

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

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

**Date of Meeting:** October 29, 2015, 6:00 – 7:00 PM

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**Meeting Participants:**

**LHAAP/BRAC:** Rose M. Zeiler

**USACE:** Aaron Williams, Richard Smith

**USAEC:** Nicholas Smith

**AECOM:** Mark Heaston, Marwan Salameh

**TCEQ:** April Palmie

**USEPA Region 6:** Rich Mayer, Janetta Coats, Kent Becher (USGS liaison), Phil Harte (USGS liaison),

**USFWS:** Paul Bruckwicki

**RAB:** **Present:** Paul Fortune, Charles Dixon, Ted Kurz, Judy Vandeventer, Tom Walker, John Pollard, Jr., Lee Guice  
**Absent:** Ken Burkhalter, Robert Cargill, Carol Fortune, Judith Johnson, James Lambright, Richard LeTourneau, Nigel Shivers, Pickens Winters, Terry Britt

**Public:** Caleb Brabham (Marshall Newspaper), Sharron McAvry, Dawn Orsak (CLI-TAG), Robert Speight

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An agenda handout for the RAB meeting, fact sheets on the Groundwater Treatment Plant performance, Harrison Bayou and Goose Prairie Creek and Perimeter Well data in addition to a hard copy of the AECOM slide presentation were provided for the meeting.

**Welcome and Introduction**

The RAB Community Co-Chair (Paul Fortune) called the meeting to order and asked if there was anyone present that had not attended before.

**Open Items**

*RAB Administrative Issues*

### *Minutes*

Dr. Zeiler asked if everyone received copies of the previous meeting's minutes and if there were any comments. The motion for approval of the June 2015 RAB meeting minutes was made by Judy Vandeventer and seconded by Charles Dixon.

### *Website Update*

Dr. Zeiler advised that the upcoming sampling schedule information has been posted to the LHAAP website.

Mark Heaston encouraged everyone to look at the website. It includes RAB Meeting Information – Agenda, Minutes, Site Updates, etc.

### *1,4-Dioxane Fact Sheet*

The 1,4-dioxane fact sheet was not provided in hard copy but was included in the slide presentation. 1,4-dioxane in groundwater was evaluated in the past at Longhorn and due to the high reporting limits, all the results were reported below detection. In response to renewed interest in it nationwide, TCEQ and EPA asked that Army conduct sampling to re-evaluate it. EPA has not promulgated Maximum Contaminant Level for 1,4-dioxane. However, the TCEQ has published standards. The 1,4-dioxane levels at the site are fairly low, but exceed the RRR industrial standard (which has been lowered) in some instances.

### *Defense Environmental Restoration Program (DERP) Update – AECOM (Mark Heaston)*

#### MNA Site Updates (LHAAP-37, 46, 50, 58, 67)

- Completed LUCs recordation for all sites.
- RACRs for LHAAP-46 and LHAAP-58 are finished and all agree they are Final.
- Working to finalize RACRs for LHAAP-37, LHAAP-50 and LHAAP-67.
- Sampling being performed quarterly for all above sites except LHAAP-37 due to Bio-Plug work. Initiated geochemical condition sampling. Once geochemical conditions have rebounded to pre-BioPlug study conditions RA-O monitoring for MNA will be initiated.
- Year 1 RA-O Reports completed for LHAAP-46, 50, 58 and 67. Year 2 RA-O Reports currently being prepared for these sites.

#### Other Active Sites

- LHAAP-29 reverted to RI/FS phase. Field work completed, RI Addendum to document nature and extent under development.
- LHAAP-18/24 – AECOM, Army and Agencies have met extensively to discuss the PSI Report. The decision has been made to collect additional data now instead of waiting until the remedial design phase. 1,4-dioxane sampling is also planned in order to determine if it will require a separate remedy component.
- GWTP operation for LHAAP-18/24 and LHAAP-16.
  - Groundwater returned via sprinkler system because the treated groundwater was being tested for 1,4-dioxane before discharge to the HB could be initiated.
  - The blower was ordered during the second week of September but has not been shipped because there is a five-week backorder period.

Slide 11 presented the amount of water collected and treated through June 2015. The amount of water treated during the second quarter was larger than during the first quarter.

Slide 12 presented results of surface water sampling.

- May results were displayed. Sample GPW-1 had 0.156 µg/L (J-flagged) in May 2015.
- August – dry, no sampling

Slide 13 – 19: Technical presentation about 1,4-dioxane

- What is 1,4-dioxane? – Stabilizer for solvents, primarily 1,1,1-TCA and to a lesser extent for TCE and PCE.
- Chemical properties: colorless liquid, flammable, pleasant odor, completely soluble in groundwater, similar specific gravity and boiling point to water, no retardation in soil.
- Environmental Perspective: not significant issue when in air since it degrades in ultraviolet light, not retained in soil, travels quickly in water, doesn't volatilize from water, chemically stable/recalcitrant.
- Toxicity: see slide for details
- Why is 1,4-dioxane of interest to us?
  - 1,4-dioxane plume is longest in 21% of sites, same length at 17% of sites, shorter at 62% of sites
- Data collection at LHAAP-18/24 will provide us with this answer.
- Will be collecting 1,4-dioxane at all other sites.
- Not seeing much 1,4-dioxane except at Sites 16, 18/24 and 12.
- Treatment challenge: Technologies treating CVOCs do not treat 1,4-dioxane.
- Questions/Discussion:
  - Judy: Is this something we should be concerned about?
  - Rose, April, Rich: Most likely not but we do not know yet. This is why we are sampling.
  - Paul: Has it been tested for before?
  - April: Yes, but detection limits were high before; analytical methods have improved.
  - Fred: Have there been other sites in the U.S. and have they been treated?
  - Rich: Yes. Some sites have been treated but it is difficult.
  - April: It is stable and that is why.
  - Fred: Do TCEQ/EPA have standards?
  - Rich: EPA has an advisory limit.
  - April: TCEQ has promulgated cleanup levels.

Rich introduced Phil Harte with USGS.

- Phil: Will give a less technical presentation. USGS is happy to support EPA.
- Outline: Try to explain variability in wells, assess hydrogeology, focused/limited effort.
  - Completed two types of sampling:
    1. Standard purge sampling and extended purge sampling.
    2. Discrete sampling (passive sampling).
      - a. Well profiling using different tools – gamma, caliper
      - b. Surface resistivity surveys – looks at formation in the ground
  - Slide showing displays of two sampling methods

- Diffusive samples for two weeks to equilibrate
  - Installed a string of diffusive samplers to detect vertical variations
- Borehole logging
- Photo of surface resistivity – direct current measures voltage received
- Slide showing site and test wells
- Example of extended purge data at 18CPTMW03SW
- Slide showing purge concentrations vs. passive sampling concentrations
  - Perchlorate concentration with depth at AWD-3
- Displayed logging results for 18CPTMW03
  - Gamma and electromagnetic tool picked up clay at 40 to 50 feet.
- Similar slide for MW-14
  - Discussed fluid logs
  - Discussed conductivity
- Slide showing resistivity lines
- Slide showing NW-2 line resistivity data – resistivity decrease, conductivity increase
- Questions/Discussion:
  - Ted: Do you know if this changes all the time?
  - Phil: We only did this once.
- Conclusion Slide
  - New sampling method told us where the contamination is.
  - Methods implemented work at this site.

Mark Heaston presented a summary slide of future field work events, Monthly Managers Meetings and RAB Meetings.

Rose proposed the next RAB meeting be held on January 21, 2016 (the 3<sup>rd</sup> Thursday of the month). There were no objections.

Mark Heaston presented a summary slide of the documents AECOM is currently working on.

#### Dispute Status Update

- Judy inquires about the status of the dispute.
- Rose: Same as before.
- Judy: Is there nothing that can be done at this time or are we choosing not to do work?
- Rose: We continue to work. We monitor Site 16, which is in dispute, and the GWTP. Army went to EPA asking for concurrence on implementing the groundwater remedies at several sites while awaiting resolution of the dispute, but this approach was overcome by events for both parties.
- Rich: If EPA prevails in the dispute, it applies to three groundwater constituents (manganese (Mn), nickel (Ni), and perchlorate) and none in the soil.
- Rose: If level is lower, we have to find a new edge of plume.
- Rich: On the two metals no problem. I see a problem with perchlorate.

