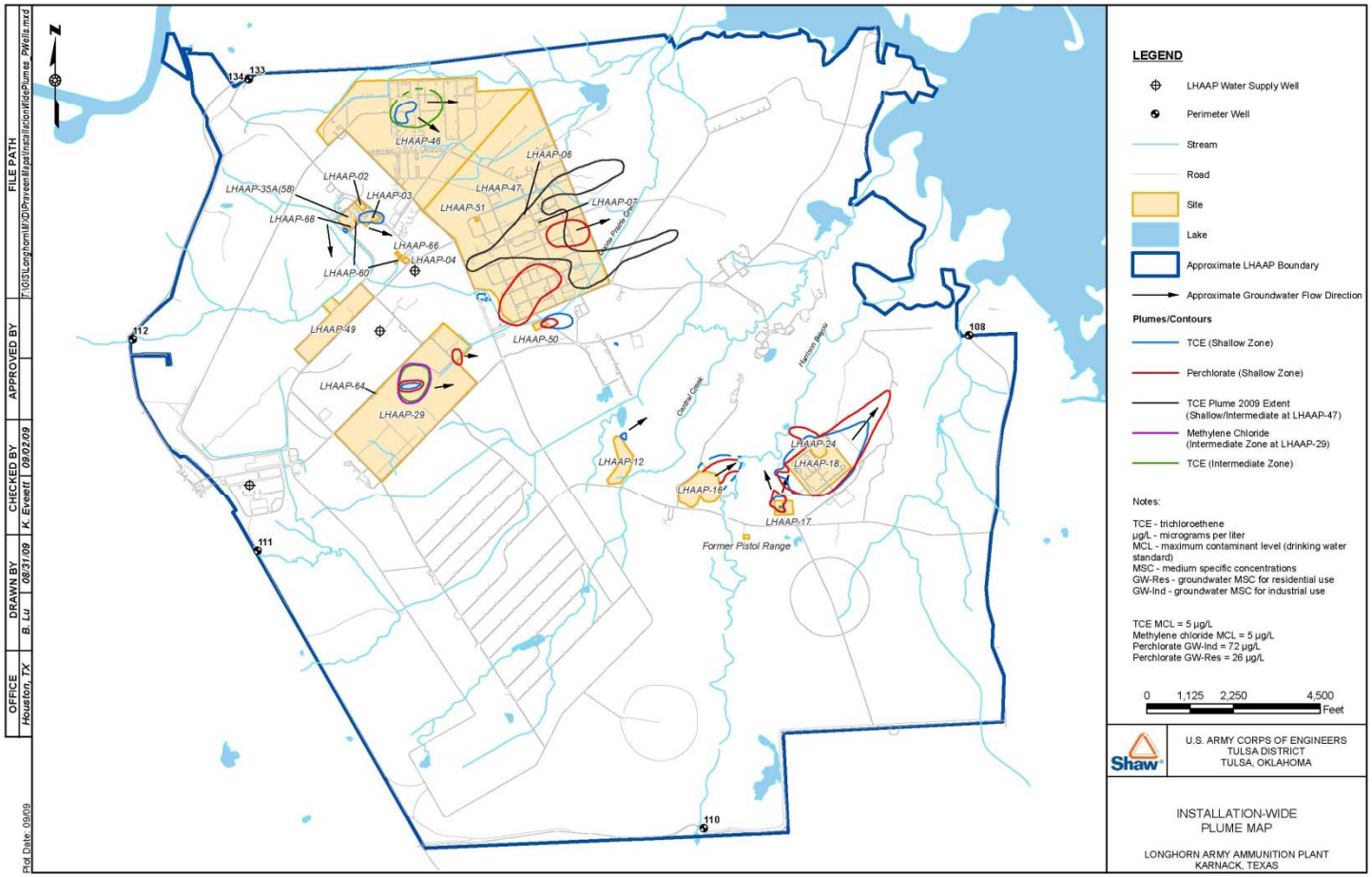
Installation-Wide Plume Map



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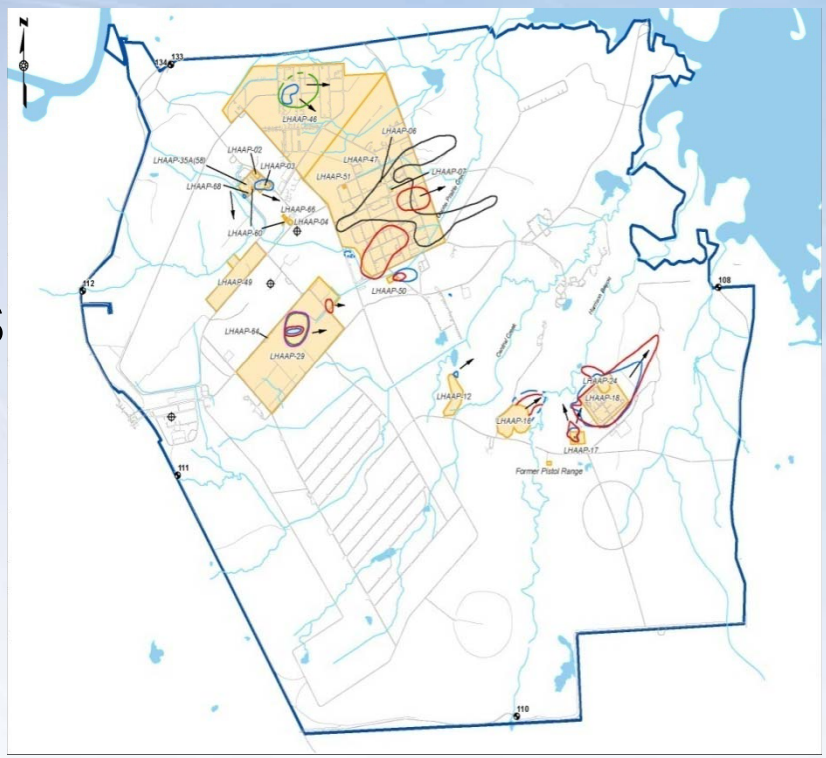
Perimeter Wells
Longhorn Army Ammunition Plant

Well ID	Screen Depth
108	5.5 to 20.5 ft bgs
110	5 to 20 feet bgs
111	5.4 to 20.4 feet bgs
112	5.25 to 20.25 feet bgs
133	64.5 to 84.5 feet bgs
134	90 to 110 feet bgs

Perimeter Well Locations



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Perimeter Wells Sampling Program
Longhorn AAP

1994 through 1999

- Explosives
- Metals
- VOCs
- SVOCs
- Nitrate
- Nitrite

Low levels or no detections

2000 through 2004

- Explosives
- Metals
- VOCs
- SVOCs
- Nitrate
- Nitrite
- Perchlorate

Low levels or no detections

Perimeter Wells Sampling Program
Longhorn AAP

- **Semiannual Sampling for Perchlorate per Dispute Resolution since 2005**

Samples collected from wells 108, 111,133, and 134 were also analyzed for perchlorate in 1999.

Perchlorate Results for Perimeter Well Sampling
Longhorn Army Ammunition Plant

Well ID	Jun 2005	Sep 2005	Sep 2006	May 2007	Aug 2007	Dec 2007	Mar 2008	Sep 2008	May 2009
LHPMW108			10 U		0.5U			2.5 U	
LHPMW110			10 U		10U			5.0 U	
LHPMW111			4 U		0.5U			0.5 U	
LHPMW112			5 U		3U			2.0 U	
LHPMW133	0.541	0.597	1.08	1 U	1.09	0.5 U	0.5 U	0.5 U	0.47 J
LHPMW134	0.811	0.725	0.708 J	1 U	0.949 J	0.5 U	0.5 U	0.829 J	0.40 J

NOTES:

all units in µg/L

µg/L migrograms/liter

U undetected

J Present below normal reporting limit but greater than or equal to the MDL and the concentration is an approximate value.

L Result biased low.

MDL method detection limit

02M062007D

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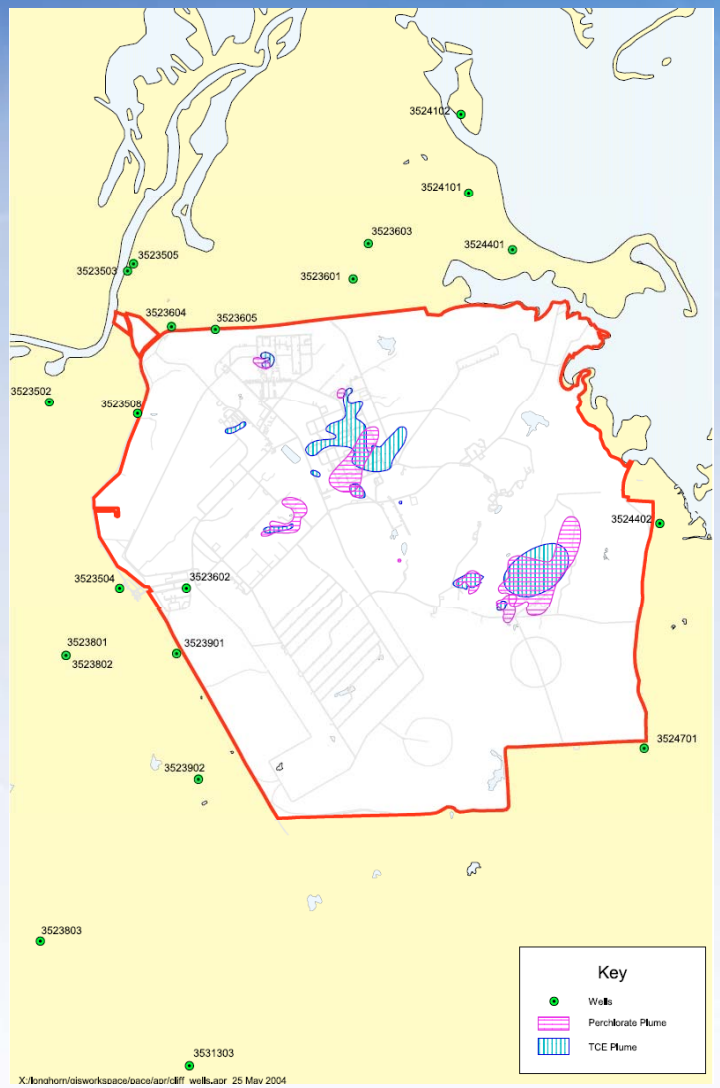
Offsite Water Supply Wells



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Summary

- Public water supply wells are mostly upgradient or lateral gradient from Longhorn
- Public water supply wells are 250-300 feet deep, much deeper than the depth of contamination at Longhorn
- Contaminant plumes at Longhorn are slow moving and are retarded by natural processes or active remedies
- Contaminant plumes are not expected to impact public water supply wells. This was supported by modeling performed in 2004.
- Toxicological information available in risk assessments in the Administrative Record
- Remedies being selected in feasibility studies are aimed to protect human health and the environment

Questions?

02M062007D

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Shaw Environmental, Inc.

Longhorn Army Ammunition Plant
Restoration Advisory Board Meeting

Location	Karnack Community Center, Karnack, Texas
Date	15-Sep-2009 6:30 PM **page 1 of 1**

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

ATTENDEES

Name (printed)	Signature	Organization	Phone	E-mail
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Nigel R. Shivers				nigelshivers@yahoo.com
Tom Walker				twalkercaddolake@gmail.com
Tony Novak				paldog_1@windstring.net
Judith Johnson	Judith Johnson	RAB		judithjohnson@webtv.net
Ken Shaw				kens@shreve.net
Longhorn Team Members and Community				
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Matthew Mechenes		USAEC	(410) 436-1505	matthew.mechenes@us.army.mil
Aaron Williams		USACE, Tulsa	(918) 669-4915	aaron.k.williams@usace.army.mil
John Lambert	John Lambert	USACE, Tulsa	(918) 669-4992	john.r.lambert@SWT03.usace.army.mil
Scottie Fiehler		USACE, Tulsa	(918) 669-7232	scottie.fiehler@us.army.mil
Steve Tzhone		USEPA, Dallas	(214) 665-8409	tzhone.stephen@epa.gov
Raji Josiam		USEPA, Dallas	(214) 665-8529	josiam.raji@epa.gov
Fay Duke		TCEQ, Austin	(512) 239-2443	fduke@tceq.state.tx.us
Dale Vodak		TCEQ	(903) 535-5142	dvodak@tceq.state.tx.us
Paul Bruckwicki		USFSW	(903) 679-4536	paul_bruckwicki@fws.gov
Barry Forsythe		USFSW	(214) 665-8467	forsythe.barry@epa.gov
Mark Williams		USFSW	(903) 679-9144	mark_williams@fws.gov
Praveen Srivastav		SHAW	(713) 996-4588	praveen.srivastav@shawgrp.com
Greg Jones	Greg N. Jones	SHAW	(713) 996-4472	greg.n.jones@shawgrp.com
Kay Everett		SHAW	(713) 996-4421	kay.everett@shawgrp.com
Gary Endsley	Gary Endsley	Today Foundation	903.665.2900	gendsley@hotmail.com
RON MUNDER	Ron M	East Texas Towns.com		ron@easttexastowns.com
CHRIS PARSONS	Chris Parsons			
Jeff Thompson	Jeff Thompson	Harrison County	903935-8402	Jeff@co.harrison.tx.us
Subramanyan Vaydl	Sub Vaydl	Shaw	713 996 4459	Van.Vaydla@Shawgrp.com

LONGHORN ARMY AMMUNITION PLANT,

Karnack, Texas

MONTHLY MANAGERS' MEETING

AGENDA

DATE:	Tuesday, 20 October 2009
TIME:	1:00 p.m.
PLACE:	Teleconference
	Call-In Number 866-797-9304, Passcode 4155734

Welcome **RMZ**

Action Items:

Army
- Provide additional language on LUC MOA with USFWS after reviewing guidance material from another installation.

Shaw
- Provide revised site schedule to Army for review and submission to EPA. Completed.

USFWS
- Review LHAAP-49 TCLP data for acceptability of transfer.

Programmatic Issues **RMZ/ST**
- Enforceable schedule

EPA Groundwater Sampling **ST**
- LHAAP-18/24
- MMRP Sites

Defense Environmental Restoration Program (DERP) PBC Update **PS/GJ**
- Document Status/Environmental Sites (Table)
- Update for LHAAP-04 and Pistol Range
- Groundwater Treatment Plant

DERP Total Environmental Restoration Contract Update
- LHAAP-37/67 – Draft Final ROD Status **RMZ**

BRAC-Funded Environmental Restoration
- LHAAP-19 – Demolition Landfill Progress **JRL/AW**

MMRP **JRL/AW**
- Status of regulatory review comment responses
  - DF MEC Removal Action Report
  - DF MC Data Summary Report

Transfer Update **RMZ**
- ECOP VI

- LUCs
- Refuge Opening

Other Issues

- 2009 IAP Status
- Powerhouse Demolition Status
- LHAAP-18/24 ESD

Adjourn

Shaw Environmental, Inc.

Subject: **Draft Final Minutes, Monthly Managers Meeting**

Location of Meeting: **Teleconference**

Date of Meeting: **October 20, 2009; 1:00 PM – 03:15 PM**

Meeting Participants:

BRAC:	Rose M. Zeiler
USAEC:	Matthew Mechenes
USACE-Tulsa:	Aaron Williams, John Lambert
Shaw:	Praveen Srivastav, Kay Everett, Greg Jones, Susan Watson
USEPA Region 6:	Steve Tzhone, Terry Burton, Kendra Gomez
Booz Allen Hamilton:	Chris Reese, Rich Mayer, Wally O'Rear
TCEQ:	Fay Duke, Dale Vodak
USFWS:	Paul Bruckwicki, Barry Forsythe

Previous Action Items

Army

- Provide additional language on LUC MOA with USFWS after reviewing guidance material from another installation. *In progress.*

Shaw

- Provide revised site schedule to Army for review and submission to EPA. *Completed*

USFWS

- Review LHAAP-49 TCLP data for acceptability of transfer. *Paul Bruckwicki indicated that the USFWS does not intend to take the parcel because Army did not collect confirmation samples after the removal of mercury-contaminated soil at LHAAP-49. Rose Zeiler said that there was no risk at the site, and that the soil removal was conducted by Shaw/Army as a voluntary action. Steve Tzhone indicated that EPA supported the finding that there is no unacceptable risk at LHAAP-49 based on past investigations. He also offered EPA to conduct some sampling if that would help alleviate concerns USFWS may*

have at LHAAP-49. Rose appreciated the offer, but indicated that any decisions would come from BRAC.

Programmatic Issues ***Rose M. Zeiler/Steve Tzhone***

Enforceable schedule

A discussion regarding scheduling ensued. Steve Tzhone said that the schedule matches pretty well with the CERCLIS dates and also provides some buffer time. He indicated that going forward there are six RODs scheduled for fiscal year 2010. He also said that EPA HQ wanted to know why the RODs for LHAAP-37/67 have been pushed to April 2010. Rose Zeiler indicated that the RODs are expected to be issued sooner, but it was best to be conservative in regard to this enforceable schedule. Steve said that with every quarterly meeting, groundwater issues are being resolved with the DERP manual. The MMRP issues are not being resolved as EPA needs additional data on new well elevations.

Steve indicated that EPA HQ would monitor the schedule on a quarterly basis with the Army at the HQ level. Any "hurdle" would immediately be placed as an agenda item each quarter.

EPA Groundwater Sampling

Steve said that EPA has some extra funding and is planning to conduct groundwater sampling at Longhorn in two areas: LHAAP-18/24 and MMRP sites.

Kent Becher with the USGS would be heading up a sampling team to sample wells at LHAAP-18/24, including those that are not on the usual sampling schedule at LHAAP-18/24. They will mobilize the week of November 7, 2009. Additional information on wells has been requested of USACE and Shaw, who will try to accommodate those requests.

EPA has contracted Booz Allen Hamilton to conduct groundwater sampling at the MMRP sites. Rich Mayer with Booz Allen Hamilton said they will be mobilizing this week to collect groundwater samples at 10 wells located at LHAAP-27 and LHAAP-54. The samples will be analyzed for metals, perchlorate, and explosives and have a two week turnaround from TestAmerica. EPA said they expect to be finished by Friday. Steve indicated that Rich will prepare a report and provide to stakeholders when the results are available.

Tyler Jones with the Tulsa USACE will be present to split samples with the sampling teams. John Lambert said that some of the constituents will go away in the MEC data summary. Steve said that this sampling will address those COCs and other COCs that are outside of this document. EPA made comments based on the MEC report and it was answered under that set of comments. USACE will clearly separate this sampling to distinguish funds. Steve said they were only looking at data gaps. John said that the perchlorate method used in that time period was 314.0. The

detection limits for this method were not low and the method was known for producing a lot of false positives. John indicated that method 6850 was used later to remove the uncertainty regarding false positives and get lower detections. Rich said they would be using method 314.0 as it is a TCEQ-approved method. Fay Duke said that using method 6850 would require some additional paperwork such as an exemption, but that it was an approved method, just not certified. This method has been used at Longhorn before and most recently during excavation activities at LHAAP-04. A discussion on TCEQ laboratory method approvals or accreditations followed.

John indicated that the split samples by Tyler will be analyzed using method 6850. A split of the split was discussed in order to run method 314.0 as well as 6850 on the Army's samples to better correlate the analytical results. Army will probably do the split of a split on one of 10 samples collected, but they will deliberate on this further.

Kent asked about some additional data for LHAAP-18/24 wells that they would like to have before mobilization. One of the issues asked was if dedicated tubing was in the wells. Praveen Srivastav indicated that there is no tubing in the wells.

Kent also mentioned updating the geodatabase and how best to get their IT folks coordinated so that the transfer of information is seamless. They need data after 2007 and facility-wide. David Kirsten is the EPA-IT Coordinator. Contact information will be emailed.

Defense Environmental Restoration Program (DERP) PBC Update **Greg Jones**

Document Status/Environmental Sites (Table)

Greg reviewed the document status table. The draft Decision Document (DD) for LHAAP-02 is in Army review. The final Site Investigation Report for LHAAP-03 was finalized, and a soil removal work plan is being prepared. The draft Completion Report for LHAAP-04 soil removal is in preparation. County notification documents are currently being prepared for LHAAP-06, -07, -51, -55, -64, -66, and -68. A draft of the LHAAP-06 affidavit packet has been submitted to Army for review. The Responses to Comments (RTCs) on the draft Feasibility Study (FS) Addendum for LHAAP-16 have been submitted to regulators. The draft final FS for LHAAP-17 is in the comment resolution stage with the Army. The RTCs from draft FS for LHAAP-18/24 is in Army review. RTCs for the draft final FS for LHAAP-29 is in Army review. The final Focused FS for LHAAP-46 is in preparation after receiving concurrence from TCEQ and EPA received. The draft Proposed Plan (PP) is in Army's review. Responses to comments on the draft FS for LHAAP-47 were returned to the Army for review after adding a new round of groundwater sampling result data. The draft final PP for LHAAP-49 is in regulatory review. The draft Record of Decision (ROD) for LHAAP-49 is in preparation. The draft final FS for LHAAP-50 is in Army's review. Revised RTCs to the Draft final FS for LHAAP-58 is with the Army for their review. The draft PP for LHAAP-58 is in Army review. The county notification documentation for LHAAP-60 is in preparation. Comments to the draft final DD for LHAAP-35/36 has been resolved; the document is currently being prepared for review by Army before submittal to the regulators. The draft Completion Report and the draft PP for the Pistol Range are in Army review.

In addition to the document status table, Praveen issued a color-coded document tracking table that highlights which entity is working on a specific document and what other documents may be submitted soon. This table is intended to help expedite the review (and comment resolution) process and to final publication.

Update for LHAAP-04 and Pistol Range **Greg Jones**

Excavation activities have been completed. Soil was removed to approximately 13 feet in almost the entire excavation. In some places the excavation stopped when groundwater was encountered at 13 feet below ground surface. It was noted that the maximum perchlorate concentrations were well above concentrations encountered during the investigation phase. Fay asked that TCEQ receive the Removal Action Report for LHAAP-04 before the well installation plan so TCEQ has all data before deciding on well location.

Groundwater Treatment Plant Update

The Groundwater Treatment Plant (GWTP) is currently operating normally. The GWTP discharged to Harrison Bayou as well as ICTs 6 and 9 this past month.

DERP Total Environmental Restoration Contract (TERC) Update **Rose M. Zeiler**

LHAAP-37/67—Draft Final ROD Status

Rose indicated that she received comments from AEC for the RODs at LHAAP-37/67 and the RODs are with ELD for a final check. She is close to sending to the regulators. Fay said she would be out of the office through November 18th.

BRAC-Funded Environmental Restoration **John Lambert/Aaron Williams**

LHAAP-19-Demolition Landfill Progress

The lab reports are back; the borings and monitoring wells for investigation purposes have been completed. The site is pretty wet, and the contractor had completed half of the top soil placement when wet weather shut the work down. They will have to wait until it dries substantially. Paul indicated that more rain was on the way and that the Pistol Range site was underwater.

Dale Vodak said that he was very pleased with cap construction to this point. It appeared to have a good clay layer on top, which was a great improvement on the previous one that had a lot of sand in the matrix. The top soil placement has to be completed before grass seed can be sown.

MMRP **John Lambert**

Status of Regulatory Review Comment Responses

DF MEC Removal Action Report: John stated they are waiting on metes and bounds for the two sites, which are being shown as segmented circles. He also indicated the deliverables are being prepared per Texas requirements, but that they also must be worked through Huntsville USACE.

DF MC Data Summary Report: John indicated that they decoupled the perchlorate and the data gap constituent of white phosphorus. They are answering other questions based on the 1998 ROD.

Transfer Update **Rose M. Zeiler**

ECOP VI
This ECOP includes LHAAP-08, -32, -48, and -53 and is still moving forward.

LUCs

Refuge Opening
The Caddo Lake National Wildlife Refuge was opened to the public on September 26, 2009. There was a great turnout. Paul indicated that attendance was estimated from approximately 800 to 1,000 people. A wildlife trail has been completed and the Refuge is currently getting ready for a restricted hunt.

Other Issues **Rose M. Zeiler**

2010 IAP Status
Hardcopies are available. The public website will be provided.

Powerhouse Demolition Status
The demolition work was completed at the Powerhouse. The building over the switch gears is completed. The ECC contractor still has some miscellaneous waste streams to dispose from the Powerhouse demolition.

LHAAP-18/24 ESD
Comments from the regulators have not been received. Fay and Steve indicated they do not remember seeing the LHAAP-18/24 ESD document. Rose indicated it was sent via email on September 17th. Steve said he would check to see if it was sent to George Malone and would forward to Fay.

The RAB meeting for December has been moved to December 1, 2009. The November monthly manager's meeting has been scheduled for November 10, 2009, at 1:00 PM.

Paul indicated that FWS now has the wildlife trail in place and that there are burn areas set up in certain places. He wanted everyone to be aware that there are currently piles of old railroad ties in various areas. These old ties will need to be sent to a landfill for proper disposal, since they have been treated with creosote. Paul indicated he would send a map showing their locations. He said some of the piles are approximately 20 feet long and 10 feet high. Paul also noted that crates and wooden pallets with possible PCP contamination were located at the old metal frame warehouse area and in a railroad yard near LHAAP-67. Rose indicated that the contractor should have gotten that before. Paul said he hadn't been over there lately and would check as that might be the case.

Meeting Adjourned

Action Items:

Army

- Provide 2009 IAP public website and hardcopies to the library.

Shaw

LONGHORN ARMY AMMUNITION PLANT
MONTHLY MANAGERS' MEETING

Location	teleconference		
Date	20-Oct-2009	**Time**	1:00 PM

ATTENDEES

Name (printed)	Signature	Organization	Phone	E-mail
Longhorn Team Members				
Rose M. Zeiler	X	BRAC	(479) 635-0110	rose.zeiler@us.army.mil
Matthew Mechenes		USAEC	(410) 436-1505	matthew.mechenes@us.army.mil
Aaron Williams	X	USACE, Tulsa	(918) 669-4915	aaron.k.williams@usace.army.mil
John Lambert	X	USACE, Tulsa	(918) 669-4992	john.r.lambert@SWT03.usace.army.mil
Scottie Fiehler		USACE, Tulsa	(918) 669-7232	scottie.fiehler@us.army.mil
Stephen Tzhone	X	USEPA, Dallas	(214) 665-8409	tzhone.stephen@epa.gov
Raji Josiam		USEPA, Dallas	(214) 665-8529	josiam.raji@epa.gov
Fay Duke	X	TCEQ, Austin	(512) 239-2443	fduke@tceq.state.tx.us
Dale Vodak	X	TCEQ, Tyler	(903) 535-5142	dvodak@tceq.state.tx.us
Barry Forsythe	X	USFSW, Dallas	(214) 665-8467	forsythe.barry@epa.gov
Paul Bruckwicki	X	USFSW, Karnack	(903) 679-4536	paul_bruckwicki@fws.gov
Mark Williams		USFSW, Karnack	(903) 679-9144	mark_williams@fws.gov
Praveen Srivastav	X	SHAW, Houston	(713) 996-4588	praveen.srivastav@shawgrp.com
Kay Everett	X	SHAW, Houston	(713) 996-4421	kay.everett@shawgrp.com
Greg Jones	X	SHAW, Houston	(713) 996-4472	greg.n.jones@shawgrp.com
Kent Becher	X	USGS		
TERRY BURTON	X	EPA		
Chris Reese	X	Booz Allen Hamilton		
Rich Mayer	X	EPA		
Wally O'Rear	X	Booz Allen Hamilton		
Kendra Gomez	X	EPA		
Susan Watson	X	Shaw		

Shaw Environmental, Inc.

Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
October 20, 2009

No.	Document in Progress	Submittal Date	Army	Regulator	Next Submittal	Expected Date	Army	Regulator	Comment Resolution	Status	Remarks
1	Draft Rev 01Decision Document, LHAAP-02	10/01/09	x		Draft Final	11/1/09	x	x		In Army review	DD calls for limited groundwater monitoring
2	Final SI Report for LHAAP-03, Rev 01	08/17/09	x	x						Report finalized. Preparing soil removal action work plan.	
3	Draft Completion Report, LHAAP-04	11/15/09	x							In preparation	
4	County Notification LHAAP-06, 07, 51, 55, 64, 66, 68	10/13/09	x							Draft for LHAAP-06 submitted for Army review. Others in preparation.	Survey completed.
5	Draft Final Feasibility Study Addendum, Rev 01, LHAAP-16	7/3/08		x	RTC	10/21/09	x	x	In progress	Army review of RTCs complete. Preparing for submittal to regulators	
6	Draft Final Feasibility Study, LHAAP-17	4/14/09	x	x	RTC	10/30/09	x	x	In progress	Revised RTCs submitted to Army on 5/29/09. Resolving additional Army comments. Resolution in progress.	Conducted pump test to determine pumping rates. Conducted water balance calculations
7	Draft Feasibility Study, LHAAP-18/24	3/3/09	x		Draft Final	01/31/09	x	x	In progress	Army comments received. Resolution in progress. Revised RTCs in Army's review as of 7/26/09	
8	Draft Final Feasibility Study, LHAAP-29	03/11/09	x	x	RTC	10/30/09	x	x	In progress	TCEQ and EPA comments received. New well installed and sampled week of 06/08/09 in groundwater below the intermediate zone. Revised RTCs in Army's review as of 9/10/09.	

Shaw Environmental, Inc.

Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
October 20, 2009

No.	Document in Progress	Submittal Date	Army	Regulator	Next Submittal	Expected Date	Army	Regulator	Comment Resolution	Status	Remarks
9	Draft Final Focused Feasibility Study, LHAAP-46	1/30/09	x	x	RTC	09/10/09	x	x	Completed	RTCs in regulatory review as of 9/10/09. TCEQ and EPA concurrence received.	Final FS in preparation
10	Draft Proposed Plan, LHAAP-46	9/29/09	x							In Army review	
11	Draft Focused Feasibility Study, LHAAP-47	12/23/08	x		RTC	09/24/09	x		In progress	Army comments received. Conducted a new round of groundwater sampling. Submitted revised RTCs on 9/24/09	
12	Draft Final Proposed Plan, LHAAP-49	9/14/09	x	x						In regulatory review	
13	Draft ROD, LHAAP-49	10/23/09	x							In preparation	
14	Draft Final Feasibility Study, LHAAP-50	11/20/08	x	x	RTC	10/13/09	x	x	In progress	RTCs in regulatory review	
15	Draft Proposed Plan, LHAAP-50	10/16/09	x							In Army's review	
16	Draft Final Feasibility Study, LHAAP-58	9/20/07	x	x	RTC	10/30/09	x	x	In progress	MNA evaluation submitted to regulators. Revised RTCs submitted to Army for review on 09/10/09	
17	Draft Proposed Plan, LHAAP-58	10/08/09	X							In Army's review	
18	County Notification, LHAAP-60	Nov 2009									

Shaw Environmental, Inc.

Status of Sites and Technical Documents
Longhorn Army Ammunition Plant – PBC Contract
October 20, 2009

No.	Document in Progress	Submittal Date	Army	Regulator	Next Submittal	Expected Date	Army	Regulator	Comment Resolution	Status	Remarks
19	Draft Final Decision Document, LHAAP-35/36	7/15/09	x	x	Final	11/30/09	x	x	Resolved	TCEQ comment received on DF DD. Resolution in progress. Revised DF in preparation. To be submitted to Army and then to regulators	
20	Draft Completion Report, Pistol Range	10/7/09	x							In Army review	
21	Draft Proposed Plan, Pistol Range	10/7/09	x							In Army review	

Longhorn AAP
Document Tracking Table

Army
TCEQ
EPA
Shaw

Site	Document	Version	Status	Document To Army	Army comments Received?	Document to EPA/TCEQ	EPA comments Received?	TCEQ comments Received?	RTC To Army	Army comments Received?	To TCEQ	TCEQ concurrence Received?	To EPA	EPA concurrence Received?
LHAAP-04	Completion Rep	Draft	in prep											
		Draft Final												
		Final												
	Proposed Plan	Draft												
		Draft Final												
		Final												
	ROD	Draft												
		Draft Final												
		Final												
Pistol Range	Completion Rep	Draft	Submitted	10/7/2009	No									
		Draft Final												
		Final												
	Proposed Plan	Draft	Submitted	10/9/2009	No									
		Draft Final												
		Final												
	ROD	Draft												
		Draft Final												
		Final												
LHAAP-16	FS	Draft Final	RTC resolution				Yes	Yes	9/11/09	Yes	10/20/09	10/20/09		
		Final												
	Proposed Plan	Draft												
		Draft Final												
		Final												
	ROD	Draft												
		Draft Final												
		Final												
LHAAP-17	FS	Draft Final	RTC resolution				Yes: 5/18/09	Yes: 5/1/09	7/22/09; 10/1/09	Yes: 10/5/09; Addnl comments				

Longhorn AAP
Document Tracking Table

Site	Document	Version	Status	Document To Army	Army comments Received?	Document to EPA/TCEQ	EPA comments Received?	TCEQ comments Received?	RTC To Army	Army comments Received?	To TCEQ	TCEQ concurrence Received?	To EPA	EPA concurrence Received?
		Final												
	Proposed Plan	Draft	In prep											
		Draft Final												
		Final												
	ROD	Draft												
		Draft Final												
		Final												
LHAAP-29	FS	Draft Final	RTC resolution				Yes	Yes	9/9/09	No		Yes (new deep well)		
		Final												
	Proposed Plan	Draft	In prep											
		Draft Final												
		Final												
	ROD	Draft												
		Draft Final												
		Final												
LHAAP-46	FS	Draft Final	Comments resolved				Yes	Yes: 5/4/09	9/9/09	yes: 9/10/09	9/10/09	9/11/09	9/10/09	9/30/09
		Final	In prep											
	Proposed Plan	Draft	Submitted	9/29/2009	No									
		Draft Final												
		Final												
	ROD	Draft												
		Draft Final												
		Final												
LHAAP-49	SE Report	Final	Submitted											
	Proposed Plan	Draft	Submitted	7/20/09	Yes				8/19/09	9/10/09				
		Draft Final	Regulatory Rev			9/14/2009	No	No						
		Final												
	ROD	Draft	In prep											
		Draft Final												
		Final												

Longhorn AAP
Document Tracking Table

Site	Document	Version	Status	Document To Army	Army comments Received?	Document to EPA/TCEQ	EPA comments Received?	TCEQ comments Received?	RTC To Army	Army comments Received?	To TCEQ	TCEQ concurrence Received?	To EPA	EPA concurrence Received?
LHAAP-50	FS	Draft Final	Comment Resolution				Yes:4/16/09	Yes:4/17/09; more expetd	9/3/09; 9/15/09	Yes	10/13/09	No	10/13/09	No
		Final												
	Proposed Plan	Draft	Submitted	10/16/09	No									
		Draft Final												
		Final												
	ROD	Draft												
		Draft Final												
		Final												
LHAAP-58	FS	Draft Final	RTC Resolution				Yes	Yes	9/10/09	No	MNA: 5/12/09		MNA: 5/12/09	
		Final												
	Proposed Plan	Draft	Submitted	10/8/2009	No									
		Draft Final												
		Final												
	ROD	Draft												
		Draft Final												
		Final												

Shaw® Shaw Environmental, Inc.

Date: ***October 28, 2009***

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-46, Plant 2 Area, Group 4**
Longhorn Army Ammunition Plant, Karnack, Texas

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

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

Item No:	***No. of Copies***	***Date:***	***Document Title***
1	2	October 2009	**Final Feasibility Study, LHAAP-46, Plant 2 Area, Group 4** Longhorn Army Ammunition Plant, Karnack, Texas

Aaron – Enclosed please find the final version of the above-named report for your records.

The document has been distributed according to the list below. Please call if any questions or comments.

Sincerely:

Praveen Srivastav
Project Manager

Distribution List:
Ms. Rose Zeiler – BRAC-LHAAP
Mr. Matthew Mechenes – AEC
Ms. Fay Duke – TCEQ (2)
Mr. Steve Tzhone – EPA (2)
Mr. Dale Vodak - TCEQ
Mr. Paul Bruckwicki –USFWS
Mr. John Lambert/Scottie Fiehler (distributed by A. Williams) - USACE

3010 Briarpark Drive, Suite 400, Houston, Texas 77042 ***Phone: (713) 996-4522/Fax: (713) 996-4436***

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

October 28, 2009

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-46, Plant 2 Area, Group 4
Longhorn Army Ammunition Plant, Karnack, Texas, October 2009

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
P. Srivastav, Shaw – Houston, TX (for project files)
J. Lambert/S. Fiehler, COE – Tulsa District, OK
M. Mechenes, USAEC, MD
A. Williams, COE – Tulsa District, OK

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

October 28, 2009

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-46, Plant 2 Area, Group 4
Longhorn Army Ammunition Plant, Karnack, Texas, October 2009
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, Ph.D.
Longhorn AAP Site Manager

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

FINAL

FEASIBILITY STUDY
LHAAP-46, PLANT 2 AREA, GROUP 4
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OCTOBER 2009

Review Comments to Draft Final Feasibility Study (published January 2009)
LHAAP-46, Plant 2 Area, Group 4
Longhorn Army Ammunition Plant, Karnack, Texas

Reviewer: Stephen Tzhone – USEPA
Respondent: Praveen Srivastav, Shaw Environmental, Inc.

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

Comment #	Page	Section/ Paragraph	Comment	C, D[1], or E	Response	A or D[2]
Pre 4-27-09 Comments						
1			There is only one deep well. It is difficult to have a confidence level regarding one data point.	D	Concentrations of TCE in the intermediate zone are relatively low. The deep zone is not contaminated as demonstrated by results from 46WW03 installed near the location where highest TCE concentrations were detected. Therefore, there was no need to install additional wells for delineation purposes.	A
2			Given the index of 1.5 and the fact that antimony has been historically used in weapons manufacture, Army should continue to sample for it.	D	The HI of 1.5 was based on historic data in the risk assessment and was not replicated in the most recent sampling using low flow techniques. As discussed in Section 3.2.1.1, paragraph 2, there is ample evidence that antimony should not be a COC at LHAAP-46. Therefore, no long term monitoring is required for antimony.	A
3			Given that the military frequently used thallium as a rodenticide, EPA is skeptical that thallium is indeed "naturally-occurring" at this site. Considering that thallium is extremely toxic, this should be a point of concern. It is a suspected carcinogen, and even dermal contact is extremely dangerous. Does the Army have a map from the US Geological Survey showing a band of naturally-occurring thallium in east Texas? That could be persuasive, and answer future questions about this.	D	The argument that thallium is likely to be naturally occurring in the groundwater is based on its correlation to iron oxides as discussed in Appendix B, page 3-8, as thallium is known to absorb on iron oxides. Even though thallium may have been used in the past as a rodenticide, as indicated by the reviewer, it does not indicate that a contaminant CERCLA release has occurred. Soil analytical results also do not indicate that there has been a release of thallium-based compounds at this site. The risk assessment showed that human health risk and hazard are within acceptable limits.	A
4			Although the argument for the cause of chromium is not completely convincing to EPA, anaerobic reduction is considered a preferred method for chromium remediation in most cases. Thus, EPA finds acceptable the chromium remediation method even if the cause is uncertain.	D	Chromium is not a COC and no remediation method was evaluated in this FS for this chemical.	A

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LHAAP-46, Plant 2 Area, Group 4
Longhorn Army Ammunition Plant, Karnack, Texas

Reviewer: Stephen Tzhone – USEPA
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5			On the other hand, manganese concentrations are expected to increase, given an anaerobic regime. While this may be acceptable, this point must be recognized by the Army.	C	Noted.	A
6			Also, arsenic produces slightly more toxic isomers upon chemical reduction. This must also be recognized by the Army.	C	Noted.	A
7			Given that the Army suspects that wells are deteriorating, this should be a cause of concern as well.	C	Noted. The stainless steel wells causing localized elevated chromium levels will be removed and plugged during the remedial action phase. These will be replaced with PVC wells as needed for MNA sampling.	A
8			EPA did not see strontium test results for 2007. Was that sampling regime performed?	C	Strontium is not on the typical TAL of metals and was not analyzed during 2007 sampling.	A
9			The document points to lower cis-DCE numbers as proof of MNA. Yet VC concentrations were not detected in 2007 samples; nor was ethene detected in 2007 sampling. This contradicts the MNA theory. Please have the Army address this point.	E	We believe that more regular sampling during the performance monitoring phase would provide suitable data to demonstrate whether or not MNA would achieve remedial action goals at this site. MNA was discussed in more detail during the April 27-28, 2009 meeting and it was agreed that MNA, with a contingency (bioremediation) will be the remedy for the site. The contingency remedy will be included in the ROD and not the FS.	A
Post 4-28-09 Comments						
1			EPA likes the transparency of the biodegradation screening parameters. EPA proposes all future documents that suggest MNA as a component of a remedy have such data as well.	C	Noted.	A
2			EPA finds acceptable the 'component' MNA remedy as proposed on 4/28. Given the new kinetics data EPA received on 5/5, it should make it much easier to objectively discern whether the MNA component is working, or if more active measures are required.	C	Noted.	A
3			Thallium and the LUCs remain a priority that EPA would like to see addressed.	E/C	Please see response above related to the question on thallium. LUCs will be a component of the remedy selected for LHAAP-46.	A

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Additional changes to be made by Shaw:						
1		Appendix A	The preliminary attenuation evaluation will be revised to include the reductive dechlorination screening and to revise the text for consistency with USEPA language.			A
2		Section 7.5 Recommendation	This section will be deleted.			A
3		Section 4	Location-specific ARAR identification and discussion will be revised to include environmental laws only.			A
4		General	Deed recordation and county notice language will be modified throughout, to be consistent with the following: "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."			A
5		General	Text will be revised for consistency when discussing "cleanup level" and "preliminary remediation goal."			A
6		Appendix E, ES, Section 7	Estimates will be revised for current rates and sampling frequencies, and the corresponding text will be updated with new numbers.			A

Comments on Draft Final Feasibility Study, LHAAP-46 (published, January 2009)
LHAAP-46, Plant 2 Area, Group 4
Longhorn Army Ammunition Plant, Karnack, Texas

August 2009

Reviewer: TCEQ
Respondents: 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]
1		Section 3.2.1.2	It states that cis-1,2-DCE and vinyl chloride were detected below MCL or were not detected; therefore, cis-1,2-DCE and vinyl chloride are not considered COC in the groundwater. Because cis-1,2-DCE and vinyl chloride are potential by-product of the degradation of TCE, these compound as well should be consider COCs. Please revise.	C	Agreed. Please see Table 4-2 in the Draft Final FS where these chemicals are listed as COCs.	A
2		Section 5.5.6	It states that degradation rate calculated from LHSMW10 data was used to estimate time for TCEQ to reach the MCL. We note that LHSMW10 is located outside of the groundwater plume and it was our understanding that TCE has not been detected in this well. Please clarify why LHSMW10 was used in calculating the degradation rate. Please also submit the data used in the calculation.	C	There is a typo in the text. The well used to calculate the degradation rate was **LHSMW18**, not LHSMW10. This well is located inside the plume and showed a decrease in concentration between the last two data points. Please see attached for calculations. The correlation between the data and the best fit line is not high but it shows that some degradation is occurring. The estimated cleanup time of 15-23 years is based on limited data, and actual cleanup time could be higher than this estimate. The estimate will be refined based on additional data collected during the performance monitoring phase. Appendix A, preliminary attenuation evaluation, will be revised, and the attached information will be included.	A
3		Section 6.2.2.1	Per our discussion in the April 28, 2009 meeting, please revise the groundwater monitoring program to reflect the increase in groundwater monitoring as recommended by EPA.	C	Agreed. The text will be revised throughout in the Final document when groundwater is discussed as follows: • Two years quarterly MNA performance monitoring • Semiannual monitoring until first 5-year review in 2014 • Post 5-year review frequency will be evaluated and recommended in the 5 year review. For cost estimating, we are assuming annual monitoring for years 5 – 10 and then once every five years thereafter.	A

Comments on Draft Final Feasibility Study, LHAAP-46 (published, January 2009)
LHAAP-46, Plant 2 Area, Group 4
Longhorn Army Ammunition Plant, Karnack, Texas

August 2009

Reviewer: TCEQ
Respondents: Shaw Environmental, Inc.

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Comment #	Page	Section/ Paragraph	Comment	C, D[1], E or X	Response	A or D[2]
4		Appendix A – MNA Evaluation	It is our opinion that the historical VOC trend and the geochemical indicators for certain portion of aquifer indicates that natural attenuation process have reduced the VOC concentrations. However, there exists uncertainties whether the conditions of the aquifer in and around LHSMW19 and 46WW02 is conducive to natural attenuation as a sole remedy to reduce VOC concentrations to MCLs.	C	Noted. Additional data to be collected during the performance monitoring phase is expected to provide more supportive evidence for MNA. The concern will be further addressed by selecting MNA with a contingent bio-enhancement remedy during the proposed plan/ROD stage.	A

Comments on Draft Final Feasibility Study, LHAAP-46 (Shaw, January 2009)
Longhorn Army Ammunition Plant (LHAAP) Superfund Site, Karnack, Texas

August 2009

Reviewer: TCEQ
Respondents: Shaw Environmental, Inc.

1. Respondent Concurs (C), Does Not Concur (D), Takes Exception (E), or Delete (X).
3. Commentor Agrees (A) with response, or Does not Agree (D) with response.

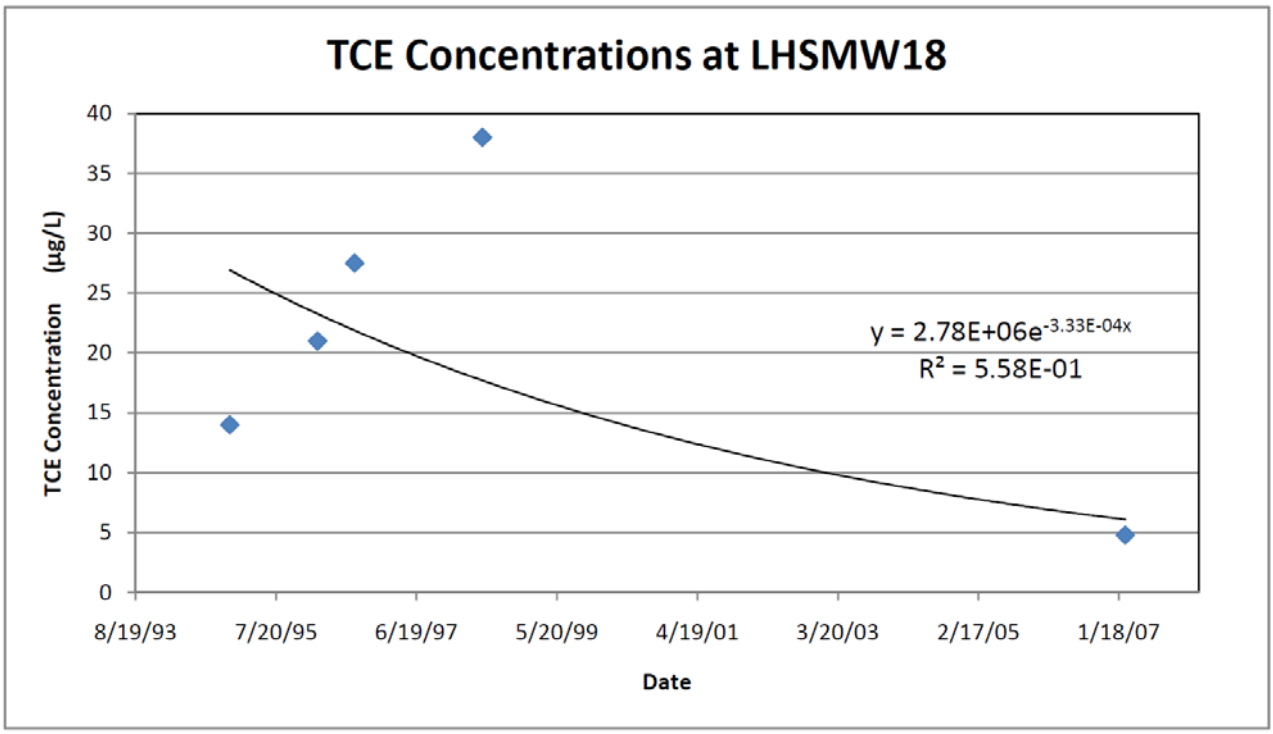
Summary of Natural Attenuation Rates and Estimated Cleanup Times
LHAAP-46, Plant 2 Area, Group 4
Longhorn Army Ammunition Plant, Karnack, Texas

Monitoring Well	Attenuation Rate Constant k (day^{-1})	Attenuation Half-Life t_{half}		Most Recent Concentration		C_t Target Concentration (µg/L)	$t_{cleanup}$ Estimated Cleanup Time (years)
		(days)	(years)	Date	C_R (µg/L)		
Time Dependent Attenuation for TCE in LHSMW18							
LHSMW18	0.000333	2082	5.7	2/20/07	4.8	5	-
Estimated Cleanup Time for TCE in LHSMW19 using rate from LHSMW18							
LHSMW19	0.000333	2082	5.7	2/20/07	85.5	5	23
Estimated Cleanup Time for TCE in 46WW02 using rate from LHSMW18							
46WW02	0.000333	2082	5.7	10/28/08	31.2	5	15

Notes:
µg/L - micrograms per liter
TCE - Trichloroethene
Attenuation Rate Constant k - from the exponent of the exponential trend line equation.
Attenuation Half Life - natural log of 2 divided by the Attenuation Rate Constant (divide by 365 to get years).

$$t_{half} = \ln(2) / k$$

Estimated Cleanup Time - natural log of (Target Concentration divided by Most Recent Concentration) divided by the Attenuation Rate Constant, then converted to years. $t_{cleanup} = (\ln(C_t/C_R) / -k) / 365$



FINAL

FEASIBILITY STUDY
LHAAP-46, PLANT 2 AREA, GROUP 4
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Prepared for

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

Prepared by

Shaw Environmental, Inc.
3010 Briarpark, Suite 400
Houston, Texas 77042

Contract No. W912QR-04-D-0027, Task Order No. DS02
Shaw Project No. 117591

October 2009

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Acronyms and Abbreviations

µg/L	micrograms per liter
AOC	area of contamination
ARARs	applicable or relevant and appropriate requirements
Army	U.S. Department of the Army
BCM	BCM Engineers, Inc.
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
CLI	Caddo Lake Institute
cm/s	centimeters per second
COC	chemical of concern
CWA	Clean Water Act of 1972
DCE	dichloroethene
FFA	Federal Facility Agreement
FR	Federal Register
FS	Feasibility Study
ft^2	square feet
GAC	granulated activated carbon
GRA	general response action
GW-Ind	groundwater medium-specific concentration for industrial use
HI	hazard index
HQ	hazard quotient
Jacobs	Jacobs Engineering Group, Inc.
LHAAP	Longhorn Army Ammunition Plant
LHAAP-46	Plant 2 Area
LTM	long-term monitoring
LUC	land use control
MARC	Multiple Award Remediation Contract
MCL	maximum contaminant level
mg/kg	milligrams per kilogram
MNA	monitored natural attenuation
MSC	medium-specific concentration
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	operation and maintenance
OSHA	Occupational Safety and Health Administration
PCB	polychlorinated biphenyl

Acronyms and Abbreviations (continued)

pH	potential hydrogen ion concentration
PP	Proposed Plan
PPE	personal protective equipment
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	remedial investigation
ROD	Record of Decision
RRR	Risk Reduction Rules
Shaw	Shaw Environmental, Inc.
STEP	Solutions to Environmental Problems, Inc.
SVOC	semivolatile organic compound
SDWA	Federal Safe Drinking Water Act
TAC	Texas Administrative Code
TBC	to-be-considered
TCE	trichloroethene
TCEQ	Texas Commission on Environmental Quality
TNRCC	Texas Natural Resources Conservation Commission
TNT	trinitrotoluene
TOC	total organic carbon
USACE	U.S. Army Corps of Engineers
USC	United States Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UTL	upper tolerance limit
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) Contract 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 remedial alternatives for the Plant 2 Area, designated as LHAAP-46, in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), and provides a basis for the remedy selection consistent with the intended future use of the LHAAP as a wildlife refuge.

LHAAP is an inactive, government-owned, formerly contractor-operated and maintained Department of Defense facility located in central-east Texas. The Plant 2 Area (LHAAP-46), approximately 190 acres, is located in the north-central portion of LHAAP. Construction of facilities for producing JB-2 propellant fuel at Plant 2 began in 1944, but construction halted in 1945 with the end of World War II. Plant 2 produced pyrotechnic devices from February 1952 to 1956. It was reactivated in 1964 and produced pyrotechnic and illumination devices until approximately 1997.

LHAAP was placed on the National Priorities List (NPL) on August 9, 1990. A Federal Facility Agreement (FFA) became effective December 30, 1991 among U.S. Environmental Protection Agency (USEPA), the U.S. Department of the Army (Army), and the Texas Natural Resources Conservation Commission (TNRCC), now the Texas Commission of Environmental Quality (TCEQ). LHAAP-46 was not one of the originally listed NPL sites; however, it is considered an NPL caliber site because of the presence of contaminated groundwater under the site. The site has been added to the list of NPL sites at LHAAP with concurrence from the Army and USEPA Headquarters.

The entire installation was under the control of the Army until May 5, 2004, when approximately two-thirds of the property was transferred to the U.S. Fish and Wildlife Service. Property transfer continues as response is completed at smaller parcels of land. The U.S. Army Environmental Command provides funding for the environmental remedial activities through restoration funding from the Defense Environmental Restoration Account. The Base Realignment and Closure Division is responsible for all aspects of LHAAP including the environmental program, operations, and land transfer.

Goose Prairie Creek watershed is the nearest significant surface water body to LHAAP-46. Runoff from the site drains into Goose Prairie Creek, which eventually flows into Caddo Lake (a drinking water source for multiple communities).

Sampling specific to LHAAP-46 media was conducted during Phase I through Phase III Remedial Investigations (RIs) by Jacobs Engineering Group, Inc. (Jacobs), and during additional investigations conducted by Solutions to Environmental Problems, Inc. (STEP), Plexus and Shaw through 2007. The baseline human health risk assessment for the Group 4 Sites, including LHAAP-46 (Jacobs, 2003), was based on data from the RIs and additional investigations through 2001. There are 46 sumps and 14 waste rack sumps located within LHAAP-46 that are included in site LHAAP-35/36, along with sumps from other sites. Shaw collected soil data around these sumps and reported the data in Final Data Evaluation Report for LHAAP-35/36 (Shaw, 2008).

Even though the groundwater at LHAAP-46 is within the acceptable cancer risk range of 1×10^{-4} to 1×10^{-6}, the total hazard index (HI) from groundwater is 31, which is above the acceptable HI of 1. Groundwater contaminants with an HI greater than 1 include thallium, antimony, and manganese. Additional evaluation of data from samples collected using low flow methods and filtering concluded that these three metals detected at high concentrations were naturally occurring or were due to suspended solids in the samples collected using earlier sampling methods. Based on recent data, these metals are not considered chemicals of concern (COCs). Chemicals detected in groundwater at concentrations that exceed their respective maximum contaminant levels (MCLs) are considered potential COCs. Metals that are naturally occurring or have recent concentrations lower than MCLs are not considered COCs. Thus, the remaining COC for this FS is trichloroethene (TCE), which is currently above its MCL in both the shallow and intermediate zones.

The Installation-Wide Baseline Ecological Risk Assessment identified no potential risk to ecological receptors at LHAAP-46 (Shaw, 2007a).

The soil at LHAAP-46 does not pose potential exposure in excess of the acceptable cancer risk range of 1×10^{-4} to 1×10^{-6} and non-cancer HI of 1 for a hypothetical future maintenance worker under an industrial scenario. Soil data collected around the sumps since the completion of risk assessment by Jacobs (2003) was evaluated with respect to the risk assessment in the Final Data Evaluation Report for LHAAP-35/36 (Shaw, 2008). The report concluded that the cancer risk and noncancer hazard were still within acceptable limits. Thus, no action is required for soil and the groundwater contamination is addressed in this FS.

The remedial action objective (RAO) established within this FS address potential human health risks for future industrial use of LHAAP-46. The RAO for LHAAP-46, which take into account the future use of the site as a wildlife refuge, include:

- Protection of human health (hypothetical future maintenance worker) by preventing exposure to groundwater contaminated with volatile organic compounds (VOCs)

The FS identifies and screens groundwater remedial technologies and associated process options that may be appropriate for satisfying the RAO for LHAAP-46. The technologies and process options are screened with respect to effectiveness, implementability, and cost. Selected remedial technologies and process options were carried forward after the initial screening and were combined to develop the following remedial alternatives for LHAAP-46:

- **Alternative 1 – No Action.** Leaves the contaminated groundwater in place with no remedial action or additional measures to prevent exposure to the COCs, and serves as a baseline for comparison with the other alternatives. A No Action alternative is required under CERCLA.
- **Alternative 2 – Monitored Natural Attenuation of Groundwater with Land Use Controls.** Utilizes natural attenuation to treat COCs in groundwater at the site, and implements land use controls (LUCs) to prevent human exposure to contaminated groundwater.
- **Alternative 3 – In Situ Bioremediation, Short Term Land Use Controls with Long-Term Monitoring of Groundwater.** Reduces contamination in the areas of highest VOC contamination via in situ processes. Implements long-term groundwater monitoring and short-term LUCs to monitor the effectiveness of the in situ processes and prevent human exposure to groundwater contaminants until such time that the COCs degrade and cleanup levels are met.

Each alternative was evaluated against CERCLA criteria to provide a basis for selecting a preferred alternative in the follow-on Proposed Plan and Record of Decision documents. The preferred alternative is Alternative 2, Monitored Natural Attenuation of Groundwater with Land Use Controls.

Table ES-1 summarizes the comparative analysis of the alternatives presented in this study. Two additional criteria, State acceptance and community acceptance, will be evaluated during the Proposed Plan stage.

Table ES-1
Comparative Analysis of Alternatives

Comparative Analysis of Alternatives Criteria	Alternative 1 No Action	Alternative 2 Monitored Natural Attenuation of Groundwater with Land Use Controls	Alternative 3 In Situ Bioremediation, Short Term Land Use Controls with Long-Term Monitoring of Groundwater
Overall protection of human health and the environment	No protection. Does not achieve remedial action objective (RAO).	Achieves RAO. Protection of human health and environment provided by maintenance of land use controls until plume degrades to maximum contaminant levels (MCLs). Monitored natural attenuation activities would demonstrate that degradation of plume is occurring.	Achieves RAO. Protection of human health and environment provided by remediation of groundwater chemicals of concern (COCs) in areas of highest contamination. Groundwater monitoring and land use controls in place until remainder of plume degrades to MCLs.
Compliance with Applicable or Relevant and Appropriate Requirements	No compliance with chemical-specific applicable or relevant and appropriate requirements (ARARs).	Complies with ARARs.	Complies with ARARs.
Long-term effectiveness and permanence	Not effective.	Decrease in contaminant concentrations and presence of degradation products suggest that contaminants are degrading naturally. Land use controls would be effective and reliable so long as they are maintained until RAO is met.	Should be effective and permanent; however, uncertainty exists concerning the effectiveness and time needed for in situ biological treatment and degradation to reduce contaminant concentrations to cleanup levels. A treatability study may be required. Long-term groundwater monitoring will follow treatment. Land use controls would be effective and reliable so long as they are maintained until remainder of plume reaches MCLs.
Reduction of toxicity, mobility, or volume through treatment	No reduction.	No active reduction in groundwater chemicals of concern would be accomplished through treatment; reduction through natural processes only.	Provides permanent reduction in groundwater through in situ bioremediation in the areas of highest contamination provided conditions are favorable.
Short-term effectiveness	No short-term impacts.	Minimal impacts to the community, workers, or the environment from short-term activities. Provides almost immediate protection.	Minimal impacts to the community, workers, or the environment from short-term activities. Provides almost immediate protection.
Implementability	Inherently implementable.	Readily implemented, but uncertainty exists regarding the time required to reduce contaminants in groundwater to cleanup levels.	Implementable, but uncertainty exists in the effectiveness and time required to reduce contaminants in groundwater to cleanup levels. Specialized knowledge required for implementation.
Cost (present worth) • Capital • Operation and Maintenance • Total	 $0 $0 $0	 $ 60,500 $460,700 $521,200	 $379,000 $365,000 $744,000

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) Contract No. W912QR-04-D-0027, for groundwater remediation activities at the former Longhorn Army Ammunition Plant (LHAAP) in Karnack, Texas. This FS presents the analysis of remediation alternatives for the Plant 2 Area designated as LHAAP-46 accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and provides a basis for remedy selection consistent with the intended future use of the LHAAP as a wildlife refuge.

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 Longhorn including the environmental program, operations, and land transfer.

1.1 Purpose and Organization of Report

The Environmental cleanup decision-making process for LHAAP-46 follows the prescribed CERCLA 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, determine the nature and extent of the contamination, and assess risks to human health and the environment from this contamination. Additional data were gathered subsequent to the RI and baseline risk assessment to further characterize the site for evaluation of alternatives. The investigatory element of decision making for the Group 4 sites, which includes LHAAP-46, has been completed and documented in the RI report (Jacobs Engineering Group, Inc. [Jacobs], 2002), the baseline human health risk assessment report (Jacobs, 2003), the environmental site assessment (Plexus, 2005), the data gaps investigation (Shaw, 2007b), modeling report (Shaw, 2007c), monitored natural attenuation (MNA) evaluation (**Appendix A**), geochemical evaluation (**Appendix B**), Building 407 Investigation (**Appendix C**), and evaluation of sumps (Shaw, 2008). No potential human health risk to a hypothetical future maintenance worker was indicated from the soil at LHAAP-46, but non-carcinogenic hazard to a hypothetical future maintenance worker from the contaminated groundwater at LHAAP-46 was identified. The human health risk was evaluated in the Final Baseline Human Health and Screening Ecological Risk Assessment for the Group 4 sites (Jacobs, 2003). The ecological risk was evaluated in the Installation-Wide Baseline Ecological Risk Assessment (Shaw, 2007a). No potential risk to ecological receptors from LHAAP-46 media was identified.

This FS takes the next step of identifying and evaluating remedial solutions. Environmental problems identified for LHAAP-46 are volatile organic compound (VOC) contamination in the

shallow groundwater. The formulation of viable alternatives involves defining remedial action objective (RAO), 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. Detailed analysis profiles 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 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. Alternatives developed in this FS address the media and chemicals of concern (COCs) at LHAAP-46 through groundwater actions. The main text of this FS is composed of the following sections:

- **Section 2.0**, "Sampling Investigations," summarizes the results of the investigations.
- **Section 3.0**, "Risk and Site Assessment," summarizes the risk assessment approach and conclusions. It also provides the conceptual site model for LHAAP-46 and discusses the media contamination assessment.
- **Section 4.0**, "Remedial Action Objective and Cleanup Levels," presents the RAO and a discussion of cleanup levels. The chemical-, location- and action-specific ARARs are presented in this section.
- **Section 5.0**, "Identification and Screening of Technologies and Process Options," summarizes the rationale for selecting technologies and process options for remediation of contamination to meet the RAO.
- **Section 6.0**, "Development and Description of Alternatives," presents the rationale for developing a range of alternatives as well as a description of each alternative.
- **Section 7.0**, "Detailed Analysis of Alternatives," evaluates, compares, and contrasts the benefits and costs of the alternatives.
- **Section 8.0**, "References," presents the references cited in this document.

Appendix A presents a preliminary evaluation of natural attenuation of COCs for LHAAP-46. **Appendix B** presents a geochemical evaluation of inorganic chemicals in the groundwater at LHAAP-46 to support their exclusion from the list of COCs for the site. **Appendix C** presents the additional investigation conducted at Building 407. **Appendix D** presents the analytical data collected in 2007 and used in the attenuation and geochemical evaluations. **Appendix E** presents the cost basis for the remedial action alternatives for LHAAP-46.

The preferred alternative for LHAAP-46 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 (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 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 Administrative Record for this project. The Administrative Record is housed at LHAAP and at the Marshall Public Library in Marshall, Texas.

1.2 Longhorn Army Ammunition Plant Background

LHAAP is located in central-east Texas in the northeastern corner of Harrison County. The former installation occupied 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.