- Rose: Metals and risk re-evaluation (human health) pretty much means starting over. Mn going from 14,000 to 1,100 in TRRP is substantial. Dinitrotoluene (DNT) going to TRRP is one order lower than RRR, so impact is large.
- Judy: This is my concern – we are at a standstill. Can we do anything?
- Rich: OMB met with EPA and asked EPA questions.
- Judy: I was just concerned.
- Rich: We agree 100%. We tried to push them RAB is concerned.
- April: We have been doing good work.
- Paul: Don't want to be negative here, but Army said approximately 10 years to complete. How long will it be?
- Rich: People simplified the conditions then but it is more complex.
- April: When we have groundwater issues things take a long time, unlike soil.
- Rich: At a site in Dallas soil was replaced with clean fill and downgradient wells are still impacted.
- Paul: No one has an answer?
- Rich: Maybe with technology advancement.
- April: Plumes are not spreading even on idle sites.
- Ted: How do you know that?
- April: Because we sample and look at perimeter wells and surface water data. It is contained.
- Ted: Not disputing but map showed plume expansion.
- April: No, that was the resistivity log. We sample Harrison Bayou.
- Ted: I know. I trust you guys.
- Paul: February call from USGS wanting to sample. Does USGS normally do that?
- Kent: Yes, we serve all industries/entities.

**Adjourn** – Motion to adjourn made by Paul, seconded by Judy.

#### **October Meeting Attachments and Handouts:**

- *Meeting Agenda*
- *AECOM PowerPoint Presentation*
- *GWTP Treated Groundwater Volumes Handout*
- *Surface Water Sampling Results Handout*
- *LHAAP Perimeter Well Sampling Results Handout*

## *Acronyms*

AECOM	AECOM Technical Services, Inc.
BRAC	Base Realignment and Closure
CLI	Caddo Lake Institute
CVOC	Chlorinated Volatile Organic Compounds
DERP	Defense Environment Response Program
DNT	Dinitrotoluene
GWTP	Groundwater Treatment Plant
LHAAP	Longhorn Army Ammunition Plant
LUCs	Land Use Controls
MNA	Monitored Natural Attenuation
OMB	Office of Management and Budget
PCE	Tetrachloroethene
PSI	Post Screening Investigation
RAB	Restoration Advisory Board
RACR	Remedial Action Completion Report
RA-O	Remedial Action Operations
RI/FS	Remedial Investigation/Feasibility Study
RRR	Risk Reduction Rule
TAG	Technical Assistance Grant
TCA	Trichloroethane
TCE	Trichloroethene
TCEQ	Texas Commission on Environmental Quality
TRRP	Texas Risk Reduction Program
USACE	United States Army Corps of Engineers
USAEC	United States Army Environmental Center
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
Ni	Nickle
Mn	Manganese



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

**AGENDA**

**DATE:** Thursday, October 29, 2015  
**TIME:** 6:00 – 7:30 PM  
**PLACE:** Karnack Community Center, Karnack, Texas

- 06:00** Welcome and Introduction
- 06:05** Open Items {RMZ}
- RAB Administrative Issues
  - Minutes
  - Website
  - 1,4-Dioxane Fact Sheet
- 06:15** Defense Environmental Restoration Program (DERP) Update {AECOM}
- MNA Site Updates
  - LHAAP-29 Updates
  - LHAAP-18/24 Updates
  - 1,4-Dioxane Introduction
  - Groundwater Treatment Plant (GWTP) Update
  - Surface Water and Perimeter Well Sampling
- 06:45** EPA Update {RM/KB}
- LHAAP-18/24 Passive Diffusion Bag Sampling
- 07:15** Other Environmental Restoration Issues {RMZ}
- Dispute Status Update
- 07:20** Next RAB Meeting Schedule and Closing Remarks
- 07:30** Adjourn {RMZ}

# **Longhorn Army Ammunition Plant Restoration Advisory Board Meeting October 29, 2015**

AECOM Environment



# Agenda

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## RAB Administrative Issues

- Minutes from June RAB Meetings
- Website Updates
- 1,4-Dioxane Fact Sheet

# Website update

HOME BACKGROUND SITES ▼ REMEDIAL TECHNOLOGIES PLUME MAPS ADMIN RECORD GET INVOLVED ▼



## Longhorn Army Ammunition Plant

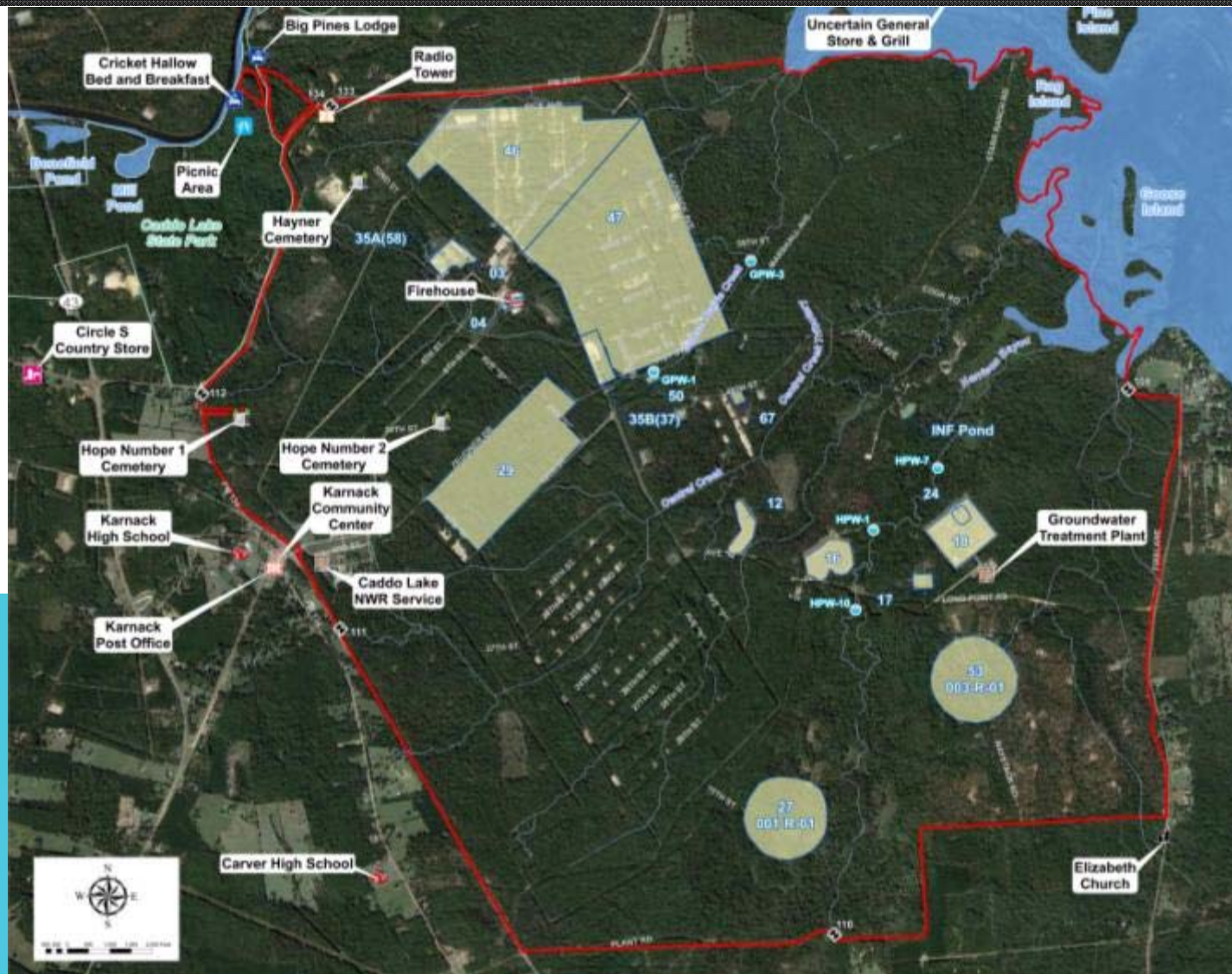
Environmental Restoration Program

◀ The next RAB meeting will be 29 October 2015 [Click on Calendar for Meeting Agenda and Details.](#) ▶

- February 2015 RAB minutes posted
- October 2015 RAB Agenda posted
- Calendar updated with upcoming sampling events



# Longhorn Map



# Longhorn Active Site List

LHAAP-03	Building 722 Paint Shop
LHAAP-04	Pilot Wastewater Treatment Plant
LHAAP-12	Landfill 12
LHAAP-16	Landfill 16
LHAAP-17	Burning Ground No.2/Flashing Area
LHAAP-18	Burning Ground No.3
LHAAP-24	Unlined Evaporation Pond
LHAAP-29	Former TNT Production Area
LHAAP-37	Chemical Laboratory Waste Pad
LHAAP-46	Plant Area 2
LHAAP-47	Plant Area 3
LHAAP-50	Former Sump Water Tank
LHAAP-58	Maintenance Complex
LHAAP-67	Aboveground Storage Tank Farm
LHAAP-001-R-01	South Test Area/Bomb Test Area
LHAAP-003-R-01	Ground Signal Test Area



# Status of Environmental Sites

- Monitored Natural Attenuation Sites
  - LHAAP-35B (37) – Chemical Laboratory
  - LHAAP-46 – Plant Area 2
  - LHAAP-50 – Former Sump Water Tank
  - LHAAP-35A (58) – Shops Area
  - LHAAP-67 – Aboveground Storage Tank Farm
- Land Use Control Boundary Surveys for groundwater use restriction are complete for all sites.
- Final Completion Reports are finished for LHAAP-46 and 58, working to finalize Completion Reports for LHAAP-35B(37), 50, and 67.
- Scheduled Quarterly/Semi-Annual Groundwater Monitoring is ongoing (all sites except LHAAP-35B (37))
- Year 1 Remedial Action Operation Reports for sites have been drafted (all sites except LHAAP-35B(37))
- Beginning work on Year 2 RAO Reports for LHAAP-67 and 46

## Status of Environmental Sites (continued)

### LHAAP-29 Former TNT Production Area

To address remedy design and implementation questions at the Draft Final ROD stage, the RI and FS were re-opened:

- RI Addendum for 29 is being prepared

### LHAAP-18/24 Former Burning Ground No. 3 and Unlined Evaporation Pond

To evaluate remedy alternatives for this site a Revised FS is being prepared:

- Post Screening Investigation
- Currently performing expanded 1,4-dioxane sampling

## Status of Environmental Sites (cont)

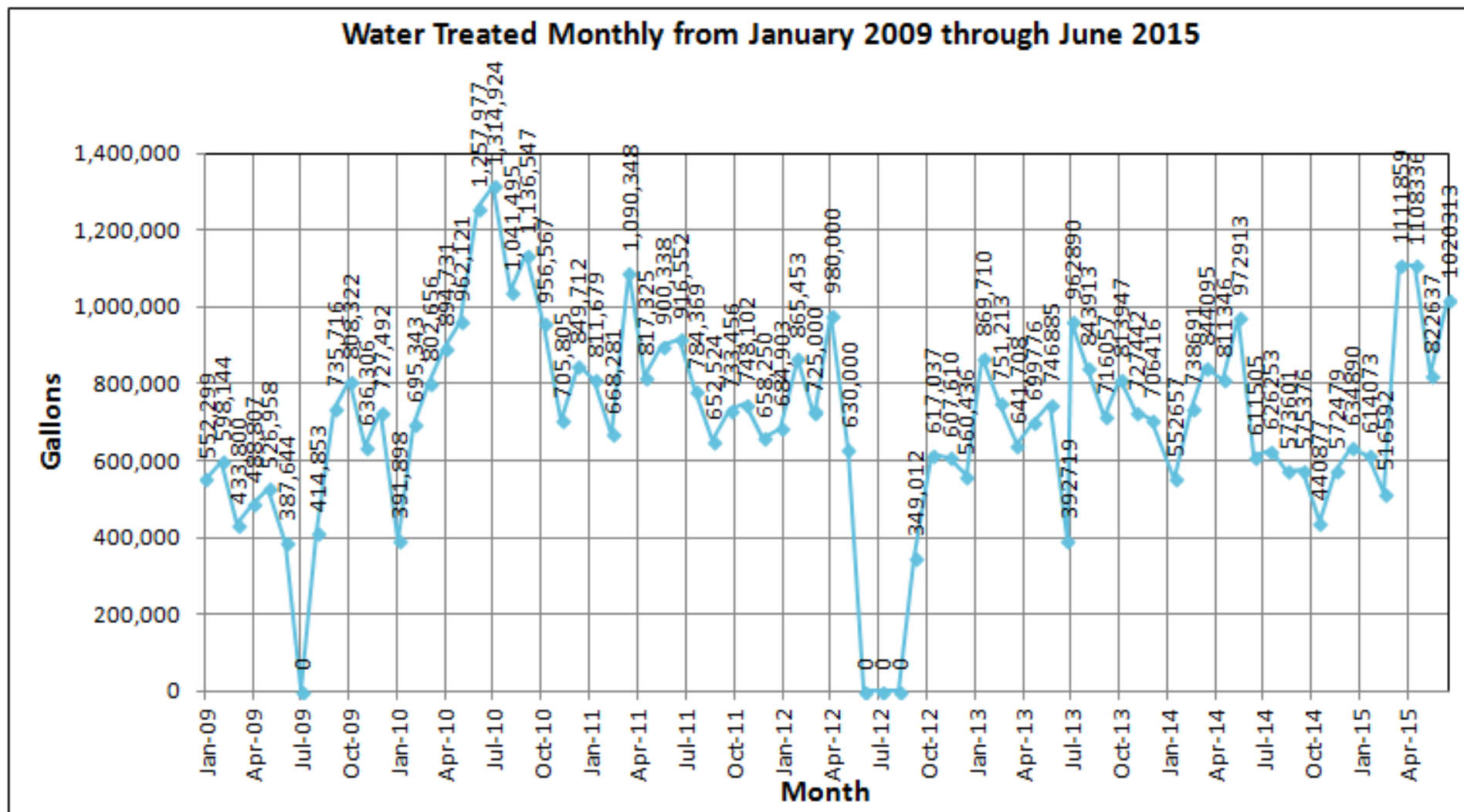
- LHAAP-03 - Record of Decision, Remedial Design/Remedial Action Work Plan On-hold Due to Dispute
- LHAAP-04 - Record of Decision, Remedial Design/Remedial Action Work Plan On-hold Due to Dispute
- LHAAP-16 - Record of Decision, Remedial Design/Remedial Action Work Plan On-hold Due to Dispute
- LHAAP-17 - Record of Decision, Remedial Design/Remedial Action Work Plan On-hold Due to Dispute
- LHAAP-47 - Record of Decision, Remedial Design/Remedial Action Work Plan On-hold Due to Dispute
- LHAAP-001-R-01 - Record of Decision, Remedial Design/Remedial Action Work Plan On-hold Due to Dispute
- LHAAP-003-R-01 - Record of Decision, Remedial Design/Remedial Action Work Plan On-hold Due to Dispute