In December 1941, near the beginning of World War II, LHAAP was established when the Army issued a contract to build a six-line production facility for manufacturing trinitrotoluene (TNT). Later 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. 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 August 9, 1990. A Federal Facility Agreement (FFA) among the USEPA, the Army, and the Texas Natural Resources Conservation Commission (TNRCC), now the TCEQ, became effective December 30, 1991. LHAAP became inactive in July 1997, and a year later the Army issued a contract to remove salvageable property. On May 5, 2004, the Army transferred approximately 5,032 acres to the U.S. Fish and Wildlife Service (USFWS) for management as the Caddo Lake National Wildlife Refuge.

Almost 2,000 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 Army's control and includes the Group 2 and 4 sites currently undergoing RI/FS process. The Army intends to transfer this land to the USFWS after the environmental response is completed.

1.3 LHAAP-46 Background

LHAAP-46 (Plant 2 Area) is in the north-central portion of LHAAP in an industrial area as shown on **Figure 1-2** where pyrotechnic and illumination devices were produced until 1997. LHAAP-46 is approximately 190 acres and is triangular in shape, bounded by Avenue "P" to the southwest, the LHAAP property boundary fence to the north, and LHAAP-47 to the southeast. The surface features at LHAAP-46 are a mixture of asphalt-paved roads, parking areas, building foundation remnants, old buildings, and overgrown wooded and grassy vegetation-covered areas. The topography in this area is relatively flat with the surface drainage flowing east into tributaries of Goose Prairie Creek. Runoff from the site enters Caddo Lake via Goose Prairie Creek.

1.4 Geology and Hydrogeology

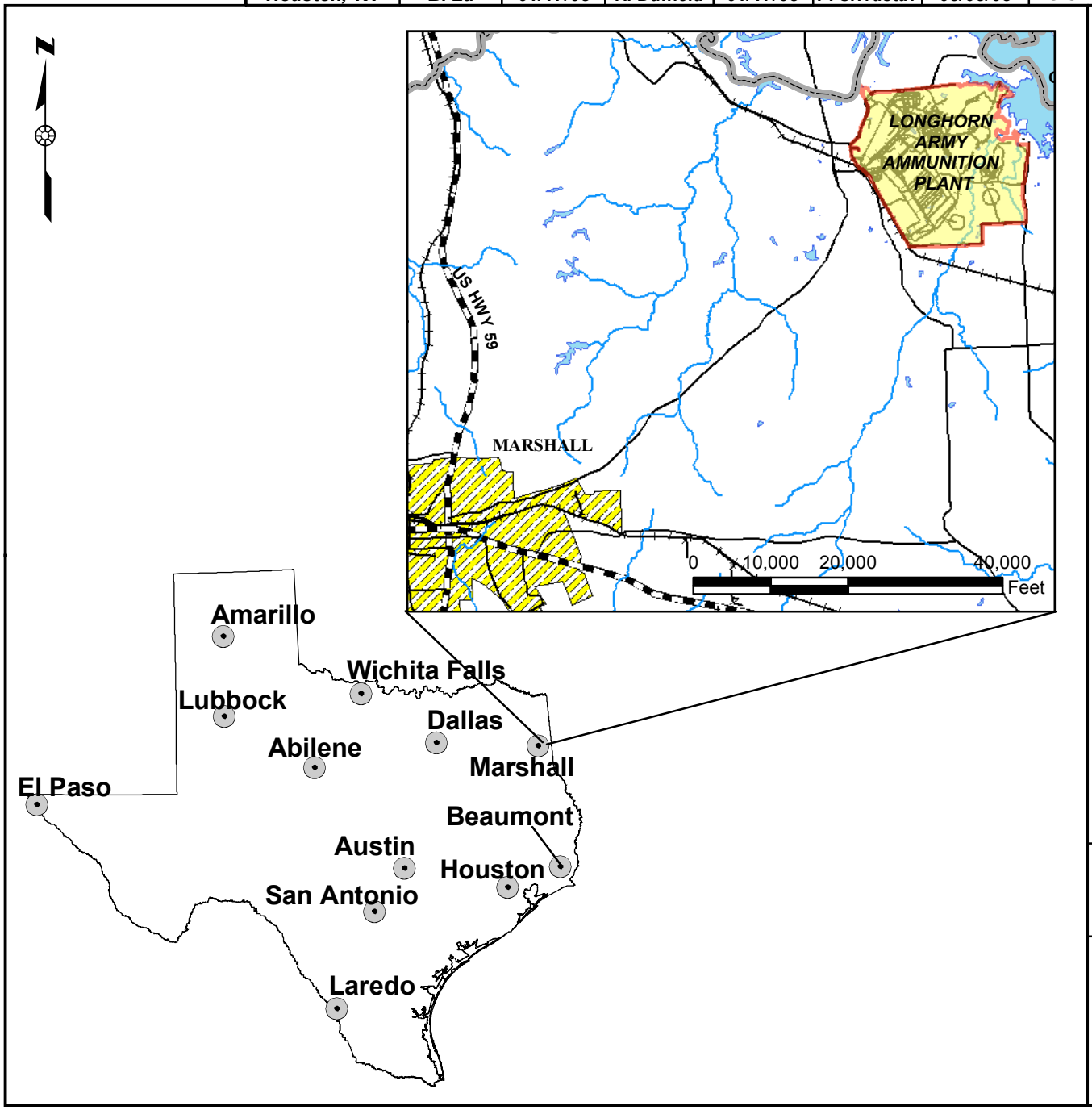
The soils at LHAAP-46 consist of mainly silty clay with thin lenses of sand. The first saturated sand layer encountered when drilling was designated as the shallow zone, the next one was designated as intermediate, followed by the deep zone. The three zones are separated by clay or silty clay layers of variable thickness that are generally not laterally continuous for large distances. Multiple sand lenses may comprise a zone, and LHSMW23 and LHSMW26 have been designated as shallow/intermediate zone wells since there is no apparent separation between the shallow and intermediate zones at these wells and the zones appear to be interconnected. These two wells will be used in the discussions of both the shallow and intermediate zone. Some of the lenses are well defined and are continuous across the site. Groundwater is present within a shallow saturated sand zone, which varies from 3 to 5 feet thick (Jacobs, 2002). Groundwater elevations were measured by Shaw in November/December 2007. The groundwater flow contours based on these data are shown on **Figure 1-3**. Depth to groundwater in the shallow zone is approximately 11 to 23 feet below ground surface (bgs) with groundwater flow to the east. The hydraulic conductivities in the shallow zone wells varied from 2.5×10^{-5} to 1.9×10^{-3} centimeters per second (cm/s) (Jacobs, 2002). Groundwater flow at LHAAP-46 was similarly to the east in 1998 (Jacobs, 2002) and in 2000 (Shaw, 2005).

Groundwater is also present in an intermediate zone and a deep zone. **Figure 1-4** shows measured groundwater elevations and groundwater contours for the intermediate wells based on the data collected in November/December 2007. Depth to groundwater in the intermediate zone is approximately 23 to 30 feet bgs. Groundwater flows to the northeast according to the

November/December 2007 groundwater elevation measurements. Hydraulic conductivities in three intermediate zone wells varied from 4.5×10^{-4} to 9.5×10^{-4} cm/s.

Based on the November/December 2007 groundwater elevation measurements, depth to groundwater in the deep zone is approximately 33 feet bgs with groundwater flow to the east or northeast. The hydraulic conductivity in the deep zone at LHAAP-46 was measured at 1.4×10^{-3} cm/s (Jacobs, 2002). With only one deep zone well at LHAAP-46, the groundwater flow direction was extrapolated from wells at multiple LHAAP sites and no specific figure for the deep zone at LHAAP-46 has been prepared.

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Lu	01/17/08	R. Duffield	01/17/08	P. Srivastav	03/05/08	T:GIS\Longhorn\MyWSP\MXD\Site46_FS\FS_AreaMap.mxd



LEGEND

- Major Texas City
- Road
- Railroad
- Creek/River
- Lake
- County Boundary
- City Boundary
- LHAAP Boundary

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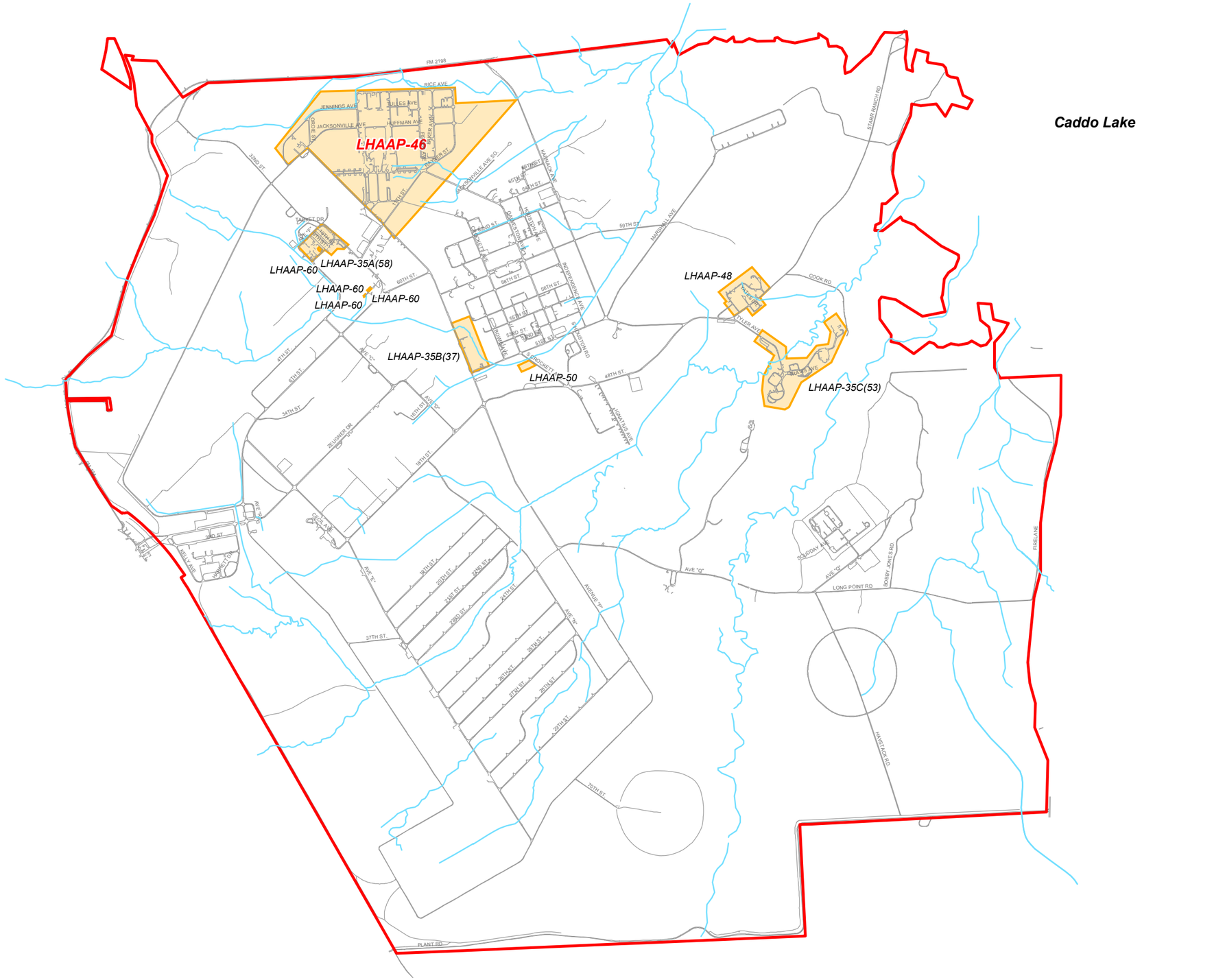
FIGURE 1-1

LHAAP LOCATION MAP
FEASIBILITY STUDY, LHAAP-46, GROUP 4

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS



LEGEND

- Stream
- Road
- Site
- Lake
- LHAAP Boundary

0 1,200 2,400 4,800 Feet

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TULSA DISTRICT
TULSA, OKLAHOMA

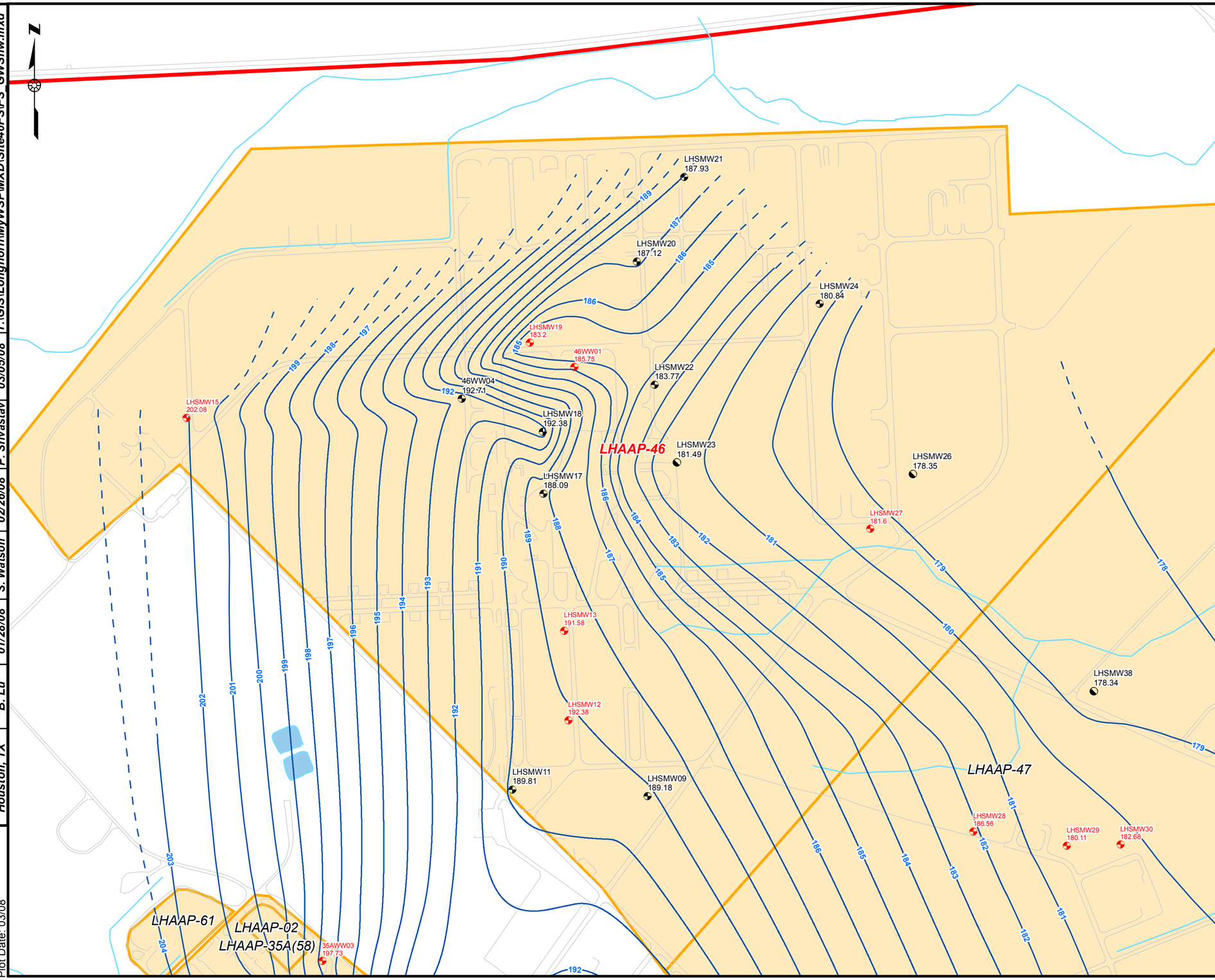
FIGURE 1-2

LHAAP-46 SITE VICINITY MAP
FEASIBILITY STUDY, LHAAP-46, GROUP 4

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Lu	01/18/08	R. Duffield	01/18/08	P. Srivastav	03/05/08	T:\GIS\Longhorn\MyWSP\MXD\Site46FSIFS_SiteVicinity.mxd

Plot Date: 03/08



LEGEND

- Shallow Monitoring Well
- Shallow/Intermediate Monitoring Well
- Dry Shallow Monitoring Well (Elevation Represents Bottom of Well)
- Groundwater Elevation Contour
- Inferred Groundwater Elevation Contour
- Stream
- Road
- Approximate LHAAP Boundary
- Site

Note:

Groundwater elevation measured on November 29 -- December 3, 2007.

0 200 400 800 Feet

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TULSA DISTRICT
TULSA, OKLAHOMA

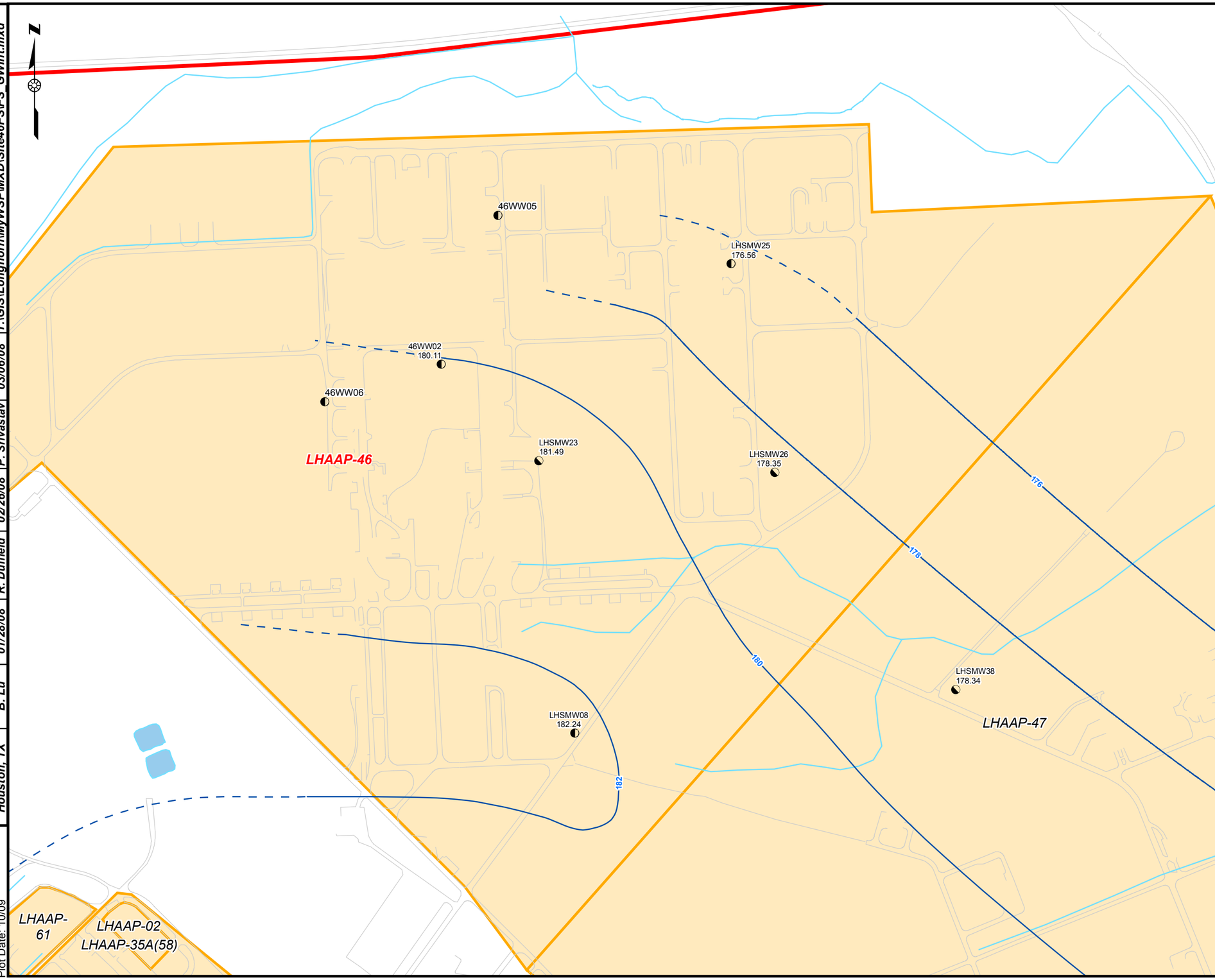
FIGURE 1-3

LHAAP-46 GROUNDWATER ELEVATION CONTOUR MAP (SHALLOW ZONE)
FEASIBILITY STUDY, LHAAP-46, GROUP 4

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Lu	01/28/08	S. Watson	02/26/08	P. Srivastav	03/05/08	T:\GIS\Longhorn\MyWSP\MXD\Site46FS\FS_GWShw.mxd

Plot Date: 03/08



LEGEND

- Shallow/Intermediate Monitoring Well
- Intermediate Monitoring well
- Groundwater Elevation Contour
- Inferred Groundwater Elevation Contour
- Stream
- Road
- Approximate LHAAP Boundary
- Site

Note:

Groundwater elevation measured on November 29 -- December 3, 2007.

0 200 400 800 Feet

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FIGURE 1-4

LHAAP-46 GROUNDWATER ELEVATION CONTOUR MAP (INTERMEDIATE ZONE)
FEASIBILITY STUDY, LHAAP-46, GROUP 4

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Lu	01/28/08	R. Duffield	02/26/08	P. Srivastav	03/06/08	T:\GIS\Longhorn\MyWSP\MXD\Site46FS\FS_GWInt.mxd

Plot Date: 10/09

2.0 Sampling Investigations

Site work at the Group 4 sites was performed in a phased approach. **Table 2-1** summarizes the investigation phases. Phase I was initiated to evaluate potentially contaminated sites for possible uncontrolled releases to the environment and to identify site-related contaminants. Phase II investigation work was conducted to further investigate those areas identified in Phase I that required additional investigation to characterize the contaminants present. Following the Phase II investigation, a Pre-Phase III investigation was conducted by USACE in May 1996. This investigation used direct push groundwater sampling devices to assist in delineating the extent of VOC contamination in the shallow groundwater beneath the Group 4 sites and to help determine additional monitoring well locations. Based upon the results of this Pre-Phase III investigation, the scope of the Phase III investigation was defined. The goal of the Phase III RI was to complete the investigation of the Group 4 sites and establish the extent of groundwater contamination. Activities conducted after Phase III were completed to respond to specific data needs to evaluate the contamination in groundwater.

2.1 Investigations through 2001

Investigations at LHAAP-46 began in November 1991 with an inventory of sumps and some soil sampling. The findings of that initial work led to Phase I investigations in 1993, Phase II investigations in 1994, some additional work in 1996, and Phase III investigations in 1998. Other investigations include groundwater sampling in 1996, 2000, and 2001. All of these activities are documented in the *Final Remedial Investigation Report* (Jacobs, 2002). There were 46 sumps and 14 waste rack sumps located within LHAAP-46 that are included within site LHAAP-35/36, along with sumps from other areas within LHAAP. The analytical results for soil around the sumps at LHAAP-46 were evaluated in the Final Data Evaluation Report for LHAAP-35/36 (Shaw, 2008). The impact of the post-2002 sump soil sampling results on the risk assessment (Jacobs, 2003) was evaluated in the report. The report concluded that the cancer risk and noncancer hazard values were still within the acceptable range, and no further action was required for the soil around the sumps at LHAAP-46 (Shaw, 2008).

Subsequent sampling for perchlorate was documented separately in the *Final Project Report, Plant-Wide Perchlorate Investigation* (Solutions to Environmental Problems, Inc. [STEP], 2005). The data from the investigations through 2001 were used in the human health risk assessment (Jacobs, 2003) and baseline ecological risk assessment (Shaw, 2007a).

2.1.1 Pre-Phase I Investigation

Initial field investigative activities relative to the Group 4 sumps started in November 1991 when BCM Engineers, Inc. (BCM) was retained by the LHAAP Operating Contractor, Thiokol, to

Table 2-1
Summary of Investigations at LHAAP-46

Pre-Phase I (Jacobs, 2002)
BCM, 1992 • Inventory of the 46 waste process sumps
USACE, 1993 • Inventory of the 46 waste process sumps and 14 waste rack sumps
Phases I-III (Jacobs, 2002)
USACE, Phase I 1993 • Collected 5 sump content samples for laboratory analysis • Completed 87 borings at the 60 sump locations and collected 199 soil samples
USACE, Phase II 1994 • Installed 20 monitoring wells and collected groundwater samples from each well • Collected 39 soil samples from 20 monitoring well locations and from 19 soil locations
USACE, Pre-Phase III 1996 • Determined locations for Phase III monitoring wells by delineating plume using site characterization and analysis penetrometer system (8 locations) • Collected 2 rounds of groundwater samples in 1996
Jacobs, Phase III 1998 • Collected 122 soil samples at 47 waste process sumps and 14 waste rack sump locations • Collected 8 surface water and 8 sediment samples • Collected 21 soil samples from 15 locations • Installed 4 monitoring wells and collected samples from each of the 4 new wells and the 20 existing wells
Additional Investigations
• Collected samples from 5 wells for perchlorate analysis in 2000 through 2002 (STEP, 2005). • Collected groundwater and soil samples at two locations in 2003 as part of the Phase II Environmental Site Assessment (Plexus, 2005) • Collected additional groundwater samples in 2004(Shaw, 2007b) • Collected samples at Building 407 in 2006 (Appendix C) • Collected additional groundwater samples for natural attenuation evaluation (Appendix A) and for geochemical evaluation (Appendix B) • Collected groundwater elevation measurements in 2007 (Figure 1-3 and Figure 1-4).

evaluate the integrity of the sumps system and the industrial wastewater treatment system at LHAAP (BCM, 1992). Although the focus was to develop more efficient wastewater management alternatives, the locations of all 125 sumps at the LHAAP facility were surveyed.

At LHAAP-46, soil samples were collected from the 2-foot bgs and 10-foot bgs intervals from soil borings drilled adjacent to sumps S-009, S-015, S-023, and S-034. These results, and all other results related to the sumps, are discussed in detail in the LHAAP-35/36 Sump Report (Shaw, 2008), which concluded with a no further action determination for the sumps at LHAAP-46. The report was reviewed by regulators who concurred with these findings.

2.1.2 Phase I Remedial Investigation

The Tulsa District USACE conducted the Phase I RI in 1993. The Phase I activities at LHAAP-46 included the collection of samples from 4 sumps and of 199 soil samples from 87

soil borings at 60 sump locations (sumps S-001 to S-035, S-037 to S-043, S-107 to S-110, and waste rack sumps WRS-004 to WRS-013, WRS-015, WRS-016, WRS-019, and WRS-021) (USACE, 1994).

Liquids from four sumps (S-004, S-031, S-033, S-110) and a solid sample from S-110 were analyzed for VOCs, semivolatile organic compounds (SVOCs), and metals. Phase I soil samples were tested for VOCs, SVOCs, and metals. All sumps were removed from the site in the mid-1990s and the LHAAP-35/36 report indicated a finding of no further action for sump related soil (Shaw, 2008).

2.1.3 Phase II Remedial Investigation

The Tulsa District USACE conducted the Phase II RI during 1994 and 1995. The purpose of Phase II was to determine the presence or absence of potential contaminants in groundwater and whether past activities had impacted the surrounding environment. To assess groundwater, 20 monitoring wells (LHSMW08 through LHSMW27) were installed, and a groundwater sample was collected from each well and analyzed for VOCs, SVOCs, explosive compounds, and metals. A surface soil sample was collected at each monitoring well boring to assess whether the surrounding soil had been impacted. Additionally, 19 surface soil samples were collected from ditches and shallow drainages near selected sump locations to determine whether the surrounding environment was being impacted (USACE, 1994). The samples were analyzed for VOCs, SVOCs, explosive compounds, and metals. The results for these samples were presented in the Final Remedial Investigation Report (Jacobs, 2002). Soil sample locations are shown on **Figure 2-1** and monitoring wells are shown on **Figure 2-2**.

2.1.4 Pre-Phase III Remedial Investigation

In February and August of 1996, groundwater samples were collected from the 20 Phase I wells (LHSMW08 through LHSMW27). Samples were tested for VOCs, SVOCs, and explosives. The results for these samples are presented in the RI Report (Jacobs, 2002).

2.1.5 Phase III Remedial Investigation

Sverdrup Environmental, Inc. conducted the field activities for the Phase III RI in 1998. Activities included collecting 122 soil samples at 47 waste process sumps and 14 waste rack sumps, collecting 21 soil samples from 15 other locations, collecting 8 surface water and 8 sediment samples, installing 4 monitoring wells, and collecting groundwater samples from each of the 4 new wells and the 20 existing wells. The results for these samples were presented in the RI Report (Jacobs, 2002) and the sump related results were analyzed further in the LHAAP-35/36 Sumps Report (Shaw, 2008).

2.1.5.1 Phase III Soil Investigation

All soil samples were analyzed for metals including beryllium, nickel, and vanadium. The 12 soil samples collected in the area of monitoring well LHSMW21 and Building 400A were analyzed for SVOCs. Nine soil samples from three soil borings (46SB01 through 46SB03) were analyzed for VOCs, SVOCs, explosive compounds, metals, pesticides/polychlorinated biphenyls (PCBs), and dioxins/furans. A subset of the sump samples were also tested for pesticides/PCBs, and dioxins/furans.

2.1.5.2 Phase III Sediment and Surface Water Investigation

Eight sediment and surface water samples were collected. Sediment samples were analyzed for VOCs, SVOCs, explosive compounds, metals, PCBs, dioxins/furans, total organic carbon (TOC), and cyanides. Surface water samples were analyzed for VOCs, SVOCs, dioxins/furans, explosives, metals, cyanide, and hardness.

2.1.5.3 Phase III Groundwater Investigation

A total of four groundwater wells were installed in 1998 during Phase III at LHAAP-46. Two shallow monitoring wells (46WW01 and 46WW04) were installed at depths of 24 feet bgs. One intermediate monitoring well (46WW02) and one deep monitoring well (46WW03) were installed at depths of 46 feet and 101 feet bgs, respectively. Twenty-five groundwater samples were collected during the Phase III investigation from the monitoring wells and were submitted for laboratory analyses for VOCs, SVOCs, explosive compounds, and metals. The groundwater samples collected from monitoring wells 46WW01 and LHSMW19 were also submitted for dioxins/furans analysis. A single sample was collected from each monitoring well with the exception of 46WW01, which was sampled in October and November 1998.

2.1.6 Other Investigations

Other investigations at LHAAP-46 have primarily involved additional soil and groundwater sampling. The USACE collected two rounds of groundwater samples in 1996. Perchlorate samples were collected by STEP from five wells in 2000 and 2001 as part of the Plant-Wide Perchlorate Investigation (STEP, 2005). Additional groundwater and soil samples were collected from two locations in 2003 as part of the Environmental Site Assessment (Plexus, 2005). Shaw collected additional soil samples around Building 407 and around former sump locations in 2006 (Shaw, 2008). Shaw collected more groundwater samples in 2007 to provide information for this FS.

2.1.6.1 Perchlorate Sampling

Perchlorate groundwater samples were collected by STEP from wells 46WW01, 46WW04, LHSMW17, LHSMW18, and LHSMW22 in 2000. Perchlorate groundwater samples were

collected from 46WW04 and LHSMW18 in 2001. These perchlorate results were presented in the plant-wide perchlorate investigation (STEP, 2005).

2.2 Investigations Since 2001

The data from the investigations collected through 2001 were used in the human health risk assessment and screening ecological risk assessment (Jacobs, 2003). Further delineation of groundwater was needed, and subsequent investigations were conducted to better define the nature and extent of contamination and address data gaps. Soil and groundwater sampling conducted in 2003 is documented in the *Environmental Site Assessment* (Plexus, 2005). Groundwater sampling conducted in 2004 is documented in the *Data Gaps Investigation* (Shaw, 2007b). An additional investigation for Building 407 was conducted in 2006 to evaluate concentrations of metals in the soil and is included in **Appendix C**. Analytical reports for the results of groundwater samples collected in 2007 to evaluate natural attenuation (**Appendix A**) and geochemistry (**Appendix B**) are included in **Appendix D** of this document.

2.2.1.1 Environmental Site Assessment

A soil boring (1000SB) was installed by Plexus in 2003 immediately downgradient of Building P-9 (inside P-10) to evaluate the presence or absence of VOCs, SVOCs, perchlorate and metals at a depth greater than five feet bgs. At the soil boring location continuous soil samples were collected and a subsurface soil sample was collected for laboratory analysis. Upon completion of the soil boring, a temporary monitoring well (1000TW001) was installed. These soil and groundwater samples were tested for VOCs, SVOCs, perchlorate, and metals.

In addition, for characterization purposes for subsequent disposal, a sample of a dark reddish liquid (1000PA001) from an equipment pit at Building P-124 and a solid sample (1000WS001) from residual material in Building 407 (from pyrotechnic testing) were collected for laboratory analysis. The liquid sample was tested for VOCs, metals, perchlorate, and explosive compounds. The solid sample was tested for metals and perchlorate. The results for these samples were presented in the Environmental Site Assessment (Plexus, 2005).

2.2.1.2 Building 407 Sampling

Soil samples were collected by Shaw in 2006 to determine if the soil around Building 407 was impacted by the release of solids residue from the pyrotechnic testing conducted within the building. The 25 soil samples, 1 solids sample, and 3 field duplicates were tested primarily by X-ray fluorescence for arsenic, chromium, copper, lead, nickel, and zinc. Three samples were also sent to a laboratory and tested for lead and chromium. The X-ray fluorescence results indicated that chromium, lead, and zinc levels are elevated with respect to background in the area around Building 407, but only in the surface soil and the solid. The maximum arsenic, lead, nickel, and zinc concentrations were less than the historic maximum soil concentrations used in

the risk assessment (Jacobs, 2003). The chromium concentration was approximately the same as the historic (i.e., 143 milligrams per kilogram [mg/kg] versus historic maximum of 131 mg/kg). The metal concentrations in the solid were higher than those encountered within the soil, 1,269.6 mg/kg lead, 3,249.6 mg/kg chromium, <255 mg/kg arsenic, 2,508.8 mg/kg copper, <900 mg/kg nickel, and 468.8 mg/kg zinc. These Building 407 results are presented in **Appendix C**.

The solid sample was collected from the black material present in the bottom portion of the approximate 1-foot by 1-foot plexiglass and metal chamber. This chamber is inside the building and is not exposed to outside elements. Furthermore, no solid residue was observed in the chamber or outside the building during a visit by Shaw in March 2008. The data, therefore, do not indicate a release from Building 407, and thus no action is required for Building 407 under CERCLA.

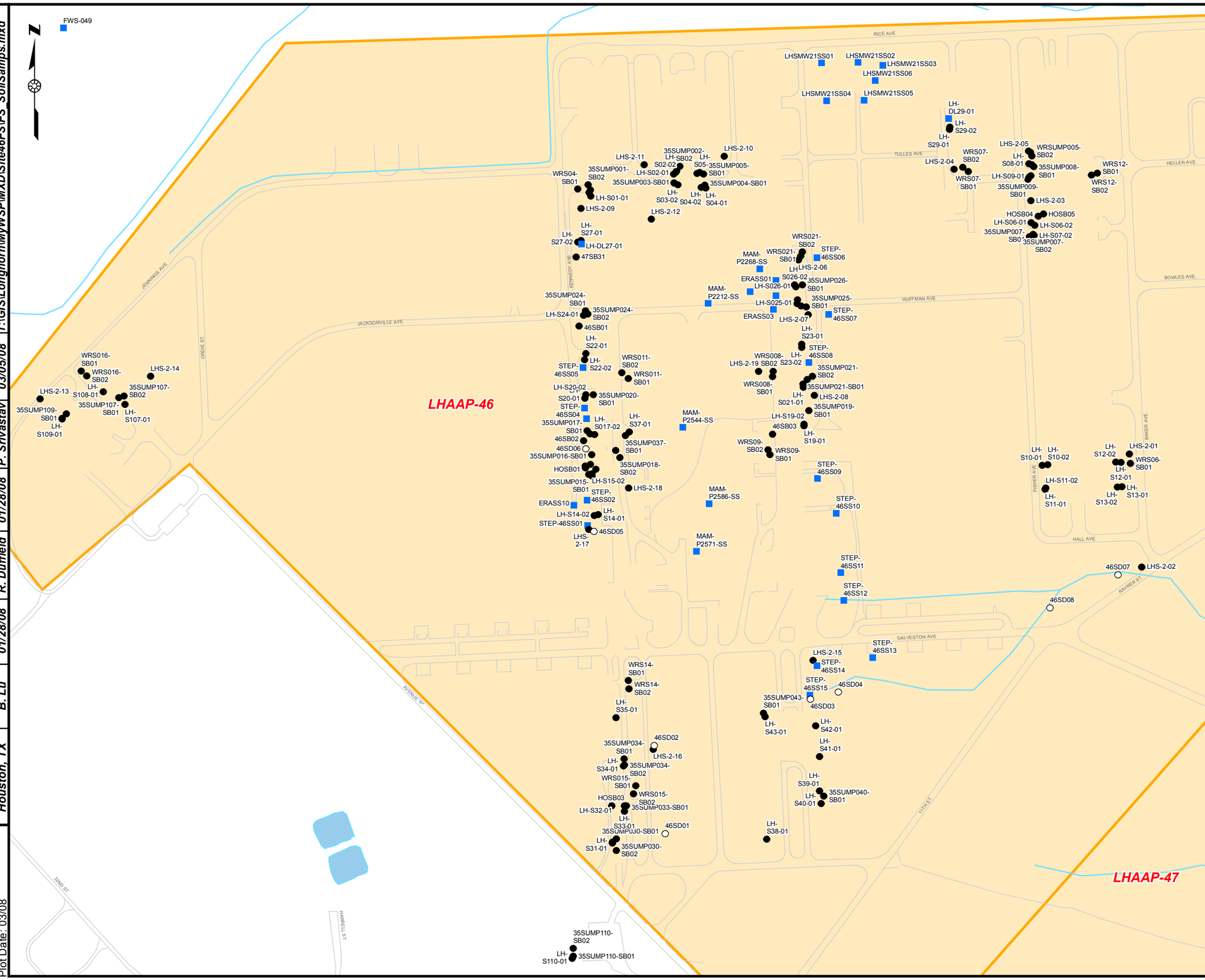
2.2.1.3 2007-2008 Groundwater Sampling

In February 2007, groundwater samples were collected from seven wells (46WW01, 46WW02, 46WW04, LHSMW18, -19, -22, and -23) to support a preliminary evaluation of MNA at LHAAP-46. Samples were tested for VOCs, MNA parameters, perchlorate, and biological microorganisms (dehalococcoides). Two VOCs were detected, cis-1,2-dichloroethene (DCE) at an estimated 1.5 micrograms per liter (µg/L) in LHSMW18 and TCE in four wells at concentrations up to 85.5 µg/L at LHSMW19. This information was used to evaluate the potential for natural attenuation in the groundwater, and that evaluation is included as **Appendix A**. These test results are included in **Appendix D**.

In September 2007, groundwater samples were collected from nine wells (46WW02, 46WW04, LHSMW11, -14, -15, -19, -22, -23, and -24). This sampling was conducted to determine whether metals (e.g., arsenic, lead, chromium) found to be elevated in historical data were in fact site-related contaminants or were artifacts of sampling techniques, otherwise being naturally occurring. Samples were tested for metals, both total and dissolved, and various general chemistry parameters. This information was used to evaluate the geochemistry of metals in the groundwater and that evaluation is included as **Appendix B**. These test results are included in **Appendix D.**

In November and December of 2007, a plant-wide groundwater elevation survey was performed for the production area. The groundwater elevations shown on **Figures 1-3** and **1-4** are from this survey. A table of field measurements is included in **Appendix D**.

In March 2008, groundwater samples were collected from two wells, LHSMW09 and LHSMW11, on the western edge of LHAAP-46 to delineate a TCE plume at the nearby site LHAAP-35A(58). No TCE was detected. The data are included in **Appendix D**.



LEGEND

- Soil Boring
- Sediment Sample
- Surface Soil Sample
- Stream
- Road
- Site

0 150 300 600 Feet

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TULSA DISTRICT
TULSA, OKLAHOMA

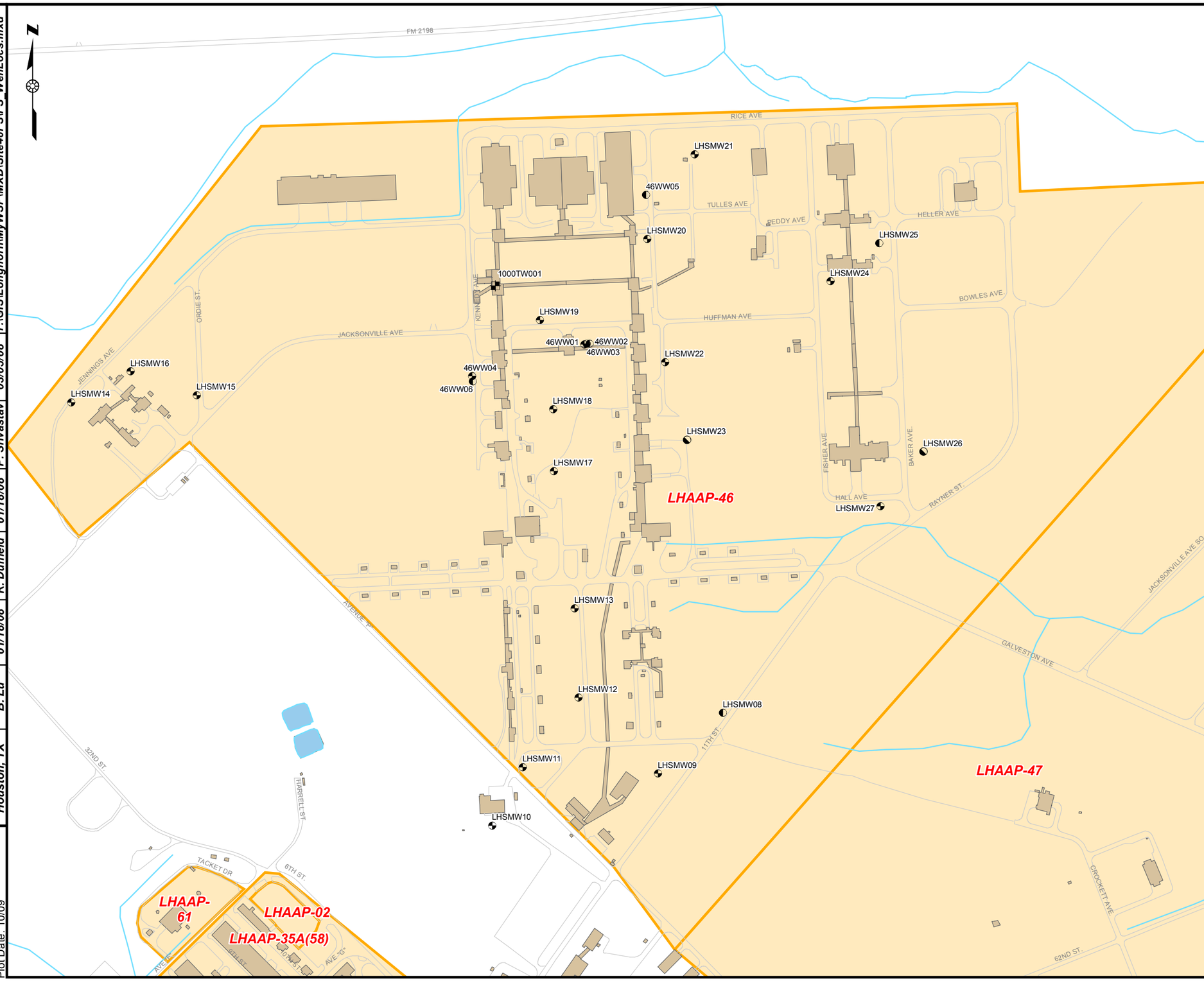
FIGURE 2-1

LHAAP-46 SOIL SAMPLE LOCATION MAP
FEASIBILITY STUDY, LHAAP-46, GROUP 4

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Lu	01/28/08	R. Duffield	01/28/08	P. Srivastav	03/05/08	T:\GIS\Longhorn\MyWSP\MXD\Site46FS\FS_SoilSamps.mxd

Plot Date: 03/08



LEGEND

- Shallow Monitoring Well
- Shallow/Intermediate Monitoring Well
- Intermediate Monitoring Well
- Deep Monitoring Well
- Temporary Shallow Monitoring Well
- Stream
- Road
- Former Building or Concrete Slab
- Site

0 200 400 800 Feet

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

FIGURE 2-2

LHAAP-46 WELL LOCATION MAP
FEASIBILITY STUDY, LHAAP-46, GROUP 4

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Lu	01/18/08	R. Duffield	01/18/08	P. Srivastav	03/05/08	T:\GIS\Longhorn\MyWSP\MXD\Site46FS\FS_WellLocs.mxd

Plot Date: 10/09

3.0 Risk and Site Assessment

This section summarizes the risk assessment approach, risk conclusions, and the conceptual site model for LHAAP-46, and assesses the media contamination at LHAAP-46.

3.1 Risk Assessment Summary for LHAAP-46

This summary is based on the conclusions presented in the *Final Baseline Human Health and Screening Ecological Risk Assessment for the Group 4 Sites* (Jacobs, 2003). The risk assessment used data from the investigations conducted through 2001 including the plant-wide perchlorate investigation. During the risk assessment, soil and groundwater data were used to calculate the aggregate risk, which was then compared to the USEPA target risk range of 1×10^{-4} to 1×10^{-6} for the excess lifetime cancer risk and to a hazard index (HI) of 1 for non-carcinogenic hazard. If there is no unacceptable risk associated with a medium, or an ARAR is not exceeded, then the medium is not identified in this FS for remediation.

The Jacobs risk assessment (Jacobs, 2003) presented the human health risks and hazards to a hypothetical future maintenance worker under an industrial scenario for soil and groundwater and presented a screening level ecological risk assessment. A baseline ecological risk assessment has been completed and does not indicate any risk to ecological receptors from LHAAP-46 (Shaw, 2007a).

3.1.1 Soil

Soil in the human health risk assessment is defined as surface soil (0 to 2 feet in depth). Hypothetical future maintenance worker exposure to soil at LHAAP-46 generated an HI of 0.12, which is below the benchmark of 1. The calculated carcinogenic risk is 1.67×10^{-5}, which is within the acceptable range (1×10^{-6} to 1×10^{-4}). Thus, the soil does not pose a carcinogenic risk or a noncarcinogenic hazard to the hypothetical future maintenance worker. Supplemental soil data collected around the sumps by Shaw was evaluated in the Final Data Evaluation Report (Shaw, 2008) which showed that the cancer risk and noncancer hazard were acceptable.

3.1.2 Groundwater

The baseline human health risk assessment reported risks from groundwater at LHAAP-46 for a hypothetical future maintenance worker under an industrial scenario as a carcinogenic risk of 4.05×10^{-5}, which is within the acceptable range (1×10^{-6} to 1×10^{-4}), and a non-carcinogenic HI of 31, which is above the benchmark of 1. The major contributors to the non-carcinogenic hazard were three metals (antimony, manganese and thallium) which account for approximately 87 percent of the total groundwater non-carcinogenic hazard.

3.2 Media Contamination Assessment for LHAAP-46

Data presented in the RI and the human health risk assessment indicate that chemicals in the soil at LHAAP-46 pose no unacceptable cancer risk or hazard to human health. However, the risk assessment indicates that antimony, manganese, and thallium in groundwater at LHAAP-46 pose an unacceptable hazard to human health. Also, the maximum concentrations of antimony, arsenic, beryllium, cadmium, chromium, lead, thallium, TCE, and bis(2-ethylhexyl)phthalate exceeded their maximum contaminant level (MCL) concentrations (Jacobs, 2002 and 2003). Evaluation of data generated after the risk assessment identified no additional potential COCs. The following sections evaluate these potential COCs to determine whether they are COCs for this FS.

3.2.1 Groundwater Contamination

Based on the human health risk assessment, groundwater at LHAAP-46 poses an unacceptable non-carcinogenic hazard to a hypothetical future maintenance worker at LHAAP-46 under an industrial scenario. Groundwater data were also compared with MCLs (USEPA, 1994). The potential COCs listed in **Table 3-1** for the LHAAP-46 groundwater include antimony, manganese, and thallium due to the contribution to non-carcinogenic hazard. Hypothetical future maintenance worker exposure to groundwater at LHAAP-46 generated an unacceptable HI of 31 with more than 78% contributed by thallium (an individual hazard quotient (HQ) of 24). Antimony contributed 1.5 to the overall HI, and manganese contributed 1.4 to the overall HI. This HI was calculated using data collected through 2001 (Jacobs, 2003). Additionally, nine chemicals are considered as potential COCs because their HI values exceeded 0.1—aluminum, barium, beryllium, cadmium, nickel, perchlorate, silver, strontium, and vanadium and are also included on **Table 3-1**. Antimony, arsenic, beryllium, cadmium, chromium, lead, and thallium, TCE, and bis(2-ethylhexyl)phthalate are included in **Table 3-1** due to exceedance of their respective MCLs. The following subsections evaluate the potential COCs.

3.2.1.1 Metals

The maximum concentration of aluminum in groundwater (80,000 µg/L) was from LHSMW16 in 1994 and exceeded the LHAAP perimeter well groundwater background value (13,400 µg/L). Aluminum was detected in 80 of the 105 groundwater samples analyzed between 1994 and 2007. The maximum concentration of aluminum in the 2007 groundwater samples was 1,360 µg/L. The geochemical evaluation (**Appendix B**) concluded that aluminum in the groundwater is primarily the result of suspended clay particles. Thus, aluminum is not considered a COC at LHAAP-46.

Groundwater samples were analyzed for antimony between 1994 and 2007. The maximum antimony concentration was 63 µg/L in LHSMW27 in 1996. That was an estimated result because the detection limits were elevated in the 1996 sampling round. In 1998, the detection

Table 3-1
Potential Chemicals of Concern in Groundwater

Chemical	Maximum Detected Concentration (µg/L)	Chemical Hazard Quotient	MCL (µg/L)	Retained as Chemical of Concern
Aluminum	80,000	0.78	--	No – Note 1
Antimony	63	1.5	6	No – Note 2
Arsenic	20	--	10	No – Note 2
Barium	1,400	0.20	2,000	No – Note 2
Beryllium	76	0.37	4	No – Note 2
Cadmium	20	0.39	5	No – Note 2
Chromium	4,700	0.03	100	No – Note 3
Lead	673	--	15	No – Note 2
Manganese	6,500	1.4	--	No – Note 4
Nickel	3,670	0.58	--	No – Note 3
Silver	120	0.23	--	No – Note 2
Strontium	12,000	0.20	--	No – Note 5
Thallium	200	24	2	No – Note 4
Vanadium	140	0.20	--	No – Notes 2 and 5
TCE	85.5	--	5	Yes
bis(2-ethylhexyl)phthalate	27	0.02	6	No – Note 6
Perchlorate	47.9	0.33	--	No – Note 2

Notes and Abbreviations:

1 – Elevated concentration in samples due to suspended particles from sampling techniques (low flow techniques not used)
2 – Recent samples do not have elevated concentration
3 – Elevated concentration due to suspended particles from well corrosion
4 – Chemical is naturally occurring
5 – Contribution to hazard index low
6 – Chemical detected in laboratory blank

-- No chemical hazard or MCL for the chemical
MCL Federal Safe Drinking Water maximum contaminant level
TCE trichloroethene
µg/L micrograms per liter

limits were not elevated, and antimony was only detected in 46WW01 at a concentration of 8 µg/L. Even though this concentration is above the MCL value of 6 µg/L, this concentration is less than the LHAAP perimeter well groundwater background 95% upper tolerance limit (UTL) value of 11.5 µg/L (Shaw, 2007d). Antimony was detected in 4 of 107 groundwater samples at LHAAP-46, and antimony was not detected in the 2007 samples. Due to lack of detection in the 2007 sampling round, and 1998 results below background, antimony is not considered a COC for LHAAP-46.

The maximum concentration of arsenic in groundwater (20 µg/L) that exceeded the MCL (10 µg/L) was detected in LHSMW17 in 1998. Other arsenic results that exceeded the MCL were found at LHSMW12 and 46WW02 in 1998 and at LHSMW22, LHSMW23 and LHSMW24 in 1996. There is no evident pattern to the arsenic detected in the groundwater at LHAAP-46. The most recent (2007) arsenic concentrations were all less than the MCL. The geochemical evaluation (**Appendix B**) identified no definite conclusions about arsenic, but noted

the detected concentrations were all estimated. The most recent samples were collected with low flow sampling methods and showed consistently lower arsenic concentrations than earlier samples. This suggests that elevated arsenic concentrations in earlier samples were associated with suspended solids caused by the sample collection method. Thus, arsenic is considered an artifact of turbid samples collected during historic sampling rounds and is not retained as a COC at LHAAP-46.

The maximum concentration of barium in groundwater (1,400 µg/L) was from LHSMW16 in 1994 and did not exceed the MCL (2,000 µg/L). The LHAAP perimeter well groundwater background value (1,990 µg/L) was less than the MCL, but greater than the highest barium concentration at LHAAP-46. Barium was detected in 84 of the 107 groundwater samples analyzed between 1994 and 2007. The most recent 2007 barium sample concentrations were all less than 50 µg/L. Thus, barium is not considered a COC at LHAAP-46.

The maximum concentration of beryllium in groundwater (76 µg/L) was from LHSMW27 in August 1996, and exceeded the MCL (4 µg/L). In 1998, the beryllium concentration from this well was 0.9 µg/L, below the MCL. Two other detectable concentrations of beryllium were slightly above the MCL in 1998, 5.4 µg/L at LHSMW17 and 6.5 µg/L at LHSMW12. There is no evident pattern to beryllium in the groundwater at LHAAP-46. Beryllium was detected in 19 of 90 groundwater samples at LHAAP-46, mostly from 1998. Beryllium was not detected in the 2007 samples. Thus, beryllium is not considered a COC for LHAAP-46.

The maximum concentration of cadmium in groundwater was 20 µg/L from LHSMW27 in 1996 and exceeded the MCL (5 µg/L). In 1998, the concentration at LHSMW27 was 0.8 µg/L, which is below the MCL. No other cadmium results exceeded the MCL. Cadmium was detected in 19 of 107 groundwater samples at LHAAP-46. The most recent (2007) cadmium concentrations were all less than the MCL. Since the only detection above the MCL was not reproducible, cadmium is not considered a COC for LHAAP-46.

The maximum concentration of chromium in groundwater (4,700 µg/L) was from LHSMW15 in 1998, and exceeded the MCL (100 µg/L). Five wells exceeded the MCL in 1994, one well exceeded the MCL in February 1996, six wells exceeded the MCL in August 1996, ten wells exceeded the MCL in 1998, and four wells exceeded the MCL in 2007. Eight of the ten wells that had chromium concentrations that exceeded the MCL in 1998 were sampled in 2007. All eight wells had detectable concentrations of chromium. Four of the wells had unfiltered results that were above the MCL, but filtered results ranged from 5.26 to 57.6 µg/L and were all lower than the MCL. Comparison of dissolved versus total chromium concentrations from 2007 showed most of the chromium as filterable particulates, not dissolved. The geochemical evaluation (**Appendix B**) suggests that the stainless steel material of the monitoring wells is the source of chromium in groundwater at LHAAP-46. A similar occurrence has been observed at

other sites, e.g., LHAAP-12 and -53. Detectable chromium concentrations associated with filterable particulates are expected as the stainless steel of the wells degrades over time. Thus, the chromium in groundwater samples at LHAAP-46 is from high filterable particulates in the samples, and chromium is not considered a COC at LHAAP-46.

The maximum concentration of lead in groundwater (673 µg/L) was from LHSMW23 in August 1996, and exceeded the MCL (15 µg/L). The anomalously high lead concentrations observed in 1996 were not duplicated in 1998 or 2007. The geochemical evaluation (**Appendix B**) suggests that any previously present lead contamination has attenuated, and an ongoing source is not present at the site. Thus, lead in groundwater is not considered a COC at LHAAP-46.

Although the risk assessment reported that the maximum concentration of manganese, 6,500 µg/L from LHSMW18 in 1994, is a contributor to the groundwater noncancer hazard (1.4), This maximum manganese concentration is less than the LHAAP perimeter well groundwater background value (95% UTL) of 7,820 µg/L (Shaw, 2007d). The most recent manganese samples from 2007 had a maximum concentration of 3,790 µg/L from LHSMW22. The geochemical evaluation (**Appendix B**) concluded that manganese detected in the site samples is most likely natural. Thus, manganese is not considered a COC for LHAAP-46.

The maximum concentration of nickel in groundwater (3,670 µg/L) was from LHSMW22 in 2007 and exceeded the LHAAP perimeter well groundwater background value (211 µg/L). Nickel was detected in 69 of the 87 groundwater samples analyzed between 1996 and 2007. The geochemical evaluation (**Appendix B**) concluded that nickel in the groundwater is local contamination as a result of corrosion of the stainless steel monitoring wells. Thus, nickel is not considered a COC at LHAAP-46.

The maximum concentration of silver in groundwater (120 µg/L) was from LHSMW15 in 1998. Silver was detected in 5 of the 107 groundwater samples analyzed between 1994 and 2007. Silver was not detected in the most recent (2007) round of sampling. Thus, silver is not considered a COC at LHAAP-46.

The maximum concentration of strontium in groundwater (12,000 µg/L) was from LHSMW25 in 1998. Strontium was detected in 82 of the 87 groundwater samples analyzed between 1994 and 1998. Strontium was not tested in 2007. The HQ associated with the strontium was 0.20. Due to the low HQ, strontium is not considered a COC at LHAAP-46.

The maximum thallium concentration of 200 µg/L was detected in LHSMW27 in 1996. The other three thallium concentrations higher than 90 µg/L were also from 1996. These high concentrations of thallium were not reproducible in subsequent rounds of sampling. The 2007 samples of thallium had a maximum concentration of 5.43 µg/L at LHSMW24, which is above the MCL value of 2 µg/L. However, the geochemical evaluation (**Appendix B**) concludes the

thallium concentrations in the groundwater are most likely natural. Thus, thallium is not considered a COC for LHAAP-46.

The maximum concentration of vanadium in groundwater (140 µg/L) was from LHSMW17 in 1998. Vanadium was detected in 11 of the 87 groundwater samples analyzed between 1996 and 2007. Vanadium was detected in only one 2007 sample with a concentration of 9.24 µg/L at LHSMW22, which would have an HQ of less than 0.1. Thus, vanadium is not considered a COC at LHAAP-46.

In summary, metals are not considered to be COCs at LHAAP-46.

3.2.1.2 Volatile Organic Compounds

Two wells, LHSMW18 and LHSMW19, had TCE concentrations that exceeded the MCL (5 µg/L) in 1994 and 1996. Four wells (LHSMW18, LHSMW19, 46WW01, and 46WW02) exceeded the MCL in 1998. Two wells (46WW02 and LHSMW19) exceeded the MCL in 2007. The maximum concentration of TCE in groundwater (85.5 µg/L) was from LHSMW19. A plume of TCE in the shallow groundwater centers around LHSMW19, and a plume of TCE in the intermediate groundwater centers around 46WW02. TCE has not been detected in the deep groundwater zone (46WW03). TCE is considered a COC in groundwater at LHAAP-46 in both the shallow and intermediate zones. **Appendix A** summarizes the TCE data, and **Figure 3-1** and **Figure 3-2** show the extent of TCE in the shallow and intermediate zones.

Cis-1,2-DCE is a daughter product of biodegradation of TCE. The maximum concentration of cis-1,2-DCE in groundwater (9.8 µg/L) was from LHSMW18 in 1998 and was less than the MCL (70 µg/L). The most recent concentrations from 2007 ranged from nondetect to an estimated 1.5 µg/L.

Vinyl chloride is a daughter product of biodegradation of cis-1,2-DCE. The maximum concentration of vinyl chloride in groundwater (0.71 µg/L) was from LHSMW18 in 1998 and was less than the MCL (2 µg/L). Vinyl chloride was not detected in the 2007 samples.

3.2.1.3 Semivolatile Organic Compounds

The maximum concentration of bis(2-ethylhexyl)phthalate in groundwater (27 µg/L) was from 46WW02 in November 1998 and exceeded the MCL (6 µg/L). Two other samples, from 46WW03 in November 1998 and LHSMW11 in 1994 also exceeded the MCL. The most recent results (November 1998) for bis(2-ethylhexyl)phthalate ranged from nondetect to 27 µg/L. In the May 1998 sample round, bis(2-ethylhexyl)phthalate was also found in the laboratory blank. It is likely that the November 1998 samples could have also been impacted by laboratory contamination. Bis(2-ethylhexyl)phthalate is not considered a COC in the groundwater at LHAAP-46 since it was an isolated detection of a common laboratory contaminant.

3.2.1.4 Perchlorate

Perchlorate was detected in 9 of the 40 groundwater samples analyzed between 2000 and 2007. Perchlorate was not detected in the 2007 samples. Since perchlorate has no MCL, the detected perchlorate results were compared to TCEQ's groundwater medium-specific concentration (MSC) for industrial use (GW-Ind) developed under the Risk Reduction Rules (RRR), Standard 2. The maximum concentration of perchlorate in groundwater was 30 µg/L at 46WW04 in 2001. This value is well below the GW-Ind value (72 µg/L); thus, perchlorate is not considered a COC at LHAAP-46.

3.2.2 Soil Contamination

Soil contamination was not found to contribute to a potential human health risk or an ecological risk, and is not addressed further under this FS.

3.3 Conceptual Site Model for LHAAP-46

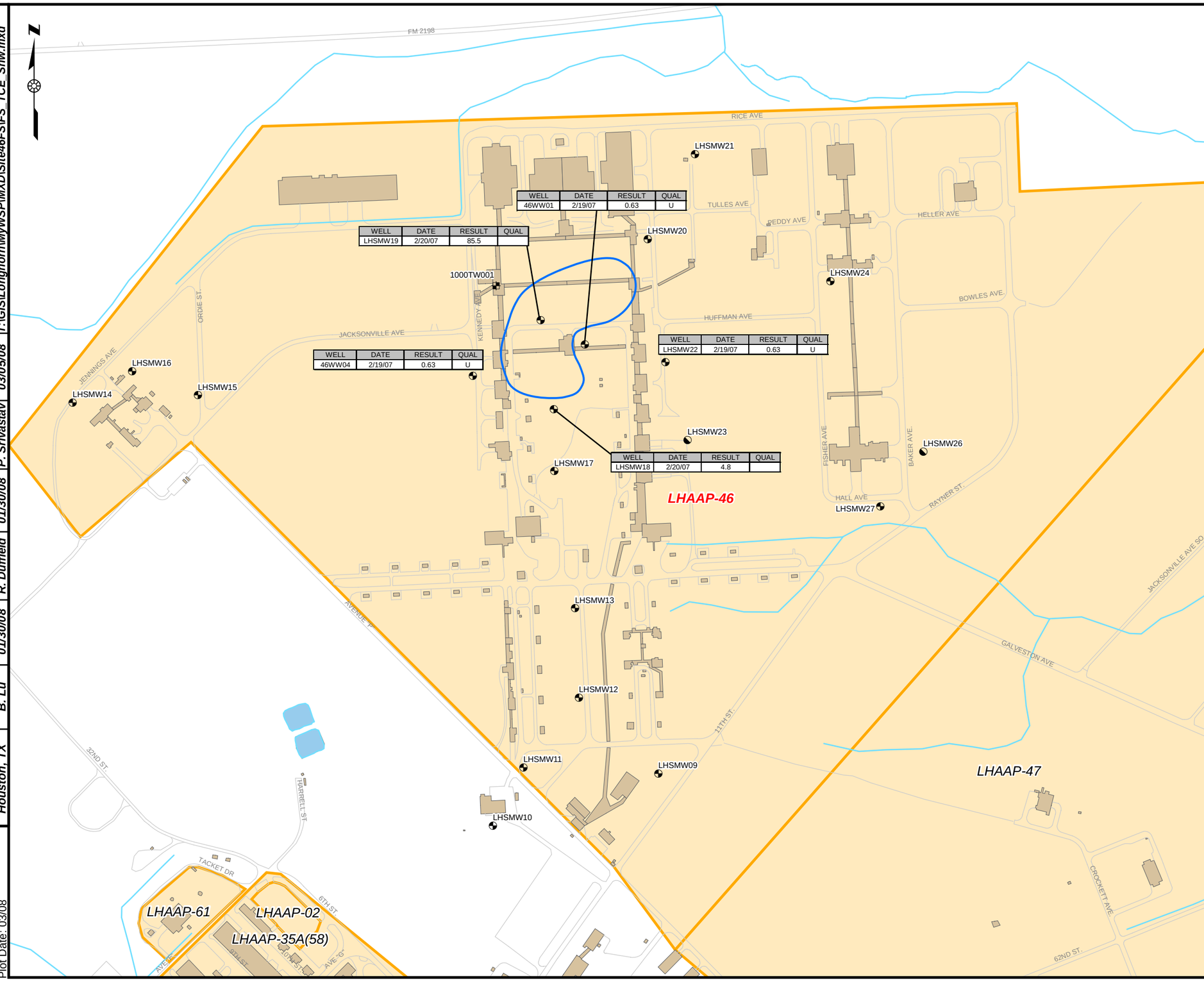
Figure 3-3 illustrates the overall conceptual site model for LHAAP-46 and presents those pathways that are being considered for remediation. Pathways that are likely to have negligible impact are not being considered for remediation.