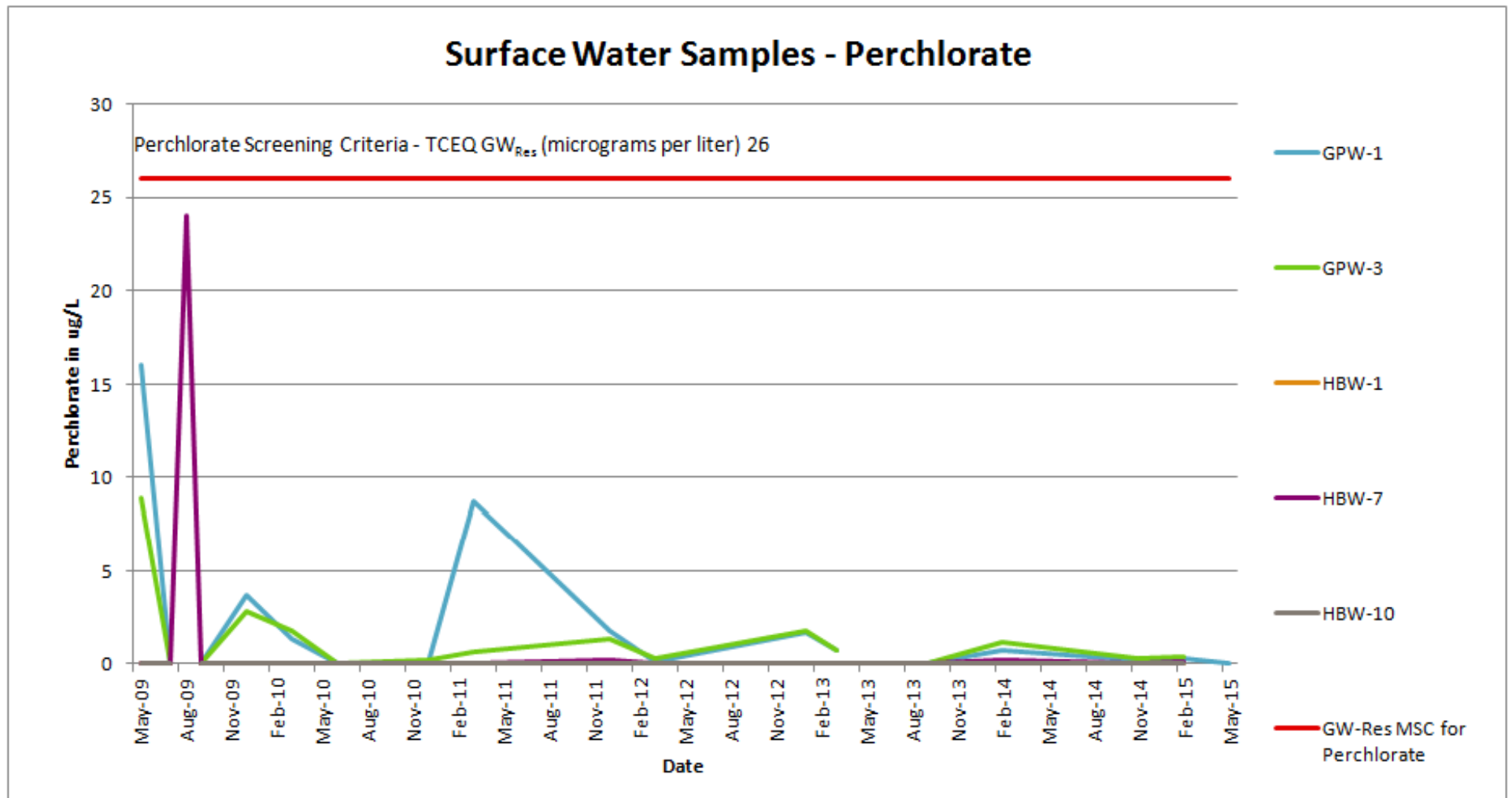
# Groundwater Treatment Plant Operations and Management

- The Groundwater Treatment Plant continues to operate to contain the plume at LHAAP-18/24 and LHAAP-16.
- Treated groundwater is currently being returned to LHAAP-18/24 through the sprinkler array.
- LHAAP-18/24 Compliance monitoring of groundwater continues per existing sampling plan.
- Maintenance and repairs of wells, pumps, tanks, and ancillary equipment is ongoing. Currently in the process of replacing the air stripper blower.

# GWTP O&M (cont)



# Surface Water Sample Results



GPW – Goose Prairie Creek  
HBW – Harrison Bayou

# Introduction to 1,4-Dioxane: Characterization and Remediation





## What is 1,4-Dioxane

- Used alone as a **solvent** from late 1920s
- Used as **solvent stabilizer** and acid corrosion inhibitor to prevent decomposition of chlorinated solvents (especially **1,1,1-trichloroethane**) (usually 3-4.5% by vol.), first patented use in 1954.
- Used as **main or minor ingredients** of many products
- Produced as **by-product** from manufacturing process

### Role of Solvent Stabilizer

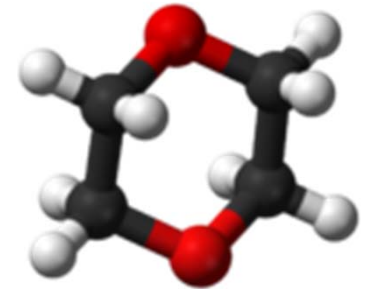
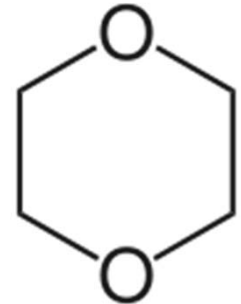
Pure solvents are inherently unstable, solvents progressively deteriorate with use due to exposure to UV light, heat, oxygen, and reactions with acids, water, metals and their salts

### Solvent stabilizer supply:

Acid acceptors, anti-oxidant, metal inhibitors

## Chemical Properties

- Cyclic ether (C<sub>4</sub>H<sub>8</sub>O<sub>2</sub>)
- Colorless, flammable liquid with faint pleasant odor
- **Completely soluble in water**
- Specific gravity 1.033
- Boiling Point 101°C
- Moderate vapor pressure (38 mm Hg at 25°C) and will volatilize from dry soil
- Not retarded by soil (low K<sub>oc</sub> 1.23, log K<sub>ow</sub> -0.27)
- Relatively non-volatile in water (very low Henry's Law Constant of  $4.88 \times 10^{-6}$  atm-m<sup>3</sup>/mol)



## Once Released.....

### Air

- Readily evaporates, moderate vapor pressure of 38.0 mm Hg at 25°C
- As a vapor, breaks down readily to form aldehydes and ketones

### Soil

- Will tend to migrate through soil rather than adsorb to particles (except for moist clay/silt)

### Water

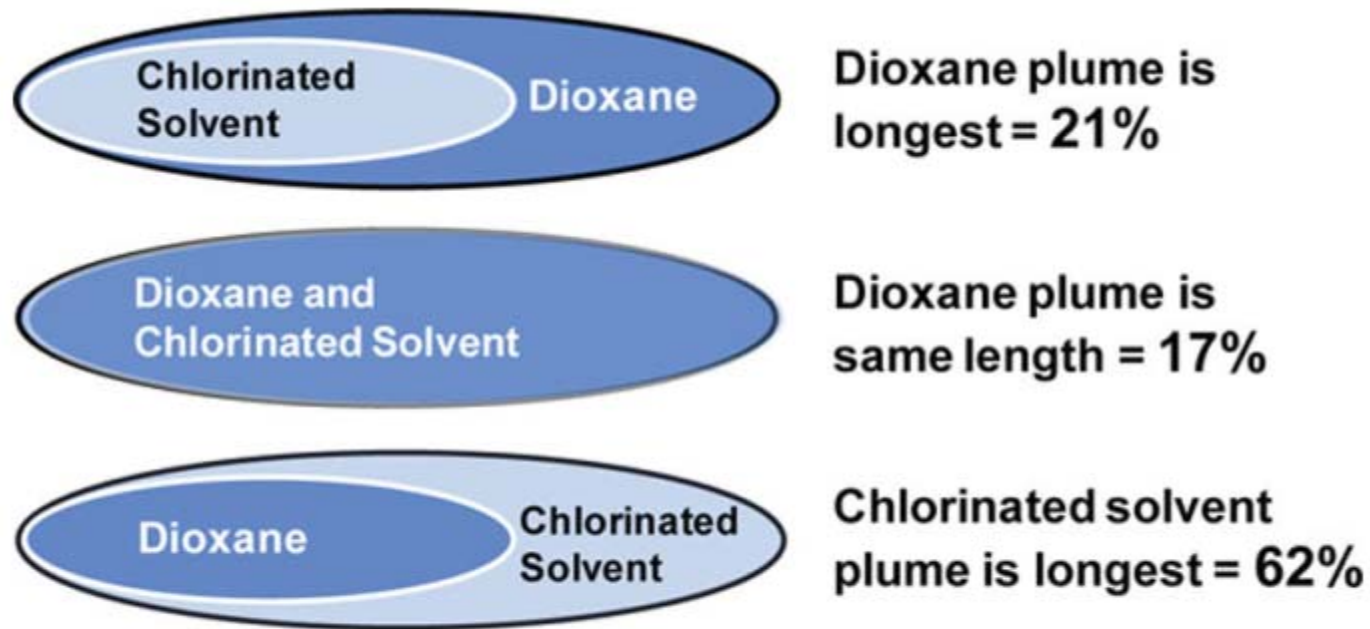
- Completely soluble in water = potentially travel faster than chlorinated solvents in plume
- Tends to stay dissolved, therefore low volatilization risk from groundwater
- Chemically stable, not expected to degrade once in groundwater or surface water

# Toxicity

- Exposures may occur via inhalation of vapor, ingestion of contaminated food and water, or via dermal contact.
- Industrial workers at greatest risk from repeated inhalation exposures.
- Short-term exposures – Irritation of the eyes and throat.
- Chronic exposures – Dermatitis, eczema, dry/cracked skin, liver and kidney damage.
- EPA classifies 1,4-dioxane as a “Probable Carcinogen” and likely to be carcinogenic to humans by all exposure routes.
  - 2010: provided an oral cancer slope factor and an oral (noncancer) reference dose.
  - 2013: released the Toxicity Review of 1,4-Dioxane (with Inhalation Update).



# 1,4-Dioxane Behavior in Groundwater



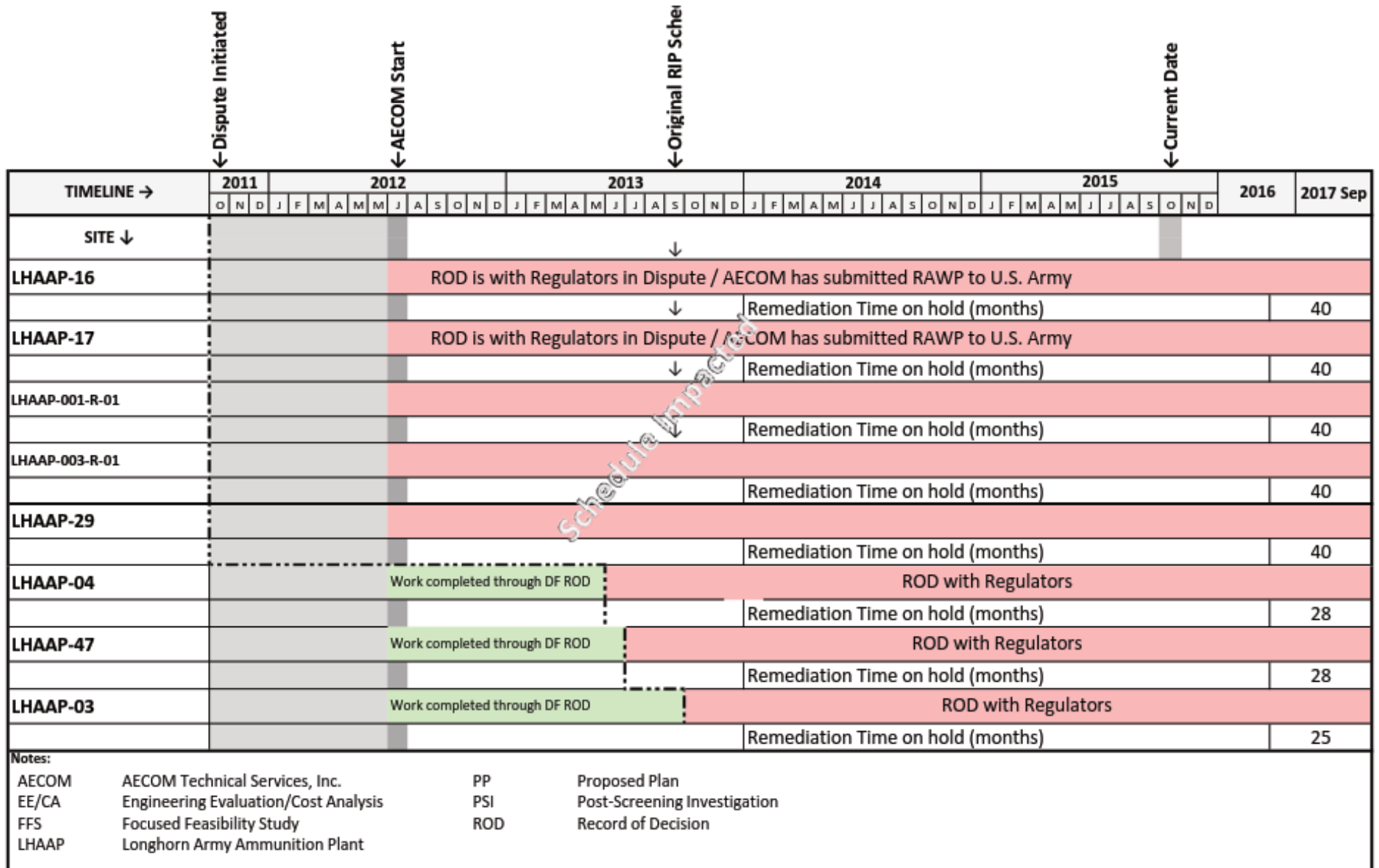
n = 103 sites where dioxane and chlorinated solvents co-occur

# Treatment Challenges

- Large dilute plumes
  - Most large 1,4-dioxane plumes have not been fully characterized.
  - Most sites have no long term monitoring data to demonstrate plume stability.
  - Low levels of 1,4-dioxane are difficult to treat, cost effective treatment technologies to capture or treat large dilute plume are needed.
  - Can bioremediation or MNA be a potential option for large dilute plume?
- 1,4-Dioxane plumes are commonly co-mingled with CVOCs, especially in source areas. CVOCs in source areas likely have remedy in place without considering 1,4-dioxane.
- Only limited number of technologies are effective for treating CVOCs and 1,4-dioxane, sequential treatment approach may be needed.
- Monitoring tools to validate treatment effectiveness and mechanisms are also needed and are being developed.

# Dispute Status

## Sites at which Work has Ceased Pending Resolution of the Dispute



# Upcoming Fieldwork, Meetings, and Documents

## Fieldwork

1. Continue RA-O sampling of groundwater monitoring networks at LHAAP-46, 50, 58, 67
2. Continue semi-annual compliance sampling for LHAAP-18/24
3. Perform 1,4-Dioxane sampling at multiple sites
4. Continue geochemistry rebound monitoring at site LHAAP-37

## Meetings

1. Continue Monthly Managers Meetings
2. Continue Quarterly RAB Meetings

## Documents

1. Finalize Completion Reports for sites LHAAP-37, 67, and 50
2. Finalize First Annual Remedial Action-Operation Reports for sites LHAAP-46, and LHAAP-58
3. LHAAP-18/24 – 1,4-Dioxane Memo
4. LHAAP-29 –Draft RI Addendum planned for Fall 2015
5. GWTP Quarterly Operation Reports

# Questions?





# Regulatory Updates

- **No Federal MCL**
- Regulatory criteria are changing and vary by state
  - **Texas has established action levels for 1,4-dioxane**
    - GW-Ind= 26 µg/L (0.026 mg/L)
    - GW-Res= 7.7 µg/L (0.0077 mg/L)

# Groundwater Treatment Plant - Treated Groundwater Volumes

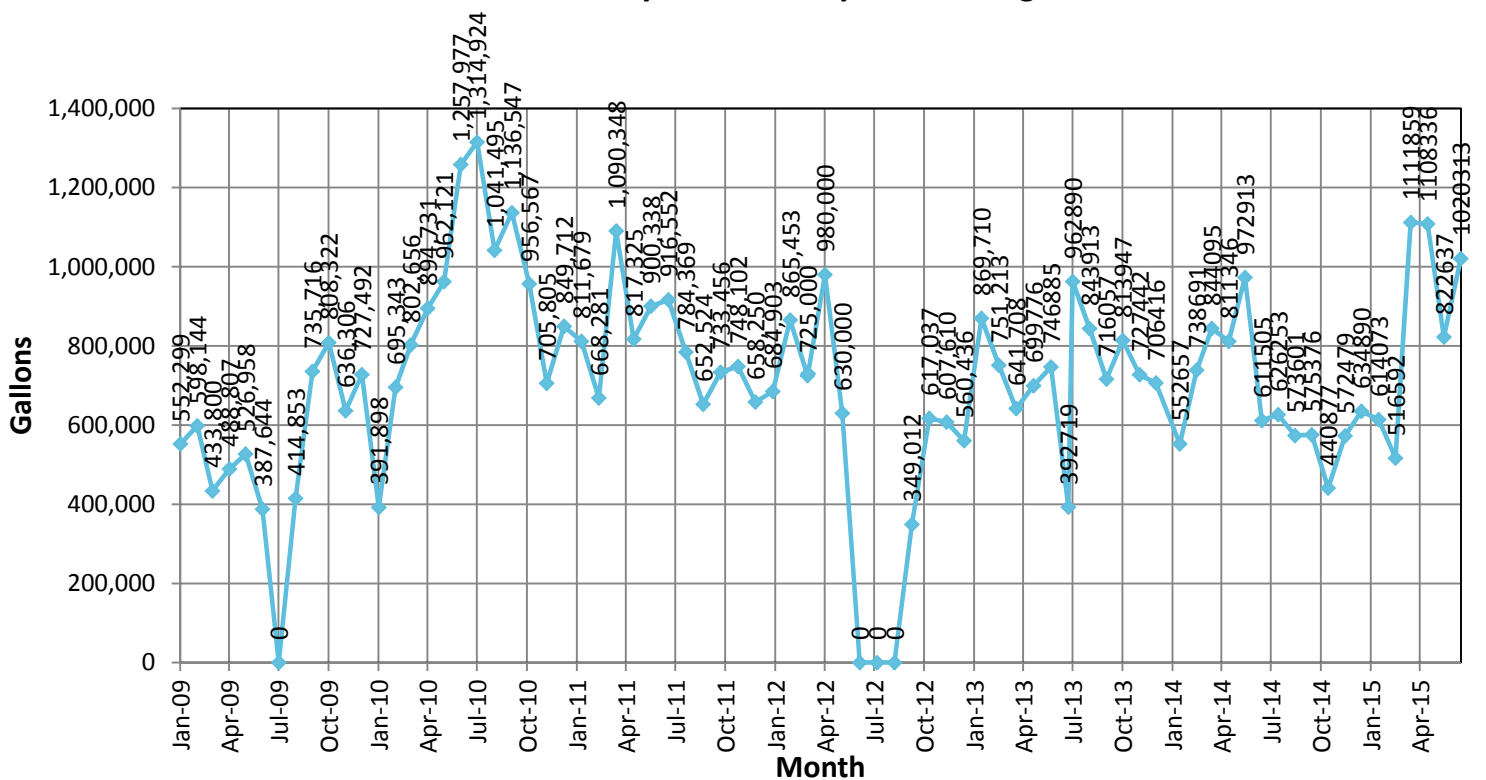
The amount of groundwater treated is determined by measuring the number of gallons of treated water returned to LHAAP-18/24, released to the INF Pond, or discharged to Harrison Bayou.