All sumps have been removed at LHAAP-46. Sampling of and near the sumps does not indicate that they are likely sources of contamination.

The original sources of contamination at LHAAP-46 were most likely small spills resulting from the variety of support services that occurred in the area. The spills would have resulted in minor soil contamination that would migrate, depending on the contaminants, through overland flow via surface runoff or through leaching to the groundwater. Overland flow does not currently appear to be contributing to a migration of contaminants, as the ditch surface water did not contain any VOCs, SVOCs, explosives, pesticides, or PCBs. Likewise, the sediment data do not show detections of VOCs, SVOCs, explosives, or pesticides. Some metals were detected in the surface water and sediment at low concentrations that occur naturally.

Metals and VOCs have been detected in the groundwater at elevated concentrations, but there is no associated soil contamination to indicate that contaminants are currently leaching from the soil to the groundwater. However, use of groundwater by a hypothetical future maintenance worker is a potential pathway that should be remediated.

Modeling calculations were completed to assess the potential for the COCs present in shallow groundwater at LHAAP-46 to migrate toward and discharge to Goose Prairie Creek. The modeling concluded that contaminants present in the shallow groundwater at LHAAP-46 will not adversely impact Goose Prairie Creek surface water (Shaw, 2007c).



LEGEND

- Shallow Monitoring Well
- Shallow/Intermediate Monitoring Well
- Temporary Shallow Monitoring Well
- TCE Plume (2007)
- Stream
- Road
- Former Building or Concrete Slab
- Site

Note:

1. Sampling results reported in micrograms per liter (µg/L).

0 200 400 800 Feet

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TULSA, OKLAHOMA

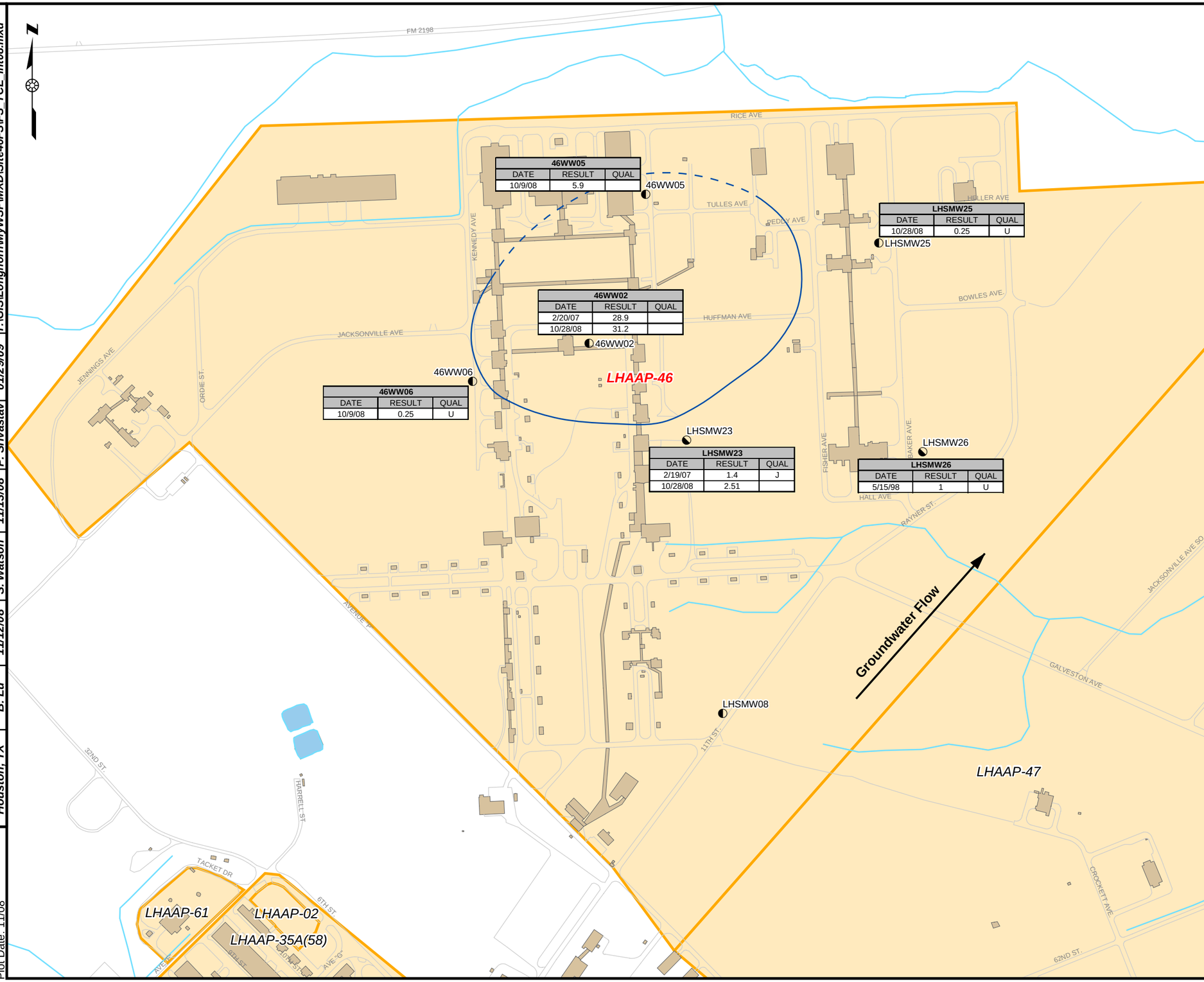
FIGURE 3-1

LHAAP-46 TCE IN SHALLOW ZONE
FEASIBILITY STUDY, LHAAP-46, GROUP 4

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Lu	01/30/08	R. Duffield	01/30/08	P. Srivastav	03/05/08	T:\GIS\Longhorn\MyWSP\MXD\Site46FS\FS_TCE_Shw.mxd

Plot Date: 03/08



46WW05		
DATE	RESULT	QUAL
10/9/08	5.9	

46WW02		
DATE	RESULT	QUAL
2/20/07	28.9	
10/28/08	31.2	

46WW06		
DATE	RESULT	QUAL
10/9/08	0.25	U

LHSMW23		
DATE	RESULT	QUAL
2/19/07	1.4	J
10/28/08	2.51	

LHSMW25		
DATE	RESULT	QUAL
10/28/08	0.25	U

LHSMW26		
DATE	RESULT	QUAL
5/15/98	1	U

LEGEND

- Shallow/Intermediate Monitoring Well
- Intermediate Monitoring Well

TCE Plumes

- 2008 TCE 5 µg/L
- 2008 TCE (Inferred) 5 µg/L
- Stream
- Road
- Former Building or Concrete Slab
- Site

Notes:

1. Sampling results reported in micrograms per liter (µg/L).
2. TCE - trichloroethene
3. TCE MCL is 5 µg/L.

0 200 400 800 Feet

U.S. ARMY CORPS OF ENGINEERS
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TULSA, OKLAHOMA

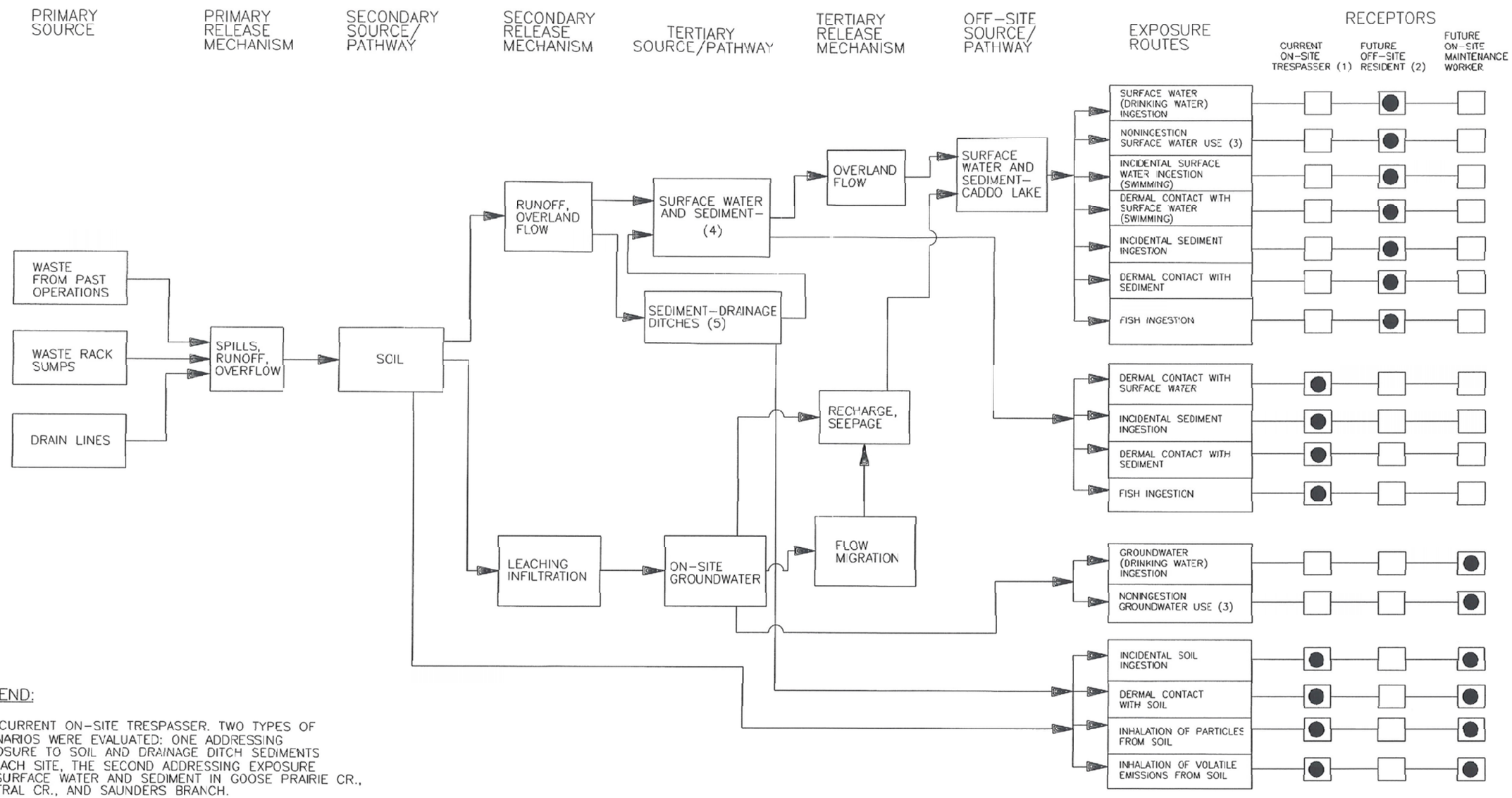
FIGURE 3-2

LHAAP-46 TCE IN INTERMEDIATE ZONE
FEASIBILITY STUDY, LHAAP-46, GROUP 4

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	FILE PATH
Houston, TX	B. Lu 11/12/08	S. Watson 11/13/08	P. Srivastav 01/29/09	T:\GIS\Longhorn\MyWSP\MXD\Site46FS\FS_TCE_Int08.mxd

Plot Date: 11/08



LEGEND:

(1) CURRENT ON-SITE TRESPASSER. TWO TYPES OF SCENARIOS WERE EVALUATED: ONE ADDRESSING EXPOSURE TO SOIL AND DRAINAGE DITCH SEDIMENTS AT EACH SITE, THE SECOND ADDRESSING EXPOSURE TO SURFACE WATER AND SEDIMENT IN GOOSE PRAIRIE CR., CENTRAL CR., AND SAUNDERS BRANCH.

(2) FUTURE OFF-SITE RESIDENT. THE SCENARIO EVALUATED ADDRESSES EXPOSURE ROUTES ASSOCIATED WITH CADDO LAKE.

(3) INCLUDES DERMAL CONTACT AND INHALATION OF VOLATILES.

(4) EVALUATED SURFACE WATER AND SEDIMENT DATA COLLECTED FROM GOOSE PRAIRIE CR., CENTRAL CR., AND SAUNDERS BRANCH.

(5) THE SEDIMENTS FROM THE DRAINAGE DITCHES WERE EVALUATED AS SOILS.

● SCENARIO EVALUATED IN THE BASELINE HUMAN HEALTH RISK ASSESSMENT

Source: Weston

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TULSA, OKLAHOMA

FIGURE 3-3

LHAAP-46 CONCEPTUAL SITE MODEL
FEASIBILITY STUDY, LHAAP-46, GROUP 4

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Lu	01/18/08	R. Duffield	01/22/08	S. Watson	10/28/09	T:\GIS\Longhorn\MyWSP\MXD\Site46FS\FS_CSM.mxd

Plot Date: 10/09

4.0 Remedial Action Objective and Cleanup Levels

This section identifies the RAO **(Section 4.1)**, potential ARARs **(Section 4.2)**, and cleanup levels **(Section 4.3)** for LHAAP-46. The RAO identifies the general goals or end points that the remediation will accomplish, while the cleanup levels identify specific cleanup levels based on ARARs.

4.1 Remedial Action Objective

RAO are established to protect human health and the environment while also meeting ARARs. The identification of the RAO must consider the environmental issues at the site and the receptors that are affected. As identified in the conceptual site model (**Section 3.3**), the primary environmental issue at LHAAP-46 is:

- Groundwater that exceeds the MCL for TCE and thus has the potential to adversely impact humans via ingestion, inhalation, or dermal contact.

The Army recognizes USEPA's policy to return usable water to their potential beneficial uses, based on the non-binding programmatic expectation in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The future use of the entire LHAAP facility is as a wildlife refuge. A hypothetical future maintenance worker has been proposed as a conservative human receptor scenario for this land use. As documented in the Baseline Ecological Risk Assessment (Shaw, 2007a), ecological risk is not currently a concern at LHAAP-46. Based on these considerations, the RAO for LHAAP-46 are as follows:

- Protect human health for the hypothetical future maintenance worker by preventing exposure to groundwater contaminated with VOCs.
- Restore groundwater to their potential beneficial uses, wherever practicable, within a reasonable time period given the particular site circumstances.

4.2 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-46 to protect human health (hypothetical future maintenance worker) by preventing exposure to the groundwater.

4.2.1 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 (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 (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 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 are listed in **Tables 4-1, 4-2,** and **4-3** and are discussed herein.

Potential Chemical-specific requirements are discussed in **Section 4.2.2**; **Table 4-1** includes a narrative listing of chemical-specific ARARs/TBCs for LHAAP-46. **Table 4-2** includes a numerical listing of chemical-specific ARARs/TBCs for groundwater. Potential Location-specific ARARs/TBCs for the sensitive resources potentially identified at LHAAP are discussed in **Section 4.2.3** and listed in **Table 4-3**. Potential Action-specific ARARs/TBCs are listed in **Table 4-4** and are grouped by component action.

4.2.2 Potential Chemical-Specific ARARs

This section identifies the potential chemical-specific ARARs that apply to soil and groundwater at LHAAP-46. These ARARs are summarized in **Table 4-1**.

Table 4-1
Potential Chemical-Specific ARARs/TBCs for Groundwater

Citation	Activity or Prerequisite/Status	Requirement
Groundwater		
Federal Safe Drinking Water Act	Applicable to drinking water at the tap—**relevant and appropriate** for water that could potentially be used for human consumption	Water designated as a current or potential source of drinking water must not exceed drinking water standard. See Table 4-2 for specific numeric criteria.
State of Texas Risk Reduction Standards 30 TAC 335.558 and 335.559(d)(2) as updated in the Texas Commission on Environmental Quality memorandum July 23, 1998	Applicable to nonresidential groundwater—**relevant and appropriate** for potential nonresidential worker exposure to groundwater	If no maximum contaminant level has been promulgated, groundwater must not exceed the nonresidential medium specific concentration.

Abbreviations:

ARAR applicable or relevant and appropriate requirement
TAC Texas Administrative Code
TBC to-be-considered [guidance]

Table 4-2
Chemical-Specific ARARs for Groundwater COCs

Chemical	MCL (µg/L)
VOCs	
Trichloroethene	5
cis-1,2-Dichloroethene[1]	70
Vinyl chloride[1]	2

Notes and Abbreviations:

[1] Cis-1,2-dichloroethene and vinyl chloride are included as the breakdown of trichloroethene is expected to produce these chemicals.
µg/L micrograms per liter
ARAR applicable or relevant and appropriate requirement
COCs chemicals of concern
MCL maximum contaminant level as established in the Federal Safe Drinking Water Act

Table 4-3
Potential Location-Specific ARARs/TBCs

Resource/Citation	Activity or Prerequisite Status	Requirement
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 potential wetlands or actions that have a potential adverse impact to, or take place within, potential wetlands—applicable if delineated wetlands are determined to be present at the site and will be adversely impacted by the action	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.

Abbreviations:

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

Table 4-4
Potential Action-Specific ARARs/TBCs

Citation	Activity or Prerequisite/Status	Requirement
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.
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.

Table 4-4 *(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 or rinsate from incinerator 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.
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.

Table 4-4 *(continued)*
Potential Action-Specific ARARs/TBCs

Citation	Activity or Prerequisite/Status	Requirement
Post-Closure Care and Land Use Controls		
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 deed recordation notification of the facility in accordance with Section 335.566. Must record 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*
FS	*feasibility study*
lb/gal	*pound per gallon*
LHAAP	*Longhorn Army Ammunition Plant*
%	*percent*
PPE	*personal protective equipment*
ppm	*part per million*
RCRA	*Resource Conservation and Recovery Act of 1976*
TAC	*Texas Administrative Code*

4.2.2.1 Chemical-Specific ARARs for Soil

Soils at LHAAP-46 were not found to pose a risk, therefore, chemical-specific ARARs have not been identified to develop cleanup levels for the soil. Proposed remedial action alternatives (other than a "no action" alternative) developed during the FS stage may involve drilling or excavation activities that may generate waste soil that will require handling, treatment or disposal. The waste soil must meet certain chemical-specific requirements for handling and disposal. Since the proposed action created the waste, the chemical-specific requirements for the waste soil are addressed as action-specific ARARs in **Section 4.2.4**.

4.2.2.2 Chemical-Specific ARARs for Air

Contaminants emitted into the air during remediation must meet certain chemical-specific requirements for fugitive particulate matter and opacity. Since emissions would be a result of a proposed action, they are addressed as action-specific ARARs in **Section 4.2.4**. However, it is unlikely the proposed actions in this FS would cause emissions that would impact the air.

4.2.2.3 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 if there is a remedial action and measures will be implemented during construction to prevent off-site migration of contaminants to surface waters.

4.2.2.4 Chemical-Specific ARARs for Groundwater

The human health risk assessment (Jacobs, 2003) indicated that the contaminated groundwater at LHAAP-46 presented an unacceptable hazard to a hypothetical future maintenance worker. For the groundwater COCs at LHAAP-46, Safe Drinking Water Act MCLs are available and are considered relevant and appropriate because LHAAP-46 is an NPL site. Thus MCLs are proposed as the cleanup levels in this FS for the groundwater at LHAAP-46. 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.

4.2.3 Potential Location-Specific ARARs

This section identifies the location-specific ARARs that may apply to LHAAP-46. These ARARs are summarized in **Table 4-3**.

4.2.3.1 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).

Although there are low-lying wetland areas associated with the tributaries to Goose Prairie Creek near LHAAP-46, no formal wetlands survey has been conducted at the LHAAP specifically (USACE, 1992; Jacobs, 2002). 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-46) 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.

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.

4.2.4 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-46.

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-46 are discussed in **Section 4.2.4.1** below. All action-specific ARARs are listed in **Table 4-4** and are grouped by component action.

4.2.4.1 ARARS for Activities Associated with Action Alternatives

Some of the proposed remedial action alternatives at LHAAP-46 will involve one or more of the following activities: waste generation, characterization, management, storage, and disposal activities; land use controls (LUCs), and long-term monitoring (LTM). Action-specific ARARs are discussed here for the activities common to the remedial activities to be proposed for LHAAP-46.

4.2.4.2 Wastes 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, 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 Resource Conservation and Recovery Act (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 4-4** for the particular type of waste stream or contaminants in the waste.

Excavated environmental media generated during the installation of wells would be sent off site for disposal or, in the case of non-hazardous well construction soil, redeposited within the area of contamination (AOC). The USEPA defines "on-site" as the lateral 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 Federal Register [FR] 51444; 55 FR 8758). ARARs for the management of such media at the site of generation (i.e., within the AOC) are listed in **Table 4-4**.

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 (55 FR 8758) (USEPA, 1989b).

4.2.4.3 Land Use Controls and Long-Term Monitoring

Some combination of restrictive covenants, administrative controls, physical barriers, physical surveillance or other controls, in combination with LTM 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 the groundwater contamination in the short term to levels that would allow industrial use of the groundwater in the near term.

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 Army transfers the land to the USFWS, a recordation of the LUC, as required by the State of Texas, will accompany the transfer documentation and be recorded in the County Courthouse. 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.

4.2.4.4 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 of the contaminated groundwater or for LTM 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-46 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.

4.2.4.5 Water Treatment

Contaminated groundwater and wastewaters collected during well drilling or decontamination activities could be transported to the on-site groundwater treatment plant 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 effluent limits 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 groundwater 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).

4.3 Cleanup Levels

The RAO listed in **Section 4.1** allows a range of response actions. For a response action that leaves contamination in place, LUCs would be needed in combination with the response action in order to prevent exposure. For a response action that removes the contamination, cleanup levels would be needed to determine when sufficient contamination has been removed. Cleanup levels are the concentrations for individual chemicals in the medium of concern above which remediation or control measures would be required. The cleanup levels for the groundwater at LHAAP-46 are determined with consideration of the ARARs identified for the site as discussed in **Section 4.2.2**.

The human health risk assessment showed an unacceptable hazard from metals. However, the metals were shown in **Section 3.2** to be unrelated to any release at the site and to likely be artifacts of sampling methods used to collect historic data. Even though it did not pose a human health risk or hazard, TCE exceeded its MCL in the site groundwater. TCE was selected as a COC based on the exceedance of the MCL and the cleanup level for TCE is set at the MCL. **Table 4-2** presents cleanup levels for TCE and its daughter products.

5.0 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-46 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 COCs (**Section 5.1**)
- Identify GRAs (**Section 5.2**)
- Identify and screen potential technologies and process options (**Section 5.3**)
- Develop and screen process options (**Section 5.4**)
- Evaluate and select representative process options (**Section 5.5**)

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

5.1 Contaminants and Media of Concern

Section 1.0 presents the site conditions at LHAAP-46. Based on sampling data available at the time of risk assessment (Jacobs, 2003), groundwater at LHAAP-46 was identified as a potential medium of concern because it posed an unacceptable non-carcinogenic hazard to a hypothetical future maintenance worker, primarily due to the presence of antimony, manganese and thallium. Based on recent sampling and the evaluation presented in **Section 3.2**, antimony, manganese, and thallium were eliminated as COCs at LHAAP-46. Other contaminants were also detected in the groundwater at concentrations exceeding their respective MCLs and were considered as possible COCs. As discussed in **Section 3.0**, based on subsequent sampling and evaluation, only TCE is considered a COC at LHAAP-46. Therefore, the remediation alternatives target the reduction of TCE concentrations.

TCE, for which the MCL is 5 µg/L, is the VOC detected most consistently during all the sampling events. Therefore, a TCE concentration of 5 µg/L was selected as a conservative basis for determining the horizontal and vertical extent of groundwater requiring remedial action at LHAAP-46. Two areas of TCE contamination are present; one in the shallow groundwater and the other in the intermediate groundwater. The estimated extent of TCE contamination in the shallow groundwater, based on 2007 data, is approximately 210,000 square feet (ft^2). The estimated extent of TCE contamination in the intermediate groundwater, based on 2007 data, is approximately 700,000 ft^2. This estimated areal extent in the intermediate zone is larger than the shallow zone because there are fewer wells in the intermediate zone with longer distances between them.

Equation 5-1 estimates the total volume of contaminated groundwater in gallons by using the vertical and lateral extents.

Lateral extent of groundwater contamination (ft^2) × vertical extent of groundwater contamination (feet) × total porosity (0.3) × 7.48 gallons per cubic foot = **Volume in gallons** **Equation 5-1**

A 3-foot vertical extent was selected for the shallow groundwater plume volume estimation based on the boring logs for wells LHSMW18, LHSMW19, and 46WW01. A 5-foot vertical extent was selected for the intermediate groundwater plume volume estimation based on the boring logs for wells LHSMW23, LHSMW25, and 46WW02. Using **Equation 5-1**, a conservative estimate of the volume of groundwater requiring remedial action for TCE is approximately 1.41 million gallons in the shallow groundwater zone and 7.85 million gallons in the intermediate groundwater zone.

5.2 General Response Actions

GRAs are general actions that can be taken to achieve the RAO for the media of concern, which is groundwater at LHAAP-46. The potential applicability of GRAs and associated technologies was evaluated based on key factors that include the type and form of wastes, geologic characteristics, and location-specific constraints. **Table 5-1** summarizes the applicable GRAs for groundwater at LHAAP-46. No action must also be considered for a baseline of comparison.

Table 5-1
General Response Actions Applicable to Groundwater RAO[a] at LHAAP-46

GRA	Description
No Action	No remedial measures. Does not satisfy RAO, but must be evaluated as the baseline for comparison of other response actions and alternatives.
Land Use	Application of administrative actions such as land use restrictions and deed recordations or monitoring to protect public health and the environment through management of potential risk.
Groundwater Removal	Extraction of contaminated groundwater for on-site treatment or off-site treatment/disposal
Groundwater Treatment	Treatment of contaminated groundwater in-situ or ex situ.
Groundwater Containment	Isolation of contaminated groundwater using subsurface barriers or an engineered cap. Typically requires combination of other GRA such as removal/treatment.
Groundwater Disposal	Treatment/disposal of contaminated groundwater. Typically coupled with removal/treatment general response action.

Notes:

[a] *remedial action objective*

5.3 Identification and Screening of Potentially Applicable Technologies

Presented below are general descriptions of potentially applicable technologies and process options for the GRAs. The term "process option" refers to specific processes within each technology type. For example, the in-situ treatment technology category could include process

options such as permeable reactive barriers, enhanced bioremediation, or chemical oxidation. Several broad technology types may be identified for each general response action, and numerous process options may exist for each technology. Even within process options there are additional levels of choice, such as different agents for enhanced bioremediation.

The identification and screening process is performed in accordance with the CERCLA FS guidance document (USEPA, 1988b), as specified by the NCP (40 CFR Part 300, Subpart F). Initial identification as potentially applicable is based primarily on technical feasibility, using the following criteria:

- Compatibility with constituent characteristics
- Compatibility with site characteristics
- Ability to achieve RAO – either alone or as a component of a treatment train
- Development status – a technology must be developed to the point of field-scale demonstration so that information is available on performance, reliability, and cost.

Based on these criteria, some remedial action technologies and the associated process options were eliminated from further consideration from the universe of technologies. Those technology types considered most likely to meet the groundwater RAO are presented in **Table 5-2**.

5.4 Development and Screening of Process Options

Each process option for a given technology provides a basis for developing remedial alternatives and evaluating their costs and attributes. However, the specific process used to implement the remedial action may not be selected until the remedial design phase of the project (USEPA, 1988b). Furthermore, pilot or treatability studies conducted prior to or during the final design may indicate that the representative technology is not feasible. If this occurs, the next best demonstrated available technology is selected.

For GRAs with more than one process option, each option is evaluated according to the following criteria:

- **Effectiveness** – which includes evaluation of the following:
  - Potential effectiveness in handling the estimated areas or volumes of media
  - Potential in meeting the RAO.
  - Potential impacts to human health and the environment during the construction and implementation phase.
  - Demonstrated reliability of the process with respect to contaminants and conditions at the site (USEPA, 1988).

Table 5-2
Identification and Screening of Groundwater Remedial Action Technologies
LHAAP-46

General Response Action Technology Type	Description and Process Options	Comments	Retain for Further Evaluation?
A. No Action	No remedial measures to be taken.	The "No Action" alternative must be fully evaluated according to 40 CFR[a] 300.68.	Yes
B. Land Use Controls	Restrict future use of and access to the groundwater to prevent unauthorized exposure to contaminated media. Monitor degradation and plume stability. Includes: • Land Use Controls • Long-Term Media Monitoring	A feasible approach for preventing exposure to on-site contamination and to verify MNA is occurring.	Yes
C. Groundwater Removal • Groundwater extraction	Remove groundwater from the subsurface to relocate it or prepare it for treatment. Includes: • Extraction wells • Interceptor trenches	A routine procedure using traditional methods such as vertical wells and trenches. Some methods are more complex such as horizontal wells. Combined with on- or off-site treatment technologies.	Yes
D. Groundwater Treatment • In situ treatment	Treat groundwater in place to reduce the contaminant mobility or toxicity. Includes: • Monitored Natural Attenuation • Air sparging/soil vapor extraction • Oxidation • Permeable reactive barriers • Bioremediation • Phytoremediation	Generally proven technologies. More difficult to design since the subsurface soil and groundwater characteristics will impact performance.	Yes
• Ex situ treatment	Treat extracted groundwater or vapor after removal from the subsurface • On-site with mobile treatment or • Burning Ground No. 3 Groundwater Treatment Plant.	Burning Ground No. 3 Groundwater Treatment Plant is operational and may have the capacity for groundwater treatment.	Yes
E. Groundwater Containment	Isolate groundwater plume in place. Includes: • Slurry walls • Engineered caps	No source area is identified. Would be difficult to key into a confining layer to isolate the groundwater contamination in just the shallow zone. TCE concentrations are relatively low in intermediate zone plume at 40 feet below ground surface, which is the larger plume.	No
F. Disposal	Discharge of treated groundwater to surface water.	Straightforward technology assuming treatment techniques have met permit requirements.	Yes

Notes:

[a] *Code of Federal Regulations*

- **Implementability** – which includes both the technical and institutional feasibility of implementing a process option:
  - Technologies passing the initial screen of applicability are screened on the basis of technical feasibility. This criterion means feasibility under site-specific conditions. This evaluation may indicate that although a technology may be generally applicable for the COCs, the specific technology may be unworkable or limited due to site-specific conditions.
  - Institutional feasibility emphasizes the institutional aspects of implementability, such as the ability to obtain permits for off-site actions; the availability of treatment, storage, and disposal services (including capacity); and the availability of equipment and skilled workers to implement the technology (USEPA, 1988).
- **Cost** – which plays a limited role in the screening of process options. Cost is considered a deciding factor only when two alternatives are found to be equally protective. Ranges or approximations of relative capital and operation and maintenance (O&M) costs are used rather than detailed estimates. The cost analysis is made on the basis of prior experience with technologies, readily available information, and engineering judgment. Each process is evaluated relative to other process options of the same technology type, based on a cost range.

Following selection of the most appropriate process options for each technology type, the process options are combined to form remedial alternatives. The remedial alternatives are discussed in **Section 6.0**.

5.5 Evaluation and Screening of Process Options

This section evaluates the process options within each technology type with respect to effectiveness, implementability, and cost. The most applicable process options are included in the subsequent development of remedial alternatives.

5.5.1 No Action

The no action option does not provide for any groundwater remedial activities. No monitoring of the groundwater conditions occurs under this option. This option is retained as a baseline with which other remediation alternatives are compared.

- **Effectiveness** – A lack of access controls or remediation of the groundwater at LHAAP-46 could result in a future exposure to humans if the groundwater is ingested.
- **Implementability** – No implementation is required.
- **Cost** – None.

5.5.2 Land Use Controls

LUCs would be implemented to regulate access to groundwater and include covenants/deed restrictions, administrative controls, and physical mechanisms. This process option controls exposure by restricting access and use of the contaminated groundwater and also provides information needed to assess future conditions at the site. The LUC process option is applicable to the groundwater at LHAAP-46. 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..

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 of groundwater use) will accompany the transfer documentation from the Army to the USFWS. Deed restrictions would be required if the property is released from a federal to a non-federal entity. These restrictions are only effective as long as the property owners and local authorities enforce them. The 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 review 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 exposure to human health posed by the site contamination at LHAAP-46. 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-46 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 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. 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 physical barriers intended to limit access to property, such as fences or signs. However, the future use of the site is to be part of a wildlife refuge under USFWS. It is anticipated that covenants/deed restrictions and administrative controls will be adequate to control access to the contaminated groundwater and physical mechanisms will not be required.

Summary of Land Use Controls Process Options

Covenants/deed restrictions and administrative controls are carried forward as representative LUC process options. The covenants/deed restrictions would only be used if the Army releases the land to a non-federal entity. The LUC process options could be combined with other process options to meet the RAO.

5.5.3 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 RAO. 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.

Summary of Long-Term Media Monitoring Process Option

Long-term media monitoring is carried forward as a process option to be combined with other process options to meet the RAO.

5.5.4 Extraction Wells

Vertically installed wells are designed to collect and extract clean or contaminated groundwater to contain a plume or to reduce contaminant mass in the plume. Extraction wells have been used with mixed results at LHAAP.

- **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 is required. The soils at LHAAP-46 consist of mainly silty clay with thin lenses of sand. Permeable layers intercepted in one monitoring well do not always appear in neighboring wells, indicating the permeable lenses are not continuous across LHAAP-46.
- **Implementability** – This process is a 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 depths required to intercept all depths of groundwater.
- **Cost** – Low to moderate.

Summary of Extraction Well Process Option

The effectiveness of vertical wells may be limited due to a potential discontinuous permeable lens containing groundwater. Because of this potential hydrogeologic condition, the extraction well process option will not be retained for remedial alternative development in this FS.

5.5.5 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 generally very effective at collecting groundwater. The trench functions like a continuous line of extraction wells. However, the nature of the permeable lenses which control shallow groundwater will limit the effective use of trenches. The soils at LHAAP-46 consist of mainly silty clay with thin lenses of sand. Permeable layers intercepted in one monitoring well do not always appear in neighboring wells, indicating the permeable lenses are not continuous across LHAAP-46.
- **Implementability** – Interception trenches are relatively easy to install with conventional construction equipment in the shallow groundwater zone. The process requires long-term maintenance to ensure that the permeable media and collection piping do not become clogged.
- **Cost** – Moderate.

Summary of Interceptor Trench Process Option

The placement of interception trenches would be difficult due to the variability in local groundwater conditions and the nature of the isolated shallow lenses which contain groundwater. It will not be retained for remedial alternative development in this FS.

5.5.6 Monitored Natural Attenuation

Natural processes such as dilution, volatilization, biodegradation, adsorption, and chemical reactions with subsurface materials are monitored to confirm their progress in reducing contaminant concentrations to cleanup levels over time. Natural attenuation may already be occurring at LHAAP-46 as discussed in **Appendix A**. The TCE found at LHAAP-46 is particularly amenable to this technology.

- **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 at LHAAP. It is effective when short term releases have been mitigated and a determination is made that natural attenuation is occurring and that further off-site releases are not occurring at unacceptable levels. Regular monitoring must be conducted throughout the process to confirm that attenuation is occurring in accordance with cleanup objectives. The evaluation of MNA parameters indicate that natural attenuation is occurring at LHAAP-46 (see **Appendix A**). By applying a degradation rate – 0.000333 day^{-1} calculated from LHSMW18 data, the estimated time for TCE to reach the MCL in the shallow zone is approximately 23 years and is approximately 15 years in the intermediate zone. These estimated cleanup times are based on limited data, and actual cleanup time could be higher or lower than these estimates.

- **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.

Summary of Monitored Natural Attenuation Process Option

Monitored Natural Attenuation is carried forward as a representative process option. This process option could be combined with other process options to meet the RAO.

5.5.7 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 humidity inhibits volatilization of contaminants. High clay content soil, however, may limit the effectiveness of air sparging by retarding the movement of air and vapors through the soil column. The effectiveness can also be limited by any presence of discontinuous high-permeability zones, which can result in preferential air flow paths.
- **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.

Summary of Air Sparging/Soil Vapor Extraction Process Option

The effectiveness of air sparging/soil vapor extraction may be limited by the site geology and is better suited where a distinct source exists with high VOC concentrations. Air sparging/soil vapor extraction will not be retained for consideration in this FS as an in situ technology.

5.5.8 In Situ Oxidation

Contaminated media are treated in situ through the addition of oxidants, such as potassium permanganate, hydrogen peroxide, or ozone, which convert the contaminants to a less mobile or toxic form. This process option is applicable to VOCs such as TCE and cis-1,2-DCE.

- **Effectiveness** – In situ oxidation is effective for treatment of VOCs (particularly TCE) in a relatively homogeneous and porous medium. This technology is typically used as a source-area treatment and is less effective for treatment of large areas of low contaminant concentrations (e.g., dissolved plumes) similar to the groundwater plume identified at LHAAP-46. The high reactivity of oxidation chemicals makes it likely that they will react with non-targeted compounds before reaching the intended target chemical in low concentration plumes. The effectiveness of the treatment usually depends on the success of the delivery method. 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.
- **Implementability** – This process option may be difficult to implement. Special handling considerations are often required due to the reactive and corrosive characteristics of the oxidants. Furthermore, in situ chemical oxidation can produce

particulates and cause a loss of permeability in the subsurface. Other potential side effects from this treatment technique include gas evolution, generation of fugitive VOC emissions, potentially toxic byproducts, release of metals from well casings, and release of heat generated during the oxidation process. Because oxidants are often highly reactive in the subsurface, they may not migrate long distances from the delivery point. Consequently, several, closely-spaced injection points would be required to adequately disperse the oxidant. A pilot test would also be required to determine the site-specific chemical transport properties of the aquifer.

- **Cost** – Low to moderate.

Summary of In Situ Oxidation Process Option

The effectiveness of in situ oxidation may be limited by the site geology and is better suited for sites with a distinct source and high VOC concentrations. In situ oxidation will not be retained for consideration in this FS as an in situ technology.

5.5.9 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), and biological material. 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 expensive yet more effective forms of iron (palletized 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.

The biological system consists of trenches filled with highly permeable reactive material along with carbon sources from organic materials such as compost, vegetable oil, and cottonseed.

- **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 to high.

Summary of Permeable Reactive Barrier Process Option

Even though a permeable reactive barrier may be effective, due to the size and low VOC concentrations of the plume, there are other lower cost in situ treatments. Additionally, long-term maintenance may be significant. Therefore, permeable reactive barriers are not retained for consideration in this FS.

5.5.10 In Situ Bioremediation

This process option covers a wide range of individual biological processes 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 the COCs at LHAAP-46, 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 in situ oxidation, but fewer and less toxic byproducts result. Pilot-scale testing at other sites has demonstrated that some enhancements will allow indigenous bacteria to degrade chlorinated solvents such as those detected at

LHAAP-46, and in situ bioremediation is applicable to the groundwater at LHAAP-46.

- **Implementability** – Enhancing the biological activity may be difficult in some of the low permeability soil at LHAAP-46 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.

Summary of In Situ Bioremediation Process Option

In situ bioremediation should be effective and implementable since a variety of biological processes can be implemented, and it is retained for further consideration in this FS.

5.5.11 Phytoremediation

Phytoremediation is an emerging technology that uses plants to control contaminant releases from soil or water. It is only applicable to contamination present in the shallow zone, and it may be effective for treatment of VOCs. Phytoremediation processes can be classified based on the contaminant fate: degradation, extraction, containment, or a combination of these. Phytoremediation mechanisms include extraction of contaminants from groundwater; concentration of contaminants in plant tissue; degradation of contaminants by biotic or abiotic processes; volatilization or transpiration of volatile contaminants from plants to the air; immobilization of contaminants in the root zone; hydraulic control of contaminated groundwater (plume control); and control of runoff, erosion, and infiltration by vegetative covers. Poplar and cottonwood trees have been successfully used to remove and degrade TCE from groundwater.

- **Effectiveness** – It has been demonstrated that TCE is effectively removed by phytodegradation or the uptake and breakdown of contaminants by metabolic processes. Hybrid poplar trees were exposed to water containing 50 parts per million TCE and metabolized the TCE within the tree. Plant uptake is controlled by hydrophobicity, solubility, and polarity. Toxic intermediates or degradation products may be formed. Phytoremediation is not effective for treatment of contamination in intermediate and deeper groundwater zones.
- **Implementability** – Time is required for the deeper-rooted trees to grow sufficiently to provide an effective remedy. The contamination depth, even in the shallow zone, would require deeper-rooted plants. This is a fairly easy process option to implement.
- **Cost** – Low to moderate.

Summary of Phytoremediation Process Options

Phytoremediation is better suited to the shallow zone and is eliminated from further consideration in this FS due to the depth of the intermediate zone.

5.5.12 On-Site Mobile 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** – The new system could be very effective. 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 have 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.

Summary of On-Site Mobile Treatment Plant Process Option

A treatment plant is not retained since extraction (wells or interceptor trench) was not retained for this FS.

5.5.13 Burning Ground No. 3 Groundwater Treatment Plant

Process wastewater and decontamination water are sent to the LHAAP groundwater treatment plant. This facility, which is currently processing contaminated groundwater from other LHAAP sites, includes unit operations such as neutralization, precipitation, biological digestion, and air stripping. The effluent from the plant is discharged to Harrison Bayou or reinjected into the ground.

- **Effectiveness** – The existing facility is currently treating groundwater. The plant has available hydraulic capacity, so additional flow could be effectively handled. The discharge requirements are routinely met, indicating an effective operation.
- **Implementability** – The treatment 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 treatment components of the plant would be necessary.
- **Cost** – Low.

Summary of Burning Ground No. 3 Treatment Plant

Treatment is not retained since this technology would be in combination with groundwater extraction which has been eliminated from further consideration in this FS.

5.5.14 Surface Water Discharge

This process option discharges treated wastewater into a surface water body, stream, or river. This would require piping and pumps or a gravity drain system to transport the treated water to the surface water discharge point. The treated wastewater would likely be discharged into a local surface water body. Currently, the existing treatment plant discharges into Harrison Bayou.

- **Effectiveness** – This process option is an effective method for disposal of water if the requisite discharge limits can be met. The current treatment system discharges to Harrison Bayou through a monitored point.
- **Implementability** – Discharge limits have already been selected for the current discharge point. The existing water treatment plant is currently discharging through this point; therefore, this process option would be easily implemented.
- **Cost** – Low.

Summary of Surface Water Discharge Process Options
Disposal is not retained since this technology was evaluated in combination with groundwater extraction which has been eliminated from further consideration in this FS.

5.6 Summary of Representative Groundwater Process Options

The following technologies/process options remain after the screening performed in **Section 5.5**:

- No Action General Response Action
  - No action
- Land Use Control General Response Action
  - Land Use Controls
  - Long-Term Monitoring
- Groundwater Removal, Treatment, and Disposal General Response Action
  - Monitored Natural Attenuation
  - In-situ biotreatment

6.0 Development and Description of Alternatives

Section 6.1 presents the development of a range of alternatives based on the key assumptions regarding site and contaminant conditions **(Section 3.0)**, the RAO **(Section 4.0)**, and the representative process options **(Section 5.0)**. **Section 6.2** presents the detailed description of the alternatives.

6.1 Development of Alternatives

6.1.1 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.

These statutory requirements and preferences were given due consideration in the development of alternatives for LHAAP-46.

6.1.2 Development using Remediation Strategies and Process Options

Remediation strategies will focus on TCE, the only COC in the groundwater at LHAAP-46. Thus, the purpose of the remedial alternatives is to present the decision maker with technical and economic options for remediation of the groundwater plumes at LHAAP-46. Although all of the action alternatives would achieve the RAO 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 remained after screening for effectiveness, implementability, and cost, identified in **Section 5.6**, are grouped and combined into alternatives. Alternatives may consist of a single process option or several to address the RAO.

6.2 Description of Remedial Alternatives

Based on the retained process options, three alternatives (including No Action) are proposed. The following sections describe the remedial alternatives with a level of detail to support the detailed evaluation and cost estimate. Designs and process options other than those considered here may be substituted once the decision on remedial approach is made.

6.2.1 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 groundwater would be left "as is," without implementing any additional containment, removal, treatment, or other mitigating actions. No actions would be implemented to reduce existing or potential future exposure to human and ecological receptors.

6.2.2 Alternative 2 – Monitored Natural Attenuation with Land Use Controls

Alternative 2 has been developed to provide actions that may be taken to limit public exposure to the contaminated media while demonstrating reduction of contamination by natural processes. The goals of this alternative are to protect the on-site hypothetical future maintenance worker and prevent exposures to groundwater until natural attenuation lowers groundwater concentrations below MCLs. Groundwater remediates naturally through intrinsic bioremediation and other physical loss mechanisms which are monitored to ensure that groundwater contamination remains localized and that contaminant migration, if any, is minimal.

The toxicity, mobility or volume of groundwater contaminants is not reduced by any engineering process. Instead, concentrations of COCs in groundwater are reduced through natural processes including biodegradation, dispersion, adsorption, volatilization, and dilution over time and with distance from the source. To document that natural attenuation is occurring, a groundwater

monitoring program will be implemented at the site. The USEPA provides guidance for MNA as a remedial action in *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites (USEPA, 1999)* This section presents a description of the alternative that may be used to implement MNA at LHAAP-46. USEPA guidance also specifies recommended lines of evidence to document natural attenuation at a site. Degradation of COCs at this site will be discussed in the effectiveness of this alternative provided in **Section 7.3.2.3**.

6.2.2.1 Groundwater Monitoring Program

For this alternative, it is assumed that a monitoring program will be implemented to address TCE contamination in the shallow and intermediate groundwater zones. Monitoring well LHSMW19 in the shallow zone and 46WW02 in the intermediate zone are the two remaining wells with TCE concentrations higher than the MCL. Shallow zone monitoring wells 46WW01, 46WW04, LHSMW17, LHSMW18, LHSMW20, and LHSMW22 and intermediate zone monitoring wells LHSMW23 and LHSMW25 will also be included in the monitoring program to provide downgradient monitoring and plume definition. Well locations are shown on **Figure 2-2**.

LUCs will be maintained until the cleanup levels are achieved. The LUCs will consist of a restriction on groundwater use at LHAAP-46. 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 is required and will be developed. Notification of industrial/recreational use will accompany all transfer documents and will be recorded with the Harrison County. 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.

Monitored Natural Attenuation

MNA performance monitoring will be performed quarterly for the first two years. After eight quarterly sampling events, MNA will be evaluated. The analytical program will consist of VOCs, including chlorinated compounds and degradation products, methane, ethene, and ethane. Initially, the following geochemical parameters will also be included in the analytical program, dissolved oxygen (field), redox potential (field), sulfate, nitrate, nitrites, alkalinity, TOC, and ferrous iron (field).

Annual reports will be prepared as needed to document the program. Sampling frequency or analytical suite may be modified based on the results of the sampling program.

Long-Term Operation

Long-term operational requirements under this alternative would be minimal, and would involve maintenance of the LUC activities discussed in **Section 6.2.2.1**. Long-term operations will begin after the 8 quarters of MNA performance monitoring. The sampling frequency will then be

changed to semiannually until the first 5-Year Review. . Sampling and analysis of groundwater would be performed at LHAAP-46 for multiple contaminants and general chemistry parameters. Monitoring would be required to demonstrate that natural attenuation is occurring, as well as compliance with ARARs and the RAO. Data obtained during the monitoring program will be used in support of the 5-year reviews required by CERCLA Section 121(c). The sampling frequency may be changed to once every five years if the data suggest that less frequent sampling is appropriate.

For cost estimating purposes, the long-term monitoring schedule is assumed to be semiannual for years 3 through 5, annually for years 6 through 10, and every 5 years thereafter. Future sampling frequency after the first 5-year review will be evaluated and determined at that time. The location and number of monitoring wells included in the LTM program will be reviewed on an annual basis. Any well that is proposed for the LTM program that becomes damaged, or is required to be removed due to construction or other activities, may be replaced or repaired, as needed. The need for continuing LTM at the location will be evaluated based on existing and expected future groundwater conditions. All water quality results, and the results of the review, will be provided in annual monitoring reports or as needed. The estimated cleanup time of 15 to 23 years is based on limited data, and actual cleanup time could be higher or lower than this estimate.

6.2.3 Alternative 3 – In Situ Bioremediation, Short-Term LUCs, and LTM

The goals of this alternative are to achieve ARARs for the COCs at the areas where TCE contaminant concentrations in groundwater are highest at LHAAP-46 and to prevent human exposure to groundwater contamination until the ARARs are achieved. In situ bioremediation will be implemented to reduce groundwater contaminant concentrations. Since there is no known source of groundwater contamination in the soils remaining at LHAAP-46, achievement of cleanup levels in groundwater would be expedited by implementing in situ bioremediation in the areas of highest concentrations. Attenuation of the COCs in the plume will be monitored until acceptable cleanup levels are met, and LUCs will be maintained to prevent human exposure until the RAO is achieved (i.e., until such time that the cleanup levels are met for groundwater contaminants).

6.2.3.1 In Situ Bioremediation for Groundwater Plume

In situ groundwater bioremediation is a technology that encourages growth and reproduction of indigenous microorganisms to enhance biodegradation of organic constituents in the saturated zone. The microbiological processes are used to degrade or transform contaminants to ultimately less toxic or nontoxic forms. Groundwater at LHAAP-46 is impacted by TCE that exceeds its respective cleanup levels in groundwater. Treatment under anaerobic conditions is often applied to these types of contaminants.

In general, the components of the in situ bioremediation action include:

- **Determining effective treatment.** Currently shallow monitoring well LHSMW19 and intermediate monitoring well 46WW02 are impacted with TCE above the MCL. Contaminated groundwater is present in shallow thin sand lenses which occur in a formation consisting primarily of clay to silty clay. Separate plumes in the shallow and intermediate zones are assumed. In situ remediation is proposed in these two areas.

- **Injecting microbial cultures and nutrients into the subsurface at a predetermined location.** Bacteria present in the groundwater can use chlorinated solvents as electron acceptors. Electron donors may include a wide variety of nutrients: sugars (molasses), alcohols (methanol, ethanol), volatile acids (acetate, lactate), and/or wastes (food processing, manure). The COCs at LHAAP-46 can degrade under anaerobic conditions, but microorganisms, mechanisms, and redox requirements differ. Bioaugmentation additives, appropriate nutrients and other materials, would be injected into the subsurface. For this FS, it is assumed that a bioaugmentation will be used at the site. This form of bioremediation combines the injection of microbial cultures capable of degrading the contaminants with a carbon source to provide adequate conditions for the proliferation of the dechlorinating organisms. For costing purposes in this FS, it is assumed that the bioaugmentation material will be injected into both the shallow (20 feet bgs) and intermediate zone (40 feet bgs) using direct-push technology within the plumes targeting areas with higher concentrations.

- **Sampling wells to monitor effectiveness.** Monitoring for contaminants would be performed to assess the effectiveness of the treatment. Anticipated remediation times may be short with appropriate contact. Assuming first order anaerobic degradation rates and reasonable half-lives for the COCs, the COCs within the treated areas could be reduced to their respective cleanup levels in approximately two years. However, it is anticipated that COCs will remain in the plumes outside the treated areas and will attenuate to levels below MCLs over time. Additional monitoring is recommended for up to 15 years after reduction of the COCs at the two biotreated areas or until cleanup levels are attained.

Annual reports will be prepared during the first 10 years to document the program.

LUCs and LTM will be maintained until the cleanup levels are achieved. The LUC will consist of a restriction on groundwater use at LHAAP-46. 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, if transfer occurs during the time frame that COCs are present above groundwater cleanup levels. 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.

6.2.3.2 Long-Term Operation

Long-term operation would include monitoring of groundwater at LHAAP-46 until the COCs throughout the plume are below MCLs (assumed to be 15 years in the estimate). The estimated cleanup time of 15 years is based on limited data with reasonable assumptions, and actual cleanup time could be higher or lower than this estimate. Sampling and analysis of groundwater would be performed at LHAAP-46 for VOCs and general chemistry parameters. Groundwater sampling would occur quarterly for the first two years. After these eight quarterly sampling events, if the data suggests that less frequent sampling is appropriate, the sampling would occur semiannually. After at least six semiannual sampling events, if the data suggests that less frequent sampling is appropriate, the sampling would occur annually. After at least five annual sampling events, if the data suggests that less frequent sampling is appropriate, the sampling would occur every five years thereafter. The sampling frequencies may change based on the results of the 5-Year Review and the contaminant concentrations at that time. Monitoring would be required to demonstrate reduction in concentrations is occurring, as well as compliance with ARARs and the RAO. Data obtained during the monitoring program will be used in support of the 5-Year Reviews required by CERCLA Section 121(c).

Any well proposed for LTM that becomes damaged, or is required to be removed due to construction or other activities, may be replaced or repaired, as needed. The need for continuing LTM at the location will be evaluated based on existing and expected future groundwater conditions. All water quality results, and the results of the review, will be provided in periodic monitoring reports.

7.0 Detailed Analysis of Alternatives

7.1 Introduction

The detailed analysis of alternatives presents and assesses information that provides the basis for selecting an alternative and preparing a ROD. **Section 7.2** provides an overview of the evaluation criteria. The detailed analysis begins with an individual analysis in **Section 7.3** in which each alternative is evaluated according to the criteria identified in the NCP (40 CFR 300.430). Following the individual analysis, 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.

7.2 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 these 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 descriptions of the nine criteria and an overview of the approach taken by this FS to address these criteria.

7.2.1 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 RAO established in **Section 4.0**. 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.

7.2.2 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 are applicable and those that are relevant and appropriate. In certain cases, standards may not exist that address the proposed action or the

COC(s). 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 potential chemical-, location-, and action-specific ARARs are presented in **Section 4.2**.

7.2.3 Criterion 3: Long-Term Effectiveness and Permanence

This criterion evaluates the extent to which an alternative achieves an overall reduction of exposure to human health and the environment after the RAO is 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.

7.2.4 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.

7.2.5 Criterion 5: Short-Term Effectiveness

This criterion addresses the effects of the construction and implementation phases of the alternative until the RAO is 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 mitigation measures are examined for maintaining protectiveness for the community, remediation workers, and environmental receptors throughout the duration of 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 exposure to the public and workers to the contaminated groundwater. This evaluation also addresses the anticipated duration of remedial activities.

7.2.6 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 treatment, storage, and disposal 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. Also addressed are uncertainties associated with construction, operation, and performance monitoring.

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.

7.2.7 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 6.0** 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.

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

7.2.8 Criterion 8: State Acceptance

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

7.2.9 Criterion 9: Community Acceptance

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

7.3 Individual Analysis of Alternatives for Groundwater

7.3.1 Alternative 1 – No Action

Under the no action alternative, no further action would be taken to control human exposure to contaminated groundwater. The contaminated groundwater would remain in place without the implementation of any contaminant removal, treatment, or containment. LUCs to prevent access

to contaminated site groundwater would not be implemented. This alternative provides a baseline for comparison purposes.

7.3.1.1 Overall Protection of Human Health and the Environment

The no action alternative does not achieve the RAO for LHAAP-46. This alternative provides no control of exposure to the TCE-contaminated groundwater by human receptors for current and future land use scenarios.

7.3.1.2 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 would not be met. Since no remedial activities would be conducted, action-specific and location-specific ARARs would not apply.

7.3.1.3 Long-Term Effectiveness and Permanence

Magnitude of Residual Risk

The no action alternative would not provide an effective or permanent long-term solution. The residual toxicity from groundwater exposure under a no action alternative would be unacceptable at LHAAP-46 since TCE groundwater concentrations are above the MCL. Currently, the groundwater at LHAAP-46 is not used for drinking water, and would not be used for drinking water under the anticipated wildlife refuge future use scenario. The shallow groundwater at the site is unlikely to be used as a water source since it is present in thin sand lenses and likely to be low in yield. Based on a groundwater flow and transport model (Shaw, 2007d), groundwater will not adversely impact Goose Prairie Creek.

Adequacy and Reliability of Controls

The no action alternative would not provide the maintenance of LUCs at LHAAP-46 and, therefore, would not reduce the existing potential for use of and subsequent exposure to contaminated site groundwater. However, use of shallow or intermediate groundwater from LHAAP-46 is unlikely.

7.3.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

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

7.3.1.5 Short-Term Effectiveness

Under the no action alternative, no remedial action would be taken; therefore, the short-term effectiveness criterion is not applicable to this alternative. No short-term risks to workers, the community or the environment would exist.

7.3.1.6 Implementability

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

7.3.1.7 Cost

There are no costs associated with the no action alternative.

7.3.2 Alternative 2 – Monitored Natural Attenuation with Land Use Controls

Alternative 2 relies on monitoring the natural reduction of contaminant levels in groundwater in an MNA program combined with the maintenance of LUCs to prevent human exposure to contaminated groundwater at LHAAP-46. LUCs are an important component of the alternative while the TCE contamination in groundwater naturally attenuates to the cleanup level. MNA activities associated with the LUCs would ensure that the COC concentrations in groundwater remain stable or continue to degrade naturally.

7.3.2.1 Overall Protection of Human Health and the Environment

Protection of Human Health

This alternative would achieve the RAO for LHAAP-46. Continued maintenance of the LUCs would prevent human access and exposure to groundwater until COCs have sufficiently degraded to below MCLs. The controls would include a combination of procedures and training, which will in turn be provided to the USFWS for incorporation into the agency's land management program. If transferred out of U. S. government control, deed restrictions would be placed on the property by the controlling federal agency to prohibit or restrict property uses (e.g., drinking water well installation) that may result in exposure to groundwater. It is unlikely that impacted groundwater at the site would be used as a water supply since it is present in narrow sand lenses that probably are low yield.

The MNA activities include monitoring the COCs in the plume and their attenuation to levels protective of human health and the environment. The monitoring will demonstrate that the plume is stable, that the COCs in groundwater are not migrating beyond the site boundary, and that the COCs continue to degrade.

Protection of the Environment

A site-wide ecological baseline risk assessment was performed for the Group 4 sites and concluded that LHAAP-46 does not pose a risk to ecological receptors.

7.3.2.2 Compliance with ARARs

Chemical-Specific ARARs

This alternative will achieve the chemical-specific ARARs for groundwater contaminants that exceed their respective ARARs in groundwater since TCE is naturally degrading; however, the time frame may be long. The time frame for achievement of ARARs is not a significant issue at LHAAP-46 because use of groundwater as a water supply is unlikely based on future land use and probable low yield of the water bearing zones, and because exposure to the groundwater will be prevented by LUCs. In addition, based on modeling performed for the site (Shaw, 2007d), groundwater does not adversely impact surface water.

Location-Specific ARARs

Activities that would 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 are anticipated. Due to the limited number and locations of activities associated with this alternative, threatened and endangered species would not likely be impacted.

Action-Specific ARARs

Activities that would be conducted under this alternative would comply with all action-specific ARARs.

7.3.2.3 Long-Term Effectiveness and Permanence

Magnitude of Residual Risks

Implementation of LUCs under this alternative would prevent direct contact by human receptors with the groundwater at LHAAP-46, thus minimizing potential hazard posed by groundwater contamination. TCE was detected in the latest sampling performed in 2007 and was present at levels exceeding ARARs. Based on modeling results, it is unlikely TCE will reach Goose Prairie Creek (Shaw, 2007d).

The USEPA guidance for MNA (USEPA, 1999) provides first, second, and third lines of evidence to support that natural attenuation is occurring. These same lines of evidence may be used to evaluate the long term effectiveness of this technology as a remedial action. The lines of evidence for natural attenuation at LHAAP-46 are discussed in **Appendix A**.

Based on the lines of evidence, natural attenuation of TCE is occurring at LHAAP-46 and is a feasible long-term sole remedy for the TCE at the site. Groundwater is currently not used and is unlikely to be used in the future due to (1) the low yield expected from thin sand lenses, and (2) the anticipated future land use. Groundwater use restrictions will control the use of groundwater until TCE has degraded to levels below MCLs.

Adequacy and Reliability of Controls

The implementation of LUCs would protect potential human receptors from exposure to contaminated groundwater at LHAAP-46. The reliability of LUCs would depend on the long-term maintenance of the controls until COCs have naturally attenuated to below action levels. Maintenance of the LUCs and MNA implemented with these controls would be required until groundwater COC concentrations attenuate to their respective MCLs over the long term. The effectiveness of the LUCs would depend on the annual and 5-year CERCLA reviews and inspections of any physical mechanisms in place at LHAAP-46. The 5-year reviews may indicate the need for components of this alternative to be maintained, modified, or replaced.

7.3.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment

This alternative would not reduce the toxicity, mobility, or volume of TCE in groundwater through an active remedial process. A reduction in groundwater contaminant concentrations is expected to occur over time through natural processes. This reduction is anticipated to take several years. Although the groundwater would be monitored until MCLs are met, no active reduction of contaminant mobility in the groundwater would be accomplished through this alternative.

7.3.2.5 Short-Term Effectiveness

Protection of the Community during Remedial Action

This alternative is protective of the surrounding community during remedy implementation because activities would primarily occur on site with very little disturbance of contaminated material.

Protection of Workers during Remedial Action

No significant short-term risks to human health or the environment would exist during implementation of this alternative. However, worker exposure to soils and contaminated groundwater is possible during drilling, well installation, and sampling activities associated with the monitoring events. The short-term risks associated with drilling and groundwater monitoring activities and may be minimized through implementation of an effective health and safety program.

Short-Term Environmental Effects

Since minimal disturbance of contaminated material would occur under this alternative, short-term impacts to the environment are unlikely. The implementation of proper engineering controls would minimize the risk of environmental impacts.

Duration of Remedial Activities

Implementation of LUCs would prevent exposure to contaminated groundwater by prohibiting installation of potable water wells at LHAAP-46. This alternative could provide almost immediate protection because LUCs can be implemented relatively quickly (e.g., within six months). Maintenance of the controls would be required until contaminant concentrations are below MCLs. The estimated cleanup time of 15 to 23 years is based on limited data, and actual cleanup time could be higher or lower than this estimate.

7.3.2.6 Implementability

Technical Feasibility

All components of this alternative are readily implementable. Minimal technical concerns exist that would hinder the implementation of this alternative because no remedial activities other than sampling under the MNA program would be performed under this alternative. However, maintenance of the LUCs would be required. All equipment, services and materials are readily available to conduct the activities for this alternative.

Administrative Feasibility

Actions under this alternative are implemented on site and 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 Army shall submit to the USEPA and TCEQ a Responsiveness Summary and a draft ROD. Following consideration of any comments by TCEQ, the ROD will be finalized jointly by the 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, it is anticipated that the alternative would adequately address 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 Army. The 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.

7.3.2.7 Cost

The total project present worth cost of this alternative is approximately $521,200. The details of the cost estimates for all of the alternatives are presented in **Appendix E**.

Direct Capital Cost

The total direct capital cost is estimated at $60,500. The direct capital cost includes the design.

MNA and O&M Cost

The total MNA and O&M cost is estimated at approximately $460,700. The O&M cost includes maintenance of LUCs and LTM through year 30. The sampling frequency for the cost estimate is quarterly for the first two years, semiannual for years three through five, annual for years six through ten, and every five years thereafter. The attenuation monitoring would support the required CERCLA 5-year reviews.

7.3.3 Alternative 3 – In Situ Bioremediation with Short-Term LUCs and LTM

This alternative reduces contamination in the area of highest concentrations in the groundwater plume via in situ bioremediation using bioaugmentation. Bioremediation will accelerate the degradation of contaminants that is naturally occurring. The residual COCs remaining in the plume after in situ bioremediation are estimated to attenuate to cleanup levels in approximately 15 years. However, this is an estimate based on assumptions of the effectiveness of the in situ bioremediation and current data defining the hydrogeologic conditions and extent of contamination. LUCs and LTM would be components of this alternative in the short term until such time that the groundwater meets cleanup levels (i.e., MCLs are achieved throughout the plumes). The in situ bioremediation would reduce COC concentrations to MCLs within the treated area of the plumes within a relatively short time period provided bioremediation results are favorable. COC concentrations in the groundwater outside of the treated area will attenuate over time until MCLs are met.