## Treated Water Data (in gallons)

Oct-07	Nov-07	Dec-07	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08
1,041,491	848,356	804,822	792,148	665,883	818,872	791,306	568,812	776,904	748,377	690,052	617,199
Oct-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09	Apr-09	May-09	Jun-09	Jul-09	Aug-09	Sep-09
655,059	619,274	726,118	552,299	598,144	433,800	488,807	526,958	387,644	0	414,853	735,716
Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	May-10	Jun-10	Jul-10	Aug-10	Sep-10
808,322	636,306	727,492	391,898	695,343	802,656	894,731	962,121	1,257,977	1,314,924	1,041,495	1,136,547
Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11
956,567	705,805	849,712	811,679	668,281	1,090,348	817,325	900,338	916,552	784,369	652,524	733,456
Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12
748,102	658,250	684,903	865,453	725,000*	730,000*	980,000*	630,000*	0	0	0	349,012
Oct-12	Nov-12	Dec-12	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13	Jul-13	Aug-13	Sep-13
617,037	607,610	560,436	869,710	751,213	641,708	699,776	746,885	392,719	962,890	843,913	716,057
Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14
813,974	727,442	706,416	552,657	738,691	844,095	811,346	972,913	611,505	626,253	573,601	575,376
Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-18	May-15	Jun-15			
440,877	572,479	634,890	614,073	516,592	1,111,859	1,108,336	822,637	1,020,313			

\*Indicates Estimate

Water Treated Monthly from January 2009 through June 2015

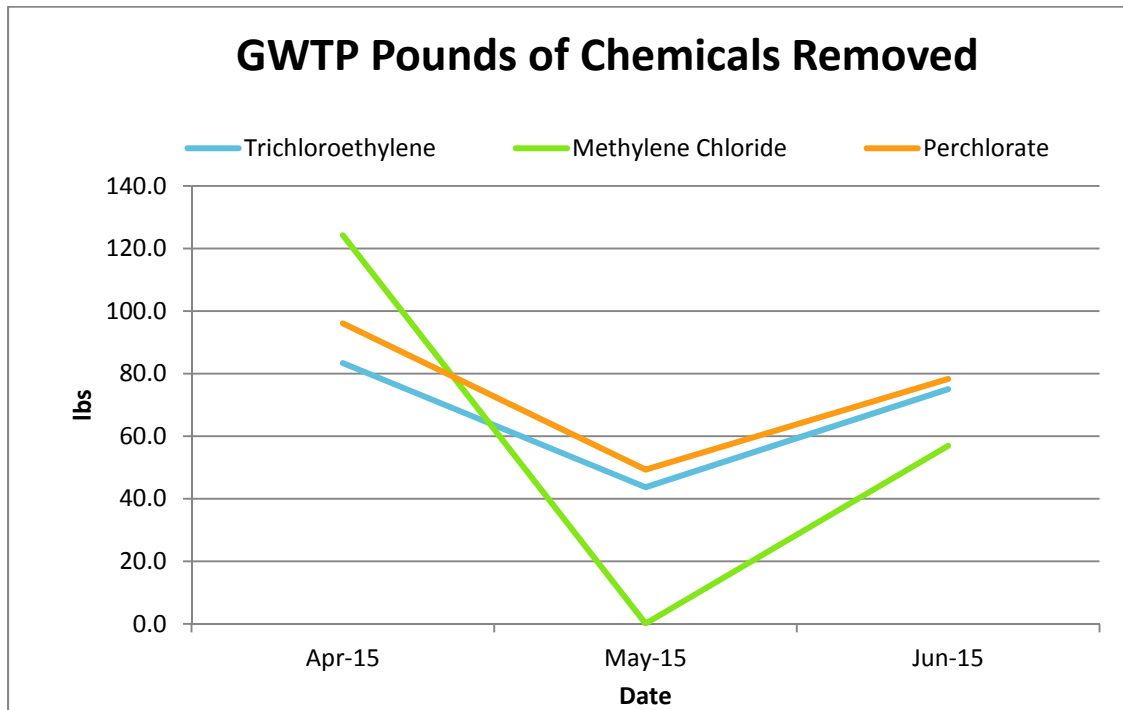


The pounds of chemicals removed for the 2nd Quarter of 2015 can be found below and are calculated by the following formula:

$$\frac{(\text{GWTP Influent Contaminant Concentration } [\mu\text{g/L}] \times \text{Volume } [\text{gallons}] \times 3.785 [\text{liters per gallon}])}{(453,600,000 \mu\text{g per pound})}$$

### Pounds of Chemicals Removed From LHAAP-18/24, 2nd Quarter 2015

	Trichloroethylene	Methylene Chloride	Perchlorate
Apr-15	83.4	124.3	96.1
May-15	43.7	0.11	49.3
Jun-15	75.0	57.0	78.3



### Water Discharge Location and Volume (Gallons)

Month	Harrison Bayou	LHAAP-18/24 Sprinklers	INF Pond
Apr-15	0	965,468	0
May-15	0	761,374	0
Jun-15	0	895,398	0



# Harrison Bayou and Goose Prairie Creek – Perchlorate Data

Surface water samples are collected quarterly from each location in Harrison Bayou and Goose Prairie Creek, unless the sampling location is dry.

## Historic Surface Water Sample Data (in micrograms per liter)

Quarter	3 <sup>rd</sup>	4 <sup>th</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	1 <sup>st</sup>
Creek Sample ID	Jul 1999	Sep 1999	Feb 2000	Apr 2000	Aug 2000	Dec 2000	Feb 2001	Apr 2001	July 2001	Oct 2001	Jan 2002
GPW-1	<1.0U	-	4	<4.0 U	<4.0 U	<4.0 U	-	2.65	<4.0 U	<4.0 U	<4.0 U
GPW-3	<1.0U	<4.0 U	17	8	<4.0 U	<4.0 U	-	2.28	<4.0 U	<4.0 U	<4.0 U
HBW-1	-	<80.0 U	310	23	-	-	<4.0 U	-	<4.0 U	<4.0 U	<4.0 U
HBW-7	-	<8.0 U	370	110	-	-	<4.0 U	-	<4.0 U	<4.0 U	<4.0 U
HBW-10	-	<8.0 U	905	650	<4.0 U	-	<4.0 U	-	<4.0 U	-	-