7.3.3.1 Overall Protection of Human Health and the Environment

Protection of Human Health

The remedial action proposed for this alternative would eventually achieve the destruction of the TCE present in groundwater above cleanup levels established for LHAAP-46. This action would reduce contaminants to below the MCLs. This alternative is protective of human health and achieves the RAO for LHAAP-46.

Protection of the Environment

The Installation-Wide Baseline Ecological Risk Assessment identified no potential risk to ecological receptors from LHAAP-46 (Shaw, 2007a).

7.3.3.2 Compliance with ARARs

Chemical-Specific ARARs

This alternative would comply with chemical-specific ARARs for groundwater throughout the site because it is estimated that the contaminant MCLs would be achieved in approximately 15 years.

Location-Specific ARARs

The activities that would be conducted under this alternative would comply with 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.

Action-Specific ARARs

The activities that would be conducted under this alternative would comply with action-specific ARARs.

7.3.3.3 Long-Term Effectiveness and Permanence

Magnitude of Residual Risks

Upon completion of groundwater biotreatment, levels of COC contamination within the treated groundwater plume would be reduced to levels that meet their MCLs. However, residual contamination above the MCLs may remain in the untreated portions of the plume. Groundwater use restrictions would be required until results from multiple rounds of sampling indicate that residual contamination is not above the MCLs. Based on modeling results, it is unlikely COCs in groundwater will adversely impact Goose Prairie Creek (Shaw, 2007d).

Adequacy and Reliability of Controls

In situ groundwater bioremediation should be effective for reducing TCE concentrations to the MCLs in LHAAP-46 groundwater. However, optimum groundwater conditions would be required to increase the effectiveness of biological activity on these contaminants. More extensive aquifer characterization/treatability study may be needed before designing the system for optimum bioaugmentation if conditions are found to be less than ideal to support biological activity. Because of the low groundwater velocity, a somewhat longer period of time is expected for degradation to occur throughout the plume. Attenuation data on the current plume is limited, and the effectiveness of this technology at LHAAP-46 cannot be fully assessed.

Short-term LUCs would prevent exposure to contaminated groundwater during the time required to restore the groundwater through bioremediation. The reliability of LUCs would depend on the maintenance of the controls. Maintenance of the LUCs would not be required once MCLs for the TCE in groundwater are met at LHAAP-46. Compliance with the ARARs would be monitored and performance of the controls would be assessed throughout the duration of this alternative. The assessment may indicate the need for components of this alternative to be maintained, modified, or replaced.

7.3.3.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

In situ bioremediation would irreversibly reduce the toxicity, mobility and volume of the contaminants in the treated portions of LHAAP-46 shallow and intermediate groundwater. This alternative proposes that the groundwater COCs would be treated to the cleanup levels in the

areas of highest contamination. This alternative would satisfy the USEPA statutory preference for remedial actions that permanently reduce contaminant toxicity, mobility and volume and utilize treatment as a principle element.

7.3.3.5 Short-Term Effectiveness

Protection of the Community during Remedial Action

This alternative is protective of the surrounding community during remedy implementation because activities would primarily occur on site with very little disturbance of contaminated material.

Protection of Workers during Remedial Action

This alternative would involve potential short-term risks to workers associated with the operation of drilling equipment and potential exposure to contaminated groundwater during sampling activities. The implementation of an effective health and safety program would minimize potential short-term risks to remediation personnel. Remediation workers would conform to the site health and safety program and would be equipped with the necessary personal protective equipment (PPE). A site-specific health and safety plan would be prepared prior to implementing this alternative.

Short-Term Environmental Effects

Some minor clearing and grubbing to install monitoring wells or injection points for bioremediation of groundwater may be required. It is unlikely that there are any sensitive species that would be impacted. Should any sensitive species be found, the appropriate regulations and best management practices would be followed.

Duration of Remedial Activities

The duration of this alternative is estimated to be approximately 15 years. In the first year, it is assumed that a treatability study and quarterly sampling are conducted to determine the effectiveness of the proposed bioaugmentation, plans are prepared, and the bioaugmentation injection/treatment is conducted. Following the bioaugmentation injection/treatment, four additional quarters of monitoring will be conducted. The time frame for this alternative is difficult to estimate since it uncertain how effective the bioaugmentation will be and how well it may disperse to influence the degradation of the plume outside the treated areas. In addition, residual contamination may be present in the clay matrix surrounding the permeable lenses and could continue to impact water quality into the future. Aquifer studies will be needed to determine the most effective location for injection. Monitoring would be needed to determine trends in groundwater contamination levels and effectiveness of the remedial action until cleanup levels are met. The monitoring time may increase or decrease, depending on the effectiveness of the treatment method. The estimated cleanup time of 15 years is based on limited data with reasonable assumptions, and actual cleanup time could be higher or lower than this estimate.

7.3.3.6 Implementability

Technical Feasibility

All components of this alternative are implementable. There are some technical concerns regarding the effectiveness of the bioremediation at the site. A treatability study may be conducted to assess the most effective bioaugmentation additive to reduce the COCs to harmless by-products and to disperse across a larger area. Either of these variables (additive and how well it disperses) could impact the effectiveness of this alternative as well as the technical feasibility of implementation. There are no technical concerns with the LUCs required as part of this alternative. The equipment and materials required for microbe and carbon source delivery are commercially available, but specialized knowledge of in situ biological treatment would be required for implementation. Very few commercial vendors have the required expertise. With sufficient study, it is likely that an implementable design could be developed; however, subsurface conditions could impact effectiveness and cost.

Administrative Feasibility

Actions under this alternative would be implemented on site and 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 Army shall submit to the USEPA and TCEQ a Responsiveness Summary and a draft ROD. Following consideration of any comments by TCEQ, the ROD will be finalized jointly by the 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 following: development of an implementation plan; a site approval process to approve land-use changes to ensure the integrity of the controls, the installation of markers to identify areas of restricted use, training of appropriate personnel regarding the location and care of the controls, 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 Army. The Army shall 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.

7.3.3.7 Cost

The total project present worth cost of Alternative 3 is approximately $744,000. The details of the cost estimates for all of the alternatives are presented in **Appendix E**.

Capital Cost

The total direct capital cost is estimated at approximately $379,000. The direct capital cost includes the activities associated with LUCs (access controls) and in situ bioremediation.

LTM and O&M Cost

The total LTM and O&M cost is estimated at approximately $365,000. The O&M cost includes a second bioremediation treatment and LTM through year 15 associated with the LUCs and the assessment of in situ bioremediation performance. The LTM will be conducted quarterly the first two years, semiannually for years three through five, annually for years six through ten and every five years thereafter.

7.4 Comparative Analysis of Alternatives

7.4.1 Introduction

This section presents a comparative analysis of the remedial alternatives for LHAAP-46 according to the CERCLA evaluation criteria described in **Section 7.2**. 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
- 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 Proposed Plan. 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 for the groundwater is presented in **Sections 7.4.2** and **7.4.3**, respectively, and is consistent with the format of the individual analysis of alternatives in **Section 7.3**.

7.4.2 Threshold Criteria

7.4.2.1 Overall Protection of Human Health and the Environment

The three alternatives provide varying levels of human health protection. Alternative 1, no action, does not achieve the RAO and provides the least protection of all the alternatives; it provides no reduction in exposure to human health or the environment because no measures would be implemented to eliminate the pathway for human exposure to the groundwater contamination.

Alternatives 2 and 3, both satisfy the RAO for LHAAP-46. Alternative 2, which relies most heavily on LUCs combined with MNA, would be protective of human health because the LUCs would prevent human access to the contaminated groundwater. Alternative 3 provides a slightly higher level of overall protection than Alternative 2 because the MCLs for the groundwater COCs would be achieved in a shorter time frame.

7.4.2.2 Compliance with ARARs

Alternative 1 does not comply with chemical-specific ARARs because no remedial action or measures would be implemented. Alternatives 2 and 3 comply with chemical-specific ARARs for groundwater.

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

7.4.3 Primary Balancing Criteria

7.4.3.1 Long-Term Effectiveness and Permanence

Alternative 1 would be the least effective and permanent in the long term because no contaminant removal or treatment would take place and no measures would be implemented to control exposure to contaminated site groundwater. Alternative 2 offers a moderate degree of long-term effectiveness through the implementation of MNA with LUCs, which would minimize the potential exposure to the contaminated groundwater.

Although Alternatives 3 may significantly reduce groundwater contaminant concentrations and achieve the MCLs in a shorter time frame, the actual potential effectiveness will be controlled by the time to achieve MCLs which is controlled by: (1) the nature of the permeable water-bearing zones and (2) the distribution and presence of COCs remaining in the groundwater in untreated areas. Alternative 3 is expected to offer a higher degree of long-term effectiveness and permanence compared to the other alternatives and relies on LTM until the MCLs are achieved through treatment and COC degradation over time.

7.4.3.2 Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternatives 1 and 2 do not employ active treatment and would not result in a reduction of toxicity, mobility, or volume of contaminants through treatment.

Alternative 3 would provide reduction in toxicity, mobility and volume of the groundwater contaminants via active treatment. However, this reduction would only occur if further evaluations of in situ bioremediation are favorable.

7.4.3.3 Short-Term Effectiveness

Because Alternative 1 does not involve any remedial measures, no short-term risk to workers, the community or the environment would exist.

Alternatives 2 and 3 involve potential short-term risks to workers associated with exposure to contaminated groundwater and operation of drilling/construction equipment. The time period to achieve the groundwater cleanup levels is the most significant difference between Alternatives 2 and 3. Alternative 3 is expected to take less time to achieve the cleanup levels than Alternative 2, provided subsurface conditions for in situ bioremediation are favorable. The implementation of Alternative 3 would require more time than for Alternative 2 due to the requirement for a remedial design and pre-design testing. Alternative 2 would provide almost immediate protection because the LUCs could be implemented relatively quickly, but maintenance of these controls would be required for a longer period than Alternative 3.

7.4.3.4 Implementability

Under the no action alternative (Alternative 1), no remedial action would be taken. Therefore, no difficulties or uncertainties would be associated with its implementation. Alternative 2 is easily implemented from a technical standpoint because no construction activities would be performed, although routine maintenance of the LUCs and groundwater sampling would be required.

Alternative 3 is also technically implementable, although less so than Alternative 2 because of the site-specific uncertainties associated with the ability of in situ bioremediation to lower contaminant levels sufficiently to reach the MCLs. Alternative 3 would also be more difficult to implement than Alternative 2 from a technical standpoint due to the specialized expertise required to design and construct the in situ bioremediation treatment elements.

Administratively, all of the alternatives are implementable.

7.4.3.5 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). Present worth costs are developed for each alternative assuming a discount rate of 2.8 percent. Total project present worth costs for each alternative are 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 2, and Alternative 3. No costs are associated with Alternative 1 because no remedial activities would be conducted. Alternative 2 has the lowest present worth and capital costs of the active remedial alternatives (Alternatives 2 and 3). The present worth costs for Alternative 2 is lower than that of Alternative 3, primarily due to the costs and activities associated with the installation of the bioremediation amendments in two phases under Alternative 3. The cost of Alternative 3 is approximately 43 percent more than the cost of Alternative 2.

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Appendix A

Preliminary Evaluation of Natural Attenuation

APPENDIX A
PRELIMINARY EVALUATION OF NATURAL ATTENUATION

FINAL

FEASIBILITY STUDY
LHAAP-46, PLANT 2, GROUP 4
LONGHORN ARMY AMMUNITION PLANT

Prepared for

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

Prepared by

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3010 Briarpark, Suite 400
Houston, Texas 77042

Contract No. W912QR-04-D-0027, Task Order No. DS02
Shaw Project No. 117591

October 2009

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Acronyms and Abbreviations

µg/L	micrograms per liter
bgs	below ground surface
cells/mL	cells per milliliter
cm/s	centimeters per second
CO_2	carbon dioxide
COC	chemical of concern
DCA	dichloroethane
DCE	dichloroethene
DHC	*dehalococcoides ethenogenes*
DO	dissolved oxygen
Fe^{+3}	ferric iron
LHAAP	Longhorn Army Ammunition Plant
LHAAP-46	Plant 2 portion of LHAAP that has been designated Site 46
MARC	Multiple Award Remediation Contract
MCL	maximum contaminant level
mg/L	milligrams per liter
MNA	monitored natural attenuation
mV	millivolts
NO_3^-	nitrate
O_2	oxygen
ORP	oxidation-reduction potential
OSWER	Office of Solid Waste and Emergency Response
PCE	tetrachloroethene
Shaw	Shaw Environmental, Inc.
SO_4^{-2}	sulfate
TCA	trichloroethane
TCE	trichloroethene
TCEQ	Texas Commission on Environmental Quality
TOC	total organic carbon
USAFCEE	U.S. Air Force Center for Environmental Excellence
USEPA	U.S. Environmental Protection Agency
VC	vinyl chloride

1.0 Introduction

The U.S. Army Corps of Engineers, Tulsa District, contracted Shaw Environmental, Inc. (Shaw), under Louisville District's Multiple Award Remediation Contract (MARC) Number W912QR-04-D-0027, Task Order No. DS02, to conduct environmental restoration at Longhorn Army Ammunition Plant (LHAAP). This report presents the evaluation for the occurrence of natural attenuation of groundwater contaminants at the Plant 2 portion of LHAAP that has been designated as LHAAP-46. The general location of LHAAP is shown on **Figure 1-1**.

LHAAP-46 is located in the northwestern portion of LHAAP and covers an area of approximately 190 acres, as shown on **Figure 1-2**. LHAAP-46 is bounded by Avenue P to the south-southwest, 11th Street and Raymer Street to the southeast and east, the northern LHAAP property fence line to the north and a heavily wooded area to the west.

The subsurface is composed of silty clay to clayey silt, and poorly sorted silty sand. The clay layers tend to separate their groundwater into shallow and intermediate groundwater zones.

The groundwater at LHAAP-46 is contaminated, with trichloroethene (TCE) as the primary COC. Sampling was conducted in February 2007 to collect data to evaluate natural attenuation of the groundwater contaminants. The results from the February 2007 sampling event are used for the evaluation of monitored natural attenuation (MNA). In 2008, two new monitoring wells were installed in the intermediate zone to better delineate the TCE plume. Samples were analyzed in October 2008 for volatile organic compounds and not attenuation parameters.

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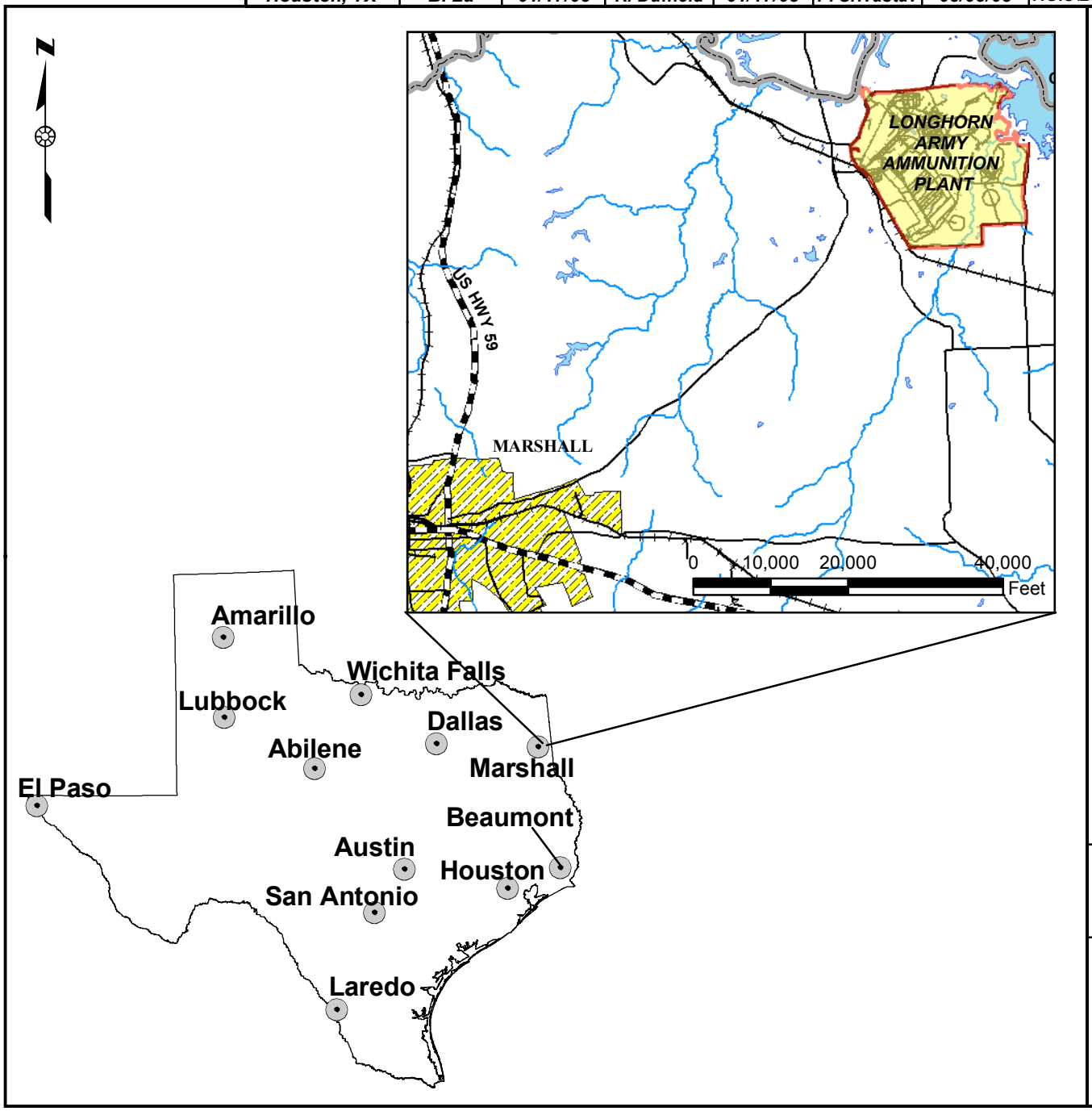

LEGEND

- Major Texas City
- Road
- Railroad
- Creek/River
- Lake
- County Boundary
- City Boundary
- LHAAP Boundary

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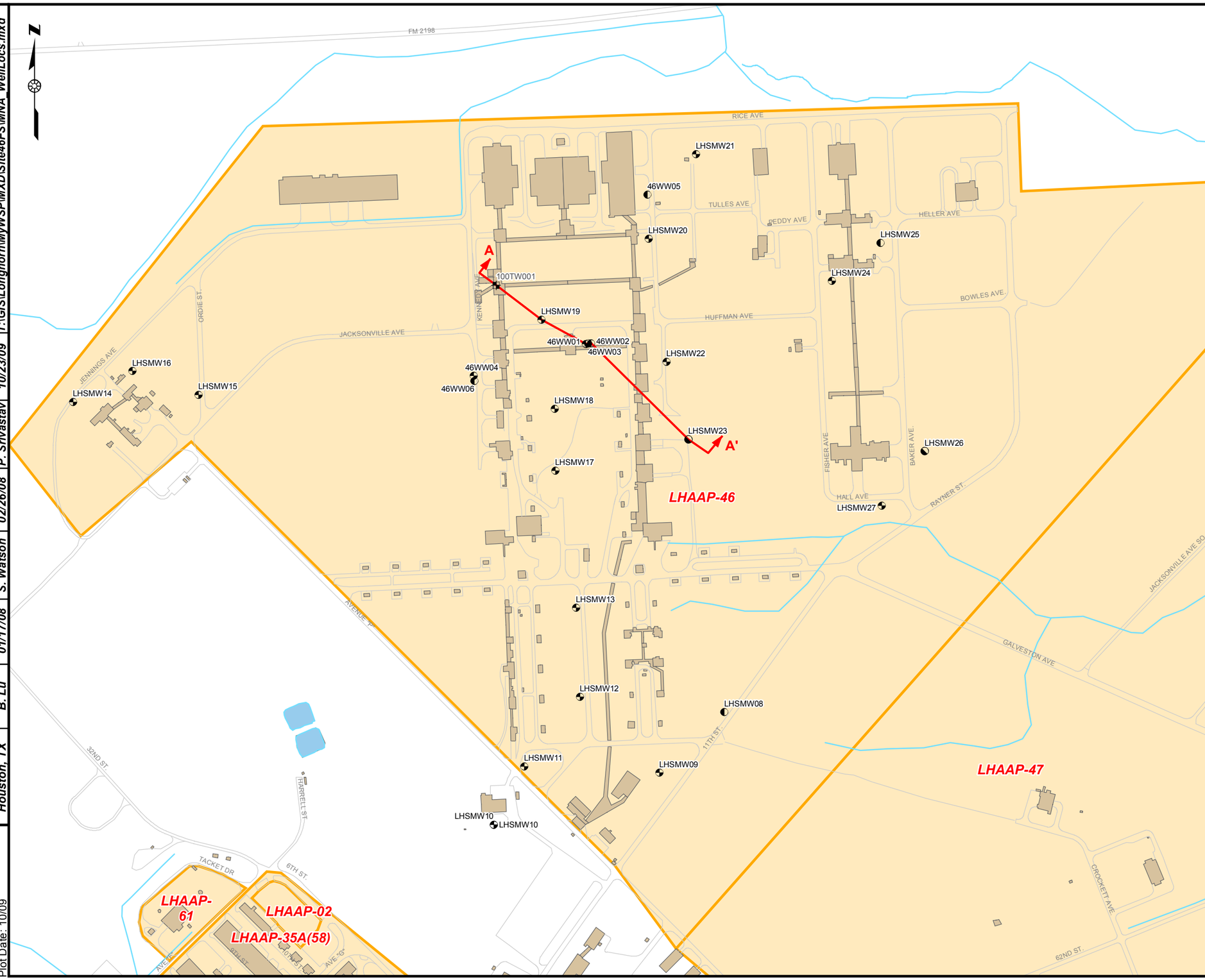
TULSA, OKLAHOMA

FIGURE 1-1

SITE LOCATION MAP

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS



LEGEND

- Shallow Monitoring Well
- Shallow/Intermediate Monitoring Well
- Intermediate Monitoring Well
- Deep Monitoring Well
- Temporary Monitoring Well
- Cross-Section Line
- Stream
- Road
- Former Building or Concrete Slab
- Site

0 200 400 800 Feet

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FIGURE 1-2

SITE MAP AND
MONITORING WELL LOCATIONS
LHAAP-46

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Lu	01/17/08	S. Watson	02/26/08	P. Srivastav	10/23/09	T:\GIS\Longhorn\MyWSP\MXD\Site46FS\MNA_WellLocs.mxd

Plot Date: 10/09

2.0 Description of Natural Attenuation

Natural attenuation is defined as the reduction of contaminants from the combined effect of intrinsic biodegradation, advection, dispersion, dilution, volatilization, and absorption mechanisms. Generally, intrinsic biodegradation is the most important natural attenuation mechanism that results in contaminant destruction. Intrinsic biodegradation can occur in any environment that supports microbial activity. The biodegradation may be limited by the lack of a suitable respiratory substrate (e.g., oxygen) or inorganic nutrients, extreme pH, or limited contaminant bioavailability. Accurate contamination delineation, subsurface conditions characterization, and contaminant migration determination are critical for defining the contribution of intrinsic biodegradation to concentration reduction, for evaluating the effectiveness of natural attenuation, and for establishing regulatory support for use of natural attenuation at a site. MNA entails the use of natural attenuation within the context of a monitoring plan to demonstrate reductions in contaminant concentrations and achievement of remedial objectives.

2.1 Natural Attenuation Lines of Evidence

The U.S. Environmental Protection Agency (USEPA) guidance, Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Groundwater (USEPA, 1998), will be used as guidance for the natural attenuation evaluation. The USEPA guidance specifies a tiered approach of recommended lines of evidence required for demonstrating that MNA is an effective remedy.

There are three lines of evidence according to the USEPA guidance document based on the Office of Solid Waste and Emergency Response (OSWER) Directive 9200.4-17 (USEPA, 1999), which are described as follows:

1. ***First line of evidence.*** Observed Reduction in Contaminant Mass and Concentration. Relies on use of historical groundwater data that demonstrate a clear trend of stable or decreasing chemical of concern (COC) concentrations over time at appropriate monitoring or sampling points.
2. ***Second line of evidence.*** Identified and Quantified Natural Attenuation Processes. Uses geochemical indicators to document certain geochemical signatures or "footprints" in the groundwater that demonstrate (indirectly) the type of natural attenuation process(es) occurring at the site and the rate at which such processes will reduce COCs to the maximum contaminant levels (MCLs).

- ***Third line of evidence.*** Microcosm Studies. Most often consists of predictive modeling studies and other laboratory/field studies that demonstrate the occurrence of natural attenuation process(es) at the site and its ability to degrade the COCs.

All three lines of evidence were evaluated for LHAAP-46 to demonstrate the occurrence of natural attenuation of groundwater COCs.

2.2 Groundwater Flow Direction

Groundwater is present in three zones at LHAAP-46, a shallow zone, an intermediate zone, and a deep zone (Jacobs, 2002). Groundwater flow direction determines the choice of downgradient wells for evaluating the first line of evidence.

Depth-to-groundwater in the shallow zone is approximately 10 to 15 feet below ground surface (bgs). Groundwater flows to the east in the shallow zone, as shown in **Figure 2-1**, based on data collected in December 2007. Hydraulic conductivities in the shallow zone wells varied from 2.5×10^{-5} to 1.9×10^{-3} centimeters per second (cm/s).

Depth to groundwater in the intermediate zone is approximately 23 to 30 feet bgs. Groundwater in the intermediate zone flows to the northeast as shown in **Figure 2-2**, based on the data collected in December 2007. Hydraulic conductivities in three intermediate zone wells varied from 4.5×10^{-4} to 9.5×10^{-4} cm/s.

Figure 2-3 shows a cross-section of shallow and intermediate zone wells that includes wells sampled in February 2007. With only one deep zone well at LHAAP-46 (46WW03), the groundwater flow direction to the east or northeast was extrapolated from wells at multiple LHAAP sites and no specific figure for the deep zone at LHAAP-46 has been prepared.

2.3 Biodegradation

Biodegradation occurs when bacteria use contaminants as carbon sources or electron acceptors. The COCs at LHAAP-46 include a chlorinated solvent exceeding its MCL. All contaminants can be degraded through microbial activity in the subsurface. Under the right conditions, all site COCs are amenable to biodegradation. A brief description of the various biodegradation pathways and mechanisms is described in the subsequent sections.

The technical protocol for evaluating natural attenuation of chlorinated solvents in groundwater (USEPA, 1998) has a preliminary screening worksheet for evaluating whether anaerobic biodegradation is occurring. The worksheet assigns points for geochemistry and the presence of daughter products. A point total of 5 or less, denotes inadequate evidence of anaerobic degradation. A point total of 15 or more is adequate evidence for anaerobic biodegradation. In between 5 and 15, the score represents limited evidence for anaerobic degradation. The preliminary screening worksheet only addresses anaerobic degradation, not any of the other pathways for natural attenuation (aerobic biodegradation, diffusion, adsorbtion, etc.).

2.3.1 Chlorinated Solvents

The chlorinated solvents at this site are classified as chlorinated ethenes, ethanes, and methane. The most abundant chlorinated solvent at the site is TCE. Chlorinated ethenes and ethanes include parent compounds (TCE, tetrachloroethene [PCE], 1,1,1-trichloroethane [TCA], 1,1,2-TCA) that biodegrade via multiple pathways and generate a variety of daughter products (cis-1,2-dichloroethene [DCE], 1,1-DCE, 1,2-dichloroethane [DCA], and vinyl chloride [VC]) that are generated from biotic or abiotic degradation of those parent compounds. Observing a decreasing trend of parent compounds and generation of daughter products are direct evidence for the occurrence of biodegradation supporting the first line of evidence.

One of the most prevalent pathways for biodegradation of chlorinated solvents is via reductive dechlorination. During this process, a chlorinated hydrocarbon is used as an electron acceptor resulting in the replacement of a chlorine atom with a hydrogen atom. The biodegradation of TCE primarily produces cis-1,2-DCE, with a trace amount of trans-1,2-DCE. 1,2-DCE isomers undergo reductive dechlorination resulting in the formation of VC, and subsequently the innocuous product ethene. When the 1,2-DCE isomers are generated, the cis-isomer is produced 10 to 100 times more often than the trans-isomer (Bouwer, 1994 and USEPA, 1998). The TCA compounds can also undergo reductive dechlorination, resulting in the formation of DCA isomers, followed by chloroethane, and then the harmless product ethane. The isomer 1,1-DCE is predominantly produced via abiotic hydrolysis of 1,1,1-TCA, and then further reduced to VC via reductive dechlorination.

Alternately, the DCE isomers, DCA and VC can be utilized as carbon sources and undergo biodegradation to carbon dioxide and chloride ions via aerobic or anaerobic oxidation. Although the chlorinated solvents can degrade via multiple biodegradation pathways, reductive dechlorination is typically the most common pathway observed. Chlorinated solvent can also undergo biogeochemical reductive dechlorination under high sulfate and iron levels (U.S. Air Force Center for Environmental Excellence [USAFCEE], 2003). During this degradation pathway, sulfate reducing bacteria produce sulfite and mineral iron without VC generation.

2.4 Geomicrobiology

Biological monitoring parameters are indicators of microbiological activity in the subsurface and are evaluated in support of the second lines of evidence. Microbial respiration is the biochemical process that leads to the oxidation of reduced organic carbon. Frequently encountered respiratory substrates (or electron acceptors) include oxygen (O_2), nitrate (NO_3^-), ferric iron (Fe^{+3}), sulfate (SO_4^{-2}), and carbon dioxide (CO_2). Respiratory substrates are used preferentially based on the amount of energy that can be derived from each of them. Respiratory substrates are used in the following order:

$$O_2 > NO_3^- > Fe^{+3} > SO_4^{-2} > CO_2$$

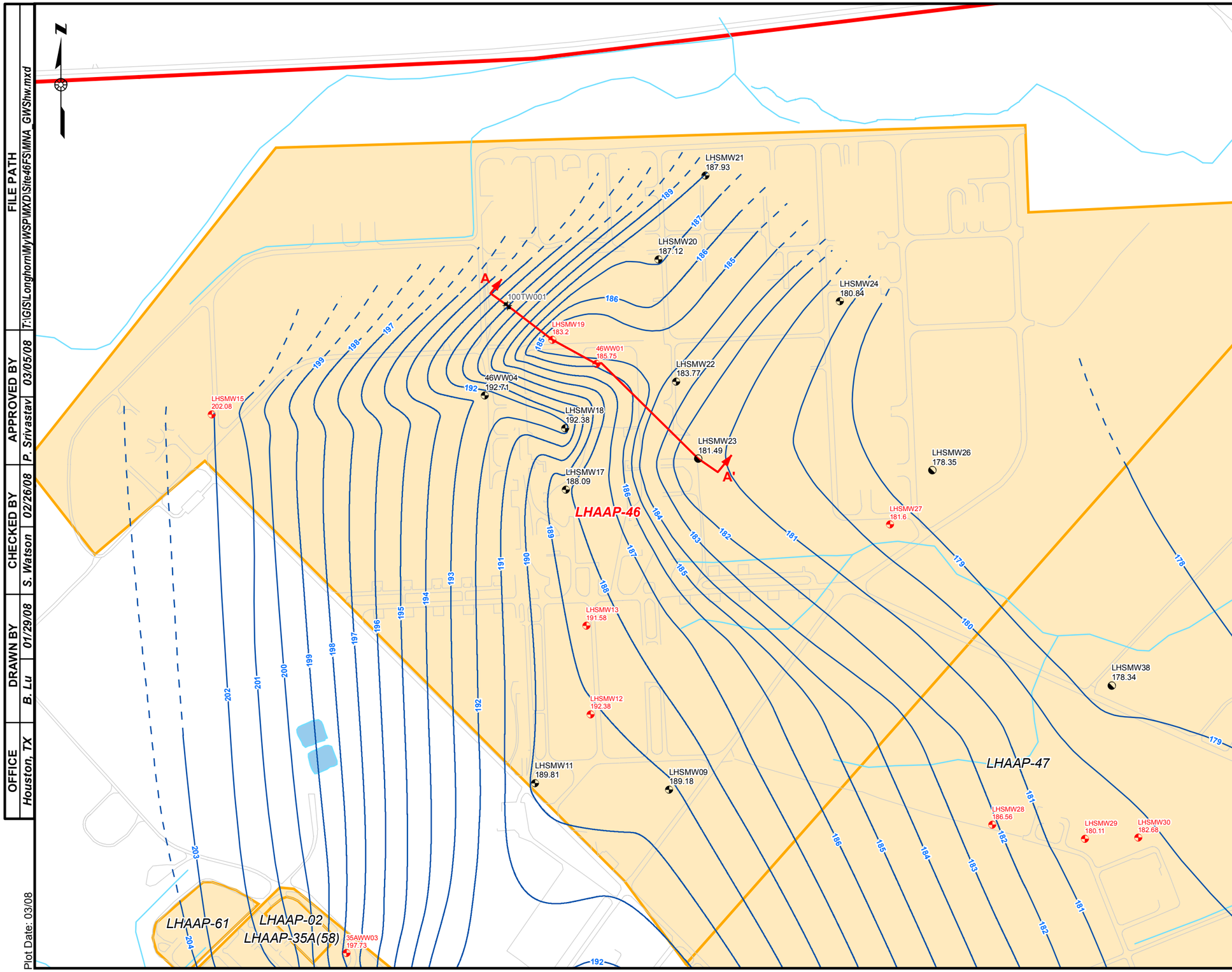
The reduction of highly chlorinated compounds like PCE, TCE, and TCA may occur under sulfate-reducing conditions; however, DCE isomers, 1,2-DCA, and VC require the more reducing methanogenic conditions to undergo reductive dechlorination, which typically commence once the sulfate concentrations near depletion.

As discussed above, the concentrations of microbial respiratory substrates and products can be used to demonstrate intrinsic biodegradation. Expected changes include depressed concentrations of dissolved oxygen (DO) and negative oxidation-reduction potential (ORP) values within and downgradient of actively degrading contaminant plumes. The concentrations of anaerobic respiratory substrates such as nitrate and sulfate should decrease in groundwater located within and downgradient of a contaminant plume that is actively undergoing intrinsic anaerobic biodegradation. Similarly, the concentrations of the products of anaerobic microbial respiration, specifically ferrous iron and methane, should increase under similar circumstances.

The biodegradation of chlorinated solvents, whether via reductive dechlorination, dichloroelimination, or anaerobic oxidation, releases chloride ions into groundwater. In areas where the groundwater has a very low background chloride concentration, an elevation in chloride concentrations may be observed as a result of biodegradation of chlorinated solvents. However, high background chloride concentrations were observed at LHAAP, thus, the slight contribution of chloride into the groundwater through biodegradation is not quantifiable.

2.5 Microbial Analysis

Microbial analysis can provide evidence to support the third line of evidence. There are multiple strains that can dechlorinate TCE and TCA under anaerobic reductive conditions, but only one strain, *Dehalococcoides ethenogenes* (DHC), can completely reduce the DCE isomers and VC to ethene. The presence of DHC in the groundwater can be the evidence to support the third line of evidence.



LEGEND

- Shallow Monitoring Well
- Shallow/Intermediate Monitoring Well
- Dry Shallow Monitoring Well (Elevation Represents Bottom of Well)
- Temporary Monitoring Well
- Cross-Section Line
- Groundwater Elevation Contour
- Inferred Groundwater Elevation Contour
- Stream
- Road
- Approximate LHAAP Boundary
- Site

Note:

Groundwater elevation measured on November 29 -- December 3, 2007.

0 200 400 800 Feet

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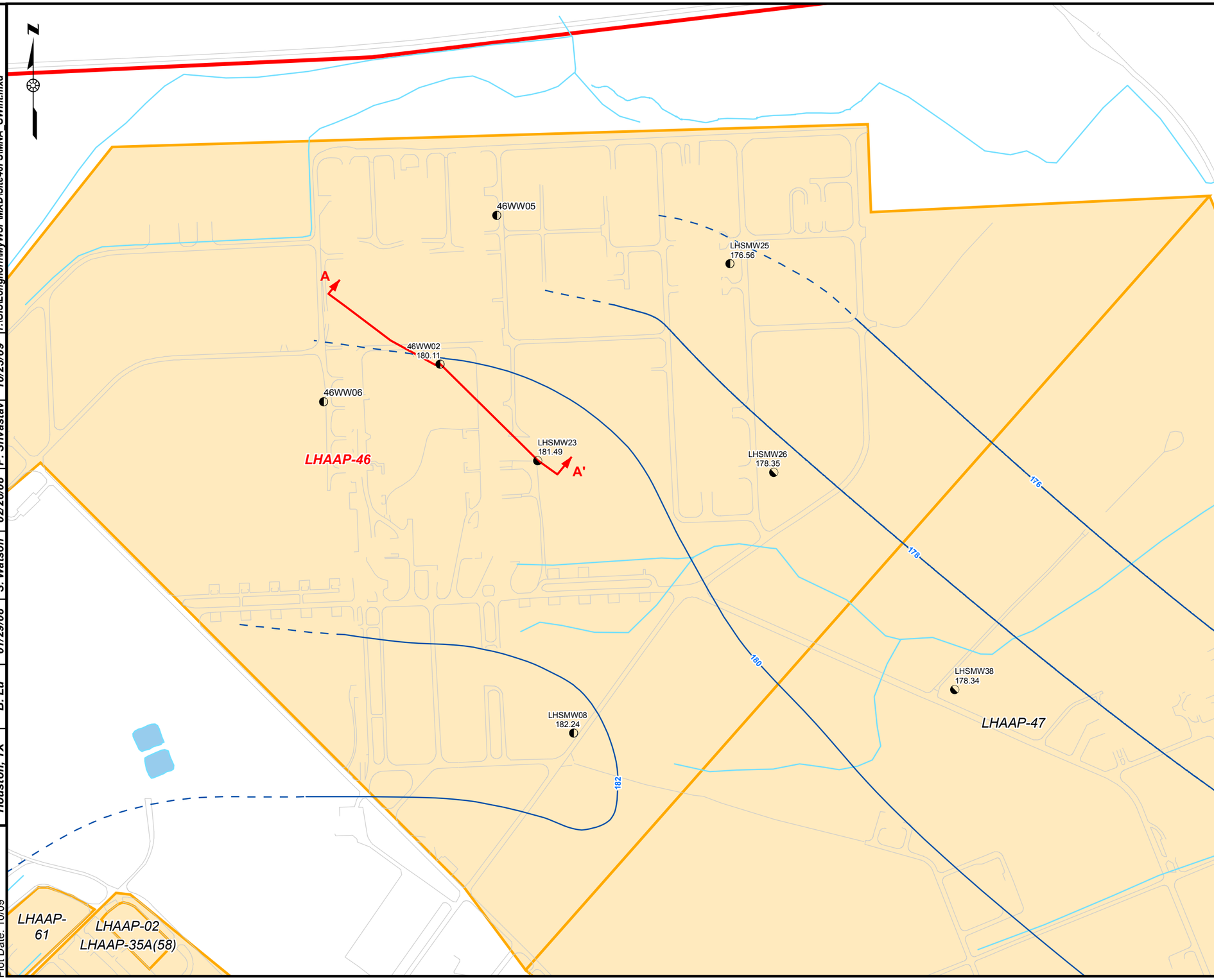
FIGURE 2-1

GROUNDWATER ELEVATION CONTOUR MAP
(SHALLOW ZONE)

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Lu	01/29/08	S. Watson	02/26/08	P. Srivastav	03/05/08	T:\GIS\Longhorn\MyWSP\MXD\Site46FS\MNA_GWShw.mxd

Plot Date: 03/08



LEGEND

- Shallow/Intermediate Monitoring Well
- Intermediate Monitoring well
- Cross-Section Line
- Groundwater Elevation Contour
- Inferred Groundwater Elevation Contour
- Stream
- Road
- Approximate LHAAP Boundary
- Site

Notes:

1. Groundwater elevation measured on November 29 -- December 3, 2007.
2. 46WW05 and 46WW06 were installed in 2008.

0 200 400 800 Feet

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FIGURE 2-2

GROUNDWATER ELEVATION CONTOUR MAP
(INTERMEDIATE ZONE)

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	FILE PATH
Houston, TX	B. Lu 01/29/08	S. Watson 02/26/08	P. Srivastav 10/23/09	T:\GIS\Longhorn\MyWSP\MXD\Site46FS\MNA_GWInt.mxd

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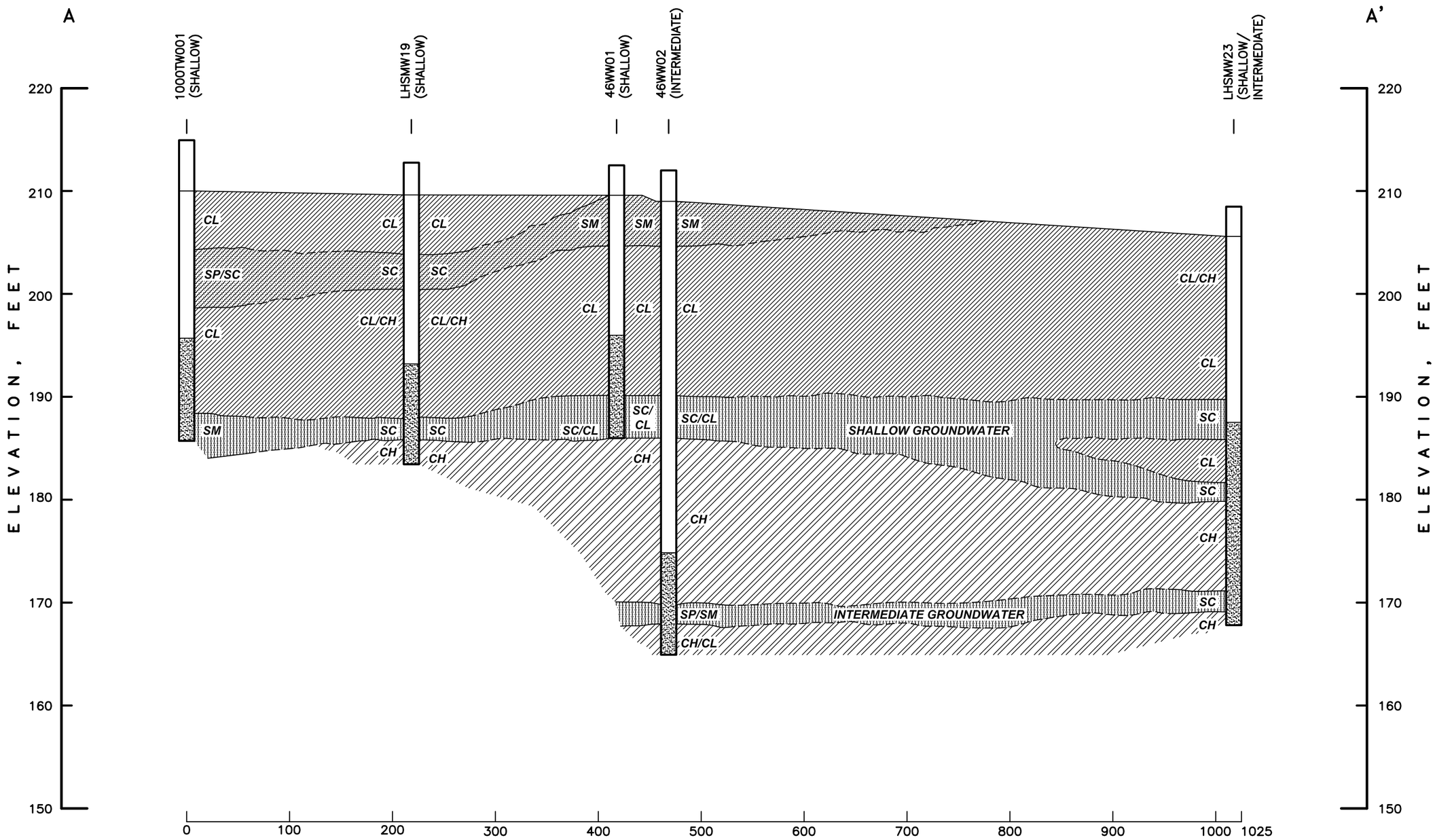

SECTION A–A'

VERTICAL SCALE

0 10 20 30 FEET

HORIZONTAL SCALE

0 100 200 300 FEET

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FIGURE 2–3

CROSS SECTION A–A'

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

IMAGE	X-REF	OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	DRAWING NUMBER
---	---	Houston, Texas	L. JONES 01/31/08	R. DUFFIELD 01/31/08	P. SRIVASTAV 03/15/08	117591–B7

PLOT DATE: 01/31/08
FORMAT REVISION 3/25/99

3.0 Natural Attenuation Evaluation Results

The following sections present the results of the natural attenuation evaluation as they pertain to demonstrating MNA in accordance with the three lines of evidence.

Seven monitoring wells were sampled for natural attenuation parameters in February 2007. These included five shallow wells (46WW01, 46WW04, LHSMW18, LHSMW19, LHSMW22) and two intermediate wells (46WW02 and LHSMW23). The current data along with historical data have been used to evaluate MNA at LHAAP-46 in this report.

For the purposes of this evaluation, the USEPA MCLs for drinking water are used as the cleanup levels for LHAAP-46. COCs that exceed their MCLs at LHAAP-46 include TCE.

The preliminary screening worksheet (USEPA, 1998) was used to evaluate if anaerobic biodegradation was occurring in wells within the TCE plume at LHAAP-46 that had most of the requisite analytical test results. Well 46WW01 scored 4 points and well LHSMW19 scored 5 points, indicating anaerobic biodegradation is probably not occurring there. The other two wells (46WW02 and LHSMW18) showed totals of 10 and 6 points; showing limited evidence of anaerobic degradation. **Table 3-1** shows the results of evaluating the preliminary screening worksheet for wells at LHAAP-46. Because the preliminary screening shows limited evidence for anaerobic biodegradation, the data was evaluated using the lines of evidence.

The evaluation of MNA lines of evidence for the shallow groundwater zone at LHAAP-46 is presented below.

3.1 Change in COC Concentrations Over Time and with Distance

The change in groundwater COC concentrations over time and with distance was evaluated at LHAAP-46. The shallow and intermediate groundwater zones are impacted with COCs and will be discussed in this evaluation. The only COC with continuing concentrations higher than its MCL is TCE.

3.1.1 Trichloroethene

During the February 2007 sampling event, TCE was observed in only two wells above the MCL (5.0 micrograms per liter [µg/L]), at 46WW02 (intermediate) and LHSMW19 (shallow) (**Table 3-2**). Historically, levels of TCE above the MCL have been observed at shallow wells 46WW01, LHSMW18, and LHSWM19, and intermediate wells 46WW02 and 46WW05. See **Figure 3-1** for an illustration of the TCE plume in shallow groundwater over time. The highest concentration of TCE at 46WW01 was 6.6 µg/L detected in October 1998 (**Table 3-3**), but subsequent results at 46WW01 in November 1998 and February 2007 were not detectable. The

highest concentration of TCE at LHSMW18 was 38 µg/L detected in May 1998, and the most recent result is below the MCL at 4.8 µg/L in February 2007. The highest concentration of TCE at LHSMW19 is 85.5 µg/L detected in February 2007. TCE concentrations at this well have varied over time but have stayed in the same order of magnitude in the range 26 µg/L to 85.5 µg/L.

Overall, the shallow TCE plume has decreased in size as shown in **Figure 3-1**. The results from 46WW01 and LHSMW18 show decreasing trends, suggesting that natural attenuation is occurring at the edges of the plume, effectively containing it. Comparing the average TCE concentration over time among the five shallow wells sampled in 2007 (46WW01, 46WW04, LHSMW18, LHSMW19, LHSMW22), the average concentration decreases over time – 25.4 µg/L in 1996, 23.7 µg/L in 1998, and 18.4 µg/L in 2007. See **Table 3-3** for TCE results.

At monitoring well 46WW02, located in the intermediate groundwater zone, TCE concentrations have remained stable approximately ten years, varying from 24 µg/L to 31.2 µg/L between November 1998 to October 2008. Monitoring well 46WW05 was installed in 2008, and the result from October 2008 showed a TCE concentration of 5.9 µg/L indicating the edge of the plume is nearby. See **Figure 3-2** for an illustration of the TCE plume in intermediate groundwater. The data suggest that the plume is stable, although attenuation has not been observed at this time.

Since the edges of the plume are stable, this indicates that natural attenuation at LHAAP-46 is acting as an effective containment mechanism and will eventually remediate the plume as its size shrinks.

3.1.2 cis-1,2-Dichloroethene

As TCE is degraded by reductive dechlorination, the daughter product cis-1,2-DCE is formed. During the February 2007 sampling event, cis-1,2-DCE was observed in two wells (shallow well LHSMW18 at 1.5 J µg/L and intermediate well 46WW02 at 1.4 J µg/L), at estimated concentrations below the MCL of 70 µg/L. At intermediate monitoring well 46WW02, the data indicate a slight increase in cis-1,2-DCE from the 1998 result of 1.0 µg/L to the 2008 concentration of 1.45 µg/L. These data show that cis-1,2-DCE has been produced via reductive dechlorination, suggesting that biological reduction of TCE is occurring at LHAAP-46. The presence of cis-1,2-DCE is a strong indicator supporting the occurrence of natural attenuation at LHAAP-46 under the first line of evidence. See **Table 3-3** for cis-1,2-DCE results.

3.1.3 Vinyl Chloride

During reductive dechlorination, VC is produced from the reduction of cis-1,2-DCE and trans-1,2-DCE. During the February 2007 sampling event, VC was not observed in any of the wells. The highest historical VC concentration was an estimated value of 0.71 µg/L at

LHSMW18, which is less than the MCL of 2 µg/L. Monitoring well LHSMW18 is the only well where VC has been detected. A low level of VC, 0.68 µg/L, was observed during the August 1996 sampling event, and in May 1998 an estimated value of 0.71 µg/L was noted, followed by a decrease to below the detection limit (0.32 µg/L) in February 2007 (**Table 3-2**). The presence and decrease of VC at LHSMW18 is a strong indicator supporting the occurrence of natural attenuation at LHAAP-46 under the first line of evidence. See **Table 3-3** for VC results.

3.1.4 Plume Extent

The evaluation of changes in COC concentrations with time has indicated the occurrence of natural attenuation. The evaluation of changes in COC concentrations with respect to distance further elucidates that natural attenuation mechanisms are controlling the plume size and migration. The historical and current data indicate a clear decreasing trend in TCE concentrations with distance away from the central location of contamination. In shallow monitoring wells 46WW04, LHSMW15, LHSMW17, LHSMW20, LHSMW22, shallow/intermediate monitoring well LHSMW23, and intermediate monitoring well LHSMW25, TCE concentrations above the MCL have not been observed during recent or historical sampling events. This data provides clear evidence that the TCE concentrations observed in shallow wells 46WW01, LHSMW18, and LHSMW19 and intermediate well 46WW02 are being attenuated before they reach downgradient monitoring wells.

The apparent extent of the TCE plume in the shallow groundwater has consistently decreased with time, between 1996 and 2007 (**Figure 3-1**). The plume in the shallow groundwater is bounded by permanent monitoring wells LHSMW22 and LHSMW27 in the downgradient direction and in all other directions except the northwest upgradient side. A temporary monitoring well 1000TW001 in that direction was sampled in December 2003 as part of the Environmental Site Assessment (Plexus, 2005). The groundwater sample from 1000TW001 was tested for volatile organic compounds, and none of the compounds were detected.

Monitoring wells 46WW02 and 46WW05 are the only wells in the intermediate zone that have shown TCE at concentrations above the MCL. Detectable TCE less than the MCL has been found at LHSMW23. The apparent groundwater flow in the intermediate zone is to the northeast at LHAAP-46 and the intermediate zone TCE plume is bounded in that direction based on data from LHSMW25 (**Figure 3-2**).

3.2 Geochemical Indicators

Groundwater field parameters, including DO, ORP, pH, temperature, and conductivity, were analyzed in the field during the 2007 sampling event. In addition, laboratory analyses for the following natural attenuation parameters were performed during the same sampling event: gases

(methane, ethane, and ethene), anions (sulfate, nitrate, nitrite, and chloride), and total organic carbon (TOC). The results of the 2007 sampling event are presented in **Table 3-2**.

Dissolved Oxygen and Oxidative-Reduction Potential: Oxygen is the preferred terminal electron acceptor during aerobic microbial respiration. DO concentrations below 0.5 milligrams per liter (mg/L) are the most favorable condition for anaerobic reductive dechlorination, and anaerobic microbial activity would not tolerate DO levels above 5 mg/L (USEPA, 1998). DO concentrations ranged from 0.44 mg/L in LHSMW23 to 3.49 mg/L in LHSMW18 during the February 2007 sampling event (**Table 3-2**). ORP often correlates with the dominant type of microbial activity. The more negative the measurement, the more likely that sulfate-reducing or methanogenic conditions can exist in the subsurface and typically require ORP values below 50 millivolts (mV) (USEPA, 1998). The ORP measurements in the shallow groundwater zone at LHAAP-50 ranged from 57.7 mV in LHSMW23 to 371.4 mV in 46WW01 during the February 2007 sampling event (**Table 3-2**). The results of DO and ORP measurements suggest both anaerobic and oxidative conditions exist, which is favorable for reductive dechlorination of chlorinated solvents in the area of anaerobic conditions (LHSMW23).

Nitrate: Following oxygen, microorganisms preferentially use nitrate as a terminal electron acceptor. Concentrations of nitrate less than 1 mg/L are not expected to interfere with anaerobic reductive dechlorination (USEPA, 1998). Active nitrate-reducing conditions are often indicated by a depletion of nitrate in groundwater and a possible increase in nitrite, which is favorable for perchlorate reduction. Nitrate and nitrite concentrations were both below detection limits in February 2007 (**Table 3-2**), which suggest that nitrate levels would not interfere with reductive dechlorination at LHAAP-46.

Ferrous Iron: Once nitrate has been depleted, microorganisms use ferric iron as the next terminal electron acceptor. As a measurement of reduced ferric iron, an accumulation of ferrous iron may be observed. Ferrous iron levels above 1 mg/L suggest that groundwater conditions are favorable for reductive dechlorination (USEPA, 1998). During the February 2007 sampling event, ferrous iron ranged from non-detect in LHSMW19 to 3.3 mg/L in LHSMW22 (**Table 3-2**). These data suggest that iron reduction is currently occurring at this site.

Sulfate: Reductive dechlorination of highly chlorinated compounds such as TCE occurs under sulfate-reducing conditions, but the reductive dechlorination of cis-1,2-DCE and VC is unlikely to occur under the same conditions. Sulfate-reducing conditions are favored when other electron acceptors such as oxygen, nitrate, and bioavailable ferric iron are depleted, leaving sulfate as the primary acceptor. Active sulfate reduction is often indicated by a depletion of sulfate in groundwater and a possible increase in sulfide. Concentrations of sulfate greater than 20 mg/L may cause competitive exclusion of reductive dechlorination (USEPA, 1998). Sulfate concentrations at LHAAP-46 ranged from 48 mg/L in 46WW01 to 1,260 mg/L in LHSMW18;

meanwhile sulfite was below the detection limit (0.2 mg/L) in all monitoring wells. This suggests that most of the site groundwater is not under sulfate-reducing conditions at this time.

Methane: Methanogenesis occurs in highly reducing conditions and an accumulation of methane above 0.5 mg/L are considered to represent methanogenic conditions (USEPA, 1998). During the February 2007 sampling event, elevated methane concentrations above 0.5 mg/L were not observed in the shallow groundwater zone at wells 46WW01, 46WW04, LHSMW22 and LHSMW23, which suggests methanogenic microbes may be present in the groundwater.

Ethane and Ethene: Ethane and ethene are the end products of reductive dechlorination. The lack of detection of ethane and ethene suggests that complete dechlorination is not occurring in the groundwater at this time (**Table 3-2**).

Total Organic Carbon: Regardless of the electron acceptor being used, organic carbon is a required source of energy to sustain microbial activity. TOC concentrations greater than 20 mg/L are considered adequate to support microbial activity (USEPA, 1998). In wells sampled in February 2007, TOC ranged from 3.0 mg/L at 46WW01 to 18.0 mg/L at LHSMW18 in the groundwater (**Table 3-2**). Even though TOC levels are not in the optimal range, the levels observed are adequate to stimulate microbial activity in the groundwater.

pH: The optimal pH range for microbial activity is between 6 and 8 standard units but pH values between 5 and 9 are tolerated. The pH within the shallow groundwater zones ranged from 4.9 to 6.5 standard units during the February 2007 sampling event (**Table 3-2**). The pH values at LHAAP-46 are generally within the tolerated range to support biodegradation.

The qualitative assessment of the geochemical indicators in the groundwater at LHAAP-46 presents evidence that geochemical conditions are not optimal at this time for anaerobic reductive dechlorination of chlorinated ethenes such as TCE.

3.3 Natural Attenuation Rate Estimation and Microbial Analysis

Natural attenuation rate estimations and microbial analysis provide supporting lines of evidence for the groundwater. These attenuation rate estimations incorporate all of the attenuation pathways, but cannot determine which pathway accounts for what portion of the attenuation.

3.3.1 Natural Attenuation Rate and Cleanup Time Estimation

Decreasing concentrations of COCs were observed in monitoring wells 46WW01 and LHSMW18. The time-dependent attenuation rates of COCs in 46WW01 and LHSMW18 were estimated, based on COC concentrations over time in the monitoring well, with the assumption of first-order degradation kinetics. The in-well attenuation rates for TCE were calculated for two wells and the results are summarized in **Table 3-4**.

Figure 3-3 shows graphical presentation of natural attenuation rate calculation for TCE in well 46WW01. The attenuation rate for TCE is 0.000467 day^{-1}, and the concentration there has already fallen below the MCL (**Table 3-4**). **Figure 3-3** also shows a graphical presentation of the time-dependent natural attenuation rate constant calculation for TCE in LHSMW18. The estimated attenuation rate was 0.000333 day^{-1}, and the concentration there is already below the MCL (**Table 3-4**).

Based on the estimated natural attenuation rates for TCE, the estimated cleanup time via natural attenuation in the shallow well LHSMW19 is 17 to 23 years and is based on limited data. The estimated cleanup time via natural attenuation in the intermediate well 46WW02 is 11 to 15 years (see **Table 3-4**) and is based on limited data. However, since the estimation is based on current limited data, the actual cleanup times could be higher or lower than this estimate. Future monitoring results should verify and update the attenuation rates and corresponding cleanup times in all monitoring wells impacted with COCs.

3.3.2 Microbial Analysis

An important indicator of reductive dechlorination is the presence of DHC, the only known species capable of complete dechlorination of TCE and its daughter products to innocuous ethene via reductive dechlorination. During the most recent sampling event in February 2007, DHC cells were observed in three wells impacted with chlorinated solvents at levels of 8,000 cells per milliliter (cells/mL) in 46WW02, 30 cells/mL in LHSMW19, and 15 cells/mL in LHSMW23 (**Table 3-2**). The presence of the dechlorinating microorganisms suggests that microbes able to process complete reductive dechlorination are present at LHAAP-46.

Table 3-1
Preliminary Screening Worksheet

Analysis	Concentration in Most Contaminated Zone	Interpretation	Value	46WW01 Points Assigned	46WW02 Points Assigned	LHSMW18 Points Assigned	LHSMW19 Points Assigned
Oxygen*	<0.5 mg/L	Tolerated, suppresses the reductive pathway at higher concentrations	3	0	0	0	0
Oxygen*	>5 mg/L	Not tolerated; however, VC may be oxidized aerobically	-3	0	0	0	0
Nitrate*	<1 mg/L	At higher concentrations may compete with reductive pathway	2	2	2	2	2
Iron II*	>1 mg/L	Reductive pathway possible; VC may be oxidized under Fe(III)-reducing conditions	3	0	3	0	0
Sulfate*	<20 mg/L	At higher concentrations may compete with reductive pathway	2	0	0	0	0
Sulfide*	>1 mg/L	Reductive pathway possible	3	0	0	0	0
Methane*	<0.5 mg/L >0.5 mg/L	VC oxidizes Ultimate reductive daughter product, VC Accumulates	0 3	0	0	0	0
Oxidation Reduction Potential* (ORP) against Ag/AgCl electrode	<50 millivolts (mV) <-100mV	Reductive pathway possible Reductive pathway likely	1 2	0	0	0	0
pH*	5 < pH < 9 5 > pH >9	Optimal range for reductive pathway Outside optimal range for reductive pathway	0 -2	0	-2	0	0
TOC	> 20 mg/L	Carbon and energy source; drives dechlorination; can be natural or anthropogenic	2	0	0	0	0
Temperature*	> 20°C	At T >20°C biochemical process is accelerated	1	0	1	0	1
Carbon Dioxide	>2x background	Ultimate oxidative daughter product	1	0	0	0	0
Alkalinity	>2x background	Results from interaction between CO2 and aquifer minerals	1	0	0	0	0
Chloride*	>2x background	Daughter product of organic chlorine	2	0	0	0	0
Hydrogen	>1 nM	Reductive pathway possible, VC may accumulate	3	NT	NT	NT	NT
Hydrogen	<1 nM	VC oxidized	0	NT	NT	NT	NT
Volatile Fatty Acids	> 0.1 mg/L	Intermediates resulting from biodegradation of more complex compounds; carbon and energy source	2	NT	NT	NT	NT
BTEX*	> 0.1 mg/L	Carbon and energy source; drives dechlorination	2	0	0	0	0
Tetrachloroethene		Material released	0	0	0	0	0
Trichloroethene*		Material released Daughter product of PCE	0 2a	0	0	0	0
DCE*		Material released Daughter product of TCE If cis is > 80% of total DCE it is likely a daughter product 1,1-DCE can be chemical reaction product of TCA	0 2a	2	2	2	2
VC*		Material released Daughter product of DCE	0 2a	0	0	2	0
1,1,1-Trichloroethane*		Material released	0	0	0	0	0
DCA		Daughter product of TCA under reducing conditions	2	0	0	0	0
Carbon Tetrachloride		Material released	0	0	0	0	0
Chloroethane*		Daughter product of DCA or VC under reducing conditions	2	0	0	0	0
Ethene/Ethane	>0.01mg/L >0.1 mg/L	Daughter product of VC/ethene	2 3	0	0	0	0
Chloroform		Material released Daughter product of Carbon Tetrachloride	0 2	0	2	0	0
Dichloromethane (Methylene Chloride)		Material released Daughter product of Chloroform	0 2	0	2	0	0
			Totals:	4	10	6	5

Notes and Abbreviation:

* - Required Analysis

a - points awarded only if it can be shown that the compound is a daughter product (not a source constituent)

NT - not tested

Table 3-2
VOC and Natural Attenuation Parameters at LHAAP-46
February 2007

Test Group	Parameter	Units	Filtered	Location	Sample	Date	Purpose	Result	LQ	VQ
DHE	Dehalococcoides	cells/ml	Y	46WW01	46WW01-FEB2007	2/19/07	REG	52	U	U
DHE	Dehalococcoides	cells/ml	Y	46WW02	46WW02-FEB2007	2/20/07	REG	8000		
DHE	Dehalococcoides	cells/ml	Y	46WW04	46WW04-FEB2007	2/19/07	REG	10	U	U
DHE	Dehalococcoides	cells/ml	Y	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	17	U	U
DHE	Dehalococcoides	cells/ml	Y	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	30		
DHE	Dehalococcoides	cells/ml	Y	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	10	U	U
DHE	Dehalococcoides	cells/ml	Y	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	15		
FIELD TESTS	Dissolved Oxygen	mg/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	1.87		
FIELD TESTS	Dissolved Oxygen	mg/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.97		
FIELD TESTS	Dissolved Oxygen	mg/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.56		
FIELD TESTS	Dissolved Oxygen	mg/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	3.49		
FIELD TESTS	Dissolved Oxygen	mg/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.78		
FIELD TESTS	Dissolved Oxygen	mg/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	3.22		
FIELD TESTS	Dissolved Oxygen	mg/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.44		
FIELD TESTS	Ferrous iron	mg/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.02		
FIELD TESTS	Ferrous iron	mg/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	1.34		
FIELD TESTS	Ferrous iron	mg/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	1.86		
FIELD TESTS	Ferrous iron	mg/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.21		
FIELD TESTS	Ferrous iron	mg/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0		
FIELD TESTS	Ferrous iron	mg/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	3.3		
FIELD TESTS	Ferrous iron	mg/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	2.49		
FIELD TESTS	Oxygen Reduction Potential	mV	N	46WW01	46WW01-FEB2007	2/19/07	REG	371.4		
FIELD TESTS	Oxygen Reduction Potential	mV	N	46WW02	46WW02-FEB2007	2/20/07	REG	277.4		
FIELD TESTS	Oxygen Reduction Potential	mV	N	46WW04	46WW04-FEB2007	2/19/07	REG	191.4		
FIELD TESTS	Oxygen Reduction Potential	mV	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	342.8		
FIELD TESTS	Oxygen Reduction Potential	mV	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	310.7		
FIELD TESTS	Oxygen Reduction Potential	mV	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	57.8		
FIELD TESTS	Oxygen Reduction Potential	mV	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	57.7		
FIELD TESTS	pH	STD UNIT	N	46WW01	46WW01-FEB2007	2/19/07	REG	5.27		
FIELD TESTS	pH	STD UNIT	N	46WW02	46WW02-FEB2007	2/20/07	REG	4.59		
FIELD TESTS	pH	STD UNIT	N	46WW04	46WW04-FEB2007	2/19/07	REG	6.2		
FIELD TESTS	pH	STD UNIT	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	6.02		
FIELD TESTS	pH	STD UNIT	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	6.41		

Table 3-2
VOC and Natural Attenuation Parameters at LHAAP-46
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Test Group	Parameter	Units	Filtered	Location	Sample	Date	Purpose	Result	LQ	VQ
FIELD TESTS	pH	STD UNIT	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	5.84		
FIELD TESTS	pH	STD UNIT	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	5.67		
FIELD TESTS	Salinity	mg/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.06		
FIELD TESTS	Salinity	mg/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.37		
FIELD TESTS	Salinity	mg/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	2.77		
FIELD TESTS	Salinity	mg/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	1.96		
FIELD TESTS	Salinity	mg/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.75		
FIELD TESTS	Salinity	mg/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	4.84		
FIELD TESTS	Salinity	mg/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	2.95		
FIELD TESTS	Specific Conductivity	uS/cm	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.138		
FIELD TESTS	Specific Conductivity	uS/cm	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.75		
FIELD TESTS	Specific Conductivity	uS/cm	N	46WW04	46WW04-FEB2007	2/19/07	REG	5.105		
FIELD TESTS	Specific Conductivity	uS/cm	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	2.98		
FIELD TESTS	Specific Conductivity	uS/cm	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	1.485		
FIELD TESTS	Specific Conductivity	uS/cm	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	8.643		
FIELD TESTS	Specific Conductivity	uS/cm	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	5.427		
FIELD TESTS	Temperature	Deg C	N	46WW01	46WW01-FEB2007	2/19/07	REG	19.3		
FIELD TESTS	Temperature	Deg C	N	46WW02	46WW02-FEB2007	2/20/07	REG	19.29		
FIELD TESTS	Temperature	Deg C	N	46WW04	46WW04-FEB2007	2/19/07	REG	19.18		
FIELD TESTS	Temperature	Deg C	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	19.57		
FIELD TESTS	Temperature	Deg C	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	19.72		
FIELD TESTS	Temperature	Deg C	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	19.33		
FIELD TESTS	Temperature	Deg C	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	19.75		
FIELD TESTS	Turbidity	NTU	N	46WW01	46WW01-FEB2007	2/19/07	REG	15		
FIELD TESTS	Turbidity	NTU	N	46WW02	46WW02-FEB2007	2/20/07	REG	2.6		
FIELD TESTS	Turbidity	NTU	N	46WW04	46WW04-FEB2007	2/19/07	REG	11.1		
FIELD TESTS	Turbidity	NTU	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	20.1		
FIELD TESTS	Turbidity	NTU	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	7.9		
FIELD TESTS	Turbidity	NTU	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	301.2		
FIELD TESTS	Turbidity	NTU	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	12.6		
GASES	Ethane	mg/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.0006	U	U
GASES	Ethane	mg/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.0006	U	U
GASES	Ethane	mg/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.0006	U	U

Table 3-2
VOC and Natural Attenuation Parameters at LHAAP-46
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Test Group	Parameter	Units	Filtered	Location	Sample	Date	Purpose	Result	LQ	VQ
GASES	Ethane	mg/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.0006	U	U
GASES	Ethane	mg/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.0006	U	U
GASES	Ethane	mg/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.0006	U	U
GASES	Ethane	mg/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.0006	U	U
GASES	Ethylene	mg/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.0008	U	U
GASES	Ethylene	mg/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.0008	U	U
GASES	Ethylene	mg/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.0008	U	U
GASES	Ethylene	mg/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.0008	U	U
GASES	Ethylene	mg/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.0008	U	U
GASES	Ethylene	mg/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.0008	U	U
GASES	Ethylene	mg/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.0008	U	U
GASES	Methane	mg/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.00052		
GASES	Methane	mg/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.00042	J	J
GASES	Methane	mg/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.00127		
GASES	Methane	mg/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.0003	U	U
GASES	Methane	mg/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.0003	U	U
GASES	Methane	mg/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.00256		
GASES	Methane	mg/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.00965		
GEN CHEMISTRY	Carbon Dioxide	mg/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	96		
GEN CHEMISTRY	Carbon Dioxide	mg/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	175		
GEN CHEMISTRY	Carbon Dioxide	mg/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	280		
GEN CHEMISTRY	Carbon Dioxide	mg/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	100		
GEN CHEMISTRY	Carbon Dioxide	mg/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	110		
GEN CHEMISTRY	Carbon Dioxide	mg/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	1380		
GEN CHEMISTRY	Carbon Dioxide	mg/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	840		
GEN CHEMISTRY	Chloride	mg/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	2.6		
GEN CHEMISTRY	Chloride	mg/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	30		
GEN CHEMISTRY	Chloride	mg/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	782		
GEN CHEMISTRY	Chloride	mg/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	410		
GEN CHEMISTRY	Chloride	mg/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	161		
GEN CHEMISTRY	Chloride	mg/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	1530		
GEN CHEMISTRY	Chloride	mg/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	1180		
GEN CHEMISTRY	Nitrate	mg/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.005	U	U

Table 3-2
VOC and Natural Attenuation Parameters at LHAAP-46
February 2007

Test Group	Parameter	Units	Filtered	Location	Sample	Date	Purpose	Result	LQ	VQ
GEN CHEMISTRY	Nitrate	mg/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.19		
GEN CHEMISTRY	Nitrate	mg/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.005	U	U
GEN CHEMISTRY	Nitrate	mg/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.19		
GEN CHEMISTRY	Nitrate	mg/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.005	U	U
GEN CHEMISTRY	Nitrate	mg/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.35		
GEN CHEMISTRY	Nitrate	mg/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.1	U	U
GEN CHEMISTRY	Nitrate / Nitrite	mg/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.05		
GEN CHEMISTRY	Nitrate / Nitrite	mg/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.2		
GEN CHEMISTRY	Nitrate / Nitrite	mg/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.02	B	J
GEN CHEMISTRY	Nitrate / Nitrite	mg/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.2		
GEN CHEMISTRY	Nitrate / Nitrite	mg/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.01	B	J
GEN CHEMISTRY	Nitrate / Nitrite	mg/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.4		
GEN CHEMISTRY	Nitrate / Nitrite	mg/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.005	U	U
GEN CHEMISTRY	Nitrite	mg/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.02	B	J
GEN CHEMISTRY	Nitrite	mg/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.01	B	J
GEN CHEMISTRY	Nitrite	mg/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.02	B	J
GEN CHEMISTRY	Nitrite	mg/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.01	B	J
GEN CHEMISTRY	Nitrite	mg/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.01	B	J
GEN CHEMISTRY	Nitrite	mg/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.05		
GEN CHEMISTRY	Nitrite	mg/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.02	B	J
GEN CHEMISTRY	Perchlorate	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	4	U	U
GEN CHEMISTRY	Perchlorate	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	4	U	U
GEN CHEMISTRY	Perchlorate	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	4	U	U
GEN CHEMISTRY	Perchlorate	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	4	U	U
GEN CHEMISTRY	Perchlorate	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	4	U	U
GEN CHEMISTRY	Perchlorate	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	4	U	U
GEN CHEMISTRY	Perchlorate	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	4	U	U
GEN CHEMISTRY	pH, lab	STD UNIT	N	46WW01	46WW01-FEB2007	2/19/07	REG	5.9		
GEN CHEMISTRY	pH, lab	STD UNIT	N	46WW02	46WW02-FEB2007	2/20/07	REG	4.9		
GEN CHEMISTRY	pH, lab	STD UNIT	N	46WW04	46WW04-FEB2007	2/19/07	REG	6.4		
GEN CHEMISTRY	pH, lab	STD UNIT	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	6.5		
GEN CHEMISTRY	pH, lab	STD UNIT	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	6.4		
GEN CHEMISTRY	pH, lab	STD UNIT	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	5.5		

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Test Group	Parameter	Units	Filtered	Location	Sample	Date	Purpose	Result	LQ	VQ
GEN CHEMISTRY	pH, lab	STD UNIT	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	5.7		
GEN CHEMISTRY	Specific Conductivity, lab	uS/cm	N	46WW01	46WW01-FEB2007	2/19/07	REG	113		
GEN CHEMISTRY	Specific Conductivity, lab	uS/cm	N	46WW02	46WW02-FEB2007	2/20/07	REG	558		
GEN CHEMISTRY	Specific Conductivity, lab	uS/cm	N	46WW04	46WW04-FEB2007	2/19/07	REG	4230		
GEN CHEMISTRY	Specific Conductivity, lab	uS/cm	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	3300		
GEN CHEMISTRY	Specific Conductivity, lab	uS/cm	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	1360		
GEN CHEMISTRY	Specific Conductivity, lab	uS/cm	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	7580		
GEN CHEMISTRY	Specific Conductivity, lab	uS/cm	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	5040		
GEN CHEMISTRY	Sulfate	mg/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	48		
GEN CHEMISTRY	Sulfate	mg/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	238		
GEN CHEMISTRY	Sulfate	mg/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	1110		
GEN CHEMISTRY	Sulfate	mg/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	1260		
GEN CHEMISTRY	Sulfate	mg/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	309		
GEN CHEMISTRY	Sulfate	mg/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	3020		
GEN CHEMISTRY	Sulfate	mg/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	902		
GEN CHEMISTRY	Sulfide	mg/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.2	U	U
GEN CHEMISTRY	Sulfide	mg/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.2	U	U
GEN CHEMISTRY	Sulfide	mg/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.2	U	U
GEN CHEMISTRY	Sulfide	mg/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.2	U	U
GEN CHEMISTRY	Sulfide	mg/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.2	U	U
GEN CHEMISTRY	Sulfide	mg/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.2	U	U
GEN CHEMISTRY	Sulfide	mg/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.2	U	U
GEN CHEMISTRY	Total Alkalinity	mg/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	38		
GEN CHEMISTRY	Total Alkalinity	mg/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	7		
GEN CHEMISTRY	Total Alkalinity	mg/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	356		
GEN CHEMISTRY	Total Alkalinity	mg/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	158		
GEN CHEMISTRY	Total Alkalinity	mg/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	138		
GEN CHEMISTRY	Total Alkalinity	mg/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	218		
GEN CHEMISTRY	Total Alkalinity	mg/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	211		
GEN CHEMISTRY	Total Organic Carbon	mg/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	3		
GEN CHEMISTRY	Total Organic Carbon	mg/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	9		
GEN CHEMISTRY	Total Organic Carbon	mg/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	3		
GEN CHEMISTRY	Total Organic Carbon	mg/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	18		

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Test Group	Parameter	Units	Filtered	Location	Sample	Date	Purpose	Result	LQ	VQ
GEN CHEMISTRY	Total Organic Carbon	mg/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	5		
GEN CHEMISTRY	Total Organic Carbon	mg/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	13		
GEN CHEMISTRY	Total Organic Carbon	mg/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	8		
VOLATILES	1,1,1-Trichloroethane	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.37	U	U
VOLATILES	1,1,1-Trichloroethane	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.37	U	U
VOLATILES	1,1,1-Trichloroethane	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.37	U	U
VOLATILES	1,1,1-Trichloroethane	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.37	U	U
VOLATILES	1,1,1-Trichloroethane	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.37	U	U
VOLATILES	1,1,1-Trichloroethane	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.37	U	U
VOLATILES	1,1,1-Trichloroethane	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.37	U	U
VOLATILES	1,1,2,2-Tetrachloroethane	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.46	U	U
VOLATILES	1,1,2,2-Tetrachloroethane	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.46	U	U
VOLATILES	1,1,2,2-Tetrachloroethane	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.46	U	U
VOLATILES	1,1,2,2-Tetrachloroethane	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.46	U	U
VOLATILES	1,1,2,2-Tetrachloroethane	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.46	U	U
VOLATILES	1,1,2,2-Tetrachloroethane	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.46	U	U
VOLATILES	1,1,2,2-Tetrachloroethane	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.46	U	U
VOLATILES	1,1,2-Trichloroethane	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.66	U	U
VOLATILES	1,1,2-Trichloroethane	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.66	U	U
VOLATILES	1,1,2-Trichloroethane	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.66	U	U
VOLATILES	1,1,2-Trichloroethane	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.66	U	U
VOLATILES	1,1,2-Trichloroethane	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.66	U	U
VOLATILES	1,1,2-Trichloroethane	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.66	U	U
VOLATILES	1,1,2-Trichloroethane	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.66	U	U
VOLATILES	1,1-Dichloroethane	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.52	U	U
VOLATILES	1,1-Dichloroethane	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.52	U	U
VOLATILES	1,1-Dichloroethane	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.52	U	U
VOLATILES	1,1-Dichloroethane	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.52	U	U
VOLATILES	1,1-Dichloroethane	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.52	U	U
VOLATILES	1,1-Dichloroethane	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.52	U	U
VOLATILES	1,1-Dichloroethane	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.52	U	U
VOLATILES	1,1-Dichloroethene	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.68	U	U
VOLATILES	1,1-Dichloroethene	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	1.3	J	J

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Test Group	Parameter	Units	Filtered	Location	Sample	Date	Purpose	Result	LQ	VQ
VOLATILES	1,1-Dichloroethene	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.68	U	U
VOLATILES	1,1-Dichloroethene	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.68	U	U
VOLATILES	1,1-Dichloroethene	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.68	U	U
VOLATILES	1,1-Dichloroethene	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.68	U	U
VOLATILES	1,1-Dichloroethene	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.68	U	U
VOLATILES	1,2-Dichloroethane	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.53	U	U
VOLATILES	1,2-Dichloroethane	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.53	U	U
VOLATILES	1,2-Dichloroethane	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.53	U	U
VOLATILES	1,2-Dichloroethane	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.53	U	U
VOLATILES	1,2-Dichloroethane	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.53	U	U
VOLATILES	1,2-Dichloroethane	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.53	U	U
VOLATILES	1,2-Dichloroethane	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.53	U	U
VOLATILES	1,2-Dichloropropane	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.59	U	U
VOLATILES	1,2-Dichloropropane	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.59	U	U
VOLATILES	1,2-Dichloropropane	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.59	U	U
VOLATILES	1,2-Dichloropropane	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.59	U	U
VOLATILES	1,2-Dichloropropane	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.59	U	U
VOLATILES	1,2-Dichloropropane	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.59	U	U
VOLATILES	1,2-Dichloropropane	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.59	U	U
VOLATILES	2-Butanone	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	3	U	U
VOLATILES	2-Butanone	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	3	U	U
VOLATILES	2-Butanone	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	3	U	U
VOLATILES	2-Butanone	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	3	U	U
VOLATILES	2-Butanone	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	3	U	U
VOLATILES	2-Butanone	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	3	U	U
VOLATILES	2-Butanone	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	3	U	U
VOLATILES	2-Hexanone	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	1.9	U	U
VOLATILES	2-Hexanone	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	1.9	U	U
VOLATILES	2-Hexanone	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	1.9	U	U
VOLATILES	2-Hexanone	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	1.9	U	U
VOLATILES	2-Hexanone	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	1.9	U	U
VOLATILES	2-Hexanone	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	1.9	U	U
VOLATILES	2-Hexanone	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	1.9	U	U

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VOC and Natural Attenuation Parameters at LHAAP-46
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Test Group	Parameter	Units	Filtered	Location	Sample	Date	Purpose	Result	LQ	VQ
VOLATILES	Acetone	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	2.8	U	U
VOLATILES	Acetone	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	2.8	U	U
VOLATILES	Acetone	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	2.8	U	U
VOLATILES	Acetone	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	2.8	U	U
VOLATILES	Acetone	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	2.8	U	U
VOLATILES	Acetone	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	4.3	J	J
VOLATILES	Acetone	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	2.8	U	U
VOLATILES	Benzene	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.23	U	U
VOLATILES	Benzene	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.23	U	U
VOLATILES	Benzene	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.23	U	U
VOLATILES	Benzene	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.23	U	U
VOLATILES	Benzene	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.23	U	U
VOLATILES	Benzene	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.23	U	U
VOLATILES	Benzene	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.23	U	U
VOLATILES	Bromodichloromethane	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.33	U	U
VOLATILES	Bromodichloromethane	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.33	U	U
VOLATILES	Bromodichloromethane	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.33	U	U
VOLATILES	Bromodichloromethane	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.33	U	U
VOLATILES	Bromodichloromethane	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.33	U	U
VOLATILES	Bromodichloromethane	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.33	U	U
VOLATILES	Bromodichloromethane	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.33	U	U
VOLATILES	Bromoform	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.65	U	U
VOLATILES	Bromoform	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.65	U	U
VOLATILES	Bromoform	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.65	U	U
VOLATILES	Bromoform	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.65	U	U
VOLATILES	Bromoform	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.65	U	U
VOLATILES	Bromoform	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.65	U	U
VOLATILES	Bromoform	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.65	U	U
VOLATILES	Bromomethane	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.47	U	U
VOLATILES	Bromomethane	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.47	U	U
VOLATILES	Bromomethane	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.47	U	U
VOLATILES	Bromomethane	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.47	U	U
VOLATILES	Bromomethane	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.47	U	U

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VOC and Natural Attenuation Parameters at LHAAP-46
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Test Group	Parameter	Units	Filtered	Location	Sample	Date	Purpose	Result	LQ	VQ
VOLATILES	Bromomethane	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.47	U	U
VOLATILES	Bromomethane	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.47	U	U
VOLATILES	Carbon disulfide	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.62	U	U
VOLATILES	Carbon disulfide	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.62	U	U
VOLATILES	Carbon disulfide	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.62	U	U
VOLATILES	Carbon disulfide	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.62	U	U
VOLATILES	Carbon disulfide	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.62	U	U
VOLATILES	Carbon disulfide	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.62	U	U
VOLATILES	Carbon disulfide	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.62	U	U
VOLATILES	Carbon tetrachloride	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.52	U	U
VOLATILES	Carbon tetrachloride	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.52	U	U
VOLATILES	Carbon tetrachloride	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.52	U	U
VOLATILES	Carbon tetrachloride	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.52	U	U
VOLATILES	Carbon tetrachloride	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.52	U	U
VOLATILES	Carbon tetrachloride	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.52	U	U
VOLATILES	Carbon tetrachloride	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.52	U	U
VOLATILES	Chlorobenzene	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.54	U	U
VOLATILES	Chlorobenzene	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.54	U	U
VOLATILES	Chlorobenzene	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.54	U	U
VOLATILES	Chlorobenzene	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.54	U	U
VOLATILES	Chlorobenzene	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.54	U	U
VOLATILES	Chlorobenzene	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.54	U	U
VOLATILES	Chlorobenzene	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.54	U	U
VOLATILES	Chloroethane	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.46	U	U
VOLATILES	Chloroethane	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.46	U	U
VOLATILES	Chloroethane	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.46	U	U
VOLATILES	Chloroethane	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.46	U	U
VOLATILES	Chloroethane	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.46	U	U
VOLATILES	Chloroethane	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.46	U	U
VOLATILES	Chloroethane	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.46	U	U
VOLATILES	Chloroform	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.66	U	U
VOLATILES	Chloroform	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.66	U	U
VOLATILES	Chloroform	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.66	U	U

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VOC and Natural Attenuation Parameters at LHAAP-46
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Test Group	Parameter	Units	Filtered	Location	Sample	Date	Purpose	Result	LQ	VQ
VOLATILES	Chloroform	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.66	U	U
VOLATILES	Chloroform	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.66	U	U
VOLATILES	Chloroform	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.66	U	U
VOLATILES	Chloroform	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.66	U	U
VOLATILES	Chloromethane	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.6	U	U
VOLATILES	Chloromethane	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.6	U	U
VOLATILES	Chloromethane	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.6	U	U
VOLATILES	Chloromethane	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.6	U	U
VOLATILES	Chloromethane	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.6	U	U
VOLATILES	Chloromethane	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.6	U	U
VOLATILES	Chloromethane	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.6	U	U
VOLATILES	cis-1,2-Dichloroethene	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.83	U	U
VOLATILES	cis-1,2-Dichloroethene	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	1.4	J	J
VOLATILES	cis-1,2-Dichloroethene	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.83	U	U
VOLATILES	cis-1,2-Dichloroethene	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	1.5	J	J
VOLATILES	cis-1,2-Dichloroethene	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.83	U	U
VOLATILES	cis-1,2-Dichloroethene	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.83	U	U
VOLATILES	cis-1,2-Dichloroethene	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.83	U	U
VOLATILES	cis-1,3-Dichloropropene	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.59	U	U
VOLATILES	cis-1,3-Dichloropropene	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.59	U	U
VOLATILES	cis-1,3-Dichloropropene	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.59	U	U
VOLATILES	cis-1,3-Dichloropropene	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.59	U	U
VOLATILES	cis-1,3-Dichloropropene	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.59	U	U
VOLATILES	cis-1,3-Dichloropropene	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.59	U	U
VOLATILES	cis-1,3-Dichloropropene	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.59	U	U
VOLATILES	Dibromochloromethane	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.68	U	U
VOLATILES	Dibromochloromethane	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.68	U	U
VOLATILES	Dibromochloromethane	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.68	U	U
VOLATILES	Dibromochloromethane	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.68	U	U
VOLATILES	Dibromochloromethane	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.68	U	U
VOLATILES	Dibromochloromethane	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.68	U	U
VOLATILES	Dibromochloromethane	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.68	U	U
VOLATILES	Ethylbenzene	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.48	U	U

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Test Group	Parameter	Units	Filtered	Location	Sample	Date	Purpose	Result	LQ	VQ
VOLATILES	Ethylbenzene	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.48	U	U
VOLATILES	Ethylbenzene	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.48	U	U
VOLATILES	Ethylbenzene	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.48	U	U
VOLATILES	Ethylbenzene	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.48	U	U
VOLATILES	Ethylbenzene	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.48	U	U
VOLATILES	Ethylbenzene	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.48	U	U
VOLATILES	Methyl isobutyl ketone	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	7.3	U	U
VOLATILES	Methyl isobutyl ketone	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	7.3	U	U
VOLATILES	Methyl isobutyl ketone	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	7.3	U	U
VOLATILES	Methyl isobutyl ketone	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	7.3	U	U
VOLATILES	Methyl isobutyl ketone	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	7.3	U	U
VOLATILES	Methyl isobutyl ketone	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	7.3	U	U
VOLATILES	Methyl isobutyl ketone	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	7.3	U	U
VOLATILES	Methylene chloride	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.67	U	U
VOLATILES	Methylene chloride	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.67	U	U
VOLATILES	Methylene chloride	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.67	U	U
VOLATILES	Methylene chloride	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.67	U	U
VOLATILES	Methylene chloride	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.67	U	U
VOLATILES	Methylene chloride	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.67	U	U
VOLATILES	Methylene chloride	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.67	U	U
VOLATILES	Styrene	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.5	U	U
VOLATILES	Styrene	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.5	U	U
VOLATILES	Styrene	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.5	U	U
VOLATILES	Styrene	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.5	U	UJL
VOLATILES	Styrene	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.5	U	U
VOLATILES	Styrene	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.5	U	U
VOLATILES	Styrene	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.5	U	U
VOLATILES	Tetrachloroethene	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.74	U	U
VOLATILES	Tetrachloroethene	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.74	U	U
VOLATILES	Tetrachloroethene	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.74	U	U
VOLATILES	Tetrachloroethene	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.74	U	U
VOLATILES	Tetrachloroethene	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.74	U	U
VOLATILES	Tetrachloroethene	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.74	U	U

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Test Group	Parameter	Units	Filtered	Location	Sample	Date	Purpose	Result	LQ	VQ
VOLATILES	Tetrachloroethene	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.74	U	U
VOLATILES	Toluene	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.54	U	U
VOLATILES	Toluene	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.54	U	U
VOLATILES	Toluene	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.54	U	U
VOLATILES	Toluene	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.54	U	U
VOLATILES	Toluene	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.54	U	U
VOLATILES	Toluene	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.54	U	U
VOLATILES	Toluene	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.54	U	U
VOLATILES	trans-1,2-Dichloroethene	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.75	U	U
VOLATILES	trans-1,2-Dichloroethene	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.75	U	U
VOLATILES	trans-1,2-Dichloroethene	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.75	U	U
VOLATILES	trans-1,2-Dichloroethene	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.75	U	U
VOLATILES	trans-1,2-Dichloroethene	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.75	U	U
VOLATILES	trans-1,2-Dichloroethene	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.75	U	U
VOLATILES	trans-1,2-Dichloroethene	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.75	U	U
VOLATILES	trans-1,3-Dichloropropene	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.61	U	U
VOLATILES	trans-1,3-Dichloropropene	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.61	U	U
VOLATILES	trans-1,3-Dichloropropene	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.61	U	U
VOLATILES	trans-1,3-Dichloropropene	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.61	U	U
VOLATILES	trans-1,3-Dichloropropene	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.61	U	U
VOLATILES	trans-1,3-Dichloropropene	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.61	U	U
VOLATILES	trans-1,3-Dichloropropene	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.61	U	U
VOLATILES	Trichloroethene	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.63	U	U
VOLATILES	Trichloroethene	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	28.9		
VOLATILES	Trichloroethene	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.63	U	U
VOLATILES	Trichloroethene	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	4.8		
VOLATILES	Trichloroethene	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	85.5		
VOLATILES	Trichloroethene	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.63	U	U
VOLATILES	Trichloroethene	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	1.4	J	J
VOLATILES	Vinyl chloride	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	0.32	U	U
VOLATILES	Vinyl chloride	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	0.32	U	U
VOLATILES	Vinyl chloride	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	0.32	U	U
VOLATILES	Vinyl chloride	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.32	U	U

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Test Group	Parameter	Units	Filtered	Location	Sample	Date	Purpose	Result	LQ	VQ
VOLATILES	Vinyl chloride	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.32	U	U
VOLATILES	Vinyl chloride	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.32	U	U
VOLATILES	Vinyl chloride	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.32	U	U
VOLATILES	Xylenes, Total	ug/L	N	46WW01	46WW01-FEB2007	2/19/07	REG	1.1	U	U
VOLATILES	Xylenes, Total	ug/L	N	46WW02	46WW02-FEB2007	2/20/07	REG	1.1	U	U
VOLATILES	Xylenes, Total	ug/L	N	46WW04	46WW04-FEB2007	2/19/07	REG	1.1	U	U
VOLATILES	Xylenes, Total	ug/L	N	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	1.1	U	U
VOLATILES	Xylenes, Total	ug/L	N	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	1.1	U	U
VOLATILES	Xylenes, Total	ug/L	N	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	1.1	U	U
VOLATILES	Xylenes, Total	ug/L	N	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	1.1	U	U

Notes:

B - parameter was also detected in the associated blank

cells/ml - cells per milliliter

Deg C - degrees Celsius

J - result is an estimated concentration

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

LQ - laboratory data qualifier

mg/L - milligrams per liter

mV - milliVolts

NTU - Nephelometric Turbidity Units

U - parameter was not detected, with the detection limit shown as the result

ug/L - micrograms per liter

umhos - micromhos

uS/cm - microseconds per centimeter

VQ - validation data qualifier

Table 3-3
LHAAP-46 Historical Concentrations of MNA Compounds

Parameter	Location	Sample	Date	Purpose	Result µg/L	LQ	VQ
cis-1,2-Dichloroethene	46WW01	46WW01-981001	10/1/98	REG	1.2		
cis-1,2-Dichloroethene	46WW01	46WW01-981107	11/7/98	REG	1	<	U
cis-1,2-Dichloroethene	46WW01	46WW01-981107FD	11/7/98	FD	1	<	U
cis-1,2-Dichloroethene	46WW01	46WW01-FEB2007	2/19/07	REG	0.83	U	U
cis-1,2-Dichloroethene	46WW02	46WW02-981106	11/6/98	REG	1		
cis-1,2-Dichloroethene	46WW02	46WW02-FEB2007	2/20/07	REG	1.4	J	J
cis-1,2-Dichloroethene	46WW02	46WW02-102808	10/28/08	REG	1.45		
cis-1,2-Dichloroethene	46WW03	46WW03-981106	11/6/98	REG	1	<	U
cis-1,2-Dichloroethene	46WW04	46WW04-981107	11/7/98	REG	1	<	U
cis-1,2-Dichloroethene	46WW04	46WW04-FEB2007	2/19/07	REG	0.83	U	U
cis-1,2-Dichloroethene	46WW05	46WW05-100908	10/9/08	REG	1.72		
cis-1,2-Dichloroethene	46WW06	46WW06-100908	10/9/08	REG	0.25	U	U
cis-1,2-Dichloroethene	LHSMW08	LHSMW08-960813FD	8/13/96	FD	0.2	<	U
cis-1,2-Dichloroethene	LHSMW08	LHSMW08-960813	8/13/96	REG	0.2	<	U
cis-1,2-Dichloroethene	LHSMW08	LHSMW08-980513	5/13/98	REG	1	<	U
cis-1,2-Dichloroethene	LHSMW12	LHSMW12-960813	8/13/96	REG	0.2	<	U
cis-1,2-Dichloroethene	LHSMW12	LHSMW12-980514	5/14/98	REG	1	<	U
cis-1,2-Dichloroethene	LHSMW13	LHSMW13-960206	2/6/96	REG	1	U	U
cis-1,2-Dichloroethene	LHSMW13	LHSMW13-960815	8/15/96	REG	0.2	<	U
cis-1,2-Dichloroethene	LHSMW13	LHSMW13-980514	5/14/98	REG	1	<	U
cis-1,2-Dichloroethene	LHSMW14	LHSMW14-960206	2/6/96	REG	1	U	U
cis-1,2-Dichloroethene	LHSMW14	LHSMW14-960814	8/14/96	REG	0.2	<	U
cis-1,2-Dichloroethene	LHSMW14	LHSMW14-960814FD	8/14/96	FD	0.2	<	U
cis-1,2-Dichloroethene	LHSMW14	LHSMW14-980514	5/14/98	REG	1	<	U
cis-1,2-Dichloroethene	LHSMW15	LHSMW15-960206	2/6/96	REG	1	U	U
cis-1,2-Dichloroethene	LHSMW15	LHSMW15-960815	8/15/96	REG	0.2	<	U
cis-1,2-Dichloroethene	LHSMW15	LHSMW15-980514	5/14/98	REG	1	<	U
cis-1,2-Dichloroethene	LHSMW15	LHSMW15-102708	10/27/08	REG	0.25	U	U
cis-1,2-Dichloroethene	LHSMW16	LHSMW16-960206	2/6/96	REG	1	U	U
cis-1,2-Dichloroethene	LHSMW16	LHSMW16-960815	8/15/96	REG	0.2	<	U
cis-1,2-Dichloroethene	LHSMW16	LHSMW16-980514	5/14/98	REG	1	<	U
cis-1,2-Dichloroethene	LHSMW17	LHSMW17-960212	2/12/96	REG	1	U	U
cis-1,2-Dichloroethene	LHSMW17	LHSMW17-960815	8/15/96	REG	0.2	<	U
cis-1,2-Dichloroethene	LHSMW17	LHSMW17-980514	5/14/98	REG	1	<	U
cis-1,2-Dichloroethene	LHSMW17	LHSMW17-000524	5/24/00	REG	1	<	U
cis-1,2-Dichloroethene	LHSMW17	LHSMW17-000524FD	5/24/00	FD	100		J
cis-1,2-Dichloroethene	LHSMW17	LHSMW17-001002FD	10/2/00	FD	0.043	<	U
cis-1,2-Dichloroethene	LHSMW17	LHSMW17-001003	10/3/00	REG	0.043	<	U
cis-1,2-Dichloroethene	LHSMW18	LHSMW18-960212	2/12/96	REG	4.5		
cis-1,2-Dichloroethene	LHSMW18	LHSMW18-960815	8/15/96	REG	6.1		
cis-1,2-Dichloroethene	LHSMW18	LHSMW18-980514	5/14/98	REG	9.8		
cis-1,2-Dichloroethene	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	1.5	J	J
cis-1,2-Dichloroethene	LHSMW19	LHSMW19-960206	2/6/96	REG	3	U	U
cis-1,2-Dichloroethene	LHSMW19	LHSMW19-960815	8/15/96	REG	0.2	<	U
cis-1,2-Dichloroethene	LHSMW19	LHSMW19-980515	5/15/98	REG	1	<	U
cis-1,2-Dichloroethene	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.83	U	U
cis-1,2-Dichloroethene	LHSMW20	LHSMW20-960207	2/7/96	REG	1	U	U

Table 3-3
LHAAP-46 Historical Concentrations of MNA Compounds

Parameter	Location	Sample	Date	Purpose	Result µg/L	LQ	VQ
cis-1,2-Dichloroethene	LHSMW20	LHSMW20-960815	8/15/96	REG	0.2	<	U
cis-1,2-Dichloroethene	LHSMW20	LHSMW20-980515	5/15/98	REG	1	<	U
cis-1,2-Dichloroethene	LHSMW20	LHSMW20-102708	10/27/08	REG	0.25	U	U
cis-1,2-Dichloroethene	LHSMW21	LHSMW21-960207	2/7/96	REG	1	U	U
cis-1,2-Dichloroethene	LHSMW21	LHSMW21-960815	8/15/96	REG	0.2	<	U
cis-1,2-Dichloroethene	LHSMW21	LHSMW21-980515	5/15/98	REG	1	<	U
cis-1,2-Dichloroethene	LHSMW22	LHSMW22-960207	2/7/96	REG	1	U	U
cis-1,2-Dichloroethene	LHSMW22	LHSMW22-960815	8/15/96	REG	0.54		
cis-1,2-Dichloroethene	LHSMW22	LHSMW22-980515	5/15/98	REG	1.1		
cis-1,2-Dichloroethene	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.83	U	U
cis-1,2-Dichloroethene	LHSMW23	LHSMW23-960206	2/6/96	REG	1	U	U
cis-1,2-Dichloroethene	LHSMW23	LHSMW23-960815	8/15/96	REG	0.2	<	U
cis-1,2-Dichloroethene	LHSMW23	LHSMW23-980515	5/15/98	REG	1	<	U
cis-1,2-Dichloroethene	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.83	U	U
cis-1,2-Dichloroethene	LHSMW23	LHSMW23-102808	10/28/08	REG	0.614	J	J
cis-1,2-Dichloroethene	LHSMW24	LHSMW24-960207	2/7/96	REG	1	U	U
cis-1,2-Dichloroethene	LHSMW24	LHSMW24-960820	8/20/96	REG	0.2	<	U
cis-1,2-Dichloroethene	LHSMW24	LHSMW24-980515	5/15/98	REG	1	<	U
cis-1,2-Dichloroethene	LHSMW25	LHSMW25-960207	2/7/96	REG	1	U	U
cis-1,2-Dichloroethene	LHSMW25	LHSMW25-960820	8/20/96	REG	0.2	<	U
cis-1,2-Dichloroethene	LHSMW25	LHSMW25-980515	5/15/98	REG	1	<	U
cis-1,2-Dichloroethene	LHSMW25	LHSMW25-102808	10/28/08	REG	0.25	U	U
cis-1,2-Dichloroethene	LHSMW25	LHSMW25-102808-QA	10/28/08	FD	0.25	U	U
cis-1,2-Dichloroethene	LHSMW26	LHSMW26-960212	2/12/96	REG	1	U	U
cis-1,2-Dichloroethene	LHSMW26	LHSMW26-960820	8/20/96	REG	0.2	<	U
cis-1,2-Dichloroethene	LHSMW26	LHSMW26-960820FD	8/20/96	FD	0.2	<	U
cis-1,2-Dichloroethene	LHSMW26	LHSMW26-980515	5/15/98	REG	1	<	U
cis-1,2-Dichloroethene	LHSMW27	LHSMW27-960208	2/8/96	REG	1	U	U
cis-1,2-Dichloroethene	LHSMW27	LHSMW27-960820	8/20/96	REG	0.2	<	U
cis-1,2-Dichloroethene	LHSMW27	LHSMW27-980515	5/15/98	REG	1	<	U
Methylene chloride	46WW01	46WW01-981001	10/1/98	REG	1	<	U
Methylene chloride	46WW01	46WW01-981107	11/7/98	REG	1	<	U
Methylene chloride	46WW01	46WW01-981107FD	11/7/98	FD	1	<	U
Methylene chloride	46WW01	46WW01-FEB2007	2/19/07	REG	0.67	U	U
Methylene chloride	46WW02	46WW02-981106	11/6/98	REG	0.88		J
Methylene chloride	46WW02	46WW02-FEB2007	2/20/07	REG	0.67	U	U
Methylene chloride	46WW02	46WW02-102808	10/28/08	REG	0.25	U	U
Methylene chloride	46WW03	46WW03-981106	11/6/98	REG	1.4		
Methylene chloride	46WW04	46WW04-981107	11/7/98	REG	1	<	U
Methylene chloride	46WW04	46WW04-FEB2007	2/19/07	REG	0.67	U	U
Methylene chloride	46WW05	46WW05-100908	10/9/08	REG	0.25	U	U
Methylene chloride	46WW06	46WW06-100908	10/9/08	REG	0.25	U	U
Methylene chloride	LHSMW08	LHSMW08-941203	12/3/94	REG	5	<	U
Methylene chloride	LHSMW08	LHSMW08-960813FD	8/13/96	FD	0.22	<	U
Methylene chloride	LHSMW08	LHSMW08-960813	8/13/96	REG	0.22	<	U
Methylene chloride	LHSMW08	LHSMW08-980513	5/13/98	REG	1	<	U
Methylene chloride	LHSMW12	LHSMW12-941202	12/2/94	REG	5	<	U

Table 3-3
LHAAP-46 Historical Concentrations of MNA Compounds

Parameter	Location	Sample	Date	Purpose	Result µg/L	LQ	VQ
Methylene chloride	LHSMW12	LHSMW12-960813	8/13/96	REG	0.22	<	U
Methylene chloride	LHSMW12	LHSMW12-980514	5/14/98	REG	1	<	U
Methylene chloride	LHSMW13	LHSMW13-941202	12/2/94	REG	5	<	U
Methylene chloride	LHSMW13	LHSMW13-960206	2/6/96	REG	1	U	U
Methylene chloride	LHSMW13	LHSMW13-960815	8/15/96	REG	0.22	<	U
Methylene chloride	LHSMW13	LHSMW13-980514	5/14/98	REG	1	<	U
Methylene chloride	LHSMW14	LHSMW14-941129	11/29/94	REG	5	<	U
Methylene chloride	LHSMW14	LHSMW14-960206	2/6/96	REG	1	U	U
Methylene chloride	LHSMW14	LHSMW14-960814	8/14/96	REG	0.22	<	U
Methylene chloride	LHSMW14	LHSMW14-960814FD	8/14/96	FD	0.22	<	U
Methylene chloride	LHSMW14	LHSMW14-980514	5/14/98	REG	1	<	U
Methylene chloride	LHSMW15	LHSMW15-941203	12/3/94	REG	5	<	U
Methylene chloride	LHSMW15	LHSMW15-960206	2/6/96	REG	1	U	U
Methylene chloride	LHSMW15	LHSMW15-960815	8/15/96	REG	0.22	<	U
Methylene chloride	LHSMW15	LHSMW15-980514	5/14/98	REG	1	<	U
Methylene chloride	LHSMW15	LHSMW15-102708	10/27/08	REG	0.25	U	U
Methylene chloride	LHSMW16	LHSMW16-941129	11/29/94	REG	5	<	U
Methylene chloride	LHSMW16	LHSMW16-960206	2/6/96	REG	1	U	U
Methylene chloride	LHSMW16	LHSMW16-960815	8/15/96	REG	0.22	<	U
Methylene chloride	LHSMW16	LHSMW16-980514	5/14/98	REG	1	<	U
Methylene chloride	LHSMW17	LHSMW17-941202	12/2/94	REG	5	<	U
Methylene chloride	LHSMW17	LHSMW17-960212	2/12/96	REG	1	U	U
Methylene chloride	LHSMW17	LHSMW17-960815	8/15/96	REG	0.22	<	U
Methylene chloride	LHSMW17	LHSMW17-980514	5/14/98	REG	1	<	U
Methylene chloride	LHSMW17	LHSMW17-000524	5/24/00	REG	2	<	U
Methylene chloride	LHSMW17	LHSMW17-000524FD	5/24/00	FD	200	<	U
Methylene chloride	LHSMW17	LHSMW17-001002FD	10/2/00	FD	1		
Methylene chloride	LHSMW17	LHSMW17-001003	10/3/00	REG	0.9		
Methylene chloride	LHSMW18	LHSMW18-941202	12/2/94	REG	5	<	U
Methylene chloride	LHSMW18	LHSMW18-960212	2/12/96	REG	1	U	U
Methylene chloride	LHSMW18	LHSMW18-960815	8/15/96	REG	0.22	<	U
Methylene chloride	LHSMW18	LHSMW18-980514	5/14/98	REG	1	<	U
Methylene chloride	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.67	U	U
Methylene chloride	LHSMW19	LHSMW19-941202	12/2/94	REG	5	<	U
Methylene chloride	LHSMW19	LHSMW19-960206	2/6/96	REG	3	U	U
Methylene chloride	LHSMW19	LHSMW19-960815	8/15/96	REG	0.22	<	U
Methylene chloride	LHSMW19	LHSMW19-980515	5/15/98	REG	1	<	U
Methylene chloride	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.67	U	U
Methylene chloride	LHSMW20	LHSMW20-941204	12/4/94	REG	5	<	U
Methylene chloride	LHSMW20	LHSMW20-960207	2/7/96	REG	1	U	U
Methylene chloride	LHSMW20	LHSMW20-960815	8/15/96	REG	0.22	<	U
Methylene chloride	LHSMW20	LHSMW20-980515	5/15/98	REG	1	<	U
Methylene chloride	LHSMW20	LHSMW20-102708	10/27/08	REG	0.25	U	U
Methylene chloride	LHSMW21	LHSMW21-941204	12/4/94	REG	5	<	U
Methylene chloride	LHSMW21	LHSMW21-960207	2/7/96	REG	1	U	U
Methylene chloride	LHSMW21	LHSMW21-960815	8/15/96	REG	0.22	<	U
Methylene chloride	LHSMW21	LHSMW21-980515	5/15/98	REG	1	<	U

Table 3-3
LHAAP-46 Historical Concentrations of MNA Compounds

Parameter	Location	Sample	Date	Purpose	Result µg/L	LQ	VQ
Methylene chloride	LHSMW22	LHSMW22-941204	12/4/94	REG	5	<	U
Methylene chloride	LHSMW22	LHSMW22-960207	2/7/96	REG	1	U	U
Methylene chloride	LHSMW22	LHSMW22-960815	8/15/96	REG	0.22	<	U
Methylene chloride	LHSMW22	LHSMW22-980515	5/15/98	REG	1	<	U
Methylene chloride	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.67	U	U
Methylene chloride	LHSMW23	LHSMW23-941204	12/4/94	REG	5	<	U
Methylene chloride	LHSMW23	LHSMW23-941204FD	12/4/94	FD	5	<	U
Methylene chloride	LHSMW23	LHSMW23-960206	2/6/96	REG	1	U	U
Methylene chloride	LHSMW23	LHSMW23-960815	8/15/96	REG	0.22	<	U
Methylene chloride	LHSMW23	LHSMW23-980515	5/15/98	REG	1	<	U
Methylene chloride	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.67	U	U
Methylene chloride	LHSMW23	LHSMW23-102808	10/28/08	REG	0.25	U	U
Methylene chloride	LHSMW24	LHSMW24-941204	12/4/94	REG	5	<	U
Methylene chloride	LHSMW24	LHSMW24-960207	2/7/96	REG	1	U	U
Methylene chloride	LHSMW24	LHSMW24-960820	8/20/96	REG	0.22	<	U
Methylene chloride	LHSMW24	LHSMW24-980515	5/15/98	REG	1	<	U
Methylene chloride	LHSMW25	LHSMW25-941204	12/4/94	REG	5	<	U
Methylene chloride	LHSMW25	LHSMW25-960207	2/7/96	REG	1	U	U
Methylene chloride	LHSMW25	LHSMW25-960820	8/20/96	REG	0.22	<	U
Methylene chloride	LHSMW25	LHSMW25-980515	5/15/98	REG	1	<	U
Methylene chloride	LHSMW25	LHSMW25-102808	10/28/08	REG	0.25	U	U
Methylene chloride	LHSMW25	LHSMW25-102808-QA	10/28/08	FD	0.25	U	U
Methylene chloride	LHSMW26	LHSMW26-941204	12/4/94	REG	5	<	U
Methylene chloride	LHSMW26	LHSMW26-960212	2/12/96	REG	1	U	U
Methylene chloride	LHSMW26	LHSMW26-960820	8/20/96	REG	0.22	<	U
Methylene chloride	LHSMW26	LHSMW26-960820FD	8/20/96	FD	0.22	<	U
Methylene chloride	LHSMW26	LHSMW26-980515	5/15/98	REG	1	<	U
Methylene chloride	LHSMW27	LHSMW27-941203	12/3/94	REG	5	<	U
Methylene chloride	LHSMW27	LHSMW27-960208	2/8/96	REG	1	U	U
Methylene chloride	LHSMW27	LHSMW27-960820	8/20/96	REG	0.22	<	U
Methylene chloride	LHSMW27	LHSMW27-980515	5/15/98	REG	1	<	U
Perchlorate	46WW01	46WW01-000519	5/19/00	REG	1	<	U
Perchlorate	46WW01	46WW01-001003	10/3/00	REG	0.85	<	U
Perchlorate	46WW01	46WW01-020310	3/10/02	REG	0.958	U	U
Perchlorate	46WW01	46WW01-020920	9/20/02	REG	11.1		
Perchlorate	46WW01	46WW01-FEB2007	2/19/07	REG	4	U	U
Perchlorate	46WW02	46WW02-020310	3/10/02	REG	9.01		
Perchlorate	46WW02	46WW02-020920	9/20/02	REG	1.45	U	U
Perchlorate	46WW02	46WW02-FEB2007	2/20/07	REG	4	U	U
Perchlorate	46WW03	46WW03-020311	3/11/02	REG	0.958	U	U
Perchlorate	46WW03	46WW03-020923	9/23/02	REG	1.45	U	U
Perchlorate	46WW04	46WW04-000915	9/15/00	REG	23		
Perchlorate	46WW04	46WW04-010212	2/12/01	REG	30		
Perchlorate	46WW04	46WW04-020310	3/10/02	REG	14		
Perchlorate	46WW04	46WW04-020919	9/19/02	REG	17		
Perchlorate	46WW04	46WW04-FEB2007	2/19/07	REG	4	U	U
Perchlorate	LHSMW13	LHSMW13-020310	3/10/02	REG	0.958	U	U

Table 3-3
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Parameter	Location	Sample	Date	Purpose	Result µg/L	LQ	VQ
Perchlorate	LHSMW13	LHSMW13-020924	9/24/02	REG	29	U	U
Perchlorate	LHSMW17	LHSMW17-000524	5/24/00	REG	1	<	U
Perchlorate	LHSMW17	LHSMW17-000524FD	5/24/00	FD	4.44		J
Perchlorate	LHSMW17	LHSMW17-001003	10/3/00	REG	0.85	<	U
Perchlorate	LHSMW17	LHSMW17-020310	3/10/02	REG	0.958	U	U
Perchlorate	LHSMW17	LHSMW17-020924	9/24/02	REG	1.45	U	U
Perchlorate	LHSMW18	LHSMW18-000519	5/19/00	REG	1	<	U
Perchlorate	LHSMW18	LHSMW18-001003	10/3/00	REG	0.85	<	U
Perchlorate	LHSMW18	LHSMW18-010212	2/12/01	REG	4	<	U
Perchlorate	LHSMW18	LHSMW18-020310	3/10/02	REG	0.958	U	U
Perchlorate	LHSMW18	LHSMW18-020920	9/20/02	REG	1.45	U	U
Perchlorate	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	4	U	U
Perchlorate	LHSMW19	LHSMW19-020310FD	3/10/02	FD	0.958	U	U
Perchlorate	LHSMW19	LHSMW19-020310	3/10/02	REG	0.958	U	U
Perchlorate	LHSMW19	LHSMW19-020920	9/20/02	REG	1.45	U	U
Perchlorate	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	4	U	U
Perchlorate	LHSMW22	LHSMW22-000519	5/19/00	REG	1	<	U
Perchlorate	LHSMW22	LHSMW22-020311	3/11/02	REG	0.958	U	U
Perchlorate	LHSMW22	LHSMW22-020923	9/23/02	REG	1.45	U	U
Perchlorate	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	4	U	U
Perchlorate	LHSMW23	LHSMW23-020310	3/10/02	REG	0.958	U	U
Perchlorate	LHSMW23	LHSMW23-020919	9/19/02	REG	1.84	J	J
Perchlorate	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	4	U	U
Perchlorate	STEP-46DW01	46DW01-020312	3/12/02	REG	0.958	U	U
Perchlorate	STEP-46DW02	46DW02-020312FD	3/12/02	FD	0.958	U	U
Perchlorate	STEP-46DW02	46DW02-020312	3/12/02	REG	0.958	U	U
Perchlorate	STEP-46DW03	46DW03-020313	3/13/02	REG	0.958	U	U
Perchlorate	STEP-46DW04	46DW04-020313	3/13/02	REG	0.958	U	U
Perchlorate	STEP-46DW05	46DW05-020315	3/15/02	REG	35.3		
Perchlorate	STEP-46DW06	46DW06-020313	3/13/02	REG	0.958	U	U
Perchlorate	STEP-46DW07	46DW07-020316	3/16/02	REG	1.39	J	U
Tetrachloroethene	46WW01	46WW01-981001	10/1/98	REG	1	<	U
Tetrachloroethene	46WW01	46WW01-981107	11/7/98	REG	1	<	U
Tetrachloroethene	46WW01	46WW01-981107FD	11/7/98	FD	1	<	U
Tetrachloroethene	46WW01	46WW01-FEB2007	2/19/07	REG	0.74	U	U
Tetrachloroethene	46WW02	46WW02-981106	11/6/98	REG	1	<	U
Tetrachloroethene	46WW02	46WW02-FEB2007	2/20/07	REG	0.74	U	U
Tetrachloroethene	46WW02	46WW02-102808	10/28/08	REG	0.25	U	U
Tetrachloroethene	46WW03	46WW03-981106	11/6/98	REG	1	<	U
Tetrachloroethene	46WW04	46WW04-981107	11/7/98	REG	1	<	U
Tetrachloroethene	46WW04	46WW04-FEB2007	2/19/07	REG	0.74	U	U
Tetrachloroethene	46WW05	46WW05-100908	10/9/08	REG	0.25	U	U
Tetrachloroethene	46WW06	46WW06-100908	10/9/08	REG	0.25	U	U
Tetrachloroethene	LHSMW08	LHSMW08-941203	12/3/94	REG	5	<	U
Tetrachloroethene	LHSMW08	LHSMW08-960813FD	8/13/96	FD	0.25	<	U
Tetrachloroethene	LHSMW08	LHSMW08-960813	8/13/96	REG	0.25	<	U
Tetrachloroethene	LHSMW08	LHSMW08-980513	5/13/98	REG	1	<	U

Table 3-3
LHAAP-46 Historical Concentrations of MNA Compounds

Parameter	Location	Sample	Date	Purpose	Result µg/L	LQ	VQ
Tetrachloroethene	LHSMW12	LHSMW12-941202	12/2/94	REG	5	<	U
Tetrachloroethene	LHSMW12	LHSMW12-960813	8/13/96	REG	0.25	<	U
Tetrachloroethene	LHSMW12	LHSMW12-980514	5/14/98	REG	1	<	U
Tetrachloroethene	LHSMW13	LHSMW13-941202	12/2/94	REG	5	<	U
Tetrachloroethene	LHSMW13	LHSMW13-960206	2/6/96	REG	1	U	U
Tetrachloroethene	LHSMW13	LHSMW13-960815	8/15/96	REG	0.25	<	U
Tetrachloroethene	LHSMW13	LHSMW13-980514	5/14/98	REG	1	<	U
Tetrachloroethene	LHSMW14	LHSMW14-941129	11/29/94	REG	5	<	U
Tetrachloroethene	LHSMW14	LHSMW14-960206	2/6/96	REG	1	U	U
Tetrachloroethene	LHSMW14	LHSMW14-960814	8/14/96	REG	0.25	<	U
Tetrachloroethene	LHSMW14	LHSMW14-960814FD	8/14/96	FD	0.25	<	U
Tetrachloroethene	LHSMW14	LHSMW14-980514	5/14/98	REG	1	<	U
Tetrachloroethene	LHSMW15	LHSMW15-941203	12/3/94	REG	5	<	U
Tetrachloroethene	LHSMW15	LHSMW15-960206	2/6/96	REG	1	U	U
Tetrachloroethene	LHSMW15	LHSMW15-960815	8/15/96	REG	0.25	<	U
Tetrachloroethene	LHSMW15	LHSMW15-980514	5/14/98	REG	1	<	U
Tetrachloroethene	LHSMW15	LHSMW15-102708	10/27/08	REG	0.25	U	U
Tetrachloroethene	LHSMW16	LHSMW16-941129	11/29/94	REG	5	<	U
Tetrachloroethene	LHSMW16	LHSMW16-960206	2/6/96	REG	1	U	U
Tetrachloroethene	LHSMW16	LHSMW16-960815	8/15/96	REG	0.25	<	U
Tetrachloroethene	LHSMW16	LHSMW16-980514	5/14/98	REG	1	<	U
Tetrachloroethene	LHSMW17	LHSMW17-941202	12/2/94	REG	5	<	U
Tetrachloroethene	LHSMW17	LHSMW17-960212	2/12/96	REG	1	U	U
Tetrachloroethene	LHSMW17	LHSMW17-960815	8/15/96	REG	0.25	<	U
Tetrachloroethene	LHSMW17	LHSMW17-980514	5/14/98	REG	1	<	U
Tetrachloroethene	LHSMW17	LHSMW17-000524	5/24/00	REG	1	<	U
Tetrachloroethene	LHSMW17	LHSMW17-000524FD	5/24/00	FD	100	<	U
Tetrachloroethene	LHSMW17	LHSMW17-001002FD	10/2/00	FD	0.088	<	U
Tetrachloroethene	LHSMW17	LHSMW17-001003	10/3/00	REG	0.088	<	U
Tetrachloroethene	LHSMW18	LHSMW18-941202	12/2/94	REG	5	<	U
Tetrachloroethene	LHSMW18	LHSMW18-960212	2/12/96	REG	1	U	U
Tetrachloroethene	LHSMW18	LHSMW18-960815	8/15/96	REG	1.3		
Tetrachloroethene	LHSMW18	LHSMW18-980514	5/14/98	REG	1.1		
Tetrachloroethene	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.74	U	U
Tetrachloroethene	LHSMW19	LHSMW19-941202	12/2/94	REG	5	<	U
Tetrachloroethene	LHSMW19	LHSMW19-960206	2/6/96	REG	3	U	U
Tetrachloroethene	LHSMW19	LHSMW19-960815	8/15/96	REG	0.25	<	U
Tetrachloroethene	LHSMW19	LHSMW19-980515	5/15/98	REG	1	<	U
Tetrachloroethene	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.74	U	U
Tetrachloroethene	LHSMW20	LHSMW20-941204	12/4/94	REG	5	<	U
Tetrachloroethene	LHSMW20	LHSMW20-960207	2/7/96	REG	1	U	U
Tetrachloroethene	LHSMW20	LHSMW20-960815	8/15/96	REG	0.25	<	U
Tetrachloroethene	LHSMW20	LHSMW20-980515	5/15/98	REG	1	<	U
Tetrachloroethene	LHSMW20	LHSMW20-102708	10/27/08	REG	0.25	U	U
Tetrachloroethene	LHSMW21	LHSMW21-941204	12/4/94	REG	5	<	U
Tetrachloroethene	LHSMW21	LHSMW21-960207	2/7/96	REG	1	U	U
Tetrachloroethene	LHSMW21	LHSMW21-960815	8/15/96	REG	0.25	<	U

Table 3-3
LHAAP-46 Historical Concentrations of MNA Compounds

Parameter	Location	Sample	Date	Purpose	Result µg/L	LQ	VQ
Tetrachloroethene	LHSMW21	LHSMW21-980515	5/15/98	REG	1	<	U
Tetrachloroethene	LHSMW22	LHSMW22-941204	12/4/94	REG	5	<	U
Tetrachloroethene	LHSMW22	LHSMW22-960207	2/7/96	REG	1		
Tetrachloroethene	LHSMW22	LHSMW22-960815	8/15/96	REG	1.9		
Tetrachloroethene	LHSMW22	LHSMW22-980515	5/15/98	REG	2.4		
Tetrachloroethene	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.74	U	U
Tetrachloroethene	LHSMW23	LHSMW23-941204	12/4/94	REG	5	<	U
Tetrachloroethene	LHSMW23	LHSMW23-941204FD	12/4/94	FD	5	<	U
Tetrachloroethene	LHSMW23	LHSMW23-960206	2/6/96	REG	1	U	U
Tetrachloroethene	LHSMW23	LHSMW23-960815	8/15/96	REG	0.25	<	U
Tetrachloroethene	LHSMW23	LHSMW23-980515	5/15/98	REG	1	<	U
Tetrachloroethene	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.74	U	U
Tetrachloroethene	LHSMW23	LHSMW23-102808	10/28/08	REG	0.25	U	U
Tetrachloroethene	LHSMW24	LHSMW24-941204	12/4/94	REG	5	<	U
Tetrachloroethene	LHSMW24	LHSMW24-960207	2/7/96	REG	1	U	U
Tetrachloroethene	LHSMW24	LHSMW24-960820	8/20/96	REG	0.25	<	U
Tetrachloroethene	LHSMW24	LHSMW24-980515	5/15/98	REG	1	<	U
Tetrachloroethene	LHSMW25	LHSMW25-941204	12/4/94	REG	5	<	U
Tetrachloroethene	LHSMW25	LHSMW25-960207	2/7/96	REG	1	U	U
Tetrachloroethene	LHSMW25	LHSMW25-960820	8/20/96	REG	0.25	<	U
Tetrachloroethene	LHSMW25	LHSMW25-980515	5/15/98	REG	1	<	U
Tetrachloroethene	LHSMW25	LHSMW25-102808	10/28/08	REG	0.25	U	U
Tetrachloroethene	LHSMW25	LHSMW25-102808-QA	10/28/08	FD	0.25	U	U
Tetrachloroethene	LHSMW26	LHSMW26-941204	12/4/94	REG	5	<	U
Tetrachloroethene	LHSMW26	LHSMW26-960212	2/12/96	REG	1	U	U
Tetrachloroethene	LHSMW26	LHSMW26-960820	8/20/96	REG	0.25	<	U
Tetrachloroethene	LHSMW26	LHSMW26-960820FD	8/20/96	FD	0.25	<	U
Tetrachloroethene	LHSMW26	LHSMW26-980515	5/15/98	REG	1	<	U
Tetrachloroethene	LHSMW27	LHSMW27-941203	12/3/94	REG	5	<	U
Tetrachloroethene	LHSMW27	LHSMW27-960208	2/8/96	REG	1	U	U
Tetrachloroethene	LHSMW27	LHSMW27-960820	8/20/96	REG	0.25	<	U
Tetrachloroethene	LHSMW27	LHSMW27-980515	5/15/98	REG	1	<	U
trans-1,2-Dichloroethene	46WW01	46WW01-981001	10/1/98	REG	1	<	U
trans-1,2-Dichloroethene	46WW01	46WW01-981107	11/7/98	REG	1	<	U
trans-1,2-Dichloroethene	46WW01	46WW01-981107FD	11/7/98	FD	1	<	U
trans-1,2-Dichloroethene	46WW01	46WW01-FEB2007	2/19/07	REG	0.75	U	U
trans-1,2-Dichloroethene	46WW02	46WW02-981106	11/6/98	REG	1	<	U
trans-1,2-Dichloroethene	46WW02	46WW02-FEB2007	2/20/07	REG	0.75	U	U
trans-1,2-Dichloroethene	46WW02	46WW02-102808	10/28/08	REG	0.25	U	U
trans-1,2-Dichloroethene	46WW03	46WW03-981106	11/6/98	REG	1	<	U
trans-1,2-Dichloroethene	46WW04	46WW04-981107	11/7/98	REG	1	<	U
trans-1,2-Dichloroethene	46WW04	46WW04-FEB2007	2/19/07	REG	0.75	U	U
trans-1,2-Dichloroethene	46WW05	46WW05-100908	10/9/08	REG	0.25	U	U
trans-1,2-Dichloroethene	46WW06	46WW06-100908	10/9/08	REG	0.25	U	U
trans-1,2-Dichloroethene	LHSMW08	LHSMW08-960813FD	8/13/96	FD	0.29	<	U
trans-1,2-Dichloroethene	LHSMW08	LHSMW08-960813	8/13/96	REG	0.29	<	U
trans-1,2-Dichloroethene	LHSMW08	LHSMW08-980513	5/13/98	REG	1	<	U