Quarter	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>
Creek Sample ID	June 2002	Sept 2002	Dec 2002	Feb 2003	June 2003	Aug 2003	July 2004	Dec 2006	May 2007	Aug 2007	Dec 2007
GPW-1	<4.0 U	<4.0 U	18.3	18.6	59.9	-	2.25	-	<1.0 U	<1.0 U	10.7
GPW-3	<4.0 U	<4.0 U	5.49	12.6	14.7	-	2.2	-	<1.0 U	<1.0 U	7.48
HBW-1	<4.0 U	<4.0 U	<4.0 U	-	<4.0 U	99.3	<0.2U	<1.0 U	<1.0 U	122	<1.0 U
HBW-7	<4.0 U	<4.0 U	<4.0 U	-	<4.0 U	<4.0 U	<0.2U	<1.0 U	<1.0 U	1.02	<1.0 U
HBW-10	<4.0 U	<4.0 U	<4.0 U	-	<4.0 U	-	<0.2U	<1.0 U	<1.0 U	<1.0 U	<1.0 U

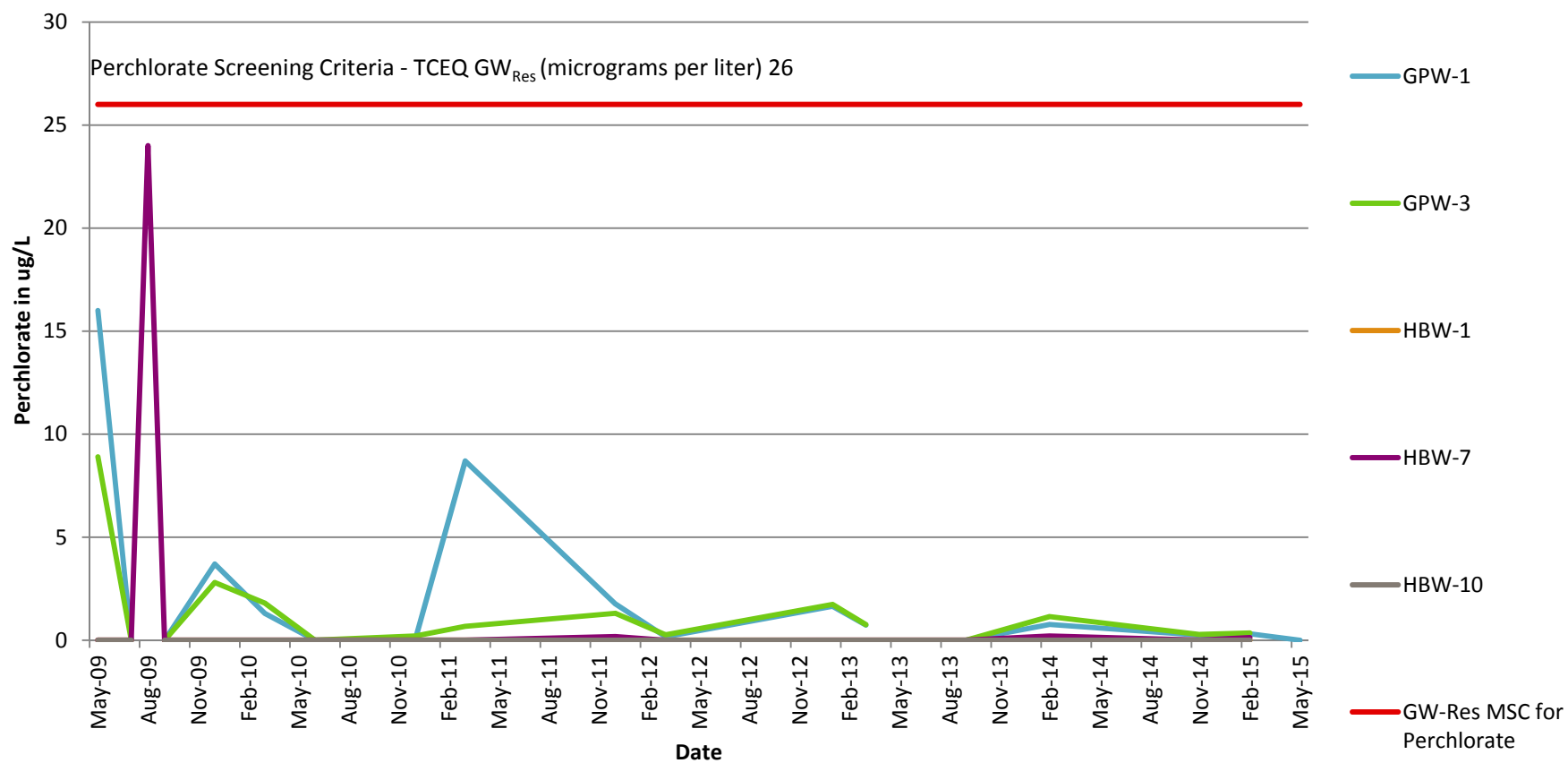
Quarter	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	3 <sup>rd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	1 <sup>st</sup>	2 <sup>nd</sup>
Creek Sample ID	Mar 2008	Jun 2008	Sep 2008	Dec 2008	May 2009	Jul 2009	Aug 2009	Sep 2009	Dec 2009	Mar 2010	Jun 2010
GPW-1	27	<0.5U	<0.5U	<0.22U	16	<4U	NS	<1.2U	3.7	1.3J	<0.6U
GPW-3	21.9	9.42	1.1	<0.22U	8.9	<4U	NS	<0.6U	2.8	1.8J	<0.6U
HBW-1	<0.5U	<0.5U	<0.5U	<0.22U	<0.55U	<4U	NS	<1.5U	<0.275U	1.5U	<0.6U
HBW-7	<0.5U	<0.5U	<0.5U	<0.22U	<0.55U	<4U	24	<1.2U	<0.275U	1.5U	<0.6U
HBW-10	<0.5U	<0.5U	<0.5U	<0.22U	<0.55U	<4U	NS	<1.5U	<0.275U	1.2U	<0.6U

Quarter	3 <sup>rd</sup>	4 <sup>th</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	1 <sup>st</sup>
Creek Sample ID	Sep 2010	Dec 2010	Mar 2011	Jun 2011	Sep 2011	Dec 2011	Mar 2012	Jun 2012	Not Applicable	Jan & Feb 2013	Mar 2013
GPW-1	dry	<0.1U	8.7	dry	dry	1.76	0.163J	dry	NS	1.65	0.735
GPW-3	dry	0.199J	0.673	dry	dry	1.31	0.261	dry	NS	1.74	0.754
HBW-1	dry	<0.1U	<0.2U	dry	dry	<0.1U	0.1U	dry	NS	<0.2U	<0.2U
HBW-7	dry	<0.1U	<0.2U	dry	dry	0.171J	0.1U	dry	NS	<0.2U	<0.2U
HBW-10	dry	<0.1U	<0.2U	dry	dry	<0.1U	0.1U	dry	NS	<0.2U	<0.2U