Table 3-3
LHAAP-46 Historical Concentrations of MNA Compounds

Parameter	Location	Sample	Date	Purpose	Result µg/L	LQ	VQ
trans-1,2-Dichloroethene	LHSMW12	LHSMW12-960813	8/13/96	REG	0.29	<	U
trans-1,2-Dichloroethene	LHSMW12	LHSMW12-980514	5/14/98	REG	1	<	U
trans-1,2-Dichloroethene	LHSMW13	LHSMW13-960206	2/6/96	REG	1	U	U
trans-1,2-Dichloroethene	LHSMW13	LHSMW13-960815	8/15/96	REG	0.29	<	U
trans-1,2-Dichloroethene	LHSMW13	LHSMW13-980514	5/14/98	REG	1	<	U
trans-1,2-Dichloroethene	LHSMW14	LHSMW14-960206	2/6/96	REG	1	U	U
trans-1,2-Dichloroethene	LHSMW14	LHSMW14-960814	8/14/96	REG	0.29	<	U
trans-1,2-Dichloroethene	LHSMW14	LHSMW14-960814FD	8/14/96	FD	0.29	<	U
trans-1,2-Dichloroethene	LHSMW14	LHSMW14-980514	5/14/98	REG	1	<	U
trans-1,2-Dichloroethene	LHSMW15	LHSMW15-960206	2/6/96	REG	1	U	U
trans-1,2-Dichloroethene	LHSMW15	LHSMW15-960815	8/15/96	REG	0.29	<	U
trans-1,2-Dichloroethene	LHSMW15	LHSMW15-980514	5/14/98	REG	1	<	U
trans-1,2-Dichloroethene	LHSMW15	LHSMW15-102708	10/27/08	REG	0.25	U	U
trans-1,2-Dichloroethene	LHSMW16	LHSMW16-960206	2/6/96	REG	1	U	U
trans-1,2-Dichloroethene	LHSMW16	LHSMW16-960815	8/15/96	REG	0.29	<	U
trans-1,2-Dichloroethene	LHSMW16	LHSMW16-980514	5/14/98	REG	1	<	U
trans-1,2-Dichloroethene	LHSMW17	LHSMW17-960212	2/12/96	REG	1	U	U
trans-1,2-Dichloroethene	LHSMW17	LHSMW17-960815	8/15/96	REG	0.29	<	U
trans-1,2-Dichloroethene	LHSMW17	LHSMW17-980514	5/14/98	REG	1	<	U
trans-1,2-Dichloroethene	LHSMW17	LHSMW17-000524	5/24/00	REG	1	<	U
trans-1,2-Dichloroethene	LHSMW17	LHSMW17-000524FD	5/24/00	FD	100	<	U
trans-1,2-Dichloroethene	LHSMW17	LHSMW17-001002FD	10/2/00	FD	0.036	<	U
trans-1,2-Dichloroethene	LHSMW17	LHSMW17-001003	10/3/00	REG	0.036	<	U
trans-1,2-Dichloroethene	LHSMW18	LHSMW18-960212	2/12/96	REG	6.5		
trans-1,2-Dichloroethene	LHSMW18	LHSMW18-960815	8/15/96	REG	9.4		
trans-1,2-Dichloroethene	LHSMW18	LHSMW18-980514	5/14/98	REG	12		
trans-1,2-Dichloroethene	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.75	U	U
trans-1,2-Dichloroethene	LHSMW19	LHSMW19-960206	2/6/96	REG	3	U	U
trans-1,2-Dichloroethene	LHSMW19	LHSMW19-960815	8/15/96	REG	0.29	<	U
trans-1,2-Dichloroethene	LHSMW19	LHSMW19-980515	5/15/98	REG	0.58		J
trans-1,2-Dichloroethene	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.75	U	U
trans-1,2-Dichloroethene	LHSMW20	LHSMW20-960207	2/7/96	REG	1	U	U
trans-1,2-Dichloroethene	LHSMW20	LHSMW20-960815	8/15/96	REG	0.29	<	U
trans-1,2-Dichloroethene	LHSMW20	LHSMW20-980515	5/15/98	REG	1	<	U
trans-1,2-Dichloroethene	LHSMW20	LHSMW20-102708	10/27/08	REG	0.25	U	U
trans-1,2-Dichloroethene	LHSMW21	LHSMW21-960207	2/7/96	REG	1	U	U
trans-1,2-Dichloroethene	LHSMW21	LHSMW21-960815	8/15/96	REG	0.29	<	U
trans-1,2-Dichloroethene	LHSMW21	LHSMW21-980515	5/15/98	REG	1	<	U
trans-1,2-Dichloroethene	LHSMW22	LHSMW22-960207	2/7/96	REG	1		
trans-1,2-Dichloroethene	LHSMW22	LHSMW22-960815	8/15/96	REG	1.9		
trans-1,2-Dichloroethene	LHSMW22	LHSMW22-980515	5/15/98	REG	3.5		
trans-1,2-Dichloroethene	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.75	U	U
trans-1,2-Dichloroethene	LHSMW23	LHSMW23-960206	2/6/96	REG	1	U	U
trans-1,2-Dichloroethene	LHSMW23	LHSMW23-960815	8/15/96	REG	0.29	<	U
trans-1,2-Dichloroethene	LHSMW23	LHSMW23-980515	5/15/98	REG	1	<	U
trans-1,2-Dichloroethene	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.75	U	U
trans-1,2-Dichloroethene	LHSMW23	LHSMW23-102808	10/28/08	REG	1.02		

Table 3-3
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Parameter	Location	Sample	Date	Purpose	Result µg/L	LQ	VQ
trans-1,2-Dichloroethene	LHSMW24	LHSMW24-960207	2/7/96	REG	1	U	U
trans-1,2-Dichloroethene	LHSMW24	LHSMW24-960820	8/20/96	REG	0.29	<	U
trans-1,2-Dichloroethene	LHSMW24	LHSMW24-980515	5/15/98	REG	1	<	U
trans-1,2-Dichloroethene	LHSMW25	LHSMW25-960207	2/7/96	REG	1	U	U
trans-1,2-Dichloroethene	LHSMW25	LHSMW25-960820	8/20/96	REG	0.29	<	U
trans-1,2-Dichloroethene	LHSMW25	LHSMW25-980515	5/15/98	REG	1	<	U
trans-1,2-Dichloroethene	LHSMW25	LHSMW25-102808	10/28/08	REG	0.25	U	U
trans-1,2-Dichloroethene	LHSMW25	LHSMW25-102808-QA	10/28/08	FD	0.25	U	U
trans-1,2-Dichloroethene	LHSMW26	LHSMW26-960212	2/12/96	REG	1	U	U
trans-1,2-Dichloroethene	LHSMW26	LHSMW26-960820	8/20/96	REG	0.29	<	U
trans-1,2-Dichloroethene	LHSMW26	LHSMW26-960820FD	8/20/96	FD	0.29	<	U
trans-1,2-Dichloroethene	LHSMW26	LHSMW26-980515	5/15/98	REG	1	<	U
trans-1,2-Dichloroethene	LHSMW27	LHSMW27-960208	2/8/96	REG	1	U	U
trans-1,2-Dichloroethene	LHSMW27	LHSMW27-960820	8/20/96	REG	0.29	<	U
trans-1,2-Dichloroethene	LHSMW27	LHSMW27-980515	5/15/98	REG	1	<	U
Trichloroethene	46WW01	46WW01-981001	10/1/98	REG	6.6		
Trichloroethene	46WW01	46WW01-981107	11/7/98	REG	1	<	U
Trichloroethene	46WW01	46WW01-981107FD	11/7/98	FD	1	<	U
Trichloroethene	46WW01	46WW01-FEB2007	2/19/07	REG	0.63	U	U
Trichloroethene	46WW02	46WW02-981106	11/6/98	REG	*24*		
Trichloroethene	46WW02	46WW02-FEB2007	2/20/07	REG	*28.9*		
Trichloroethene	46WW02	46WW02-102808	10/28/08	REG	*31.2*		
Trichloroethene	46WW03	46WW03-981106	11/6/98	REG	1	<	U
Trichloroethene	46WW04	46WW04-981107	11/7/98	REG	0.71		J
Trichloroethene	46WW04	46WW04-FEB2007	2/19/07	REG	0.63	U	U
Trichloroethene	46WW05	46WW05-100908	10/9/08	REG	*5.9*		
Trichloroethene	46WW06	46WW06-100908	10/9/08	REG	0.25	U	U
Trichloroethene	LHSMW08	LHSMW08-960813FD	8/13/96	FD	0.25	<	U
Trichloroethene	LHSMW08	LHSMW08-960813	8/13/96	REG	0.25	<	U
Trichloroethene	LHSMW08	LHSMW08-980513	5/13/98	REG	1	<	U
Trichloroethene	LHSMW12	LHSMW12-960813	8/13/96	REG	0.25	<	U
Trichloroethene	LHSMW12	LHSMW12-980514	5/14/98	REG	1	<	U
Trichloroethene	LHSMW13	LHSMW13-960206	2/6/96	REG	1	U	U
Trichloroethene	LHSMW13	LHSMW13-960815	8/15/96	REG	0.25	<	U
Trichloroethene	LHSMW13	LHSMW13-980514	5/14/98	REG	1	<	U
Trichloroethene	LHSMW14	LHSMW14-941129	11/29/94	REG	5	<	U
Trichloroethene	LHSMW14	LHSMW14-960206	2/6/96	REG	1	U	U
Trichloroethene	LHSMW14	LHSMW14-960814	8/14/96	REG	0.25	<	U
Trichloroethene	LHSMW14	LHSMW14-960814FD	8/14/96	FD	0.25	<	U
Trichloroethene	LHSMW14	LHSMW14-980514	5/14/98	REG	1	<	U
Trichloroethene	LHSMW15	LHSMW15-960206	2/6/96	REG	1	U	U
Trichloroethene	LHSMW15	LHSMW15-960815	8/15/96	REG	0.25	<	U
Trichloroethene	LHSMW15	LHSMW15-980514	5/14/98	REG	1	<	U
Trichloroethene	LHSMW15	LHSMW15-102708	10/27/08	REG	0.25	U	U
Trichloroethene	LHSMW16	LHSMW16-941129	11/29/94	REG	5	<	U
Trichloroethene	LHSMW16	LHSMW16-960206	2/6/96	REG	1	U	U
Trichloroethene	LHSMW16	LHSMW16-960815	8/15/96	REG	0.25	<	U

Table 3-3
LHAAP-46 Historical Concentrations of MNA Compounds

Parameter	Location	Sample	Date	Purpose	Result µg/L	LQ	VQ
Trichloroethene	LHSMW16	LHSMW16-980514	5/14/98	REG	1	<	U
Trichloroethene	LHSMW17	LHSMW17-960212	2/12/96	REG	1	U	U
Trichloroethene	LHSMW17	LHSMW17-960815	8/15/96	REG	0.25	<	U
Trichloroethene	LHSMW17	LHSMW17-980514	5/14/98	REG	1	<	U
Trichloroethene	LHSMW17	LHSMW17-000524	5/24/00	REG	1	<	U
Trichloroethene	LHSMW17	LHSMW17-000524FD	5/24/00	FD	100	<	U
Trichloroethene	LHSMW17	LHSMW17-001002FD	10/2/00	FD	0.057	<	U
Trichloroethene	LHSMW17	LHSMW17-001003	10/3/00	REG	0.057	<	U
Trichloroethene	LHSMW18	LHSMW18-941202	12/2/94	REG	*14*		
Trichloroethene	LHSMW18	LHSMW18-960212	2/12/96	REG	*21*		
Trichloroethene	LHSMW18	LHSMW18-960815	8/15/96	REG	*27.5*		
Trichloroethene	LHSMW18	LHSMW18-980514	5/14/98	REG	*38*		
Trichloroethene	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	4.8		
Trichloroethene	LHSMW19	LHSMW19-941202	12/2/94	REG	*26*		
Trichloroethene	LHSMW19	LHSMW19-960206	2/6/96	REG	*77*		
Trichloroethene	LHSMW19	LHSMW19-960815	8/15/96	REG	*47.1*		
Trichloroethene	LHSMW19	LHSMW19-980515	5/15/98	REG	*70*		
Trichloroethene	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	*85.5*		
Trichloroethene	LHSMW20	LHSMW20-960207	2/7/96	REG	1	U	U
Trichloroethene	LHSMW20	LHSMW20-960815	8/15/96	REG	0.25	<	U
Trichloroethene	LHSMW20	LHSMW20-980515	5/15/98	REG	1	<	U
Trichloroethene	LHSMW20	LHSMW20-102708	10/27/08	REG	0.25	U	U
Trichloroethene	LHSMW21	LHSMW21-960207	2/7/96	REG	1	U	U
Trichloroethene	LHSMW21	LHSMW21-960815	8/15/96	REG	0.25	<	U
Trichloroethene	LHSMW21	LHSMW21-980515	5/15/98	REG	1	<	U
Trichloroethene	LHSMW22	LHSMW22-960207	2/7/96	REG	1		
Trichloroethene	LHSMW22	LHSMW22-960815	8/15/96	REG	1.7		
Trichloroethene	LHSMW22	LHSMW22-980515	5/15/98	REG	3.1		
Trichloroethene	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.63	U	U
Trichloroethene	LHSMW23	LHSMW23-941204	12/4/94	REG	5	<	U
Trichloroethene	LHSMW23	LHSMW23-941204FD	12/4/94	FD	5	<	U
Trichloroethene	LHSMW23	LHSMW23-960206	2/6/96	REG	1	U	U
Trichloroethene	LHSMW23	LHSMW23-960815	8/15/96	REG	0.25	<	U
Trichloroethene	LHSMW23	LHSMW23-980515	5/15/98	REG	1.3		
Trichloroethene	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	1.4	J	J
Trichloroethene	LHSMW23	LHSMW23-102808	10/28/08	REG	2.51		
Trichloroethene	LHSMW24	LHSMW24-941204	12/4/94	REG	5	<	U
Trichloroethene	LHSMW24	LHSMW24-960207	2/7/96	REG	1	U	U
Trichloroethene	LHSMW24	LHSMW24-960820	8/20/96	REG	0.25	<	U
Trichloroethene	LHSMW24	LHSMW24-980515	5/15/98	REG	1	<	U
Trichloroethene	LHSMW25	LHSMW25-941204	12/4/94	REG	5	<	U
Trichloroethene	LHSMW25	LHSMW25-960207	2/7/96	REG	1	U	U
Trichloroethene	LHSMW25	LHSMW25-960820	8/20/96	REG	0.25	<	U
Trichloroethene	LHSMW25	LHSMW25-980515	5/15/98	REG	1	<	U
Trichloroethene	LHSMW25	LHSMW25-102808	10/28/08	REG	0.25	U	U
Trichloroethene	LHSMW25	LHSMW25-102808-QA	10/28/08	FD	0.25	U	U
Trichloroethene	LHSMW26	LHSMW26-941204	12/4/94	REG	5	<	U

Table 3-3
LHAAP-46 Historical Concentrations of MNA Compounds

Parameter	Location	Sample	Date	Purpose	Result µg/L	LQ	VQ
Trichloroethene	LHSMW26	LHSMW26-960212	2/12/96	REG	1	U	U
Trichloroethene	LHSMW26	LHSMW26-960820	8/20/96	REG	0.25	<	U
Trichloroethene	LHSMW26	LHSMW26-960820FD	8/20/96	FD	0.25	<	U
Trichloroethene	LHSMW26	LHSMW26-980515	5/15/98	REG	1	<	U
Trichloroethene	LHSMW27	LHSMW27-960208	2/8/96	REG	1	U	U
Trichloroethene	LHSMW27	LHSMW27-960820	8/20/96	REG	0.25	<	U
Trichloroethene	LHSMW27	LHSMW27-980515	5/15/98	REG	1	<	U
Vinyl chloride	46WW01	46WW01-981001	10/1/98	REG	1	<	U
Vinyl chloride	46WW01	46WW01-981107	11/7/98	REG	1	<	U
Vinyl chloride	46WW01	46WW01-981107FD	11/7/98	FD	1	<	U
Vinyl chloride	46WW01	46WW01-FEB2007	2/19/07	REG	0.32	U	U
Vinyl chloride	46WW02	46WW02-981106	11/6/98	REG	1	<	U
Vinyl chloride	46WW02	46WW02-FEB2007	2/20/07	REG	0.32	U	U
Vinyl chloride	46WW02	46WW02-102808	10/28/08	REG	0.25	U	U
Vinyl chloride	46WW03	46WW03-981106	11/6/98	REG	1	<	U
Vinyl chloride	46WW04	46WW04-981107	11/7/98	REG	1	<	U
Vinyl chloride	46WW04	46WW04-FEB2007	2/19/07	REG	0.32	U	U
Vinyl chloride	46WW05	46WW05-100908	10/9/08	REG	0.25	U	U
Vinyl chloride	46WW06	46WW06-100908	10/9/08	REG	0.25	U	U
Vinyl chloride	LHSMW08	LHSMW08-960813FD	8/13/96	FD	0.24	<	U
Vinyl chloride	LHSMW08	LHSMW08-960813	8/13/96	REG	0.24	<	U
Vinyl chloride	LHSMW08	LHSMW08-980513	5/13/98	REG	1	<	U
Vinyl chloride	LHSMW12	LHSMW12-960813	8/13/96	REG	0.24	<	U
Vinyl chloride	LHSMW12	LHSMW12-980514	5/14/98	REG	1	<	U
Vinyl chloride	LHSMW13	LHSMW13-960206	2/6/96	REG	1	U	U
Vinyl chloride	LHSMW13	LHSMW13-960815	8/15/96	REG	0.24	<	U
Vinyl chloride	LHSMW13	LHSMW13-980514	5/14/98	REG	1	<	U
Vinyl chloride	LHSMW14	LHSMW14-960206	2/6/96	REG	1	U	U
Vinyl chloride	LHSMW14	LHSMW14-960814	8/14/96	REG	0.24	<	U
Vinyl chloride	LHSMW14	LHSMW14-960814FD	8/14/96	FD	0.24	<	U
Vinyl chloride	LHSMW14	LHSMW14-980514	5/14/98	REG	1	<	U
Vinyl chloride	LHSMW15	LHSMW15-960206	2/6/96	REG	1	U	U
Vinyl chloride	LHSMW15	LHSMW15-960815	8/15/96	REG	0.24	<	U
Vinyl chloride	LHSMW15	LHSMW15-980514	5/14/98	REG	1	<	U
Vinyl chloride	LHSMW15	LHSMW15-102708	10/27/08	REG	0.25	U	U
Vinyl chloride	LHSMW16	LHSMW16-960206	2/6/96	REG	1	U	U
Vinyl chloride	LHSMW16	LHSMW16-960815	8/15/96	REG	0.24	<	U
Vinyl chloride	LHSMW16	LHSMW16-980514	5/14/98	REG	1	<	U
Vinyl chloride	LHSMW17	LHSMW17-960212	2/12/96	REG	1	U	U
Vinyl chloride	LHSMW17	LHSMW17-960815	8/15/96	REG	0.24	<	U
Vinyl chloride	LHSMW17	LHSMW17-980514	5/14/98	REG	1	<	U
Vinyl chloride	LHSMW17	LHSMW17-000524	5/24/00	REG	1	<	U
Vinyl chloride	LHSMW17	LHSMW17-000524FD	5/24/00	FD	100	<	U
Vinyl chloride	LHSMW17	LHSMW17-001002FD	10/2/00	FD	0.068	<	U
Vinyl chloride	LHSMW17	LHSMW17-001003	10/3/00	REG	0.068	<	U
Vinyl chloride	LHSMW18	LHSMW18-960212	2/12/96	REG	1	U	U
Vinyl chloride	LHSMW18	LHSMW18-960815	8/15/96	REG	0.68		

Table 3-3
LHAAP-46 Historical Concentrations of MNA Compounds

Parameter	Location	Sample	Date	Purpose	Result µg/L	LQ	VQ
Vinyl chloride	LHSMW18	LHSMW18-980514	5/14/98	REG	0.71		J
Vinyl chloride	LHSMW18	LHSMW18-FEB2007	2/20/07	REG	0.32	U	U
Vinyl chloride	LHSMW19	LHSMW19-960206	2/6/96	REG	3	U	U
Vinyl chloride	LHSMW19	LHSMW19-960815	8/15/96	REG	0.24	<	U
Vinyl chloride	LHSMW19	LHSMW19-980515	5/15/98	REG	1	<	U
Vinyl chloride	LHSMW19	LHSMW19-FEB2007	2/20/07	REG	0.32	U	U
Vinyl chloride	LHSMW20	LHSMW20-960207	2/7/96	REG	1	U	U
Vinyl chloride	LHSMW20	LHSMW20-960815	8/15/96	REG	0.24	<	U
Vinyl chloride	LHSMW20	LHSMW20-980515	5/15/98	REG	1	<	U
Vinyl chloride	LHSMW20	LHSMW20-102708	10/27/08	REG	0.25	U	U
Vinyl chloride	LHSMW21	LHSMW21-960207	2/7/96	REG	1	U	U
Vinyl chloride	LHSMW21	LHSMW21-960815	8/15/96	REG	0.24	<	U
Vinyl chloride	LHSMW21	LHSMW21-980515	5/15/98	REG	1	<	U
Vinyl chloride	LHSMW22	LHSMW22-960207	2/7/96	REG	1	U	U
Vinyl chloride	LHSMW22	LHSMW22-960815	8/15/96	REG	0.24	<	U
Vinyl chloride	LHSMW22	LHSMW22-980515	5/15/98	REG	1	<	U
Vinyl chloride	LHSMW22	LHSMW22-FEB2007	2/19/07	REG	0.32	U	U
Vinyl chloride	LHSMW23	LHSMW23-960206	2/6/96	REG	1	U	U
Vinyl chloride	LHSMW23	LHSMW23-960815	8/15/96	REG	0.24	<	U
Vinyl chloride	LHSMW23	LHSMW23-980515	5/15/98	REG	1	<	U
Vinyl chloride	LHSMW23	LHSMW23-FEB2007	2/19/07	REG	0.32	U	U
Vinyl chloride	LHSMW23	LHSMW23-102808	10/28/08	REG	0.412	J	J,H
Vinyl chloride	LHSMW24	LHSMW24-960207	2/7/96	REG	1	U	U
Vinyl chloride	LHSMW24	LHSMW24-960820	8/20/96	REG	0.24	<	U
Vinyl chloride	LHSMW24	LHSMW24-980515	5/15/98	REG	1	<	U
Vinyl chloride	LHSMW25	LHSMW25-960207	2/7/96	REG	1	U	U
Vinyl chloride	LHSMW25	LHSMW25-960820	8/20/96	REG	0.24	<	U
Vinyl chloride	LHSMW25	LHSMW25-980515	5/15/98	REG	1	<	U
Vinyl chloride	LHSMW25	LHSMW25-102808	10/28/08	REG	0.25	U	UJ,H
Vinyl chloride	LHSMW25	LHSMW25-102808-QA	10/28/08	FD	0.25	U	U
Vinyl chloride	LHSMW26	LHSMW26-960212	2/12/96	REG	1	U	U
Vinyl chloride	LHSMW26	LHSMW26-960820	8/20/96	REG	0.24	<	U
Vinyl chloride	LHSMW26	LHSMW26-960820FD	8/20/96	FD	0.24	<	U
Vinyl chloride	LHSMW26	LHSMW26-980515	5/15/98	REG	1	<	U
Vinyl chloride	LHSMW27	LHSMW27-960208	2/8/96	REG	1	U	U
Vinyl chloride	LHSMW27	LHSMW27-960820	8/20/96	REG	0.24	<	U
Vinyl chloride	LHSMW27	LHSMW27-980515	5/15/98	REG	1	<	U

Notes:

< - parameter was not detected, with the detection limit shown as the result

µg/L - micrograms per liter

FD - sample is a field duplicate

H - result may be biased high

J - result is an estimated concentration

LQ - laboratory data qualifier

REG - sample is a regular sample

U - parameter was not detected, with the detection limit shown as the result

VQ - validation data qualifier

Table 3-4
Time-Dependent Attenuation Rates and Estimated Cleanup Times

Monitoring Well	Attenuation Rate Constant k (day^{-1})	Attenuation Half-Life		Most Recent Concentration		C_t Target Concentration (µg/L)	$t_{cleanup}$ Estimated Cleanup Time (years)
		(days)	t_{half} (years)	Date	C_R (µg/L)		
Trichloroethene (TCE) Attenuation Rates							
46WW01	0.000467	1,484	4.1	2/19/07	< 0.63	5	Completed
LHSMW18	0.000333	2,082	5.7	2/20/07	4.8	5	Completed
Estimating Cleanup Times for 46WW02 (intermediate zone)							
46WW02	0.000467	1,484	4.1	10/28/08	31.2	5	11
46WW02	0.000333	2,082	5.7	10/28/08	31.2	5	15
Estimating Cleanup Times for LHSMW19 (shallow zone)							
LHSMW19	0.000467	1,484	4.1	2/20/07	85.5	5	17
LHSMW19	0.000333	2,082	5.7	2/20/07	85.5	5	23

Notes:

µg/L - micrograms per liter

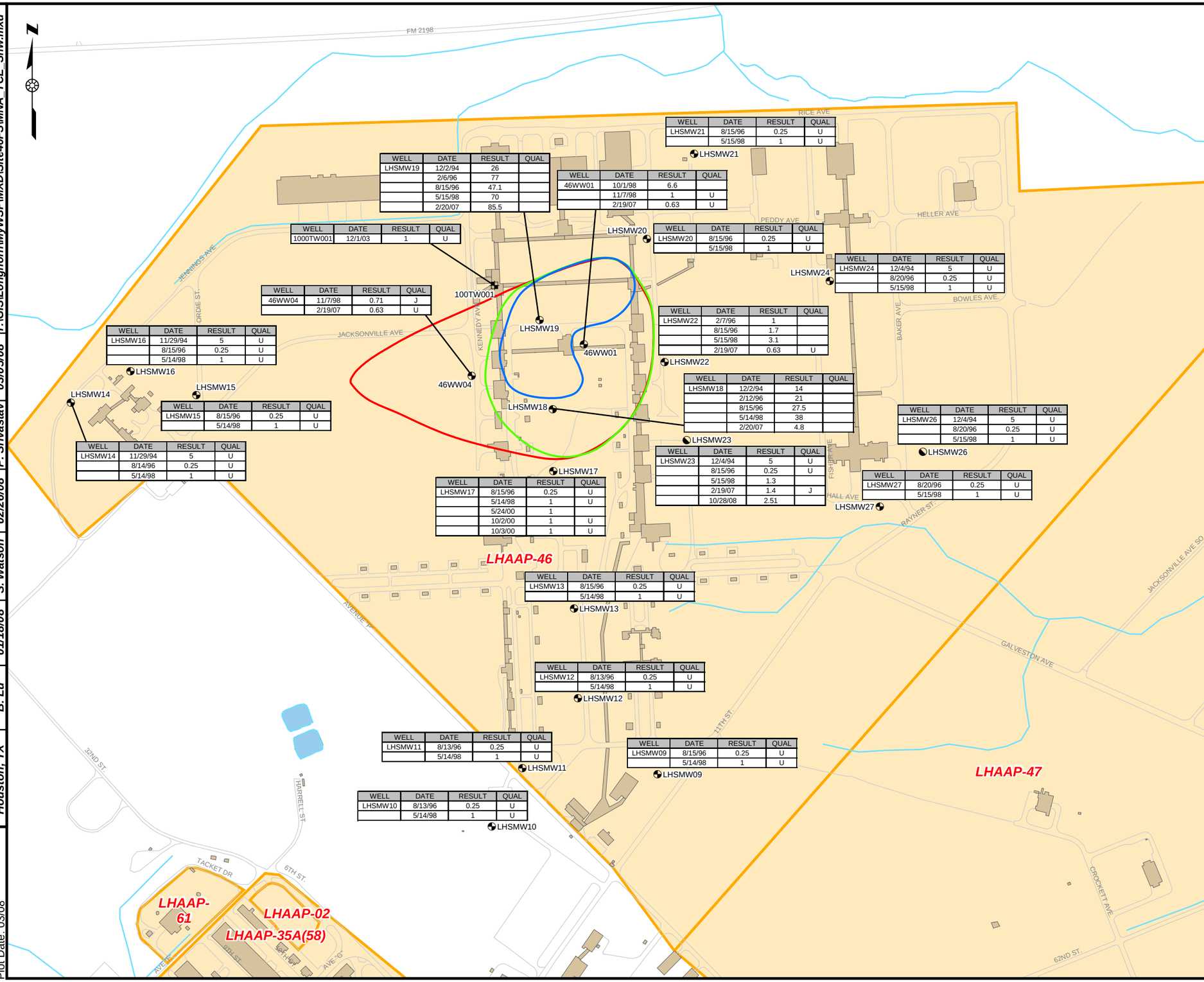
Attenuation Rate Constant k - from the exponent of the exponential trend line equation.

Attenuation Half Life - natural log of 2 divided by the Attenuation Rate Constant (divide by 365 to get years).

$$t_{half} = \ln(2) / k$$

Estimated Cleanup Time - natural log of (target concentration dvided by most recent concentration) divided by the attenuation rate constant, then converted to years.

$$t_{cleanup} = (\ln(C_t/C_R) / -k) / 365$$



WELL	DATE	RESULT	QUAL
LHSMW21	8/15/96	0.25	U
	5/15/98	1	U

WELL	DATE	RESULT	QUAL
LHSMW19	12/2/94	26	
	2/6/96	77	
	8/15/96	47.1	
	5/15/98	70	
	2/20/07	85.5	

WELL	DATE	RESULT	QUAL
46WW01	10/1/98	6.6	
	11/7/98	1	U
	2/19/07	0.63	U

WELL	DATE	RESULT	QUAL
1000TW001	12/1/03	1	U

WELL	DATE	RESULT	QUAL
LHSMW20	8/15/96	0.25	U
	5/15/98	1	U

WELL	DATE	RESULT	QUAL
LHSMW24	12/4/94	5	U
	8/20/96	0.25	U
	5/15/98	1	U

WELL	DATE	RESULT	QUAL
46WW04	11/7/98	0.71	J
	2/19/07	0.63	U

WELL	DATE	RESULT	QUAL
LHSMW22	2/7/96	1	
	8/15/96	1.7	
	5/15/98	3.1	
	2/19/07	0.63	U

WELL	DATE	RESULT	QUAL
LHSMW16	11/29/94	5	U
	8/15/96	0.25	U
	5/14/98	1	U

WELL	DATE	RESULT	QUAL
LHSMW18	12/2/94	14	
	2/12/96	21	
	8/15/96	27.5	
	5/14/98	38	
	2/20/07	4.8	

WELL	DATE	RESULT	QUAL
LHSMW26	12/4/94	5	U
	8/20/96	0.25	U
	5/15/98	1	U

WELL	DATE	RESULT	QUAL
LHSMW15	8/15/96	0.25	U
	5/14/98	1	U

WELL	DATE	RESULT	QUAL
LHSMW14	11/29/94	5	U
	8/14/96	0.25	U
	5/14/98	1	U

WELL	DATE	RESULT	QUAL
LHSMW23	12/4/94	5	U
	8/15/96	0.25	U
	5/15/98	1.3	
	2/19/07	1.4	J
	10/28/08	2.51	

WELL	DATE	RESULT	QUAL
LHSMW27	8/20/96	0.25	U
	5/15/98	1	U

WELL	DATE	RESULT	QUAL
LHSMW17	8/15/96	0.25	U
	5/14/98	1	U
	5/24/00	1	
	10/2/00	1	U
	10/3/00	1	U

WELL	DATE	RESULT	QUAL
LHSMW13	8/15/96	0.25	U
	5/14/98	1	U

WELL	DATE	RESULT	QUAL
LHSMW12	8/13/96	0.25	U
	5/14/98	1	U

WELL	DATE	RESULT	QUAL
LHSMW11	8/13/96	0.25	U
	5/14/98	1	U

WELL	DATE	RESULT	QUAL
LHSMW09	8/15/96	0.25	U
	5/14/98	1	U

WELL	DATE	RESULT	QUAL
LHSMW10	8/13/96	0.25	U
	5/14/98	1	U

LEGEND

- Shallow Monitoring Well
- Shallow/Intermediate Monitoring Well
- Temporary Monitoring Well

TCE Plumes (5 µg/L)

- 1996
- 1998
- 2007
- Stream
- Road
- Former Building or Concrete Slab
- Site

Note:

1. Sampling results reported in micrograms per liter (µg/L).

0 200 400 800 Feet

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

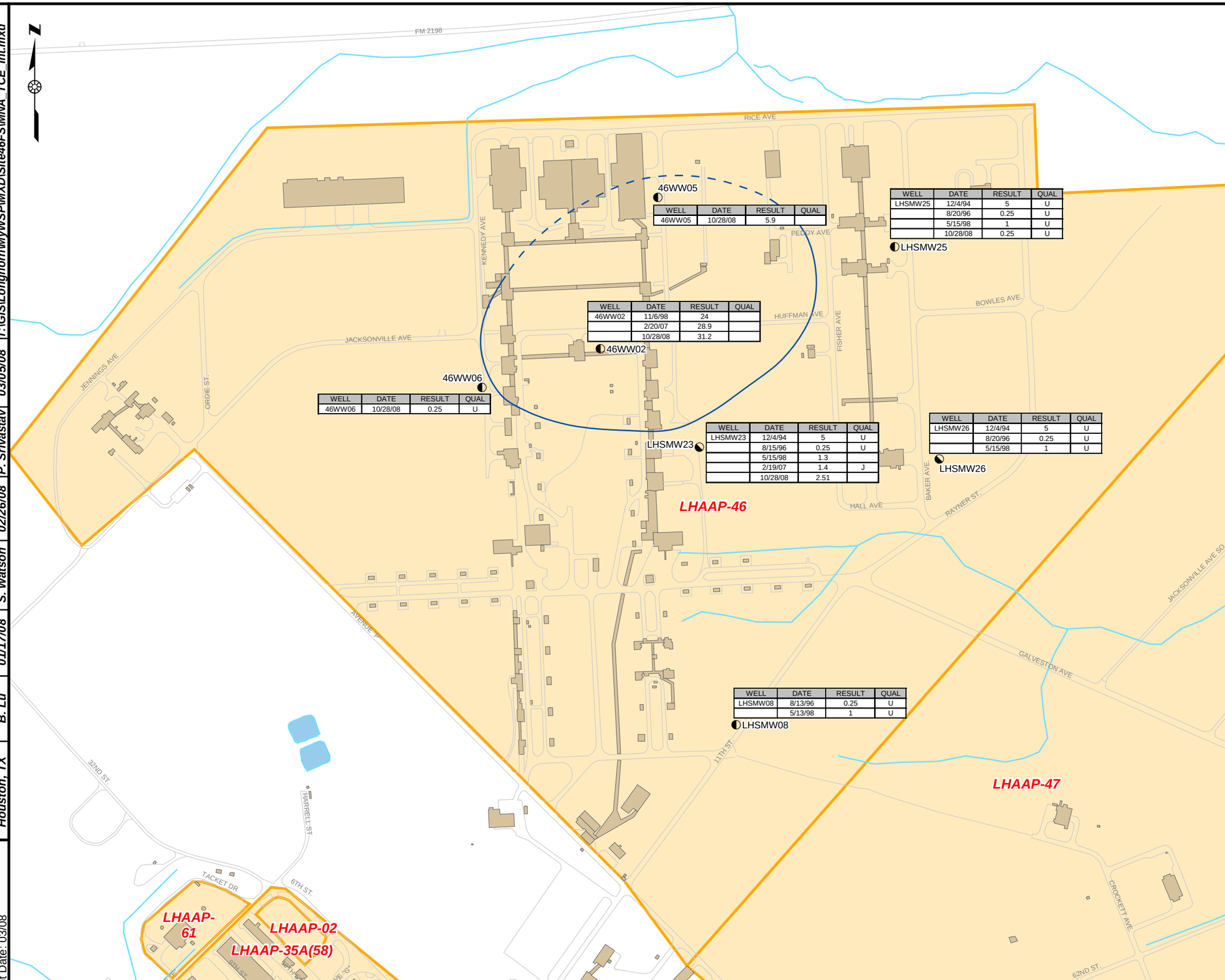
FIGURE 3-1

TCE IN SHALLOW ZONE
LHAAP-46

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	FILE PATH
Houston, TX	B. Lu 01/18/08	S. Watson 02/26/08	P. Srivastav 03/05/08	T:\GIS\Longhorn\MyWSP\MXD\Site46FS\MNA_TCE_Shw.mxd

Plot Date: 03/08



WELL	DATE	RESULT	QUAL
46WW05	10/28/08	5.9	

WELL	DATE	RESULT	QUAL
46WW02	11/6/98	24	
	2/20/07	28.9	
	10/28/08	31.2	

WELL	DATE	RESULT	QUAL
46WW06	10/28/08	0.25	U

WELL	DATE	RESULT	QUAL
LHSMW23	12/4/94	5	U
	8/15/96	0.25	U
	5/15/98	1.3	
	2/19/07	1.4	J
	10/28/08	2.51	

WELL	DATE	RESULT	QUAL
LHSMW25	12/4/94	5	U
	8/20/96	0.25	U
	5/15/98	1	U
	10/28/08	0.25	U

WELL	DATE	RESULT	QUAL
LHSMW26	12/4/94	5	U
	8/20/96	0.25	U
	5/15/98	1	U

WELL	DATE	RESULT	QUAL
LHSMW08	8/13/96	0.25	U
	5/13/98	1	U

LEGEND

- Shallow/Intermediate Monitoring Well
- Intermediate Monitoring Well

TCE Plumes (5 µg/L)

- 2008
- 2008 (Inferred)
- Stream
- Road
- Former Building or Concrete Slab
- Site

Note:

1. Sampling results reported in micrograms per liter (µg/L).

0 200 400 800 Feet

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

FIGURE 3-2

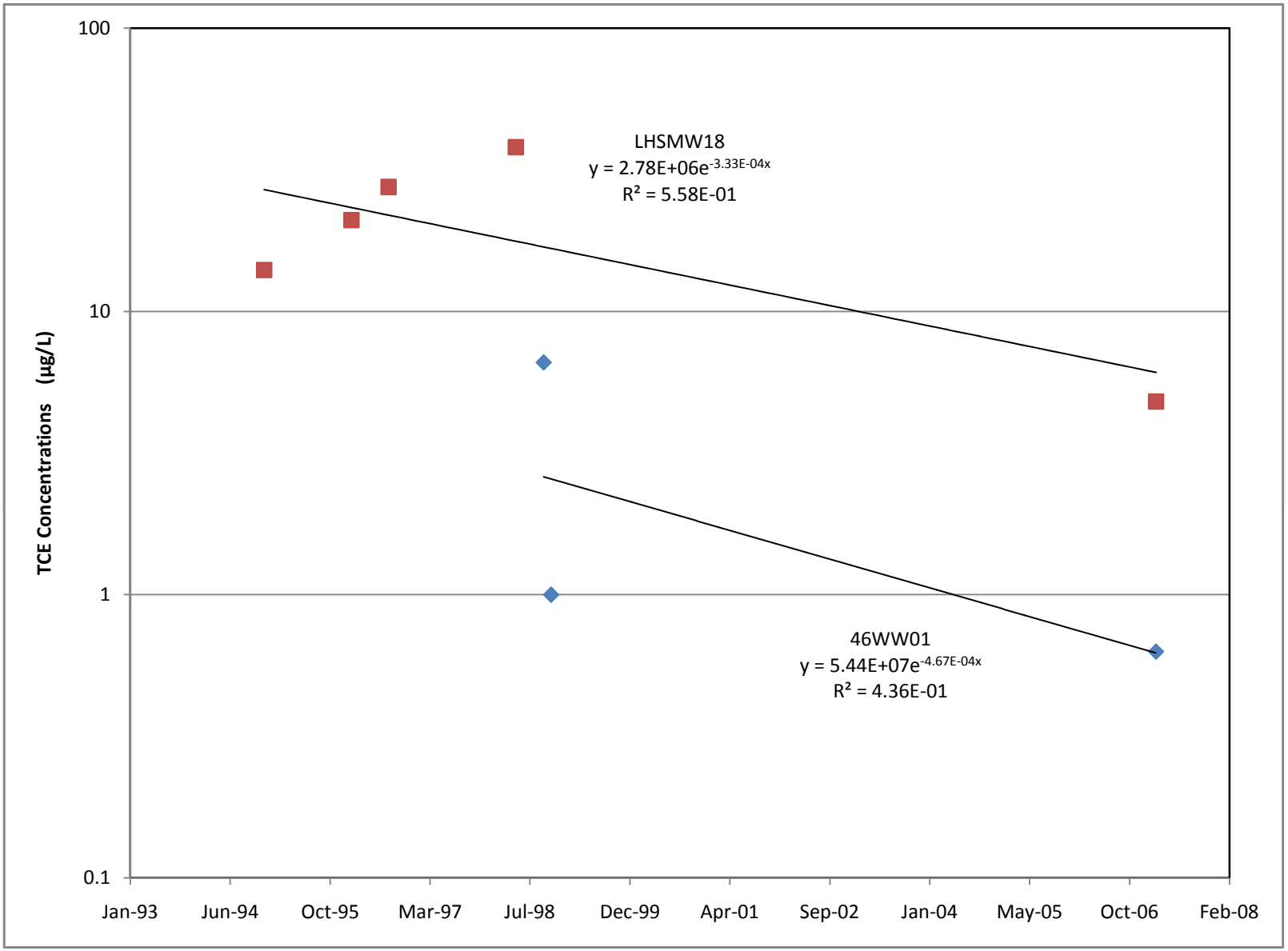
TCE IN INTERMEDIATE ZONE
LHAAP-46

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	FILE PATH
Houston, TX	B. Lu 01/17/08	S. Watson 02/26/08	P. Srivastav 03/05/08	T:\GIS\Longhorn\MyWSP\MXD\Site46F\SIM\NA_TCE_Int.mxd

Plot Date: 03/08

Figure 3-3
Time-Dependent Attenuation Rates at 46WW01 and LHSMW18



4.0 Summary of Results and Conclusions

Historical VOC data and geochemical indicators for the groundwater at LHAAP-46 were evaluated to determine if MNA can be used as a feasible remedy for chlorinated solvents and perchlorate present in the shallow groundwater. Preliminary screening of multiple wells at LHAAP-46 indicated limited evidence for anaerobic biodegradation, and a more detailed evaluation was made. A tiered approach using three lines of evidence was used to examine the occurrence of natural attenuation in site groundwater. The first line of evidence evaluated reductions in COC concentrations over time and with distance, the second line of evidence evaluated geochemical indicators, while the third line of evidence entailed estimation of natural attenuation rate and microbial analysis. The results of the tiered evaluation and the conclusions are summarized below.

The COC exceeding MCLs in the shallow or intermediate groundwater zone at LHAAP-46 is TCE. Wells designated as deep are not affected.

First Line of Evidence: Historical analytical data indicate the occurrence of chlorinated solvent biodegradation at this site. The decreasing in-well concentration trends of TCE over time were observed in monitoring wells at LHAAP-46. Comparing the analytical result from upgradient and downgradient wells also suggests decreasing trends of TCE with distance away from the central location of contamination. These results show that TCE has been attenuated over time and over distance.

Second Line of Evidence: The qualitative assessment of the geochemical indicators in the shallow groundwater zones at LHAAP-46 present evidence that geochemical conditions are not optimal for the degradation of chlorinated solvents via reductive dechlorination. In the shallow groundwater zone, the elevated DO and ORP levels suggest aerobic and oxidative conditions exist at most but not all locations. Ferrous iron results suggest the groundwater is reducing and can support reductive dechlorination. The TOC concentrations observed at LHAAP-46 shallow groundwater zone are not at optimal levels to support microbial activity, but are adequate for reductive chlorination to occur. The time-dependent in-well natural attenuation rates were calculated for TCE in two wells. TCE attenuation is the limiting step to reach site wide cleanup. Based on in-well time dependent attenuation rates, the estimated cleanup time is 17 to 23 years for TCE to achieve the MCL in shallow monitoring well LHSMW19, and 11 to 15 years in intermediate monitoring well 46WW02.

Third Line of Evidence: The presence of the dechlorinating microorganisms at the impacted areas is further evidence that site conditions are capable of complete dechlorination.

Conclusion: The natural attenuation evaluation demonstrates that natural attenuation is occurring at LHAAP-46. COCs are attenuated via mechanisms including cometabolic degradation, dispersion, dilution, volatilization, and sorption. Although the geochemical conditions are not optimal for reductive dechlorination, the COC concentrations are decreasing and moderate cleanup times were estimated.

The natural attenuation evaluation demonstrates that MNA is feasible in the shallow groundwater at LHAAP-46. If attenuation rates calculated at 46WW01 and LHSMW18 are applied to the TCE concentration at LHSMW19, the estimated cleanup time of less than 30 years is based on limited data and the actual cleanup time could be higher or lower. No strong determination can be made for the intermediate groundwater, although if attenuation rates calculated from wells 46WW01 and LHSMW18 are applied to the intermediate zone well 46WW02, the estimated cleanup time of less than 20 years is based on limited data and the actual cleanup time could be higher or lower.

5.0 References

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Appendix B

Geochemical Evaluation of Selected Elements in Groundwater at LHAAP-46

APPENDIX B
GEOCHEMICAL EVALUATION OF SELECTED ELEMENTS IN GROUNDWATER AT LHAAP-46

FINAL

FEASIBILITY STUDY
LHAAP-46, PLANT 2, GROUP 4
LONGHORN ARMY AMMUNITION PLANT

Prepared for

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

Prepared by

Shaw Environmental, Inc.
3010 Briarpark, Suite 400
Houston, Texas 77042

Contract No. W912QR-04-D-0027, Task Order No. DS02
Shaw Project No. 117591

October 2009

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Acronyms and Abbreviations

µg/L	micrograms per liter
Al	aluminum
As	arsenic
Cr	chromium
DCE	dichloroethene
DO	dissolved oxygen
EPRI	Electric Power Research Institute
Fe	iron
LHAAP	Longhorn Army Ammunition Plant
mg/L	milligrams per liter
Mn	manganese
mV	millivolts
Ni	nickel
NTU	nephelometric turbidity unit
OH_3	hydroxide
ORP	oxidation-reduction potential
PCE	tetrachloroethene
Shaw	Shaw Environmental, Inc.
TAL	target analyte list
TCE	trichloroethene
TDS	total dissolved solids
Tl	thallium
TSS	total suspended solids
VOC	volatile organic compound
Zn	zinc

1.0 Introduction

This report provides the results of a geochemical evaluation of inorganic constituents in groundwater samples from the Plant 2 area at Longhorn Army Ammunition Plant (LHAAP) designated as LHAAP-46, in Karnack, Texas. Elevated concentrations of arsenic, chromium, lead, manganese (Mn), nickel, and thallium (Tl) were observed in the historical site data set, which included samples collected from November 1994 through November 1998 at 23 site wells. Preliminary geochemical evaluation indicated that anomalously high concentrations of these six elements were present in the historical data set, indicating potential site-related contamination. A new round of samples was subsequently obtained from a subset of the site wells in September 2007, and further geochemical evaluation was performed to determine if detected concentrations in these samples are naturally occurring or reflect site-related contamination.

Included in this evaluation are the groundwater samples that were collected in September 2007 from wells 46WW02, 46WW04, LHSMW11, -14, -15, -19, -22, -23, and -24. The 87 historical samples are also included for comparative purposes and to permit qualitative evaluation of temporal trends in element concentrations at the site. All of the samples were analyzed for the full suite of 23 target analyte list (TAL) metals, and the 2007 samples were also analyzed for total dissolved solids (TDS) and total suspended solids (TSS). Installation-wide background data for TAL metals in groundwater are provided in the *Final Evaluation of Perimeter Well Data for Use as Groundwater Background* (Shaw Environmental, Inc. [Shaw], 2007) and are used for comparative purposes in the evaluation.

2.0 Geochemical Evaluation Methodology

Geochemical evaluations are based on the well-known chemical behavior of elements in groundwater and are performed to determine if the observed metals concentrations at a site reflect natural conditions or site-related contamination (Thorbjornsen and Myers, 2007, 2008). Elevated concentrations of inorganic constituents in groundwater samples may be due to naturally high dissolved concentrations, the presence of suspended particulates in the samples, reductive dissolution, or contamination resulting from site activities. The effects of suspended particulates and reductive dissolution are discussed below.

Effects of Suspended Particulates. Under natural conditions, metals concentrations are commonly controlled through adsorption on suspended particulates. The most common suspended particulates in ground water samples are clay minerals, hydrous aluminum oxides ($Al_2O_3 \bullet nH_2O$), and aluminum hydroxides [$Al(OH)_3$], hereafter referred to as "clays"; and iron oxide (Fe_2O_3), hydrous iron oxide, iron hydroxide [$Fe(OH)_3$], and iron oxyhydroxide ($FeO \bullet OH$) minerals, hereafter referred to as "iron oxides." Aluminum is a primary component of all clay minerals, which have low solubilities over the neutral pH range (6 to 8). Measured concentrations of aluminum greater than approximately 1 milligram per liter (mg/L) indicate the presence of suspended clay minerals (Hem, 1985; Stumm and Morgan, 1996); the higher the aluminum concentration, the greater the mass of suspended clay minerals in the sample. Iron oxides also have very low solubilities under oxic neutral-pH conditions, but they are redox-sensitive. Measured iron concentrations above approximately 1 mg/L under neutral-pH and moderate to oxidizing redox conditions indicate the presence of suspended iron oxides (Hem, 1985).

Samples containing trace elements adsorbed on suspended clay particulates should show a positive correlation with aluminum concentrations, and samples containing trace elements adsorbed on suspended iron oxides should show a positive correlation with iron concentrations. These correlations are evaluated by generating x-y plots of the concentrations of an elevated trace metal versus aluminum or iron (depending on the trace element). Divalent cations such as barium, lead, and zinc (Zn) have an affinity to adsorb on clay surfaces, which tend to maintain a net negative charge under neutral pH conditions (Electric Power Research Institute [EPRI], 1984; Brookins, 1988). Concentrations of barium, lead, or Zn in a set of samples can be evaluated through comparison to the corresponding aluminum concentrations. Under oxidizing conditions, elements such as arsenic, selenium, and vanadium are usually present as oxyanions and have a strong affinity to adsorb on iron oxide surfaces, which tend to maintain a net positive charge (Pourbaix, 1974; Hem, 1985; Brookins, 1988; Bowell, 1994). Concentrations of arsenic, selenium, or vanadium can be evaluated through comparison to the corresponding iron

concentrations. Chromium (Cr) can exist as a mixture of aqueous species with different charges [$Cr(OH)_2^+$, $Cr(OH)_3^o$, and $Cr(OH)_4^-$], depending on pH (EPRI, 1984), so it can be distributed on several different types of sorptive surfaces, including clay and iron oxide minerals.

If the concentrations of trace elements in unfiltered samples are positively correlated with aluminum or iron, then they are most likely adsorbed to the surfaces of suspended particulates. If all of the samples fall on a common trend with a positive slope, then the elevated concentrations are most likely natural.

As an example geochemical evaluation, the detected concentrations of Zn (y-axis) would be plotted against the corresponding detected concentrations of aluminum (x-axis), due to the affinity for Zn adsorption on clays under neutral-pH conditions. If all of the samples display a common trend with a positive slope (similar Zn/Al ratios), then it is likely that the Zn concentrations are due to the presence of suspended clay minerals in the samples. If a sample plots above the trend established by the other samples, then that sample has an anomalously high Zn/Al ratio and likely contains excess Zn that cannot be explained by these natural processes.

Ratio plots are also a useful tool for interpreting the relationship between trace and major elements and for identifying anomalous samples that may contain a component of contamination. Ratio plots display trace element concentrations on the y-axis and trace/major element ratios on the x-axis, and they are employed in conjunction with correlation plots in those cases where it is not immediately apparent which site samples have anomalously high elemental ratios on the correlation plots. However, ratio plots must be used with care when depicting aqueous data. For samples from low-redox areas, redox-sensitive elements (such as arsenic, iron, and Mn) are expected to display a higher degree of scatter on correlation plots and, hence, a wider range of ratios on ratio plots.

In addition to the evaluation of trace-versus-major element correlations, the effects of suspended particulates can be assessed via the evaluation of element-versus-turbidity correlations, evaluation of element-versus-TSS correlations, and comparison of filtered versus unfiltered splits. Evaluations of turbidity and TSS measurements provide additional lines of evidence that support the conclusions drawn from the evaluation of trace-versus-major element correlations. However, turbidity and TSS measurements are qualitative and cannot distinguish between suspended iron oxides, clay minerals, and natural organic material. Consequently, they do not provide the mechanistic information afforded by the correlations of trace elements versus aluminum or trace elements versus iron. Turbidity readings are also affected by the size and shape of suspended particulates. Comparisons of filtered versus unfiltered splits of samples are highly informative and permit the identification of elements that are present as suspended particulates versus those that are in true solution. Although filtered splits were not obtained during the historical sampling events, they were obtained during the September 2007 sampling

event. Comparisons of filtered versus unfiltered splits are provided below for data from this event.

Effects of Reductive Dissolution. The release of organic contaminants such as chlorinated solvents, jet fuel, or gasoline can establish local reducing environments caused by microbial degradation of the organic compounds. The establishment of local reducing conditions can drive the dissolution of iron and Mn oxides, which become soluble as the redox potential drops below a threshold value. Dissolution of these oxide minerals can mobilize the trace elements adsorbed on the oxide surfaces, which is a process termed "reductive dissolution." Many investigations have documented the mobilization of arsenic, selenium, and other trace elements under locally reducing redox conditions (e.g., Sullivan and Aller, 1996; Nickson *et al.*, 2000; Belzile *et al.*, 2000). Reducing conditions can also exist naturally in groundwaters and surface waters that are associated with swamp or wetland environments.

Evidence for reductive dissolution includes high Fe/Al ratios and correlation between elevated trace elements (arsenic, selenium, and vanadium in particular) versus lower redox conditions. Low redox conditions can be identified by local depressions in oxidation-reduction potential (ORP) or dissolved oxygen (DO) measurements or by the presence of reducing gases such as hydrogen, methane, ethane, or ethene. Anaerobic microbes can also reduce sulfate to sulfide and nitrate to ammonia, resulting in local depressions in sulfate and nitrate concentrations and local detections of sulfide and ammonia. In areas impacted by chlorinated solvents, additional evidence for the establishment of anaerobic reducing conditions is the presence of *cis*-1,2-dichloroethene (DCE) and/or vinyl chloride, which are reductive dechlorination products resulting from the microbial degradation of trichloroethene (TCE) or tetrachloroethene (PCE) under anaerobic conditions.

3.0 Geochemical Evaluation of Selected Elements in LHAAP-46 Groundwater Samples

This section presents the results of the geochemical evaluation of arsenic, chromium, lead, Mn, nickel, and Tl concentrations in the September 2007 LHAAP-46 groundwater samples. Although they are not chemicals of concern, aluminum and iron are evaluated first because they are the primary reference elements used to evaluate trace element concentrations, and because the ratios of their absolute concentrations provide important information regarding redox conditions at the sampled locations. Samples exhibiting high trace-versus-major element ratios relative to background samples (or other uncontaminated samples) are described as having "anomalously high" elemental ratios, if such elevated ratios cannot be explained as the result of natural processes. The term "anomalously high" is also used in reference to the elevated element concentrations of such samples. **Table 1** provides a list of the site samples that were identified in the LHAAP-46 geochemical evaluation as having anomalously high element concentrations (i.e., ratios), which may reflect site-related contamination.

For the September 2007 samples, field-measured pH readings range from 4.92 to 6.53, with a median of 6.13 and mean of 5.96. These values indicate slightly acid to neutral conditions at the sample locations. Field-measured DO readings range from 0.35 to 2.69 mg/L, with a median of 1.54 mg/L and mean of 1.38 mg/L; and ORP readings range from +22 to +106 millivolts (mV), with a median of +99 mV and mean of +80 mV. These values suggest moderate to oxidizing redox conditions at most of the sample locations. The available turbidity measurements range from 0 to 44.6 nephelometric turbidity units (NTU), with a median of 7.2 NTU and mean of 14 NTU. These readings suggest that most samples contained a relatively low mass of suspended particulates.

Aluminum and Iron. Aluminum was detected in only four of the ten unfiltered groundwater samples, at concentrations ranging from 233 to 1,360 micrograms per liter (µg/L). As discussed previously, aluminum concentrations in excess of approximately 1,000 µg/L in neutral-pH groundwater indicate the presence of suspended clays. Some fraction of detected aluminum will be present in solution at a pH below about 4 and above 10 (Drever, 1997), but the site pH readings are within this range. Iron was detected in all ten unfiltered groundwater samples, at concentrations ranging from 413 to 9,820 µg/L. Iron concentrations in excess of approximately 1,000 µg/L in neutral-pH, moderate to oxidizing groundwater conditions indicate the presence of suspended iron oxides. Iron, unlike aluminum, is a redox-sensitive element, and its dissolved concentrations will increase under reducing conditions. Reducing conditions can be natural, or they can be induced by the microbial degradation of chlorinated solvents and fuel hydrocarbons (**Section 2.0**). The available DO and ORP readings suggest moderate to oxidizing conditions at

the sampled wells; iron is therefore expected to be present in particulate form in at least some of the site samples.

A plot of aluminum versus iron concentrations can be used as a qualitative indicator of the amount of suspended particulates in the groundwater samples, as well as an indicator of the redox conditions at the sample locations (**Figure 1**). A linear trend with a positive slope is typically observed when both aluminum and iron are present in particulate form, and just such a trend is observed in **Figure 1** for the historical site samples and most of the background and 2007 site samples. The samples with the highest aluminum concentrations also have proportionally higher iron and lie on the linear trend. The 2007 site samples exhibit Al/Fe ratios that are consistent with those of the background samples. These observations suggest that the aluminum is due to the presence of suspended clay particulates, and that it is natural.

This conclusion is corroborated by comparison of filtered versus unfiltered splits and comparison of unfiltered aluminum concentrations versus TSS concentrations. The four site samples with detectable aluminum in the unfiltered splits are all nondetect for aluminum in the corresponding filtered splits, at a reporting limit of 100 µg/L. The samples with the highest unfiltered aluminum concentrations also have high TSS concentrations, as seen in **Figure 2**. The decrease in concentration after filtration and the correlation between unfiltered aluminum versus TSS provide additional lines of evidence that aluminum detected in the unfiltered splits is associated with filterable suspended particulates, such as clays.

As indicated above, some portion of the iron in the site samples is also associated with suspended particulates. This conclusion is corroborated by comparison of filtered versus unfiltered splits. A plot of unfiltered iron concentrations versus filtered/unfiltered ratios is provided in **Figure 3**. Only samples with both filtered and unfiltered splits can be depicted in the plot. A generally negative slope is apparent in **Figure 3**, reflecting the decrease in iron concentrations after filtration; the samples with the highest unfiltered iron concentrations generally have the lowest filtered/unfiltered ratios.

Six site samples with detectable iron in their unfiltered splits cannot be depicted in **Figure 1** because they lack detectable aluminum (reporting limit of 100 µg/L). Their iron concentrations range from 449 to 9,820 µg/L, with a mean of 3,915 µg/L. The presence of detectable iron (at relatively high concentrations, in most cases) and the lack of detectable aluminum indicate low redox conditions, in which iron is expected to be present primarily in solution. The elevated iron in these samples may be an indirect effect of the volatile organic compound (VOC) contamination, which creates a reducing environment that allows the naturally occurring iron oxides in the aquifer matrix to dissolve.

Arsenic. Arsenic was detected in seven of the ten unfiltered site groundwater samples in September 2007, at concentrations ranging from 2.87 J to 8.71 J µg/L. As discussed previously, arsenic under natural conditions is present in groundwater primarily as oxyanions and its concentrations are often controlled by adsorption on iron oxides. A positive correlation between arsenic and iron concentrations is expected for uncontaminated samples under oxidizing conditions. However, arsenic exhibits complex behavior in groundwater systems, and it is strongly affected by both pH and redox conditions. Arsenic (as arsenate) is less strongly sorbed to iron oxides as pH increases above 9 (Smedley and Kinniburgh, 2002), but the pH values for the LHAAP-46 samples with detectable arsenic are all below 9. Arsenic will also desorb from iron oxides under reducing conditions, and these reducing conditions may be natural or caused by the degradation of organic contaminants such as fuels and chlorinated solvents. In addition to these mechanisms, arsenic concentrations can also increase if the element is added to the groundwater system as a primary contaminant, such as through the release of arsenic compounds such as arsenical herbicides. Such contamination would be manifested as an anomalous As/Fe ratios relative to the background samples.

The September 2007 LHAAP-46 samples with detectable arsenic either have a calculated Fe/Al ratio significantly greater than 1 or detectable iron and nondetectable aluminum. Volatile organic compound analyses were not obtained during the September 2007 sampling event. However, several historical samples from the wells with detectable arsenic in the September 2007 samples contained detectable VOCs such as PCE, TCE, *cis*-1,2-DCE, and/or *trans*-1,2-DCE. The elevated Fe/Al ratios (calculated and inferred) indicate low redox conditions, and the historical VOC detections suggest that the low redox might be induced by the degradation of the organic contaminants, at least locally. Accordingly, it is expected that some portion of the detected arsenic will be in solution.

A plot of arsenic versus iron in the LHAAP-46 and background samples is provided in **Figure 4**. Many historical site samples, two background samples, and one September 2007 site sample form a common trend with a positive slope. The As/Fe ratios of these site samples are relatively consistent and similar to those of the background samples, which suggests a natural source for their arsenic concentrations. Above this trend lie several historical and 2007 samples, along with one background sample. The anomalously high As/Fe ratios of these samples suggest that they contain excess arsenic from a contaminant source or that their arsenic concentrations may be elevated due to reductive dissolution. Sample LHSMW11-090707 has filtered/unfiltered ratio below one (0.63), which may indicate that some portion of the arsenic in this sample is associated with filterable particulates such as iron oxides. However, the estimated (J-qualified) nature of the site arsenic detections indicates a high degree of uncertainty regarding their actual arsenic concentrations, and this adds uncertainty to the filtered/unfiltered ratios. The filtered/unfiltered arsenic ratios for the other September 2007 site samples range from 1.0 to 1.4.

Another perspective on the data sets is provided by a plot of unfiltered arsenic concentrations versus the corresponding As/Fe ratios (**Figure 5**). This ratio plot more clearly reveals that several of the September 2007 site samples have anomalous As/Fe ratios relative to background. **Table 1** indicates the samples with the elevated arsenic. The arsenic concentrations are all J-qualified, which indicates a high degree of analytical uncertainty. These samples should be considered suspect, but it cannot be concluded that the elevated concentrations are from site contamination.

Chromium. Chromium was detected in all ten unfiltered site groundwater samples, at concentrations ranging from 8.87 J to 1,020 µg/L. Chromium can be present in solution as Cr(VI) species under strongly oxidizing conditions or as Cr(III) species under oxidizing to reducing conditions (Brookins, 1988). Naturally occurring Cr(VI) species have been observed, but are not common, so the identification of Cr(VI) is generally considered to be an indicator of contamination. Chromium (VI) species are highly soluble and do not strongly adsorb, so they are not associated with suspended particulates. Chromium (III) species, in contrast, have low solubilities and strongly adsorb, so they usually are associated with suspended particulates. The degree of association with suspended particulates can thus be used to determine if the detected concentrations are natural or have a contaminant source. As noted in **Section 2.0**, chromium can adsorb on suspended clays or iron oxides, depending on pH. If a sample contains suspended clays or iron oxides, then it is expected to contain detectable concentrations of aluminum or iron and associated trace elements such as chromium.

Chromium and iron are components of the stainless steel used to construct the LHAAP-46 monitoring wells. Iron released from the corrosion of steel will form insoluble oxides (rust) in an oxidizing environment, and will locally contribute suspended oxide particulates to groundwater in the vicinity of the well. Chromium released from the corrosion of the steel will be in the insoluble trivalent state, and will tend to remain with the iron oxide particles. Filtered/unfiltered chromium ratios below 1 would therefore be expected, as would a positive correlation between chromium and iron concentrations (although the Cr/Fe ratios may differ from those of samples from unaffected groundwater).

The background samples and most of the LHAAP-46 samples form a common trend with a positive slope in a plot of chromium versus iron (**Figure 6**). Covariance between chromium and iron concentrations is often observed for uncontaminated samples under natural conditions, although it can also be observed in samples from groundwaters impacted by corrosion of stainless steel, as discussed above. Some of the historical site samples and a few of the September 2007 site samples have Cr/Fe ratios that are consistent with background (**Figure 7**). However, several site samples have Cr/Fe ratios that exceed the background ratio range, and the elevated chromium in these samples should be considered suspect.

Chromium concentrations in all of the September 2007 site samples decreased upon filtration, as seen in the plot of unfiltered chromium versus filtered/unfiltered ratios (**Figure 8**). Two samples cannot be depicted in the plot because their filtered splits are nondetect for chromium. In addition, the samples with elevated chromium generally have higher TSS concentrations (**Figure 9**). The significant decrease in chromium concentrations upon filtration and the positive correlation with TSS concentrations suggest that chromium in the site samples is associated with filterable, suspended particulates, such as iron oxides.

Evaluation of the LHAAP-46 data suggests localized chromium contamination from well construction, but not necessarily site-related contamination from historical LHAAP activities. The nickel evaluation (below) provides more details on the corrosion of stainless steel in contact with groundwater, and the geochemical factors that affect it. **Table 1** lists the seven September 2007 samples that exhibit anomalously high chromium Cr/Fe ratios relative to background.

Lead. Anomalously high lead concentrations (43 to 673 µg/L) were observed in the 1996 samples from fourteen wells (LHSMW08, -11, -15, -16, -18, -19, -20, -21, -22, -23, -24, -25, -26, and -27). However, the 1998 samples from these wells were nondetect for the element (at a reporting limit of 3 µg/L) and all ten September 2007 site samples are nondetect for lead (at a reporting limit of 5 µg/L). These observations suggest that any lead contamination, if previously present, has attenuated or the elevated detections were due to turbid samples, and that an ongoing source is not present at the site. Because very few samples contained detectable lead concentrations, no more detailed analysis was made.

Manganese. Manganese was detected in all ten unfiltered site groundwater samples, at concentrations ranging from 23.7 to 3,790 µg/L. Manganese usually displays complex behavior in natural systems because of three possible valence states (+2, +3, and +4), each with different solubilities and sorptive properties (Hem, 1985). Manganese is similar to iron in that it is soluble under reducing conditions but has very low solubilities under oxidizing conditions. One difference between Mn and iron is that the critical redox potential for dissolution of Mn oxides is higher than the redox potential for dissolution of iron oxides. This means that dissolved Mn concentrations are a more sensitive indicator of local redox depressions than dissolved iron concentrations. Reducing conditions can be natural, or they can be induced by the microbial degradation of chlorinated solvents and fuels (**Section 2.0**).

A plot of Mn versus iron in the LHAAP-46 and background samples is provided in **Figure 10**. Most of the historical site samples, all of the intermediate-zone background samples, three shallow-zone background samples, and six September 2007 site samples exhibit similar Mn/Fe ratios and form a common trend with a positive slope in this plot. Several historical site samples, the majority of shallow-zone background samples, and four September 2007 site samples lie

above the trend established by the other samples and exhibit a higher degree of scatter. The higher Mn/Fe ratios of these samples may indicate slightly lower redox conditions than is present at the other sampling locations with lower Mn/Fe ratios.

The filtered/unfiltered ratios for Mn in most of the site samples are close to 1 (**Figure 11**), which indicates that the Mn is primarily in solution in these samples. However, lower filtered/unfiltered ratios are generally observed for the site samples with lower Mn concentrations (186 µg/L and lower). These lower ratios indicate that some portion of the Mn in those samples is associated with suspended particulates, which may reflect slightly higher redox conditions at those sampling locations. The differing Mn/Fe ratios and range of filtered/unfiltered Mn ratios suggest the presence of a redox gradient at the site. However, because the background samples exhibit similar trends, these gradients may be natural.

All of the Mn/Fe ratios of the LHAAP-46 samples are consistent with those of the background samples, which indicate that the site samples do not contain excess Mn from a contaminant source. This also suggests that any VOC-induced reductive dissolution, if present, is not a significant control on the Mn concentrations. Manganese detected in the site samples is most likely natural.

Nickel. Nickel was detected in all ten unfiltered site groundwater samples, at concentrations ranging from 13.5 J to 3,490 µg/L. Under natural conditions, nickel is commonly present as the divalent cation (Ni^{2+}) at pH values below about 8 (Brookins, 1988). As discussed in **Section 2.0**, cationic species have an affinity to adsorb on the surfaces of suspended clay minerals, which tend to maintain a net negative surface charge. If an uncontaminated sample contains a high proportion of suspended clay minerals, then it is expected to contain naturally high concentrations of aluminum and proportionally higher concentrations of associated trace elements such as nickel. Additionally, if nickel is adsorbed on suspended particulates, it would be expected to exhibit low filtered/unfiltered ratios and its unfiltered concentrations should covary with TSS concentrations.

A plot of nickel versus aluminum in the LHAAP-46 and background data sets is provided in **Figure 12**. Although a common trend with a positive slope is observed for some of the background and historical site samples, there are several samples that lie above this trend, giving the appearance of two parallel trends. The samples that form the higher of the parallel trends on **Figure 12** form a cluster on the right side of the ratio plot (**Figure 13**), indicating higher Ni/Al ratios. In addition, of the samples depicted in the plot, one September 2007 sample and several historical site samples have Ni/Al ratios that exceed the background ratio range. Only samples with both detectable nickel and detectable aluminum can be depicted on the correlation plot and ratio plot. Not shown in **Figure 12** and **Figure 13** are six 2007 site samples with detectable nickel (58.4 to 3,490 µg/L) and nondetectable aluminum.

The nickel concentrations in the site samples did not decrease upon filtration, as seen in the plot of unfiltered nickel versus filtered/unfiltered ratios (**Figure 14**). The filtered/unfiltered ratios of approximately 1 indicate that most of the detected nickel in these samples is in solution (although some proportion may be associated with particulates small enough to pass through the filter pores).

A plot of nickel versus chromium in the unfiltered samples is provided in **Figure 15**. This plot reveals that most of the samples with elevated nickel also have elevated chromium, which suggests that nickel and chromium are co-contaminants at the site. This is expected, as nickel and chromium are components of the stainless steel used to construct the monitoring wells.

Type 304 stainless steel is a commonly alloy used for well screens and risers. This alloy contains 18 percent chromium and 8 percent nickel. All steel alloys are susceptible to several types of corrosion when in contact with groundwater. Pitting corrosion starts with the oxidation and dissolution of a small area of exposed metal, which initiates the formation of a pit. Subsequent pit growth is aided by electrochemical reactions. Metal inside of the pit acts as an anode, while the remaining metal surface in contact with the bulk electrolyte (groundwater) acts as a cathode. The establishment of this electrochemical cell drives the pit growth forward. Factors that affect the initiation of pitting include the extent of heat treatment, surface roughness, internal stresses, and local impurities, as well as time, temperature, and groundwater composition (Oakley and Korte, 1996). The diversity of these factors may explain why screens and casings of the same compositions at LHAAP may display different corrosion behavior at different wells.

The corrosion of some metal alloys is self-limited by the formation of a “passivating layer,” which is a thin film of metal oxide adhering to the surface of the alloy. The rate-limiting step for corrosion under these conditions is the diffusion of oxidants across the passivating layer, and this process can be slow. However, the presence of natural metal complexing agents such as chloride, and to a lesser extent, fluoride and sulfate, can dissolve the passivating layer and expose fresh metal surfaces.

The susceptibility of stainless-steel alloys to corrosion in natural water compositions was investigated by Kain, *et al*. (1984). Test results showed that chloride concentrations as low as 100,000 µg/L could accelerate crevice corrosion in Type 304 stainless steel. Elevated chloride concentrations were observed in the historical LHAAP-46 samples (3,600 to 1,870,000 µg/L; mean of 447,000 µg/L) and shallow background samples (2,070 to 1,930,000 µg/L; mean of 974,000 µg/L). These concentrations are relatively high and approach those observed in groundwaters impacted by oil-field brines or saltwater intrusion. The high chloride concentrations in LHAAP-46 groundwater thus permit continued corrosion of the stainless steel well materials and continued release of iron, nickel and chromium to groundwater.

Iron released from the corrosion of steel will form insoluble oxides (rust) in an oxidizing environment, and will locally contribute suspended oxide particulates to groundwater in the vicinity of the well. Chromium released from the corrosion of the steel will be in the insoluble trivalent state, and will tend to remain with the iron oxide particles. Nickel released from the corrosion of the casings and screens is more soluble than iron or chromium, and will tend to dissolve in the groundwater.

Evaluation of the LHAAP-46 data suggests localized nickel contamination from well construction, but not necessarily site-related contamination from historical LHAAP activities. **Table 1** lists the September 2007 samples that exhibit anomalously high nickel concentrations relative to background. They include one sample with an anomalously high Ni/Al ratio (LHSMW11-090707) and six samples with detectable nickel but nondetectable aluminum.

Thallium. Thallium was detected in nine of the ten unfiltered site groundwater samples, at concentrations ranging from 1.94 J to 8.54 J µg/L. All of the background samples are nondetect for Tl; however, the background reporting limit of 20 µg/L and background method detection limit of 10 µg/L are higher than those of the site samples (reporting limit of 2 µg/L). The large difference in site versus background detection limits precludes proper comparison of the site and background Tl concentrations. It is worth noting that all of the September 2007 site detections are below the background method detection limit.

Thallium can occur in three oxidation states (+1, +2, and +3), and it is known to adsorb on iron oxides and Mn oxides (Alina Kabata-Pendias, 2000). A plot of Tl versus iron is provided in **Figure 16**. Only samples with detectable Tl and iron can be depicted, so only the September 2007 site samples and a subset of historical site samples are shown. Four historical site samples (93 to 200 µg/L Tl) lie well above the other samples in **Figure 16**. The anomalously high Tl/Fe ratios of those four samples suggest contamination. In contrast, the consistent Tl/Fe ratios of the September 2007 samples suggest that the recent Tl detections have a natural source. A stronger correlation is not observed for the September 2007 site samples partly because their Tl detections are estimated (J-qualified) and therefore uncertain, and also because some portion of their Tl is in solution, as evidenced by their filtered/unfiltered ratios of approximately 1.

The anomalously high Tl concentrations noted above represent the February 1996 or August 1996 samples from wells LHSMW08, -21, -24, and -27. These elevated concentrations are not reproducible in subsequent rounds. The 1998 samples from LHSMW08 and -27 are nondetect for Tl (at a reporting limit of 1 µg/L). The 1998 Tl detections for the LHSMW21 and -24 samples (1.5 µg/L and 4.5 µg/L) are most likely natural, as evidenced by their much lower Tl/Fe ratios. The 2007 Tl detection from LHSMW24 is also low (5.29 J µg/L) and is most likely natural, as discussed above.

4.0 Summary

A geochemical evaluation was performed to determine if arsenic, chromium, Mn, nickel, and Tl concentrations in the September 2007 LHAAP-46 groundwater samples represent potential contamination or have a natural source. The evaluation indicated that all detected concentrations of Mn and Tl in the ten site samples are most likely natural. Anomalously high arsenic concentrations are present in six samples; one possible explanation is that the arsenic in these samples is elevated due to reductive dissolution of naturally occurring iron oxide and Mn oxide minerals, which is a secondary effect of the VOC contamination at the site. Anomalously high concentrations of chromium and nickel are present in seven samples each, but they most likely represent localized contamination from the stainless-steel monitoring wells, as opposed to contamination from historical site operations. **Table 1** lists the September 2007 samples with anomalously high element concentrations.

It should be noted that although anomalously high lead concentrations were observed in the 1996 samples from fourteen wells, the element was not detected in the 1998 samples from the same wells. In addition, all ten September 2007 site samples are nondetect for lead. These observations suggest that any lead contamination, if previously present, has attenuated and that an ongoing source is not present at the site. With very few detectable lead results, no more detailed analysis was made.

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Tables

Table 1
September 2007 Groundwater Samples with Anomalous Element Concentrations

Well	Sample	Date	Purpose	Element(s)
46WW04	46WW04-090707	7-Sep-07	REG	Chromium, Nickel
LHSMW11	LHSMW11-090707	7-Sep-07	REG	Arsenic, Chromium, Nickel
LHSMW14	LHSMW14-090707	10-Sep-07	REG	Chromium
LHSMW15	LHSMW15-090707	10-Sep-07	REG	Arsenic, Chromium, Nickel
LHSMW22	LHSMW22-090707	11-Sep-07	REG	Arsenic, Nickel
LHSMW23	LHSMW23-090707	11-Sep-07	REG	Arsenic, Chromium, Nickel
LHSMW24	LHSMW24-090707	11-Sep-07	REG	Arsenic, Chromium, Nickel

Notes and Abbreviations:

1. Only arsenic, chromium, lead, manganese, nickel, and thallium were evaluated.
2. The elevated chromium and nicel concentrations specified above most likely reflect localized contamination from the stainless-steel monitoring wells, not site-related contamination.

REG - regular environmental sample

Figures

Acronyms for Figures 1 – 16

Al	**aluminum**
As	**arsenic**
BG	**background**
Cr	**chromium**
Fe	**iron**
mg/L	**microgram per liter**
Ni	**nickel**
Vs.	**versus**

Figure 1. Aluminum vs. Iron in Unfiltered Groundwater, LHAAP-46

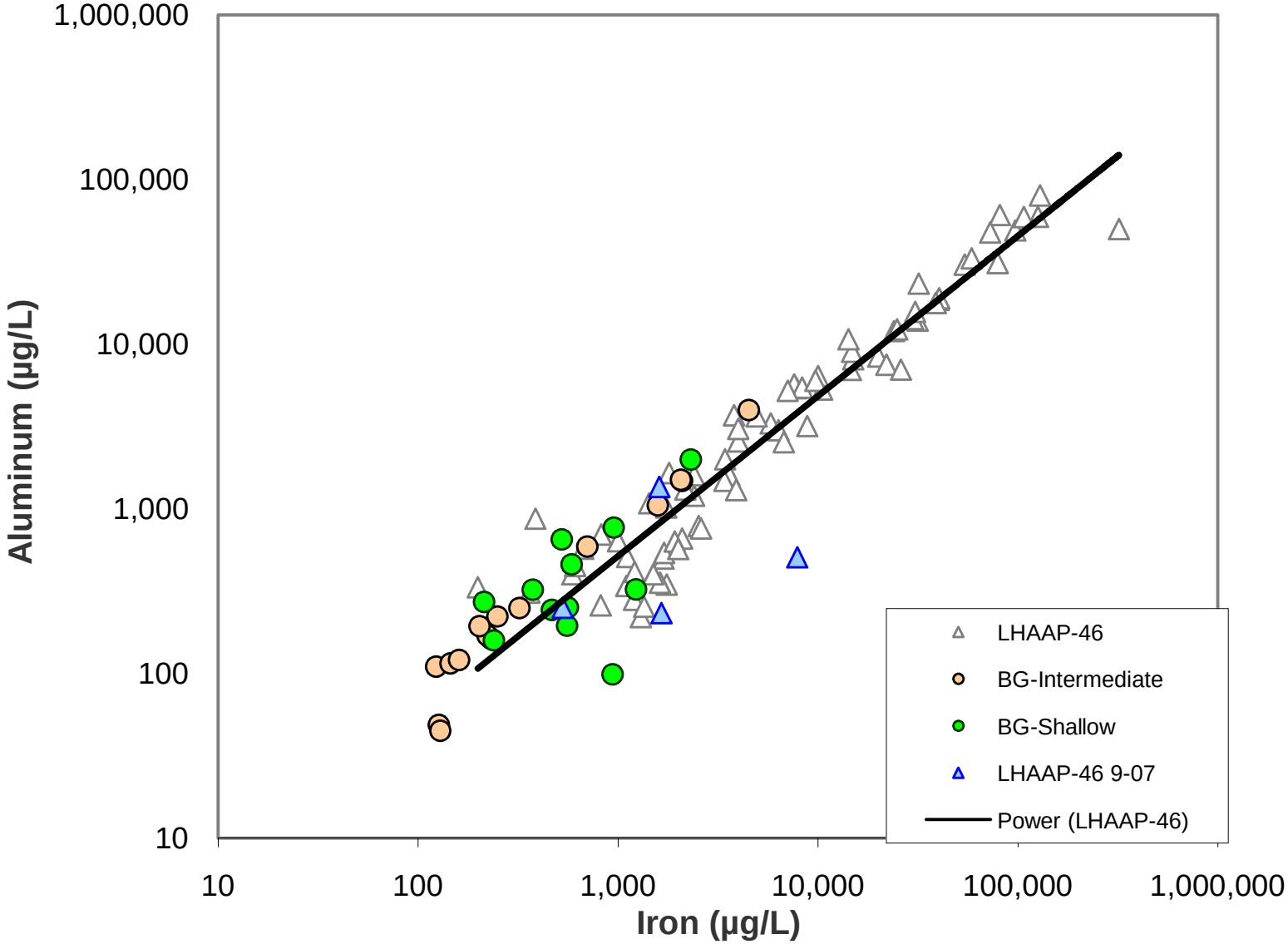


Figure 2. Unfiltered Aluminum vs. Total Suspended Solids in LHAAP-46 Groundwater

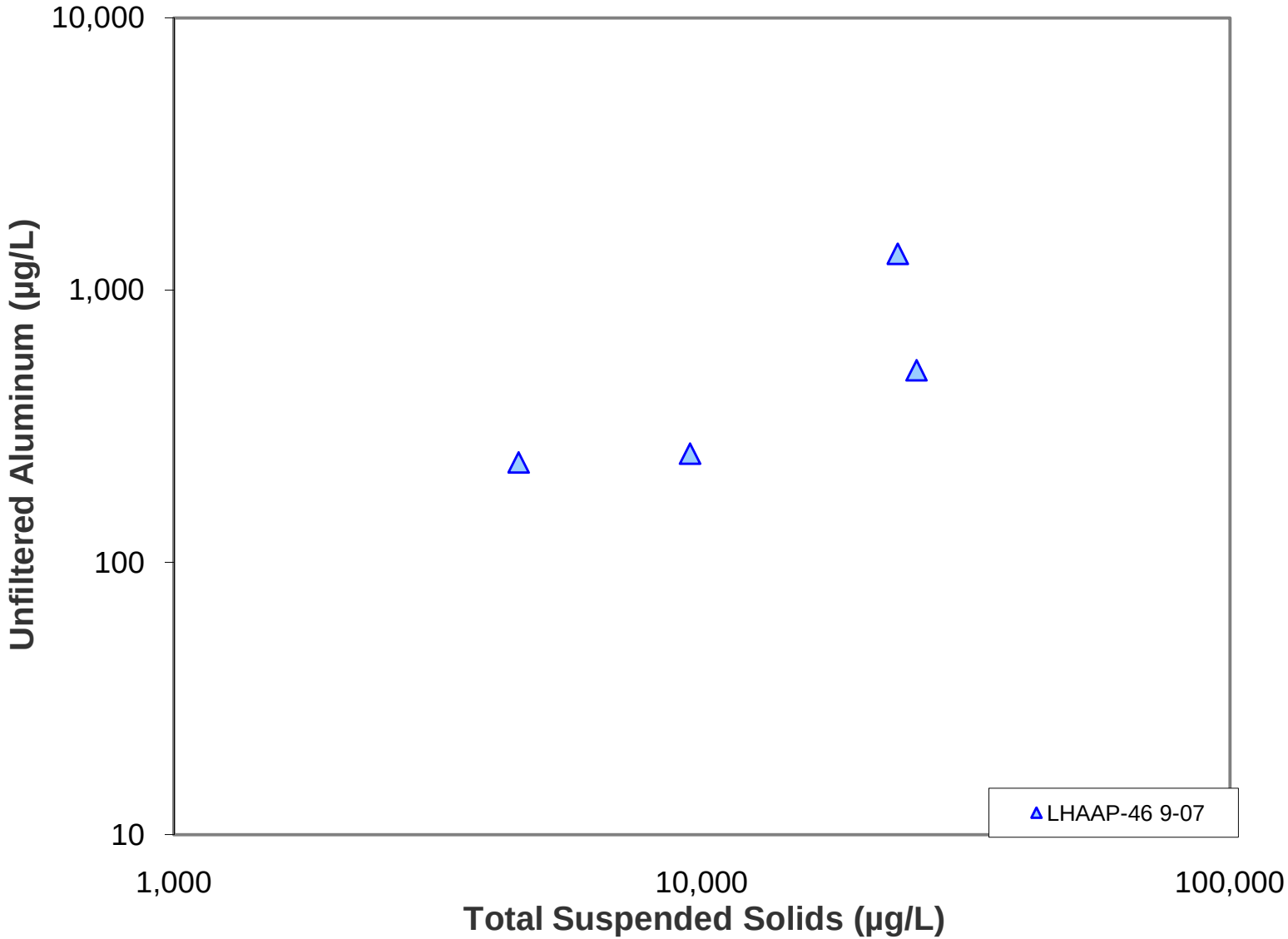


Figure 3. Unfiltered Iron vs. Filtered/Unfiltered Ratios, LHAAP-46 Groundwater

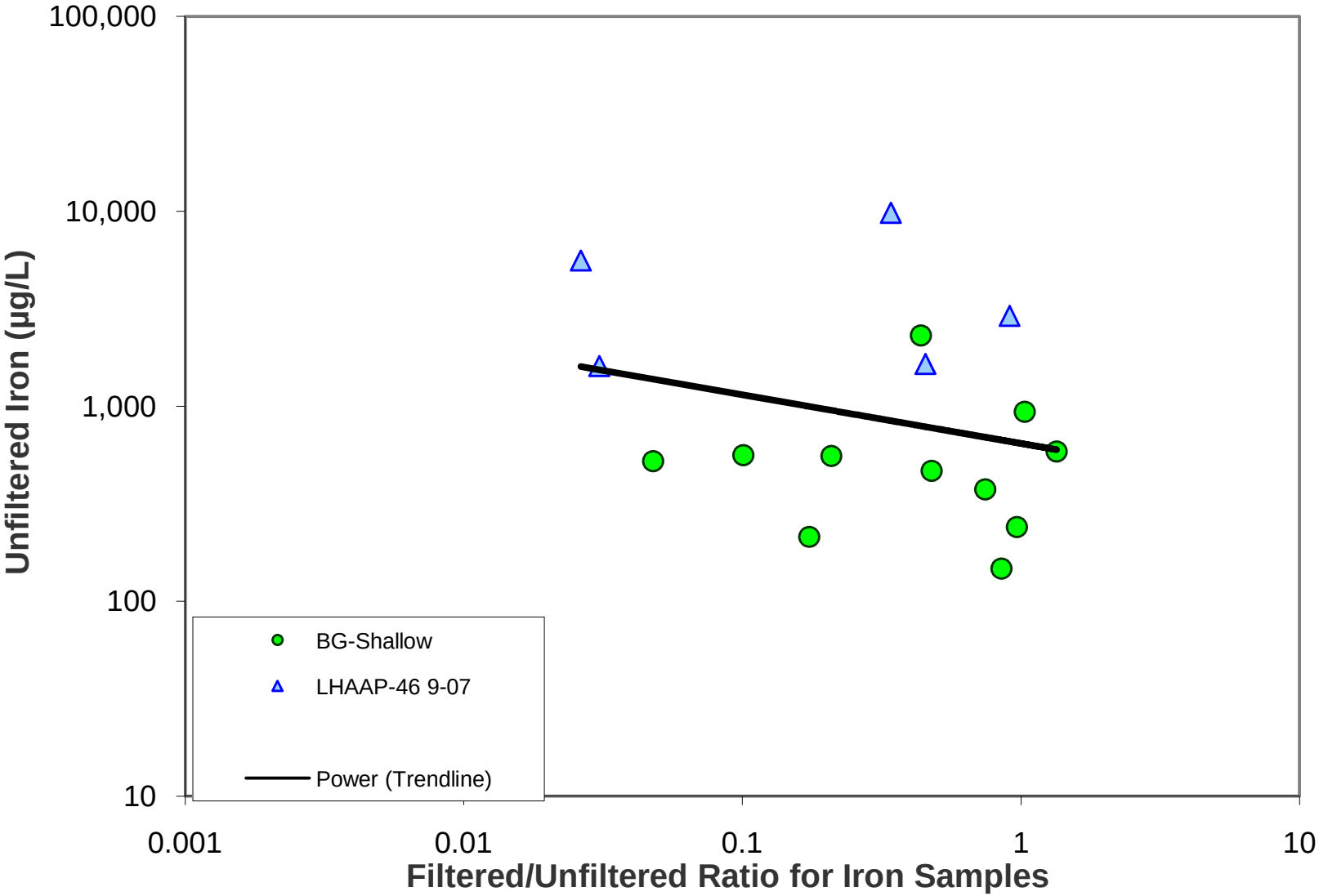


Figure 4. Arsenic vs. Iron in Unfiltered Groundwater, LHAAP-46

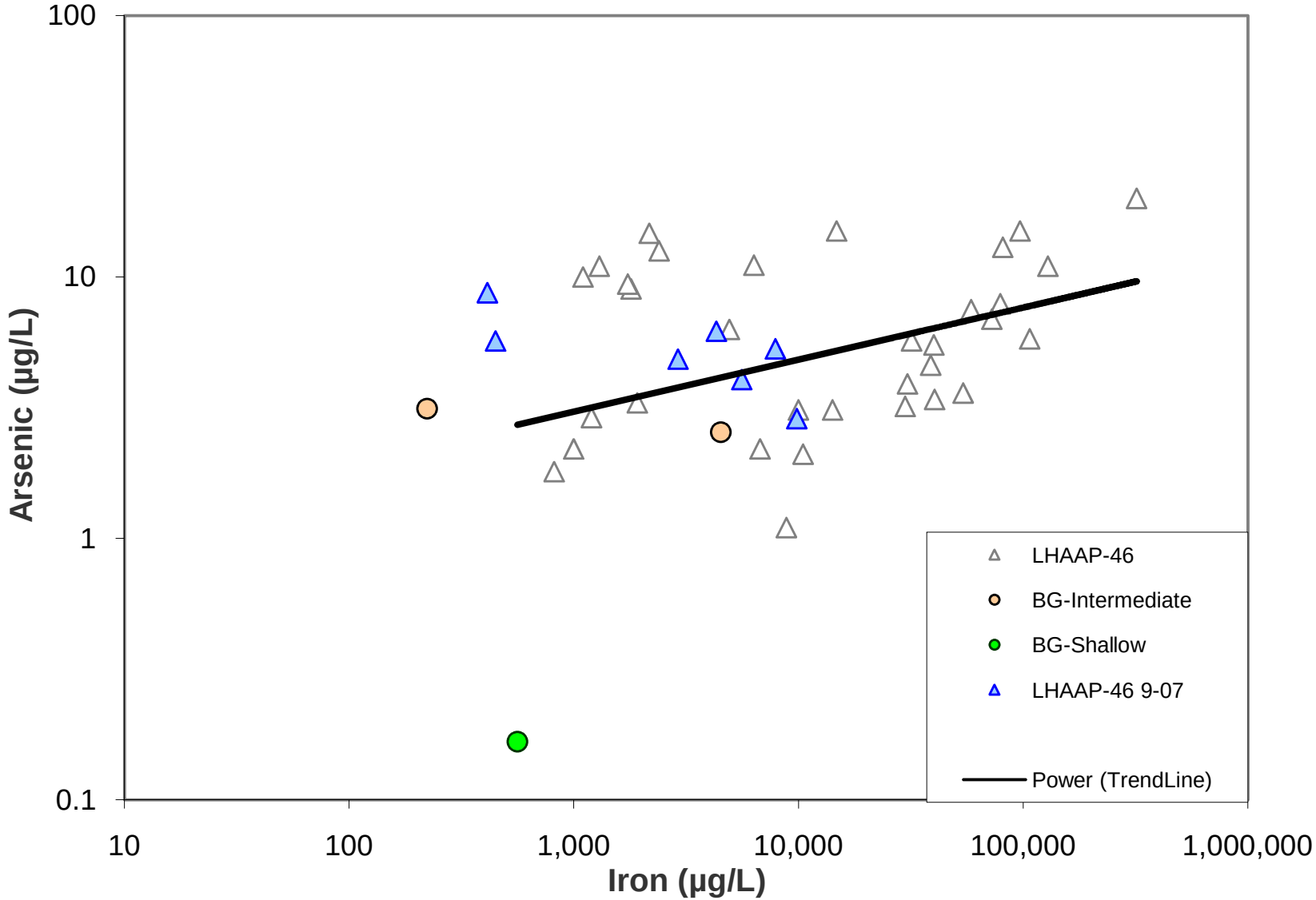


Figure 5. Arsenic vs. As/Fe Ratios in Unfiltered Groundwater, LHAAP-46

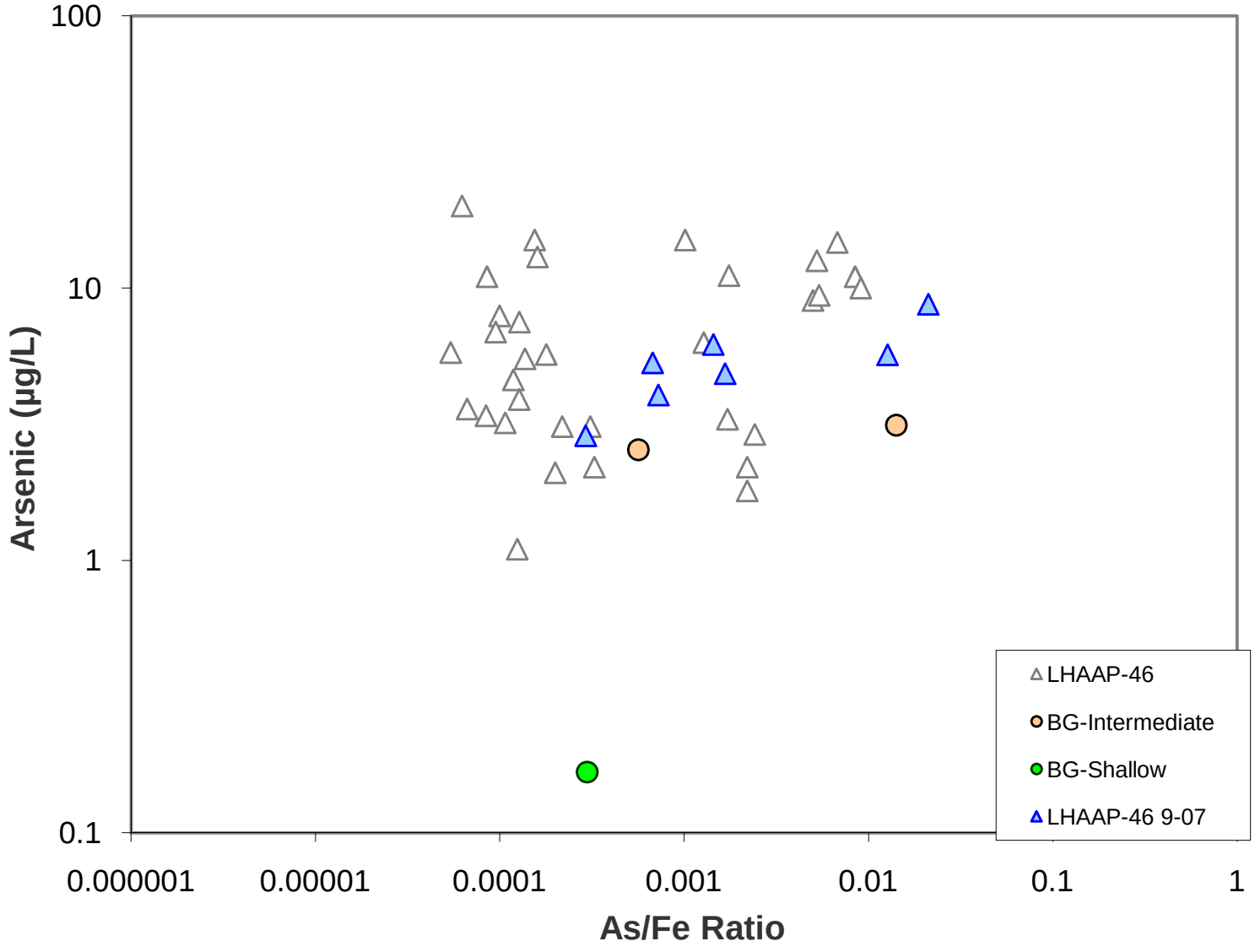


Figure 6. Chromium vs. Iron in Unfiltered Groundwater, LHAAP-46

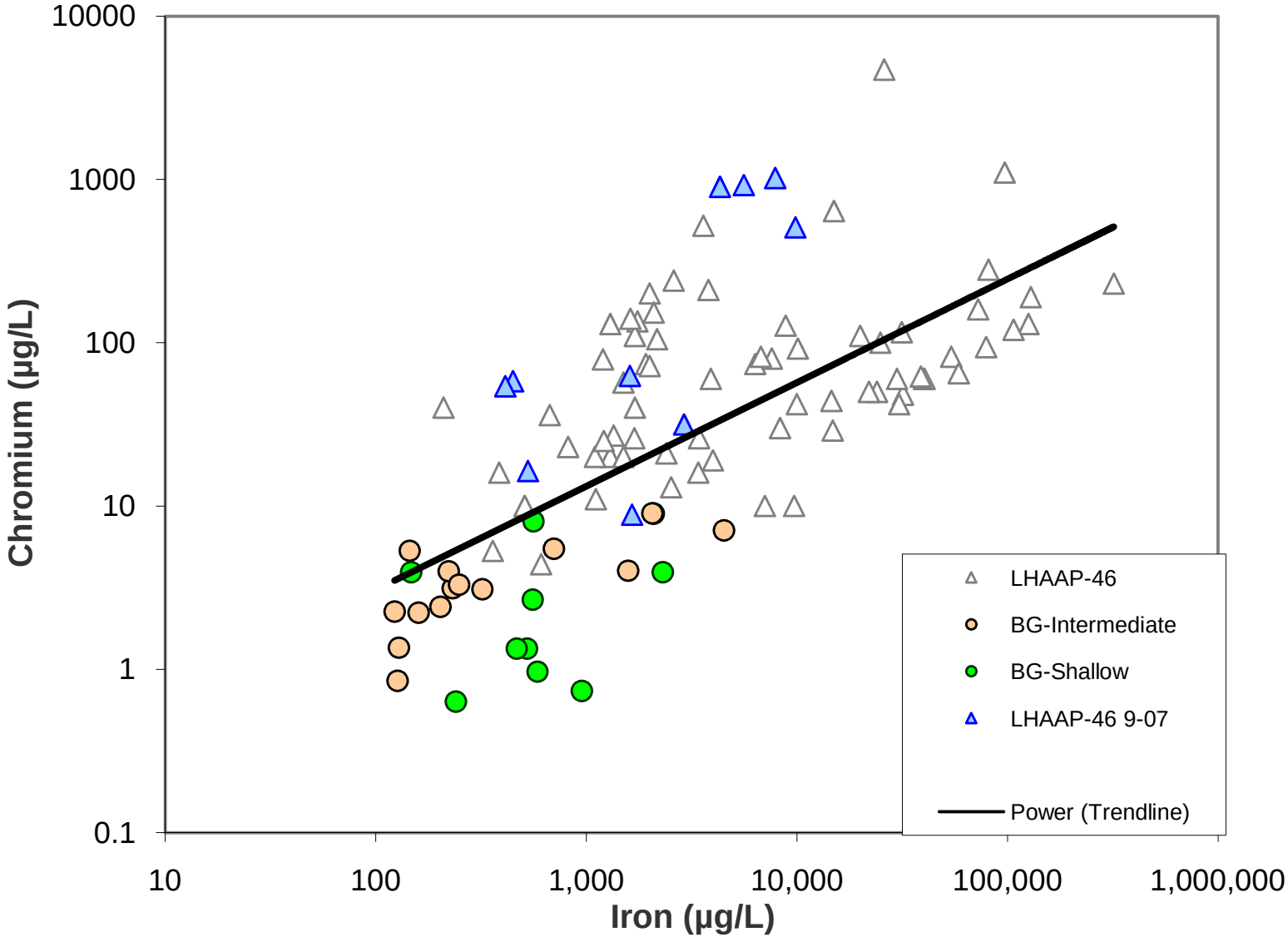


Figure 7. Chromium vs. Cr/Fe Ratios in Unfiltered Groundwater, LHAAP-46

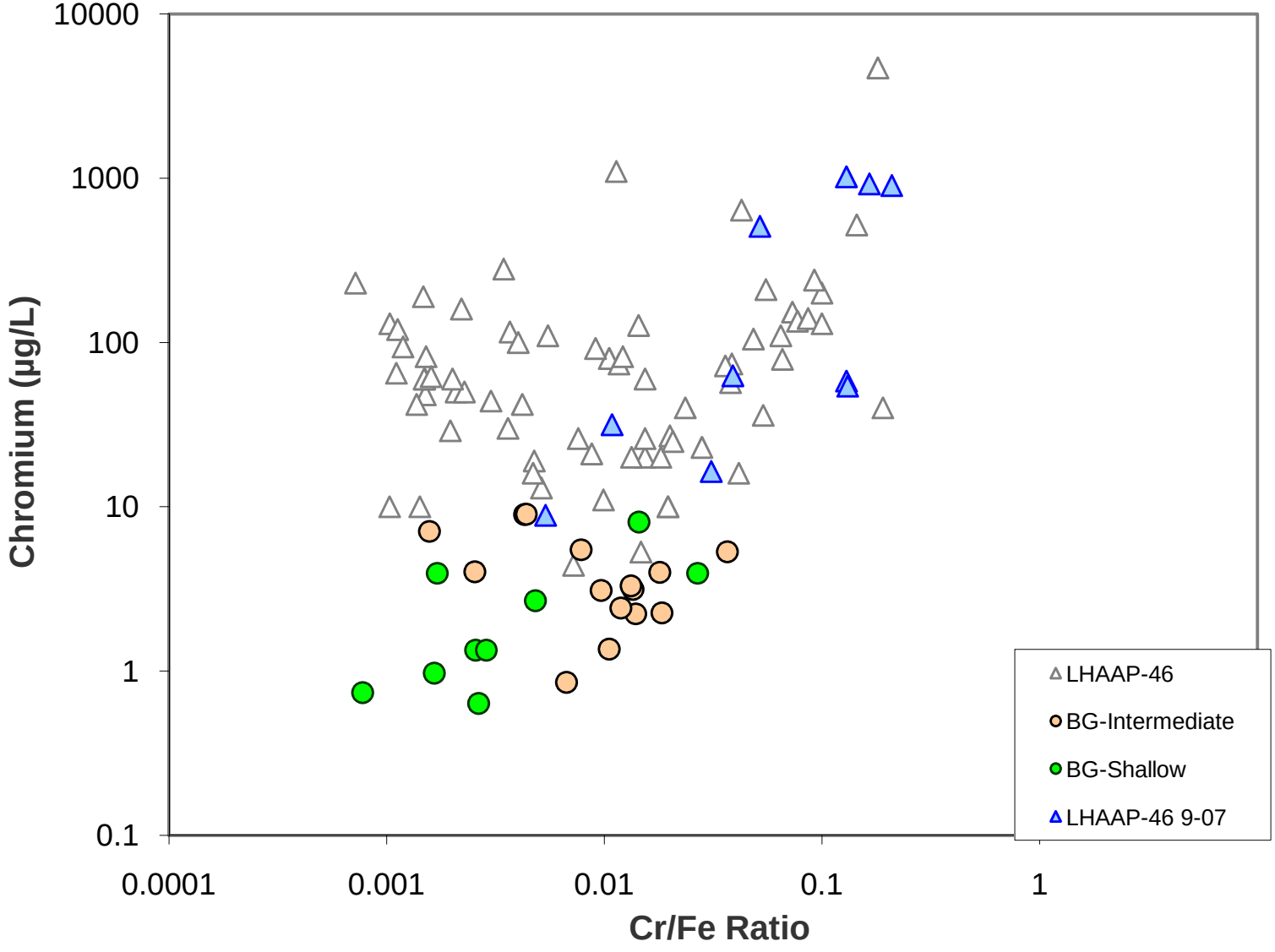


Figure 8. Unfiltered Chromium vs. Filtered/Unfiltered Ratios, LHAAP-46 Groundwater

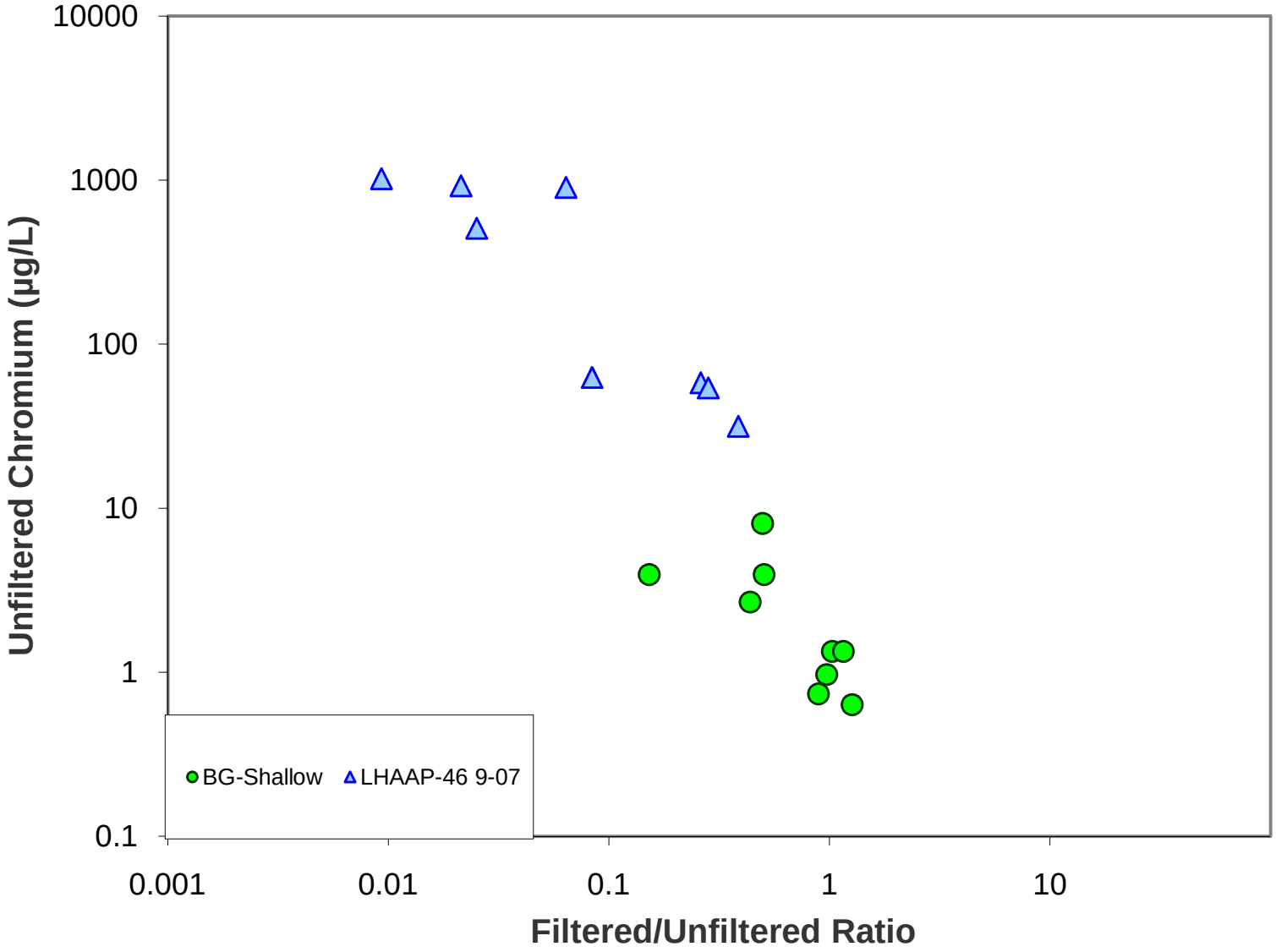


Figure 9. Unfiltered Chromium vs. Total Suspended Solids in LHAAP-46 Groundwater

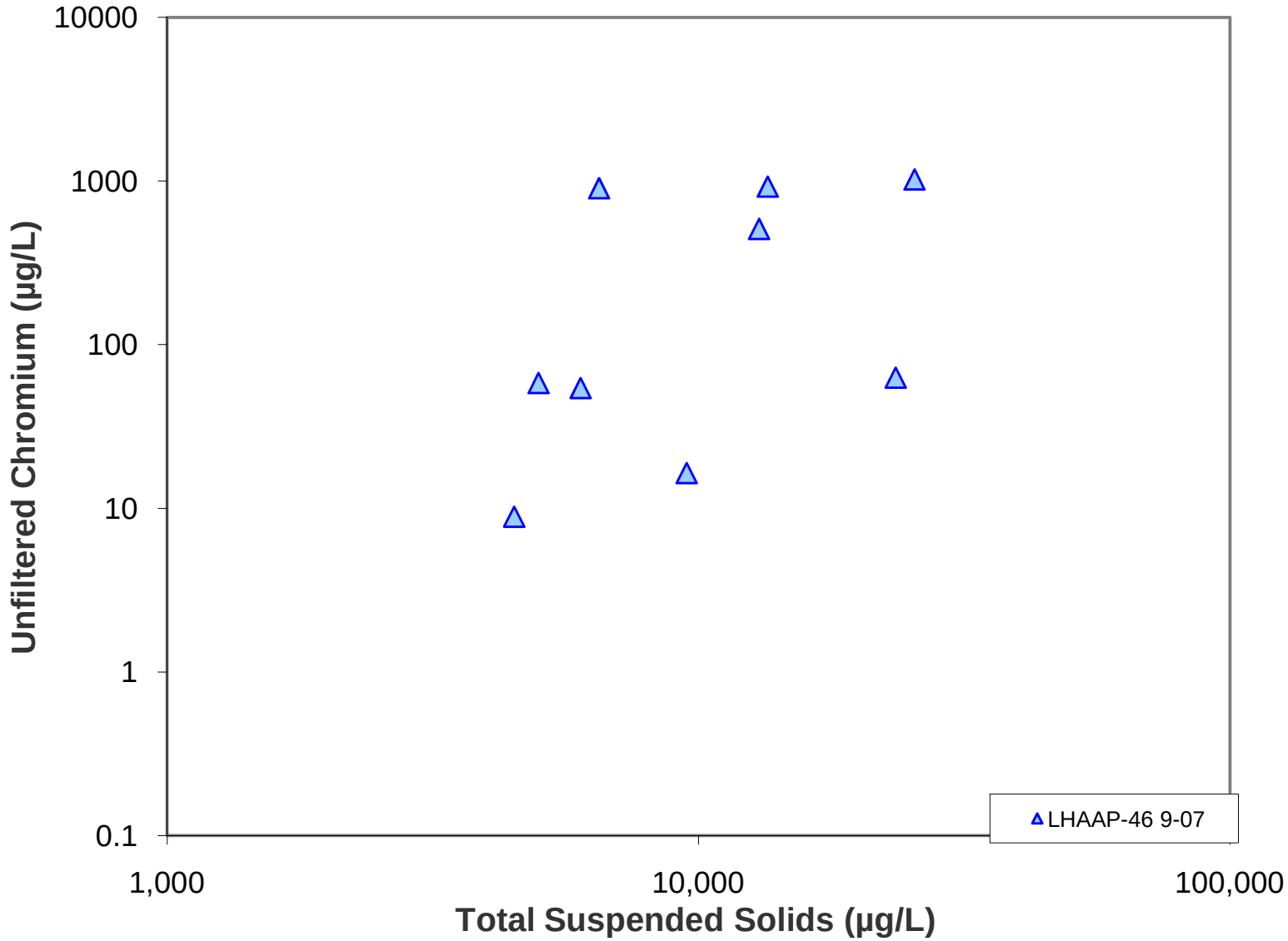


Figure 10. Manganese vs. Iron in Unfiltered Groundwater, LHAAP-46

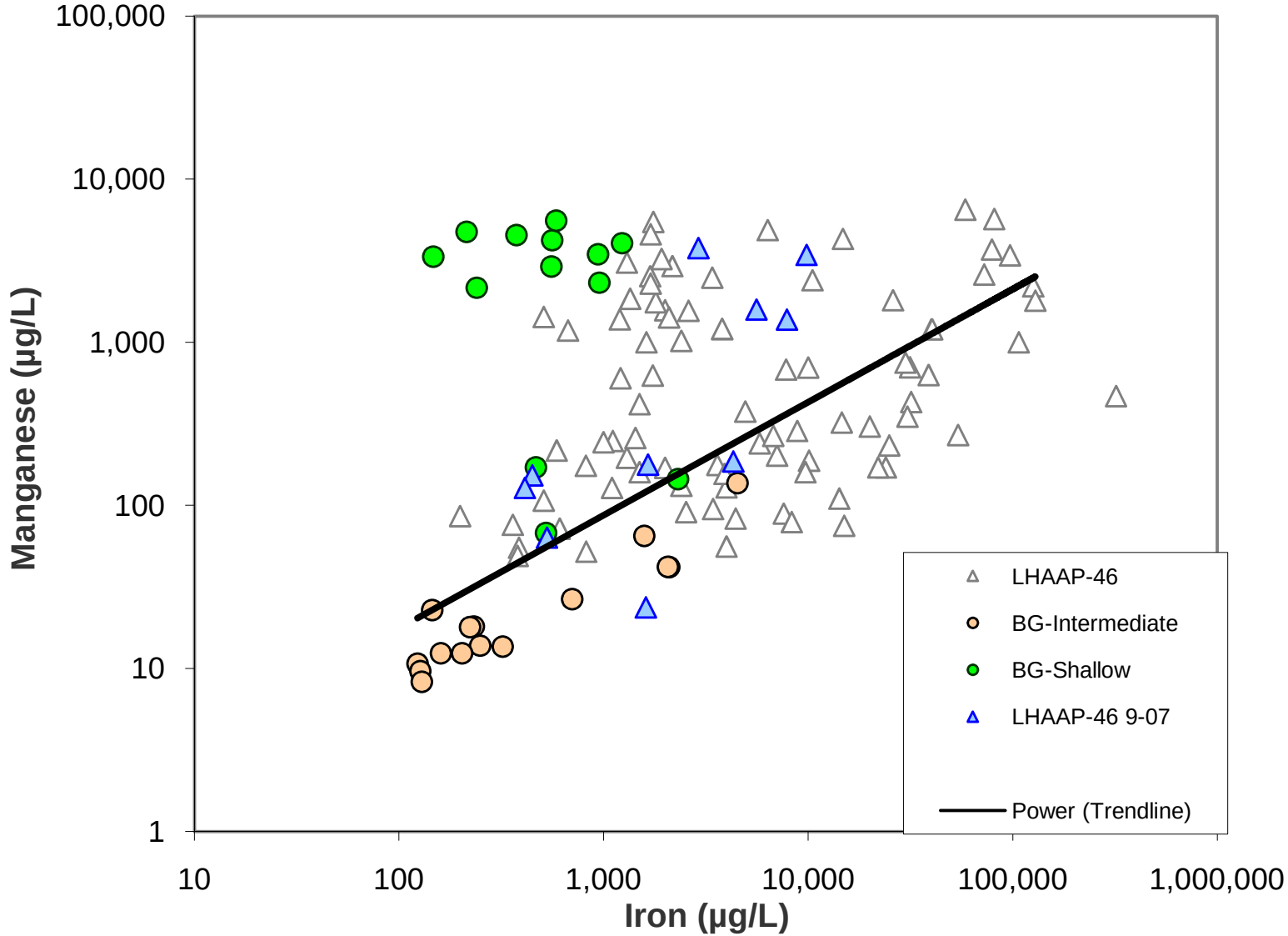


Figure 11. Unfiltered Manganese vs. Filtered/Unfiltered Ratio, LHAAP-46 Groundwater

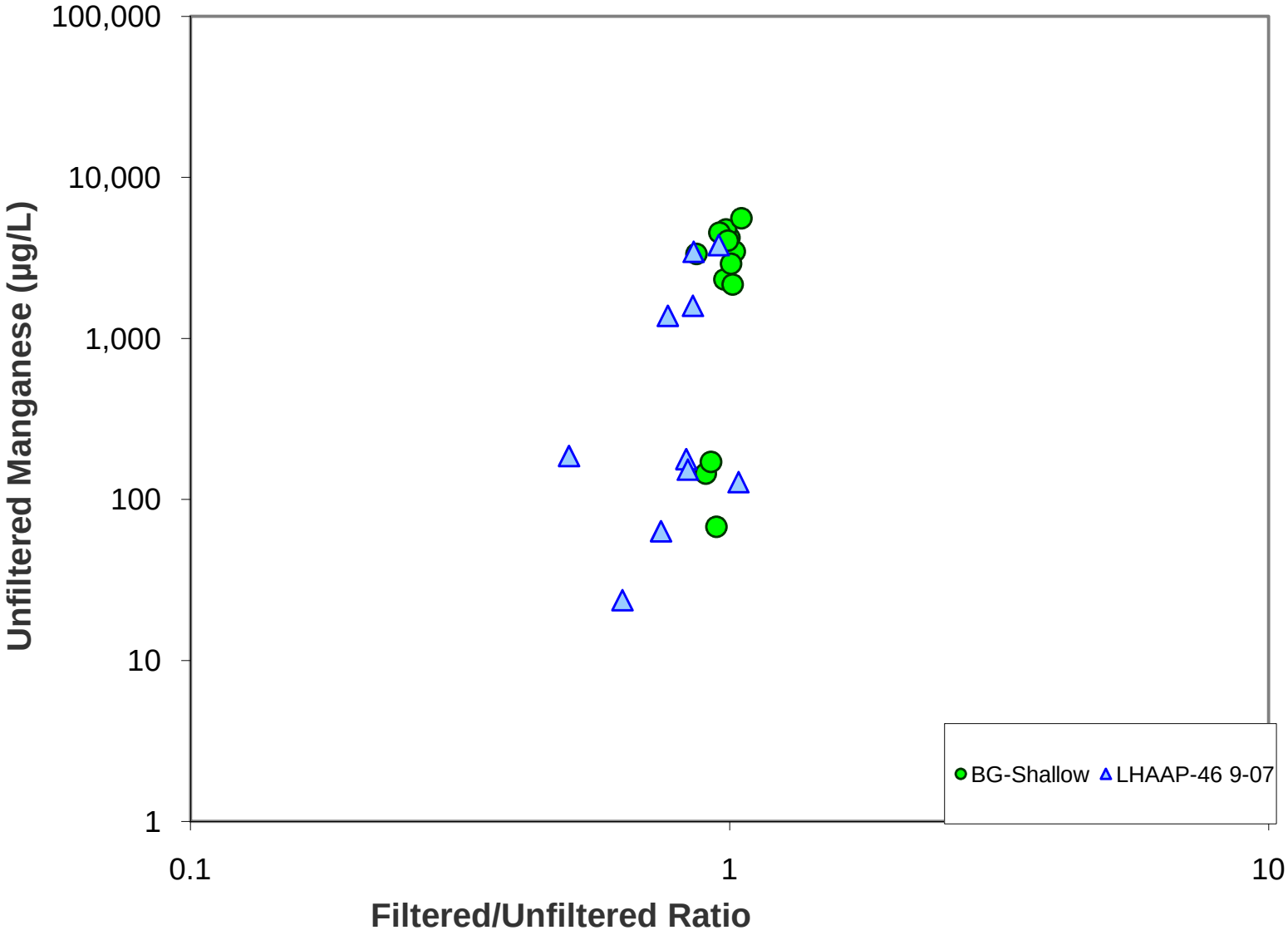


Figure 12. Nickel vs. Aluminum in Unfiltered Groundwater, LHAAP-46

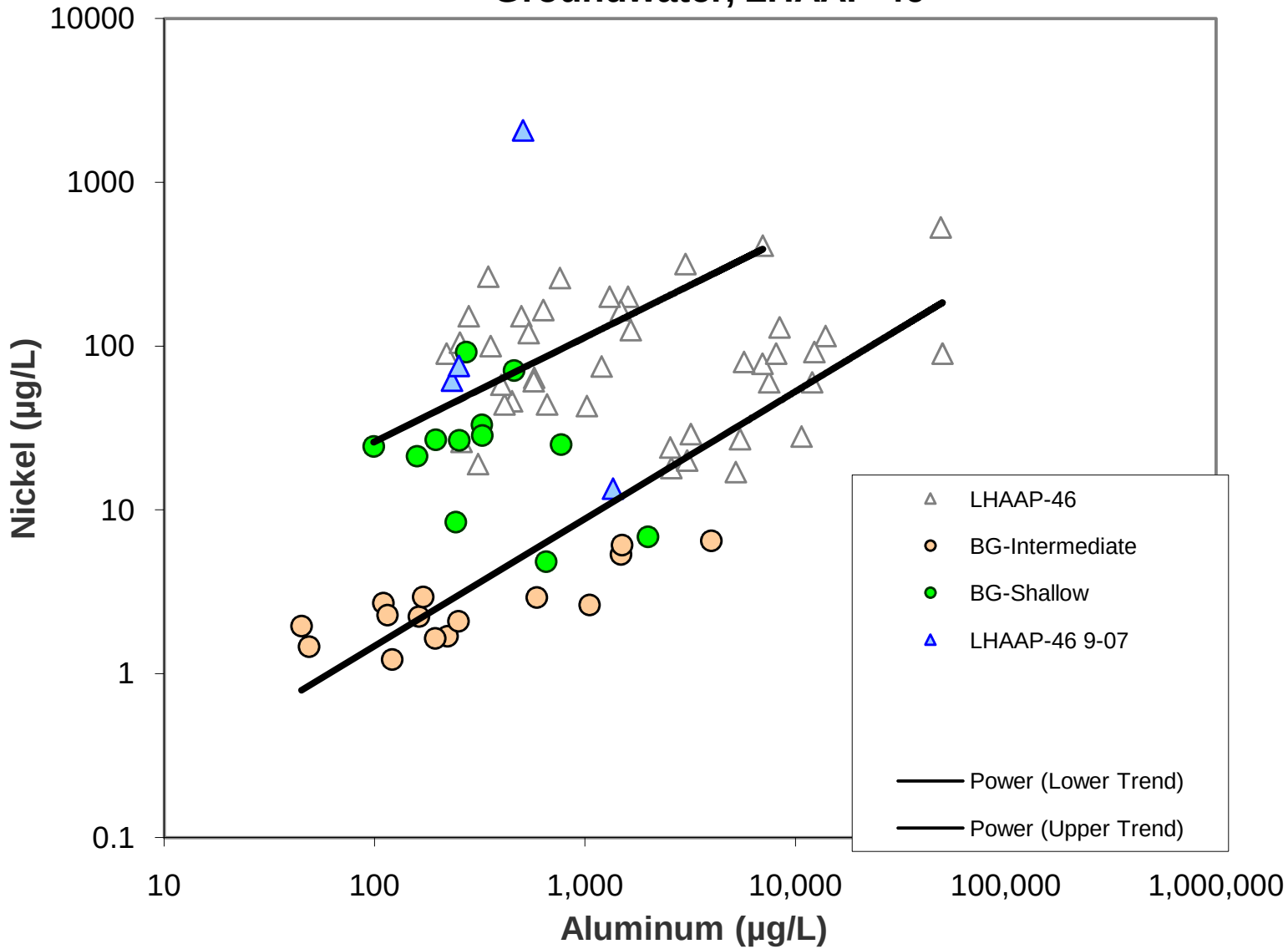


Figure 13. Nickel vs. Ni/Al Ratios in Unfiltered Groundwater, LHAAP-46

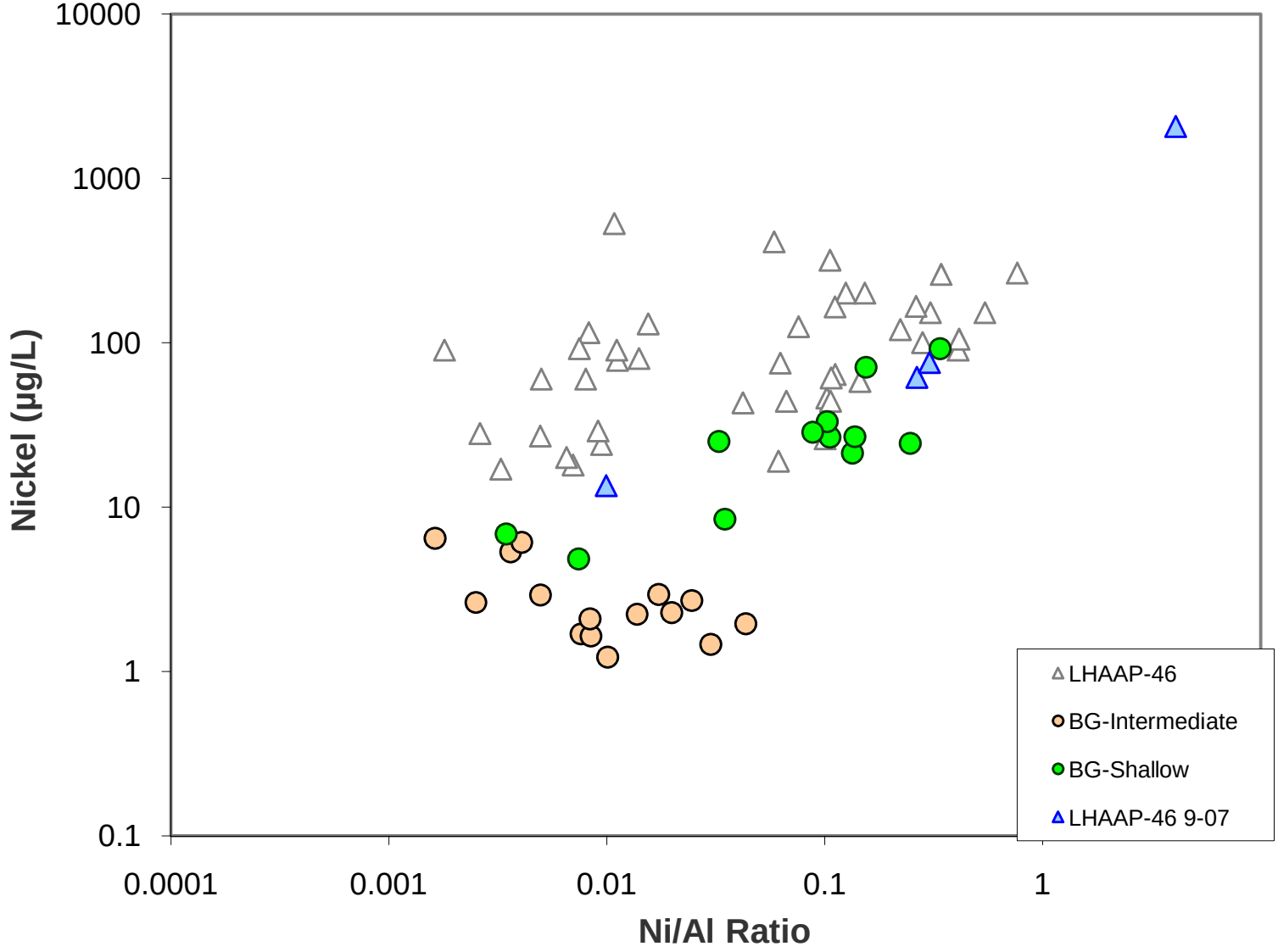


Figure 14. Unfiltered Nickel vs. Filtered/Unfiltered Ratios, LHAAP-46 Groundwater

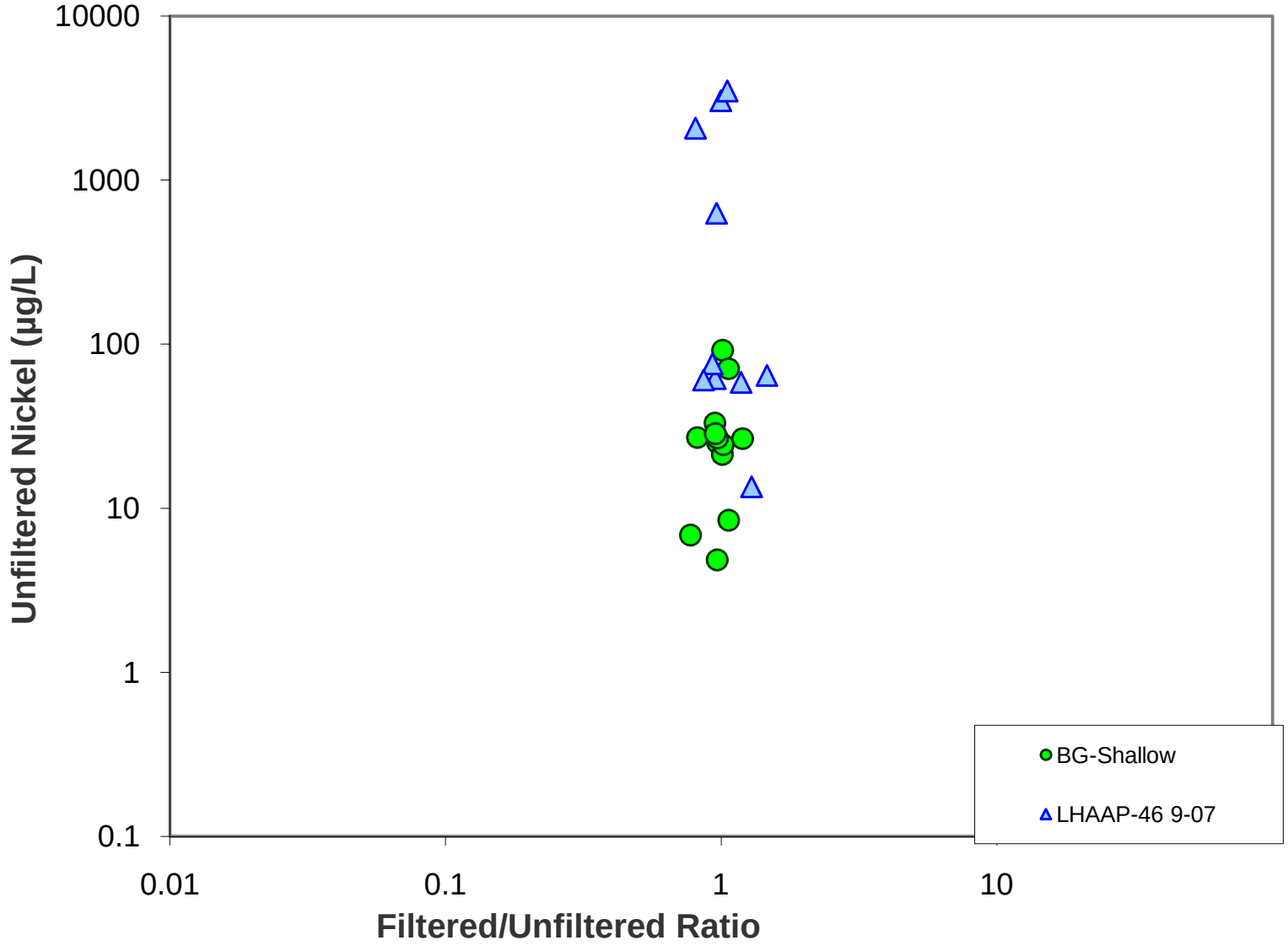


Figure 15. Nickel vs. Chromium in Unfiltered Groundwater, LHAAP-46

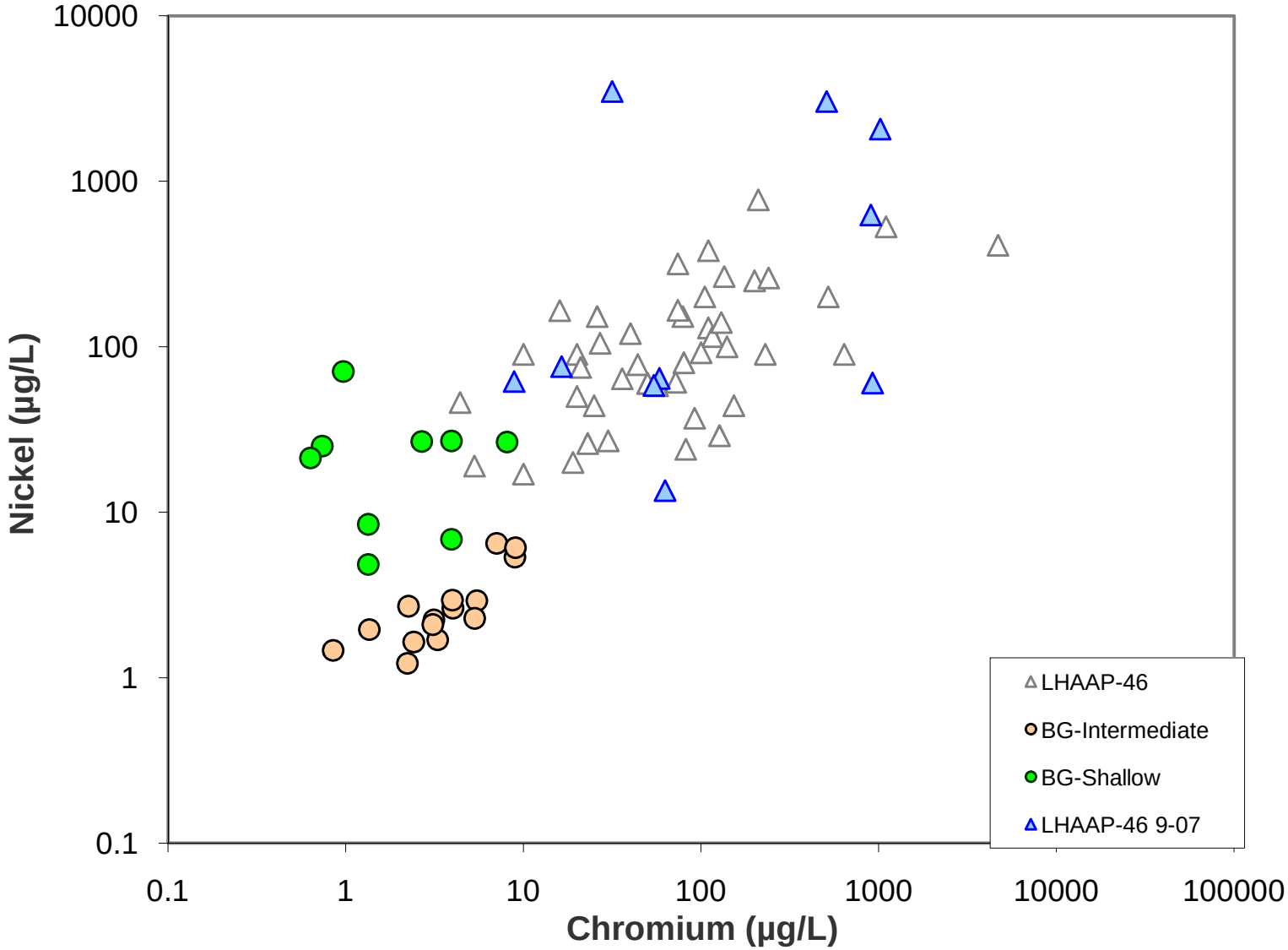
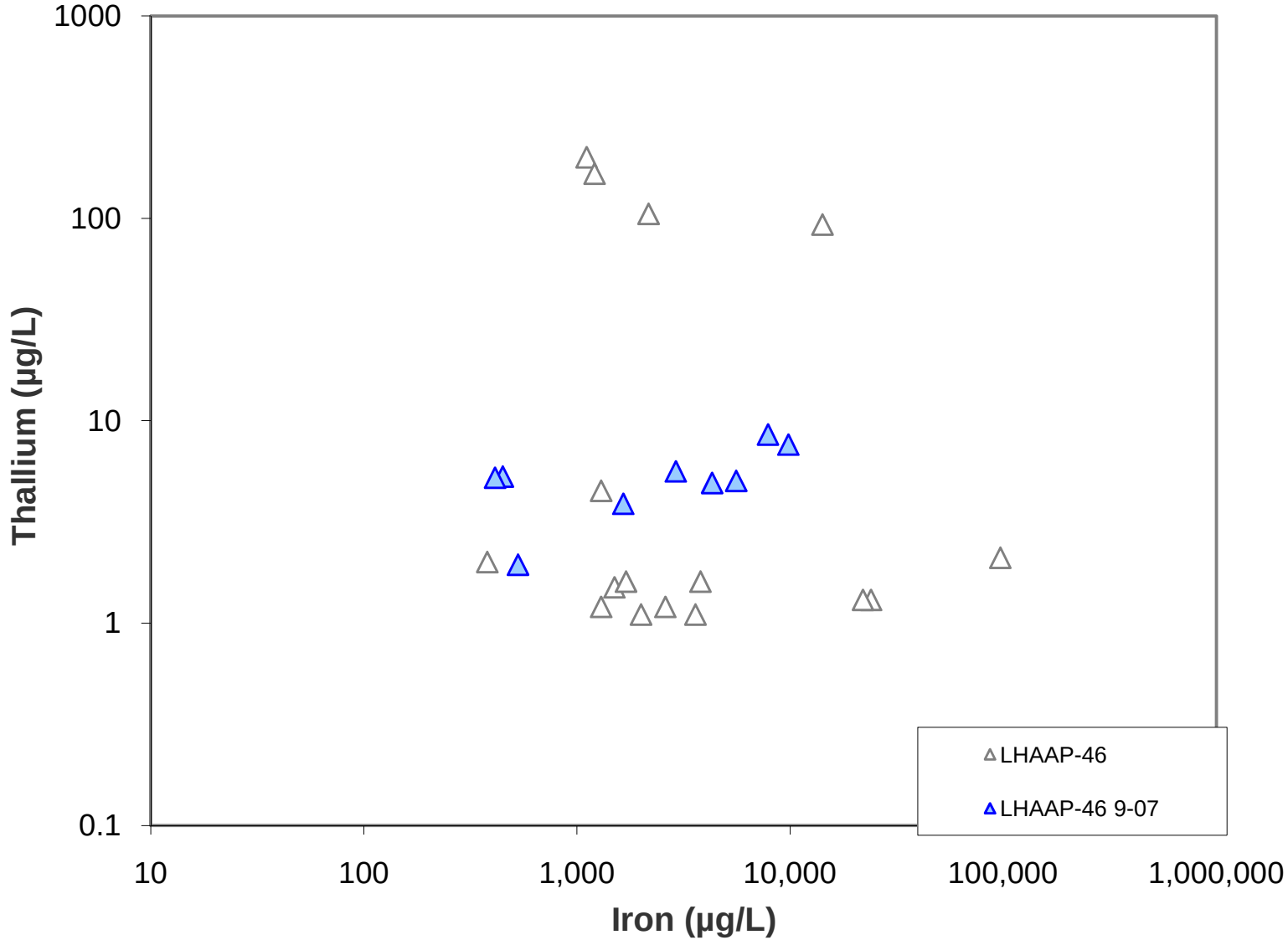


Figure 16. Thallium vs. Iron in Unfiltered Groundwater LHAAP-46



Appendix C

Building 407 Report

FINAL

ADDITIONAL INVESTIGATION RESULTS
THE PISTOL RANGE
BUILDING 407 AT LHAAP-46 (PLANT 2 AREA/PYROTECHNIC OPERATIONS AREA)
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

Prepared for

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

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

February 2009

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Acronyms and Abbreviations

bgs	below ground surface
DPT	direct push technology
GPS	global positioning system
LHAAP	Longhorn Army Ammunition Plant
MARC	Multiple Award Remediation Contract
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
ppm	parts per million
RPD	relative percent difference
Shaw	Shaw Environmental, Inc.
TCLP	toxicity characteristic leaching procedure
UPL	upper prediction limit
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
XRF	x-ray fluorescence

1.0 Introduction

The U.S. Army Corps of Engineers (USACE), Tulsa District, contracted Shaw Environmental, Inc. (Shaw), to perform closure of multiple sites at the former Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas, under the Louisville District's Multiple Award Remediation Contract (MARC) No. W912QR-04-D-0027, Task Order DS02. As part of this contract, Shaw performed an additional investigation to delineate the horizontal and vertical extent of metals at the Pistol Range, and at Building 407 located within LHAAP-46. The additional investigation was performed with oversight by the Tulsa District. This report provides details about the work activities performed for the field investigation of the Pistol Range and Building 407 at LHAAP-46, and describes the results of the investigation.