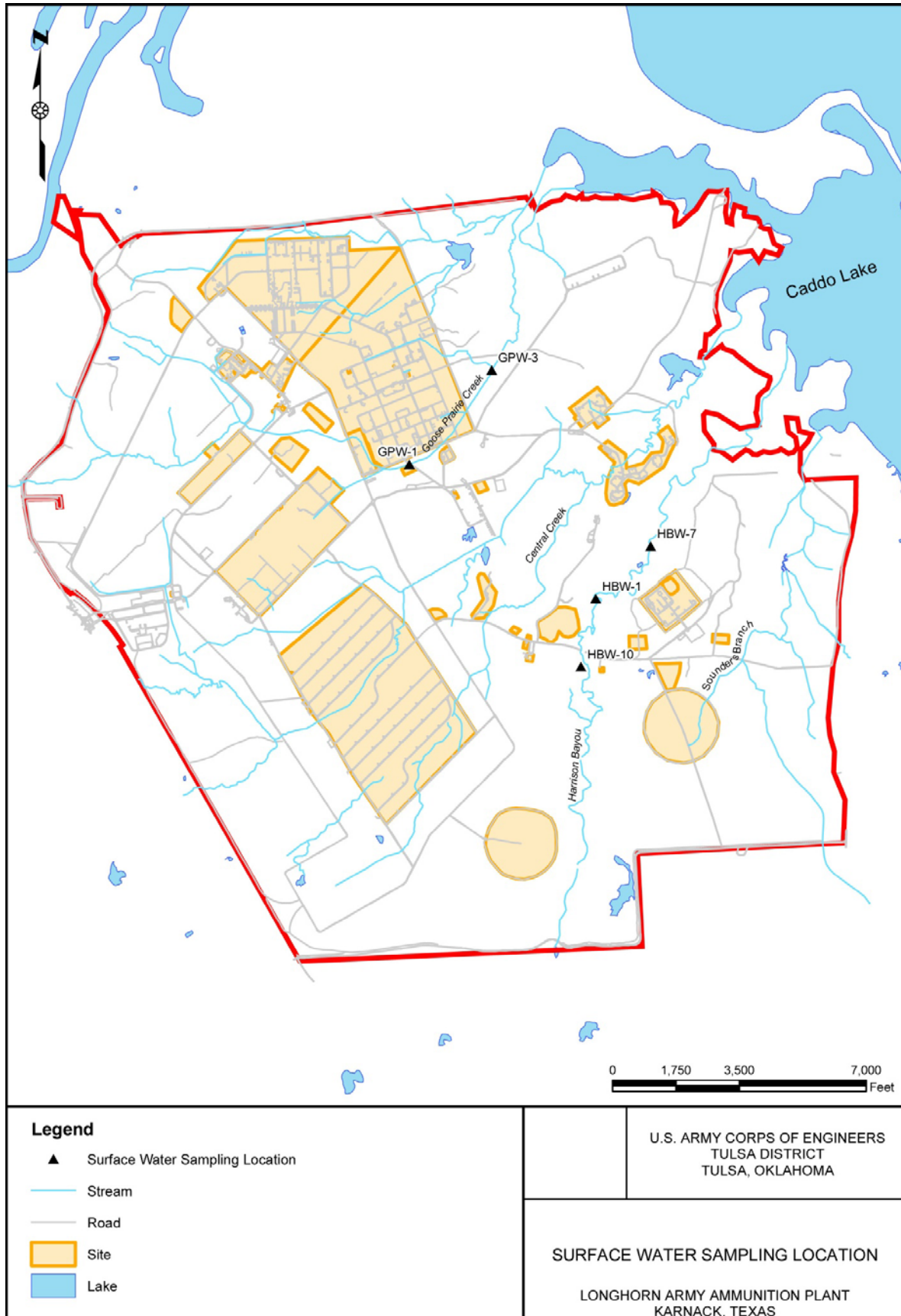
Quarter	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>
Creek Sample ID	Jun 2013	Sept 2013	Dec 2013	Feb 2014	May 2014	Aug 2014	Nov 2014	Feb 2015	May 2015	Aug 2015
GPW-1	dry	<0.2 U	dry	0.766	dry	dry	0.244 J	0.311 J	0.156J	dry
GPW-3	dry	<0.2 U	dry	1.15	dry	dry	0.276 J	0.344 J	NS	dry
HBW-1	<0.2U	<0.2 U	dry	<0.2 U	dry	dry	<0.2 U	<0.2 U	NS	dry
HBW-7	<0.2U	<0.2 U	dry	0.201 J	dry	dry	<0.2 U	0.124 J	NS	dry
HBW-10	<0.2U	<0.2 U	dry	<0.2 U	dry	dry	<0.2 U	<0.2 U	NS	dry

NS – not sampled      U – non-detect      J – Estimated      Dry – no surface water

## Surface Water Samples - Perchlorate



## Longhorn Army Ammunition Plant Creek Sampling Locations



# LHAAP Perimeter Well Monitoring – Perchlorate Data

Groundwater samples are currently collected annually from four wells and semi-annually from two wells on the LHAAP perimeter.

## Historic Perimeter Well Sample Data (in micrograms per liter)

Well ID	Jun 2005	Sep 2005	Sep 2006	May 2007	Aug 2007	Dec 2007	Mar 2008	Sep 2008	May 2009	Sep 2009	Mar 2010
108	NS	NS	10 U	NS	0.5 U	NS	NS	2.5 U	NS	1.2 U	NS
110	NS	NS	10 U	NS	10 U	NS	NS	5.0 U	NS	6 U	NS
111	NS	NS	4 U	NS	0.5 U	NS	NS	0.5 U	NS	0.3 U	NS
112	NS	NS	5 U	NS	3 U	NS	NS	2.0 U	NS	3 U	NS
133	0.541	0.597	1.08	1 U	1.09	0.5 U	0.5 U	0.5 U	0.47 J	0.32	Dry
134	0.881	0.725	0.708 J	1 U	0.949 J	0.5 U	0.5 U	0.829 U	0.04 J	0.3 U	0.3 U

Well ID	Sep 2010	Mar 2011	Sep 2011	Oct 2012	Mar 2013	Jun 2013	Apr 2014	Jun 2014	Dec 2014	Jun 2015
108	3 U	NS	0.1 U	0.2 U	0.2 U	NS	NS	0.2 U	NS	0.566
110	Dry	NS	Dry	0.535	0.2 U	NS	NS	0.2 U	NS	2U
111	Dry	NS	Dry	Dry	1.32	NS	NS	Dry	NS	0.2U
112	3 U	NS	0.26	0.2 U	0.2 U	NS	NS	0.458	NS	2U
133	0.32	Dry	0.68	0.598	0.655	0.685	0.988	0.887	0.665	0.692
134	0.45	0.636	1.11	0.671	0.698	0.706	0.863	0.989	0.890	1.11

Notes:

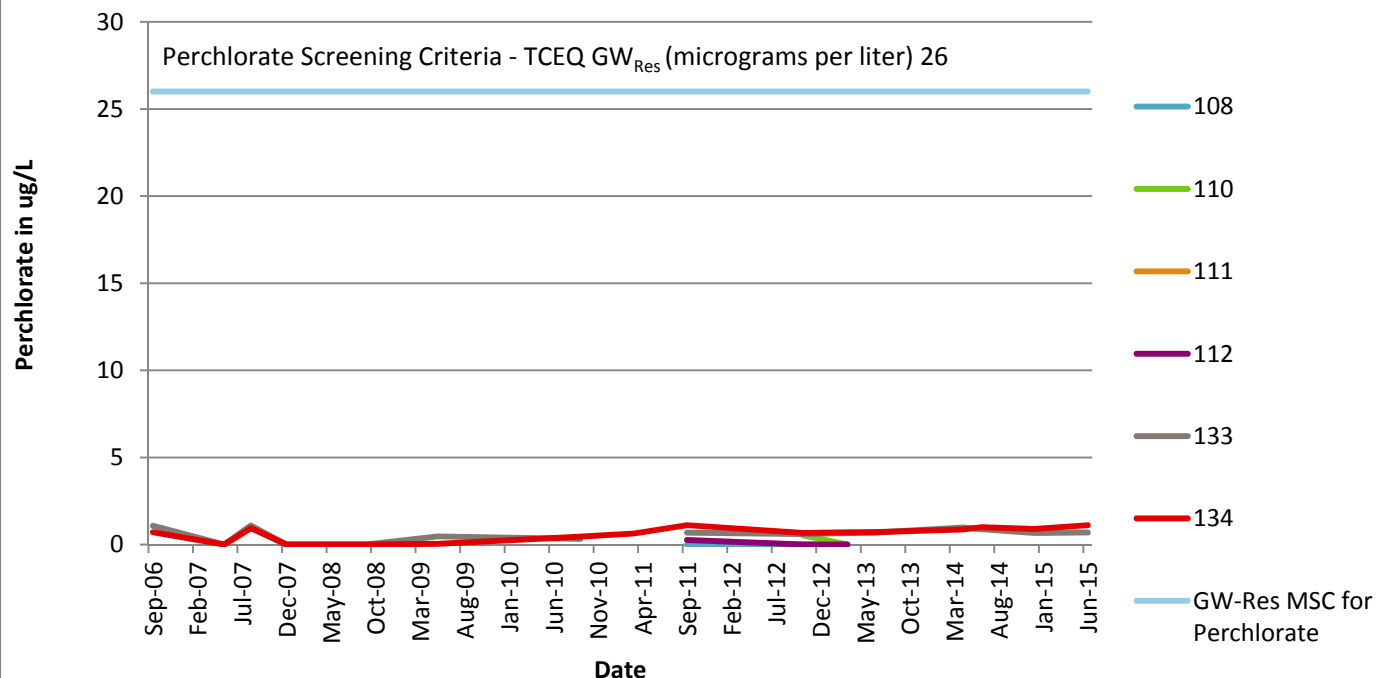
J – Estimated

U – Non-Detect

Dry – Well Dry

NS – Not Sampled

## Perimeter Wells - Perchlorate



Longhorn Army Ammunition Plant Map with Perimeter Well Locations