1.1 Project Objectives

The objective of the activities described in this report was to delineate the horizontal and vertical extent of metals contamination, within the areas designated as the Pistol Range, and Building 407 at LHAAP-46. A portable x-ray fluorescence (XRF) spectrometer was used to quantify the horizontal and vertical extent of metals. Soil samples were collected for laboratory analysis to confirm the XRF results.

1.2 Pistol Range and Building 407 Location and Background

The Pistol Range is located in a heavily wooded area at the end of Robert Avenue, south of Avenue "Q". The site is located directly east of Harrison Bayou in the southern portion of the former LHAAP installation, as depicted in **Figure 1**. The Pistol Range was a small arms firing range, but its history and usage is not well documented.

Building 407 is located in the north-central section of the LHAAP installation in the area known as Production Area 2. It is located off of Jennings Avenue at the far western edge of the LHAAP-46 site boundary (**Figure 1**). Pyrotechnic and illuminant testing operations were performed in Building 407 using a chamber. This operation resulted in an ash residue that was released in the vicinity of Building 407. Ash material was also reported to be present inside Building 407 (Plexus, 2005).

1.3 Report Organization

This report consists of five sections and two appendices. **Section 1.0** provides a brief introduction to the LHAAP installation and specifically describes the location, background and investigation objectives at the Pistol Range and at Building 407 at LHAAP-46. **Section 2.0** explains field procedures and rationale for the investigation activities performed at the sites. **Section 3.0** presents the analytical data, **Section 4.0** summarizes the findings at each site, and

Section 5.0 cites the references used in this report. **Appendix A** contains field data forms associated with these field investigations and **Appendix B** contains the Data Evaluation Reports.

1.4 Previous Investigation

Six soil samples were collected on June 21, 1995, and a subsequent sample was collected on November 11, 1995 at the Pistol Range (Complete Environmental Service, 2004). The samples were analyzed for toxicity characteristic leaching procedure (TCLP) lead. Samples collected from 12 inches below ground surface (bgs) or from the clay berm had TCLP lead concentrations of 0.46 milligrams per liter (mg/L) or less. Soil samples collected from the ground surface between the berm and the target line had concentrations up to 1,100 mg/L for TCLP lead.

Historical documentation indicated that ash from Building 407 may have been deposited in the vicinity of the building in the northwest direction. There was no indication that ash was deposited outside the close vicinity (greater than 30 feet) of Building 407. In 1993, sampling was conducted near other buildings in the Plant 2, but not in the vicinity of Building 407. In 2005 sampling of the ash residue inside Building 407 indicated high levels of chromium (1,740 milligrams per kilogram [mg/kg]) and lead (12,000 mg/kg) (Plexus, 2005).

2.0 Field Investigation

Field sampling activities performed at the Pistol Range and in the vicinity of Building 407 at LHAAP-46 included site reconnaissance, marking the sampling locations at the sites prior to sampling, screening with a field portable Niton 733Q XRF spectrometer to delineate metals contamination, and the collection of confirmation analytical samples.

2.1 XRF Screening Methods

The XRF spectrometer was utilized to field screen soil samples at the Pistol Range and Building 407 at LHAAP-46 in order to determine the presence of metals contamination and to characterize the lateral and vertical extent of contamination. For field screening, soil was analyzed in situ or in a sample container in accordance with SW-846 Method 6200 (U.S. Environmental Protection Agency [EPA], 1997), utilizing the XRF spectrometer. To verify the accuracy of the XRF spectrometer in the field, chemical standards of lead, copper, arsenic, zinc, and nickel were used to calibrate the instrument. More information on the operation of the portable XRF spectrometer can be found in the standard operating procedure located in Appendix D of the *Final Installation-Wide Work Plan* (Shaw, 2006a).

Screening samples were collected with a decontaminated stainless steel hand trowel or auger to a depth of 0 to 6 inches at all locations. The sampled soil was placed into a disposable aluminum pan for homogenization and preparation**.** Any large or non-representative debris was removed from the soil before analysis. This debris included rocks, pebbles, leaves, vegetation, roots, and concrete. The soil surface was as smooth as possible so that the probe window had a good contact with the surface. The soil had a moisture content of less than 20 percent.

Surface soil samples were collected for screening from every sample location at the Pistol Range and Building 407 at LHAAP-46. In the XRF samples collected from both sites, the measured surface soil lead concentration was compared to the maximum background value of 33.8 parts per million (ppm), and if the concentration was less than 33.8 ppm, then no subsurface soil samples were collected. At the Pistol Range, near the toe of the berm face at the range impact zone, 11 soil borings were advanced to a minimum depth of 18 inches bgs with one boring reaching refusal at 12 inches bgs. One soil boring (N50, E25) was advanced to 30 inches bgs. In the vicinity of Building 407 at LHAAP-46, 25 samples were collected from the surface.

2.2 Pistol Range Investigation

XRF sample locations were positioned and marked using wooden stakes. The locations were based on a pre-established grid. **Figure 2** shows the grid pattern established in 25-foot rectangular sections to cover the site. The historical findings discussed in **Section 1.4** were used

to adjust the grid. The grid provided 38 locations to be screened (sampled) at the grid node points. Samples were taken at incremental depths. Originally, 25 sample locations were proposed in the *Final Addendum 2 Additional Investigation at Pistol Range to Final Installation-Wide Work Plan* (Shaw, 2006b). However, due to the lack of historical information pertaining to the western part of the Pistol Range, the grid was extended 135 feet west to include 13 additional sampling locations to determine if any contamination existed in this area. The grid was also extended northeast to include three additional sample locations, since screening results indicated elevated concentrations of lead at location N75,0. Three samples were collected and screened within the ditch south of the Pistol Range, yielding a total of 52 sampling locations screened at the Pistol Range.

Samples were collected at each of the grid nodes shown on **Figure 2.** Additional sample locations were established on and around the berm since lead concentrations were higher at these locations. Sample locations at the berm varied as a function of elevation along the west-facing berm. Locations included two height intervals corresponding to the approximate lower and upper half of the berm. At each of these height intervals in the berm, a series of grab samples were collected from borings drilled into the face of the berm at intervals ranging from 0 to 6 inches, 6 to 12 inches, 12 to 18 inches, and 18 to 24 inches. Sample location labels were suffixed with –Upper or –Up and –Lower or –Low, depending upon whether a sample was collected from the upper half or lower half of the berm. Four sampling locations were established at the firing line to check for the presence of lead residue from firearm discharge.

For sampling the area west of the berm, initial samples were collected at each sampling point at the ground surface using a decontaminated hand auger or stainless steel trowel advanced to 6 inches bgs. A second sample was collected at the 0.5- to 1-foot bgs interval. A third sample was collected from the 1- to 1.5-feet bgs. XRF readings exhibited high concentrations for the third interval at N25,E75-Lower; N50,E25; and N50,E50-Lower; therefore, a fourth sample was collected at the 18- to 24-inch interval at these locations. XRF readings still exhibited high concentrations at N50,E25. Subsequently, a fifth sample was collected from the 24 to 30 inch interval.

All sample locations for the Pistol Range are listed in **Table 1**. Nine of the samples screened using the XRF spectrometer were also collected as confirmation laboratory samples (see **Table 2**). To the extent practical, the confirmation samples covered the range of results observed with the XRF spectrometer. Laboratory analytical results provided a quality control check for the XRF results. Results of both XRF screening and laboratory samples are provided in **Table 1.**

2.3 Building 407 Investigation

XRF sample locations were based on a 25-foot grid system and marked with stakes in the vicinity of Building 407 at LHAAP-46. Twenty-two samples were screened at the surface grid node points to 6 inches bgs. No deeper samples were needed for vertical delineation according to XRF sample screening results (see **Figure 3**). Following the *Draft Final Addendum 3 Additional Investigation at Building 407 within LHAAP-46, Plant 2 Area/Pyrotechnic Operations Area, Final Installation-Wide Work Plan* (Shaw, 2006c), additional samples were collected inside the building from the incineration chamber (Shaw, 2006c). Three samples were also collected from a ditch that was observed northwest of Building 407, along Jennings Avenue.

All sample locations for Building 407 are listed in **Table 3**. Three of the 22 samples screened using the XRF spectrometer were collected and submitted as confirmation laboratory samples (see **Table 4**). To the extent practical, the confirmation samples covered the range of results observed with the XRF. The laboratory samples are identified as NA5, SA3, and SA6. In addition, a sample of the ash residue was collected from the incineration chamber inside Building 407 and analyzed for lead and chromium.

2.4 Surveying

Shaw used a global positioning system (GPS) unit (Trimble© XRS) to survey the sampling locations, approximate boundary of the actual firing range, approximate location of the firing line, and general boundaries of the berm.

3.0 Investigation Results

3.1 XRF Screening Results at the Pistol Range

Fifty-two locations (88 samples total) were screened with the XRF spectrometer for lead, copper, arsenic, zinc, and nickel. All five metals were detected within the soil samples. The XRF screening results are provided in **Table 1** and locations with results above the upper prediction limit (UPL) of background are shown in **Figure 2**. The UPLs were calculated from the LHAAP background soil dataset presented in the *Final Background Soil Study Report* (Shaw, 2005).

The 95 percent UPL of background concentrations were used for screening XRF measurements. The 95 percent UPL value represents the concentration that will be above the next single background measurement with 95 percent confidence. The 95 percent UPL background concentrations were calculated according to EPA (1992) guidance.

The TCEQ has shown preference in the past for, and EPA has accepted, the use of UPLs instead of other criteria, such as upper tolerance limits or upper confidence limits for comparing site data to background data.

The maximum surface concentration of lead, 3,978 ppm, was detected at the surface soil sample (0 to 6 inches bgs) at N50,E25. This location also yielded the highest subsurface (6 to 12 inches) concentration of lead, 1,180 ppm. Elevated lead readings were also present at this location for the 12 to 18, 18 to 24, and 24 to 30 inches intervals. Copper was detected by the XRF spectrometer in 6 of 88 samples. The maximum surface concentration of copper, 148 ppm, was detected at N50,E25 (0 to 6 inches). The maximum subsurface concentration, 104 ppm, was observed from the sample collected from N25,E75-Lower (6 to 12 inches). Arsenic was detected in 2 of 88 samples. N50,0 (0 to 6 inches), which had an arsenic concentration of 102 yielded the maximum reading. Zinc was detected in 60 of 88 samples. The maximum concentration, 142 ppm, was detected at S25,0 (0 to 6 inches). The sample collected from N50,E50-Lower (6 to 12 inches), yielded the highest subsurface concentration of Zinc, 65.6 ppm. The maximum nickel concentration, 145 ppm, was detected at 0,E50 (6 to 12 inches). This was also the maximum subsurface concentration. The maximum surface concentration was 142 ppm at N25,0 (0 to 6 inches).

Sample locations 0,W75; S25,W50; S50,W25; and S75,0 were associated with the firing line where shells, shot, and/or bullets may have been discharged. Zinc was the only metal detected by the XRF spectrometer at the surface (0 to 6 inches) at location S75,0 (0 to 6 inches). Concentrations of lead and zinc were detected within the surface soil at S25,W50. No metals were detected by the XRF spectrometer at S50,W25.

Sample locations N75,E25-Lower; N75,E25-Upper; N50,E50-Lower; N50,E50-Upper; N25,E75-Lower; and N25,E75-Upper were associated with the berm. The "upper" sample description refers to the upper area of the berm where the sample was collected; and likewise, the "lower" designates samples from the lower area of the berm.

Due to the possibility of runoff from the site, samples from the ditch located south of the Pistol Range were also screened with the XRF spectrometer. Zinc was detected at concentrations of 29.9 ppm and 36.9 ppm in the Center Ditch and the East Ditch, respectively. Lead concentrations of 10.70 mg/kg were detected in the West Ditch laboratory confirmation sample. All other metals were below levels of detection in the other samples associated with the ditch.

3.2 XRF Screening Results at Building 407 at LHAAP-46

Twenty-two locations were screened with the XRF spectrometer for lead, chromium, arsenic, copper, nickel, and zinc in the vicinity of Building 407 at LHAAP-46. The XRF results are presented in **Table 3**. Of the 22 locations screened, only 9 samples were above the detection limit for lead ranging from 13.5 ppm (NA3) to 43.7 ppm (SA3). The only hit of chromium was observed in the NA5 sample with a concentration of 143 ppm. Arsenic was recorded only in the EA (0,W50) sample with a concentration of 18.1 ppm and no copper concentrations were recorded above the detection limit for the samples screened. Five hits of nickel were observed ranging from 84.7 ppm (NA4) to 120.6 ppm (EA [0,W50]). There were 14 hits of zinc observed ranging from 36 ppm (NA4) to 273.6 ppm (NA5).

Three locations were screened with the XRF spectrometer in the ditch located north of Building 407 at LHAAP-46 along Jennings Avenue due to the possibility of runoff from the site. Three XRF readings from 0 to 6 inches (North Ditch #1, North Ditch #2, and North Ditch #3) were taken along the ditch. Lead was detected in the Ditch #1 sample at a concentration of 11.5 ppm. Zinc was detected at concentrations of 52.2 ppm (North Ditch #1), 69.3 ppm (North Ditch #2), and 64.2 ppm (North Ditch #3).

A sample of the ash residue collected from the incineration chamber inside Building 407 was screened with the XRF spectrometer for lead, chromium, arsenic, copper, nickel, and zinc. Lead concentrations were recorded as 1,170 ppm. Chromium was recorded as 3,250 ppm. Copper was recorded as 2,509 ppm and zinc was 469 ppm. Arsenic and nickel were less than the limit of detection.

3.3 Laboratory Confirmation Sampling

To provide a quality control check for the XRF results, nine samples collected from the Pistol Range and three samples collected from Building 407 at LHAAP-46 were submitted to the laboratory for analysis. These samples were selected in the field, based on the XRF survey results. The samples selected for laboratory confirmation were N50,E25 (0 to 6 inches), N50,0

(0 to 6 inches), N25,E75-Lower (6 to 12 inches), N25,E75-Lower (0 to 6 inches), N25,E75 Lower (12 to 18 inches), N25,0 (0 to 6 inches), N25,E25 (0 to 6 inches), N25,E75-Upper (0 to 6 inches), West Ditch (0 to 6 inches) from the Pistol Range, and NA5, SA3, and SA6 from Building 407. **Tables 2** and **4** present the parameters analyzed for these locations.

During the field screening process, the XRF was used to obtain the lowest detection concentrations for lead, the leading screening parameter. With the confirmation laboratory results, a relative percent difference (RPD) was calculated by taking the difference in the XRF screening results and the laboratory data results, dividing this value by the average of the two data (XRF and laboratory data results) and multiplying by 100 (see **Table 5**). The RPDs calculated for lead are up to 70 percent and indicate that the XRF results for lead appear to be biased low in comparison to laboratory analytical results. Calculated RPDs for arsenic, copper, chromium, nickel, and zinc are frequently higher, as shown in **Table 5**. Several of these RPDs are indicative of very low laboratory analytical results and high XRF detection limits.

4.0 Summary of Findings

During this investigation, the extent of metals contamination was determined laterally and vertically at the Pistol Range and Building 407 at LHAAP-46 by screening soil samples collected using the XRF spectrometer. Nine confirmation laboratory samples were collected from the samples screened with the XRF spectrometer at the Pistol Range, and three confirmation laboratory samples were collected from the samples screened with the XRF spectrometer from Building 407 at LHAAP-46. These laboratory samples helped correlate the results of the XRF survey.

4.1 Pistol Range

As expected, the highest levels of metals concentration were associated with the berm, specifically in the northern berm area and the area immediately west of the berm. The maximum concentration of lead, 3,978 ppm was observed in the surface sample at the N50,E25 boring location with lead concentrations progressively declining with depth.

Copper was detected by the XRF spectrometer unit in 6 of 88 samples. Arsenic was detected in 2 of 88 samples. Zinc was detected in 60 of 88 samples and was the only metal detected by the XRF at the surface (0 to 6 inches) at location S75,0 (0 to 6 inches). Nickel was detected in 13 of 88 samples.

Sample locations 0,W75; S25,W50; S50,W25; and S75,0 were associated with the firing line where shells, shot, and/or bullets may have been discharged. Concentrations of lead and zinc were detected within the surface soil at S25,W50, but no metals were detected by the XRF spectrometer at S50,W25.

These results indicate that the contamination associated with the operation of the Pistol Range is limited primarily to the northern part of the berm and the area immediately west of the berm. Further, the contamination is shallow, limited to the upper 18 inches at most locations. No contamination was observed in the western part of the site, to the west of Robert Avenue.

4.2 Building 407 at LHAAP-46

The highest concentrations of chromium and zinc, 143 ppm and 274 ppm, respectively, were observed in the NA5 sample located next to the northern side of the building. There were sporadic hits of metals, including lead, chromium, nickel, and zinc observed at the site consistent with the operational description.

Of the three samples collected along the northern ditch area, only one sample showed lead at 11.5 ppm (North Ditch 1 sample). All three samples were above the detection limits for zinc; the results ranged from 52.2 ppm to 69.3 ppm. Samples collected from the chamber inside Building 407 indicated high concentrations of chromium and lead, which is consistent with results from a previous investigation of the material found in the chamber (Plexus, 2005).

These results indicate that chromium, lead, and zinc levels are elevated with respect to the background in the area around Building 407. The elevated concentrations of metals are, however, limited to the surface soil only (0 to 6 inches) and the chamber ash found inside the building. Zinc is slightly elevated in the ditch north of the building.

5.0 References

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Tables

Table 1
XRF Screening and Laboratory Results for the Pistol Range

Sample Location	Date/Time	XRF Result in ppm	Laboratory Result in mg/kg	XRF Result in ppm	Laboratory Result in mg/kg	XRF Result in ppm	Laboratory Result in mg/kg	XRF Result in ppm	Laboratory Result in mg/kg	XRF Result in ppm	Laboratory Result in mg/kg
		Pb	Pb	Cu	Cu	As	As	Zn	Zn	Ni	Ni
UPL in mg/kg		17.8		8.37		5.86		24.5		9.4	
N75,0 (0-6")	2/22/2006 10:20	1000		<49.35		<56.25		92.6		81.1	
N75,0 (6-12")	2/22/2006 10:32	246.6		<51.45		<33.75		60.3		<89.85	
N75,0 (12-18")	2/22/2006 10:48	25.6		<54.9		<19.65		57.4		<103.2	
N50,E25 (0-6")	2/22/2006 11:02	3977.6	5,240.00	148.4	186	<110.55	2.51	39	65.1	<79.8	7.51
N50,E25 (6-12")	2/22/2006 11:11	1180		79.1		<55.2		56.8		<64.65	
N50,E25 (12-18")	2/22/2006 11:20	244.8		77.8		<30.6		53.3		<73.8	
N50,E25 (18-24")	2/22/2006 11:32	624.8		<52.8		<46.5		<33.15			
N50,E25 (24-30")	2/22/2006 11:51	564.4		<51.15		<45.15		51.3		<77.85	
N25,E50 (0-6")	2/22/2006 13:46	27.5		<48.15		<16.95		40		<71.85	
N25,E50 (6-12")	2/22/2006 13:53	12.7		<43.8		<14.55		40.7		<65.85	
0,E75 (0-6")	2/22/2006 14:31	24.5		<48.75		<16.65		39.3		<84.6	
0,E75 (6-12")	2/22/2006 14:45	<12.9		<46.8		<15.75		45.2		<85.5	
0,E75 (12-18")	2/22/2006 14:59	<11.85		<44.4		<14.7		33.8		<77.55	
0,E50 (0-6")	2/22/2006 15:31	15.3		<48.45		<15.9		<30		118.6	
0,E50 (6-12")	2/22/2006 15:47	16.3		<51.15		<17.85		<31.8		144.9	
0,E50 (12-18")	2/22/2006 15:59	15.3		<48		<16.35		52.6		<85.35	
N25,E25 (0-6")	2/22/2006 16:16	55.7	32.00	<62.85	NA	<24.75	NA	<37.65	NA	<124.2	NA
N25,E25 (6-12")	2/22/2006 16:27	<13.2		<48.75		<16.35		<30.15		79.4	
N25,E25 (12-18")	2/22/2006 16:39	<12.75		<47.55		<15.3		35.7		<72.6	
N50,0 (0-6")	2/23/2006 9:13	1120	1,220.00	<59.7	5.86	101.5	14.2	66	46.6	<108.3	8.71
N50,0 (6-12")	2/23/2006 9:25	71.1		<48.6		<21.3		33.1		<84.75	
N50,0 (12-18")	2/23/2006 9:33	<13.05		<45.45		<15.75		<28.5		<75.15	
N50,W25 (0-6")	2/23/2006 9:48	33.1		<46.2		<16.95		43.2		<74.85	
N25,0 (0-6")	2/23/2006 9:56	33.1	68.50	<85.2	NA	<29.1	NA	<52.65	NA	141.6	NA
0,E25 (0-6")	2/23/2006 10:03	<15		<52.8		<17.4		<32.85		<92.4	
S25,E50 (0-6")	2/23/2006 10:10	21.3		<46.2		<16.2		55.1		<83.7	
N25,W25 (0-6")	2/23/2006 10:18	40.4		<45.3		<17.4		<28.5		<70.2	
0,0 (0-6")	2/23/2006 10:29	<13.65		<47.85		<15.6		34.1		<79.2	
S25,E25 (0-6")	2/23/2006 10:40	<12.6		<49.5		<16.35		<30.75		88.3	
N25,W50 (0-6")	2/23/2006 10:47	<13.05		<45.15		<15.3		41.9		<75.15	
0,W25 (0-6")	2/23/2006 10:58	18.1		58.8		<17.1		72.7		<90.45	
S25,0 (0-6")	2/23/2006 11:08	<14.7		<58.35		18.4		142.4		<96.3	
S50,E25 (0-6")	2/23/2006 11:17	<9.9		<38.85		<11.85		35.1		<59.25	

Table 1
XRF Screening and Laboratory Results for the Pistol Range

Sample Location	Date/Time	XRF Result in ppm	Laboratory Result in mg/kg	XRF Result in ppm	Laboratory Result in mg/kg	XRF Result in ppm	Laboratory Result in mg/kg	XRF Result in ppm	Laboratory Result in mg/kg	XRF Result in ppm	Laboratory Result in mg/kg
		Pb	Pb	Cu	Cu	As	As	Zn	Zn	Ni	Ni
UPL in mg/kg		17.8		8.37		5.86		24.5		9.4	
0,W50 (0-6")	2/23/2006 11:24	31.4		<43.2		<16.95		46.9		<70.8	
S25,W25 (0-6")	2/23/2006 11:31	12.8		66.7		<10.35		43.9		62	
S50,0 (0-6")	2/23/2006 11:49	<12		<43.5		<14.85		<27.3		<82.2	
N75,W25 (0-6")	2/23/2006 15:09	<12.75		<47.55		<15.45		31.3		<77.25	
N75,W25 (6-12")	2/23/2006 15:19	<13.8		<52.5		<16.35		<32.85		<87.75	
N75,W25 (12-18")	2/23/2006 15:29	<14.1		<51.9		<16.8		37.7		<86.85	
N100,W25 (0-6")	2/23/2006 15:41	<12.9		<49.5		<15.6		37.7		<82.05	
N100,W25 (6-12")	2/23/2006 15:53	<14.25		<51.6		<17.25		39		<88.95	
N100,W25 (12-18")	2/23/2006 16:05	<15		<53.25		<17.55		<33.6		<100.95	
N100,0 (0-6")	2/23/2006 16:22	<13.35		<47.1		<15.9		39.8		<82.35	
N100,0 (6-12")	2/23/2006 16:36	<12.9		<49.95		<15.3		<30.6		113	
N100,0 (12-18")	2/23/2006 16:48	<14.25		<51.9		<16.65		52.7		<84	
N75,E25-Low (0-6")	2/24/2006 10:02	750.8		<46.5		<50.1		<30.15		<67.65	
N75,E25-Low (6-12")	2/24/2006 10:09	51.8		<49.95		<20.55		<30.75		<74.4	
N75,E25-Low (12-18")	2/24/2006 10:16	21.4		<49.2		<17.85		<30.3		<74.4	
N75,E25-Up (0-6")	2/24/2006 10:25	52.4		<44.1		<18.9		<28.5		<65.55	
N75,E25-Up (6-12")	2/24/2006 10:33	20.8		<49.2		<17.25		36.2		<76.65	
N75,E25-Up (12-18")	2/24/2006 10:42	16.2		<47.7		<16.35		36.4		<74.1	
N50,E50-Low (0-6")	2/24/2006 11:00	559.2		<50.85		<45.3		46.1		<81.75	
N50,E50-Low (6-12")	2/24/2006 11:12	604.8		<54.15		<47.7		65.6		<89.55	
N50,E50-Low (12-18")	2/24/2006 11:21	181.1		<49.95		<27.3		37.2		<76.95	
N50,E50-Low (18-24")	2/24/2006 11:36	24.4		<47.7		<16.8		44.7		<73.8	
N50,E50-Up (0-6")	2/24/2006 13:11	117.9		<50.55		<25.2		37.1		<74.85	
N50,E50-Up (6-12")	2/24/2006 13:19	24.1		<46.2		<16.65		42.2		80.6	
N50,E50-Up (12-18")	2/24/2006 13:28	16.9		<43.8		<14.55		41.8		<75.45	
N25,E75-Low (0-6")	2/24/2006 13:42	527.2	937.00	<45.15	NA	<40.35	NA	<28.2	NA	<67.65	NA
N25,E75-Low (6-12")	2/24/2006 13:49	763.2	952.00	104.1	148	<52.65	1.75	41.2	52.2	92.9	8.11
N25,E75-Low (12-18")	2/24/2006 13:57	161.1	245.00	<50.85	NA	<27	NA	<31.65	NA	7<5.9	NA
N25,E75-Low (18-24")	2/24/2006 14:05	29.8		<40.35		<14.55		40.1		<61.05	
N25,E75-Up (0-6")	2/24/2006 14:19	14.8	11.00	<44.85	NA	<15.75	NA	<28.5	NA	<65.25	NA
N25,E75-Up (6-12")	2/24/2006 14:26	17.5		<48.45		<16.65		<30.15		<70.2	
N25,E75-Up (12-18")	2/24/2006 14:32	<12.15		<44.25		<15.15		28.9		<67.05	

Table 1
XRF Screening and Laboratory Results for the Pistol Range

Sample Location	Date/Time	XRF Result in ppm	Laboratory Result in mg/kg	XRF Result in ppm	Laboratory Result in mg/kg	XRF Result in ppm	Laboratory Result in mg/kg	XRF Result in ppm	Laboratory Result in mg/kg	XRF Result in ppm	Laboratory Result in mg/kg
		Pb	Pb	Cu	Cu	As	As	Zn	Zn	Ni	Ni
UPL in mg/kg		17.8		8.37		5.86		24.5		9.4	
0,E100 (0-6")	2/24/2006 14:44	<12.3		<47.85		<15.3		60		<77.85	
0,E100 (6-12")	2/24/2006 14:51	<14.4		<54		<17.1		64.7		<91.2	
0,E100 (12-18")	2/24/2006 14:58	<13.95		<52.35		<16.65		54.6		<100.5	
0,W75 (0-6")	2/24/2006 15:42	<14.55		<55.95		<17.55		47.8		<95.4	
S25,W50 (0-6")	2/24/2006 15:47	16.6		<52.2		<17.7		40.6		<87.9	
S50,W25 (0-6")	2/24/2006 15:53	<12.3		<42.45		<14.25		<26.7		<72.3	
S75,0 (0-6")	2/24/2006 15:59	<12.15		<48.45		<15		35.8		<84.3	
S50,W100 (0-6")	2/24/2006 16:05	<14.1		<50.4		<16.8		34.5		<80.85	
S75,W75 (0-6")	2/24/2006 16:10	<12		<45.75		<14.55		<28.2		<69.9	
S100,W50 (0-6")	2/24/2006 16:16	24.2		<46.2		<16.05		<28.95		97.4	
S50,W125 (0-6")	2/24/2006 16:22	26.1		<49.05		<17.25		31.1		<78.15	
S75,W100 (0-6")	2/24/2006 16:28	15.5		<51.3		<16.2		<31.5		<78.6	
S100,W75 (0-6")	2/24/2006 16:34	<13.05		<49.2		<15.75		49.1		<86.55	
S125,W50 (0-6")	2/24/2006 16:40	<12.15		<45.6		<14.7		41.7		77.1	
S150,W100 (0-6")	2/24/2006 16:46	<12.45		<45.15		<14.1		33.2		<70.05	
S125,W125 (0-6")	2/24/2006 16:52	<12.6		<43.35		<15.15		42		<69.9	
S100,W150 (0-6")	2/24/2006 16:58	<12.15		<45		<14.4		38.7		<71.25	
S100,W175 (0-6")	2/24/2006 17:04	<13.8		<47.7		<15.45		45.1		85.2	
S125,W150 (0-6")	2/24/2006 17:10	<12.9		<47.85		<15.15		<28.8		<76.65	
S150,W125 (0-6")	2/24/2006 17:16	<13.5		<47.55		<16.05		34.6		<82.5	
East Ditch (0-6")	2/24/2006 17:22	<11.4		<43.2		<13.65		36.9		<67.65	
Center Ditch (0-6")	2/24/2006 17:27	<12.6		<45		<14.55		29.9		<73.05	
West Ditch (0-6")	2/24/2006 17:34	<11.4	10.70	<41.7	NA	<13.2	NA	<24.9	NA	<64.5	NA

Notes:

Laboratory resutls were analyzed using EPA Method 6010B

Bold Confirmation (Laboratory) Sample Collected
As Arsenic
Cu Copper
mg/kg milligrams per kilogram
NA not available
Ni Nickel
Pb Lead
ppm parts per million
UPL upper prediction limit
XRF x-ray fluorescence
Zn Zinc

Table 2
Laboratory Confirmation Samples from the Pistol Range

Sample ID	Chromium	Lead	Copper	Arsenic	Nickel	Zinc
Pistol Range						
West Ditch (0-6")	NA	X	NA	NA	NA	NA
N25,E75-Up (0-6")	NA	X	NA	NA	NA	NA
N25,E25 (0-6")	NA	X	NA	NA	NA	NA
N25,0 (0-6")	NA	X	NA	NA	NA	NA
N25,E75-Low (12-18")	NA	X	NA	NA	NA	NA
N25,E75-Low (0-6")	NA	X	NA	NA	NA	NA
N25,E75-Low (6-12")	NA	X	X	X	X	X
N50,0 (0-6")	NA	X	X	X	X	X
N50,E25 (0-6")	NA	X	X	X	X	X

Notes:
NA Not Analyzed
X Analyzed

Table 3
XRF Screening and Laboratory Results for Building 407 at LHAAP-46

Site	Date/Time	XRF Result in ppm Pb	Laboratory Result in mg/kg Pb	XRF Result in ppm Cr	Laboratory Result in mg/kg Cr	XRF Result in ppm As	XRF Result in ppm Cu	XRF Result in ppm Ni	XRF Result in ppm Zn
UPL in mg/kg		17.8		29		5.86	8.37	9.4	24.5
NA6	2/27/2006 9:24	17.5		<195		<18.3	<54.45	<97.35	48.5
NA5	2/27/2006 9:30	22	39.80	143	12.90	<16.65	<52.65	<70.05	273.6
NA4	2/27/2006 9:36	14.3		<150		<15.9	<46.95	84.7	36
SA3	2/27/2006 9:44	43.7	56.80	<131.1	10.90	<17.1	<48.15	<69.75	115.3
SA2	2/27/2006 9:50	13.7		<128.25		<15.15	<44.55	<66.15	35.3
SA1	2/27/2006 9:57	19.7		<127.5		<15.45	<45.3	<66.6	97
NA1	2/27/2006 10:04	<12.3		<150		<15	<49.5	107.2	97
NA2	2/27/2006 10:12	<13.2		<165		<15.75	<46.35	<82.65	<28.2
NA3	2/27/2006 10:20	13.5		<150		<15.6	<45.6	88	43.5
SA6	2/27/2006 10:27	18.6	30.90	<150	12.40	<17.55	<49.8	<79.5	73.5
SA5	2/27/2006 10:34	<12.6		<129.75		<14.4	<45.15	<69.9	30.6
SA4	2/27/2006 10:43	<11.25		<114.15		<13.95	<42.75	<62.4	77.4
EA1	2/27/2006 10:50	<11.85		<134.4		<14.4	<45.9	<70.65	<28.8
EA (N50,0)	2/27/2006 10:57	<13.8		<150		<16.05	<48.6	<79.2	<30.6
EA (N25,0)	2/27/2006 11:03	<12.75		<134.1		<15.45	<45.9	<72.15	<28.5
EA (0,0)	2/27/2006 11:09	<14.25		<150		<15.9	<48.15	114.8	<30.3
EA (0,W25)	2/27/2006 11:16	<13.65		<148.05		<15.9	<47.55	<76.95	<30
EA (N25,W25)	2/27/2006 11:22	<12.3		<137.7		<15.15	<46.05	<72.3	45.7
EA (N50,W25)	2/27/2006 11:28	17.7		<149.1		<16.35	<46.2	<76.65	<29.85
EA (N50,W50)	2/27/2006 11:34	<14.55		<165		<16.8	<51.45	<88.95	41.3
EA (N25,W50)	2/27/2006 11:40	<13.8		<150		<16.2	<50.4	<77.25	<31.5
EA (0,W50)	2/27/2006 11:47	<13.95		<180		18.1	<51.6	120.6	45
North Ditch 1	2/27/2006 13:24	11.5		<127.5		<12.6	<38.7	<63.6	52.2
North Ditch 2	2/27/2006 13:33	<12.6		<136.5		<14.7	<47.4	<75.15	69.3
North Ditch 3	2/27/2006 13:40	<12.6		<150		<15.3	<47.85	<78.6	64.2
Chamber Ash	2/27/2006 14:07	1269.6		3249.6		<255	2508.8	<900	468.8
NA5 - FD	2/27/2006 14:49	25.2		<165		<18.3	<53.4	<79.95	185.5
SA3 - FD	2/27/2006 14:58	46.1		<150		<19.2	<53.7	<81.6	159.2
SA6 - FD	2/27/2006 15:07	19.6		<150		<17.4	<49.95	<77.7	46.4

Notes:

This table includes the electronic data file from the XRF instrument and contains more information than the handwritten field sheets.

Laboratory results were analyzed using EPA Method 6010B

Bold Confirmation (Laboratory) Sample Collected

As Arsenic
Cu Copper
FD Field Duplicate
mg/kg milligram per kilogram
Ni Nickel
Pb Lead
ppm parts per million
XRF x-ray fluorescence
Zn Zinc

Table 4
Laboratory Confirmation Samples from Building 407 at LHAAP-46

Sample ID	Chromium	Lead	Copper	Arsenic	Nickel	Zinc
Building 407 at LHAAP-46						
NA5	X	X	NA	NA	NA	NA
SA3	X	X	NA	NA	NA	NA
SA6	X	X	NA	NA	NA	NA

Notes:
NA not analyzed
X analyzed

Table 5
Relative Percent Difference in XRF Screening and Laboratory Results for the Pistol Range and Building 407 of LHAAP-46

Pistol Range

Sample Location	XRF Result in ppm	Laboratory Result in mg/kg	Relative % Difference	XRF Result in ppm	Laboratory Result in mg/kg	Relative % Difference	XRF Result in ppm	Laboratory Result in mg/kg	Relative % Difference	XRF Result in ppm	Laboratory Result in mg/kg	Relative % Difference	XRF Result in ppm	Laboratory Result	Relative % Difference
	Pb	Pb	Pb	Cu	Cu	Cu	As	As	As	Zn	Zn	Zn	Ni	Ni	Ni
N50,E25 (0-6")	3977.6	5,240.00	27.39	148.4	186.00	22.49	<110.55	2.51	191.12	39	65.10	50.14	<79.8	7.51	169.59
N25,E25 (0-6")	55.7	32.00	54.05	<62.85	NA		<24.75	NA		<37.65	NA		<124.2	NA	
N50,0 (0-6")	1120	1,220.00	8.55	<59.7	5.86	164.25	101.5	14.2	150.91	66	46.6	34.46	<108.3	8.71	170.22
N25,0 (0-6")	33.1	68.50	69.69	<85.2	NA		<29.1	NA		<52.65	NA		141.6	NA	
N25,E75-Low (0-6")	527.2	937.00	55.98	<45.15	NA		<40.35	NA		<28.2	NA		<67.65	NA	
N25,E75-Low (6-12")		952.00	22.01	104.1	148.00	34.83	<52.65	1.75	187.13	41.2	52.2	23.55	92.9	8.11	167.88
N25,E75-Low (12-18")	161.1	245.00	41.32	<50.85	NA		<27	NA		<31.65	NA		<75.9	NA	
N25,E75-Up (0-6")	14.8	11.00	29.46	<44.85	NA		<15.75	NA		<28.5	NA		<65.25	NA	
West Ditch (0-6")	<11.4	10.70	6.33	<41.7	NA		<13.2	NA		<24.9	NA		<64.5	NA	

Building 407 at LHAAP-46

Sample Location	XRF Result in ppm	Laboratory Result in mg/kg	Relative % Difference	XRF Result in ppm	Laboratory Result in mg/kg	Relative % Difference
	Pb	Pb	Pb	Cr	Cr	Cr
NA5	22	39.80	57.61	143	12.90	166.90
SA3	43.7	56.80	26.07	<131.1	10.90	169.30
SA6	18.6	30.90	49.70	<150	12.40	169.46

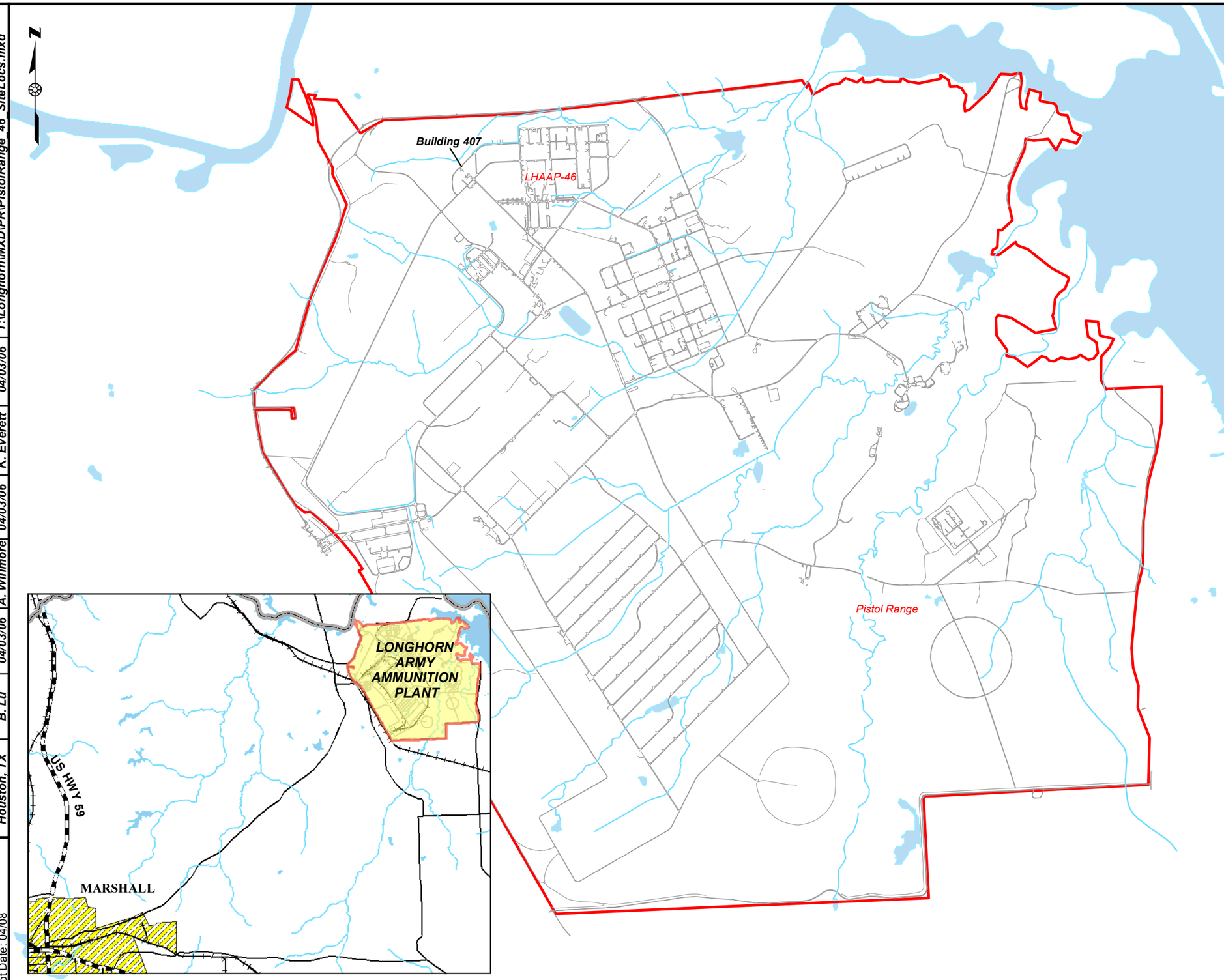
Notes:

Laboratory resutls were analyzed using EPA Method 6010B

Relative % difference is the difference in XRF screening result and laboratory data result divided by the average of two results and multiplied by 100.

As Arsenic
Cr Chromium
Cu Copper
mg/kg milligrams per kilogram
NA not available
Ni Nickel
Pb Lead
ppm parts per million
XRF x-ray fluorescence
Zn Zinc

Figures



Legend

- Stream
- Road
- Former Building or Tank
- Site
- Lake
- LHAAP Boundary

0 1,250 2,500 5,000 Feet

OFFICE	DRAWN BY		CHECKED BY		APPROVED BY		FILE PATH
Houston, TX	B. Lu	04/03/06	A. Willmore	04/03/06	K. Everett	04/03/06	T:\Longhorn\MXD\PR\PistolRange_46_SiteLocs.mxd

Plot Date: 04/08

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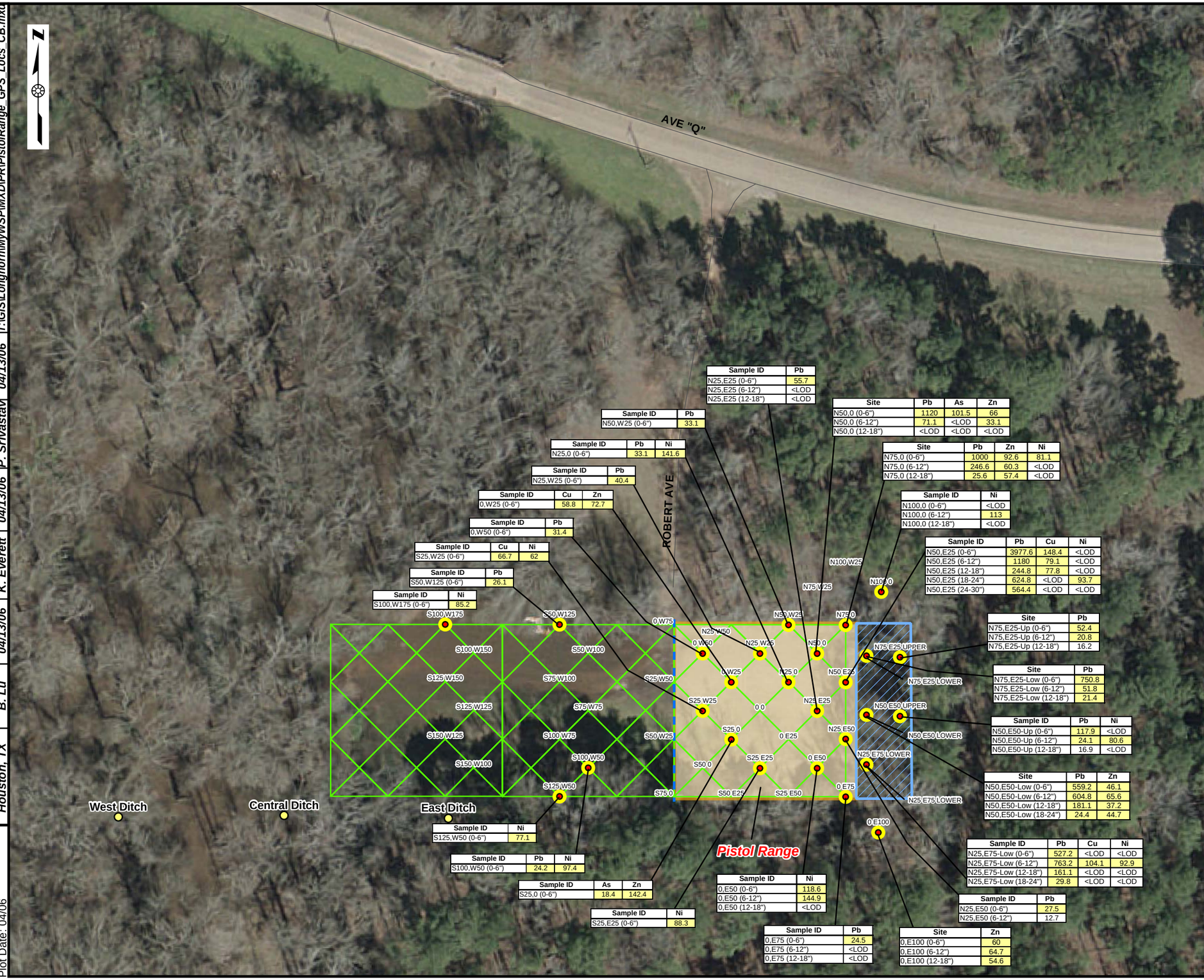
TULSA, OKLAHOMA

FIGURE 1

SITE LOCATION MAP
PISTOL RANGE & LHAAP-46

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS



Sample ID	Pb
N25,E25 (0-6")	55.7
N25,E25 (6-12")	<LOD
N25,E25 (12-18")	<LOD

Sample ID	Pb
N50,W25 (0-6")	33.1

Sample ID	Pb	Ni
N25,0 (0-6")	33.1	141.6

Sample ID	Pb
N25,W25 (0-6")	40.4

Sample ID	Cu	Zn
0,W25 (0-6")	58.8	72.7

Sample ID	Pb
0,W50 (0-6")	31.4

Sample ID	Cu	Ni
S25,W25 (0-6")	66.7	62

Sample ID	Pb
S50,W125 (0-6")	26.1

Sample ID	Ni
S100,W175 (0-6")	85.2

Site	Pb	As	Zn
N50,0 (0-6")	1120	101.5	66
N50,0 (6-12")	71.1	<LOD	33.1
N50,0 (12-18")	<LOD	<LOD	<LOD

Site	Pb	Zn	Ni
N75,0 (0-6")	1000	92.6	81.1
N75,0 (6-12")	246.6	60.3	<LOD
N75,0 (12-18")	25.6	57.4	<LOD

Sample ID	Ni
N100,0 (0-6")	<LOD
N100,0 (6-12")	113
N100,0 (12-18")	<LOD

Sample ID	Pb	Cu	Ni
N50,E25 (0-6")	3977.6	148.4	<LOD
N50,E25 (6-12")	1180	79.1	<LOD
N50,E25 (12-18")	244.8	77.8	<LOD
N50,E25 (18-24")	624.8	<LOD	93.7
N50,E25 (24-30")	564.4	<LOD	<LOD

Site	Pb
N75,E25-Up (0-6")	52.4
N75,E25-Up (6-12")	20.8
N75,E25-Up (12-18")	16.2

Site	Pb
N75,E25-Low (0-6")	750.8
N75,E25-Low (6-12")	51.8
N75,E25-Low (12-18")	21.4

Sample ID	Pb	Ni
N50,E50-Up (0-6")	117.9	<LOD
N50,E50-Up (6-12")	24.1	80.6
N50,E50-Up (12-18")	16.9	<LOD

Site	Pb	Zn
N50,E50-Low (0-6")	559.2	46.1
N50,E50-Low (6-12")	604.8	65.6
N50,E50-Low (12-18")	181.1	37.2
N50,E50-Low (18-24")	24.4	44.7

Sample ID	Pb	Cu	Ni
N25,E75-Low (0-6")	527.2	<LOD	<LOD
N25,E75-Low (6-12")	763.2	104.1	92.9
N25,E75-Low (12-18")	161.1	<LOD	<LOD
N25,E75-Low (18-24")	29.8	<LOD	<LOD

Sample ID	Pb
N25,E50 (0-6")	27.5
N25,E50 (6-12")	12.7

Site	Zn
0,E100 (0-6")	60
0,E100 (6-12")	64.7
0,E100 (12-18")	54.6

Sample ID	Pb
0,E75 (0-6")	24.5
0,E75 (6-12")	<LOD
0,E75 (12-18")	<LOD

Sample ID	Ni
0,E50 (0-6")	118.6
0,E50 (6-12")	144.9
0,E50 (12-18")	<LOD

Sample ID	Ni
S25,E25 (0-6")	88.3

Sample ID	As	Zn
S25,0 (0-6")	18.4	142.4

Sample ID	Pb	Ni
S100,W50 (0-6")	24.2	97.4

Sample ID	Ni
S125,W50 (0-6")	77.1

Legend

- XRF Soil Sample Location
- Sample Location with Result above UPL
- XRF Sediment Sample Location
- Road
- Firing Line
- Site
- 25-foot Grid
- BERM

Notes:

1. Highlighted concentrations exceed background Upper Prediction Limits (UPLs).
2. XRF screening concentrations reported in parts per million (ppm).
3. Results are presented only for locations with samples exceeding UPLs.
4. <LOD - below level of detection
5. Upper Prediction Limit (UPL) values in mg/kg:
   Arsenic (As): 5.86
   Copper (Cu): 8.37
   Nickel (Ni): 9.4
   Lead (Pb): 17.8
   Zinc (Zn): 24.5

0 30 60 120 Feet

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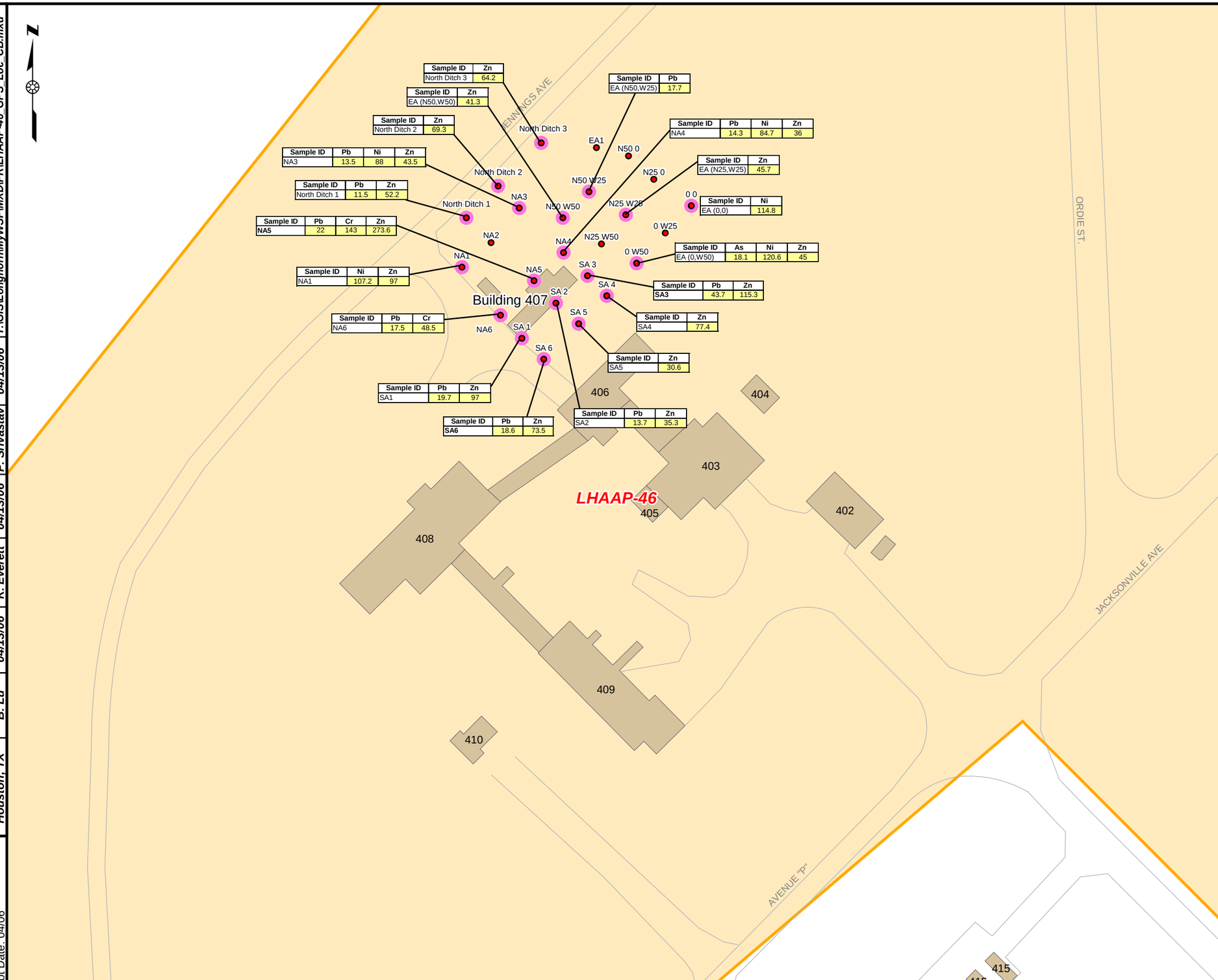
FIGURE 2

XRF SAMPLE LOCATION MAP AND RESULTS
PISTOL RANGE

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	FILE PATH
Houston, TX	B. Lu 04/13/06	K. Everett 04/13/06	P. Srivastav 04/13/06	T:\GIS\Longhorn\MyWSP\MXD\PR\PistolRange_GPS_Locs_CB.mxd

Plot Date: 04/06



Legend

- XRF Sample Location
- Sample Location with Result above UPL
- Road
- Building or Concrete Slab
- Site

Notes:

1. Highlighted concentrations exceed background Upper Prediction Limits (UPLs).
2. XRF screening concentrations reported in parts per million (ppm).
3. Call out boxes generated for locations with samples exceeding UPLs.
4. <LOD - below level of detection
5. All XRF readings were taken on the surface.
6. Upper Prediction Limit (UPL) values in mg/kg:
   Arsenic (As): 5.86
   Chromium (Cr): 29
   Copper (Cu): 8.37
   Nickel (Ni): 9.4
   Lead (Pb): 17.8
   Zinc (Zn): 24.5

0 30 60 120 Feet

U.S. ARMY CORPS OF ENGINEERS
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FIGURE 3

XRF SAMPLE LOCATION MAP AND RESULTS
BUILDING 407 AT LHAAP-46

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

OFFICE	DRAWN BY	CHECKED BY	APPROVED BY	FILE PATH
Houston, TX	B. Lu 04/13/06	K. Everett 04/13/06	P. Srivastav 04/13/06	T:\GIS\Longhorn\MyWSP\MXD\PR\LHAAP-46_GPS_Loc_CB.mxd

Plot Date: 04/06