# LONGHORN ARMY AMMUNITION PLANT

# KARNACK, TEXAS

# ADMINISTRATIVE RECORD

# VOLUME 1 of 10

# 1997

**Bate Stamp Numbers**
**018431 - 19552**

***Prepared for:***

**Department of the Army**
**Longhorn Army Ammunition Plant**
**Marshall, Texas 75671**

**1997**

**VOLUME 1 OF 10**

**1997**

A. Title: Letter - Longhorn Army Ammunition Plant (LHAAP), Solid Waste Registration No. 30990, Agreed Order Effective December 4, 1995; Ordering Provision No. 17, Annual Groundwater Monitoring Reports
Location: Longhorn Army Ammunition Plant
Agency: Texas Natural Resource Conservation Commission
Author(s): Ms. Cathy Remmert, Senior Coordinator, I&HW Team I, Waste Section, Enforcement Division
Recipient: Mr. Ira C. Nathan, Operations Review Division (LHAAP)
Date: January 8, 1997
Bate Stamp: 018431

B. Title: Minutes - Subject: Monthly Manager's Meeting
Group(s): All
Site(s): All
Location: Offices of TNRCC - Austin, TX
Date: January 14, 1997
Bate Stamp: 018432-018433

C. Title: Letter - Subject: Longhorn Army Ammunition Plant, Group 2, Aesthetic Treatment Criteria and Biomonitoring for the Treated Ground Water from Landfill Site 16
Group(s): 2
Site(s): 16 (Old Landfill)
Location: Longhorn Army Ammunition Plant
Agency: Texas Natural Resource Conservation Commission
Author(s): Ms. Diane R. Poteet, Project Manager, RI/FS II Unit, Superfund Investigation Section, Pollution Cleanup Division
Recipient: Mr. James A. McPherson, Commander's Representative
Date: January 21, 1997
Bate Stamp: 018434-018435

D. Title: Letter - Subject: Standard Exemption, Registration No. 34480, Soil and Groundwater Remediation, Longhorn Army Ammunition Plant, Marshall, Harrison County, Account ID No. 93-4480-R
Location: Longhorn Army Ammunition Plant
Agency: Texas Natural Resource Conservation Commission
Author(s): Ms. Tammy Villarreal, Manager, Chemical Section, New Source Review Permits Division
Recipient: Mr. James A. McPherson, Commander's Representative
Date: January 30, 1997
Bate Stamp: 018436-018437

E.
Title: Report - Subject: Installation Action Plan
Group(s): All
Site(s): All
Location: Longhorn Army Ammunition Plant
Agency: U.S. Army Corps of Engineers, Southwestern Division
Date: February 1997
Bate Stamp: 018438-018518

F.
Title: Letter - Subject: Proposed Phase III Monitoring Well, Site 16, Locations, Including Optional Monitoring Wells at the Longhorn Army Ammunition Plant, Karnack, Texas
Group(s): 2
Site(s): 16 (Old Landfill)
Location: Longhorn Army Ammunition Plant
Agency: Department of The Army, Marshall, Texas
Author(s): Mr. James McPherson, Commander's Representative
Recipient: Ms. Diane Poteet, Superfund Investigation Section, Texas Natural Resource Conservation Commission
Date: February 3, 1997
Bate Stamp: 018519-018520

G.
Title: Letter - Subject: Proposed Phase III Monitoring Well, Site 16, Locations, Including Optional Monitoring Wells at the Longhorn Army Ammunition Plant, Karnack, Texas (w/enclosure)
Group(s): 2
Site(s): 16 (Old Landfill)
Location: Longhorn Army Ammunition Plant
Agency: Department of The Army, Marshall, Texas
Author(s): Mr. James McPherson, Commander's Representative
Recipient: Mr. H. L. Jones, Texas Natural Resource Conservation Commission
Date: February 3, 1997
Bate Stamp: 018521-018522

H.
Title: Letter - Subject: Proposed Phase III Monitoring Well, Site 16, Locations, Including Optional Monitoring Wells at the Longhorn Army Ammunition Plant, Karnack, Texas
Group(s): 2
Site(s): 16 (Old Landfill)
Location: Longhorn Army Ammunition Plant
Agency: Department of The Army, Marshall, Texas
Author(s): Mr. James McPherson, Commander's Representative
Recipient: Mr. Chris Villarreal, Superfund Division, U. S. Environmental Protection Agency
Date: February 3, 1997
Bate Stamp: 018523-018524

I.
Title: Memorandum - Subject: Proposed Phase III Monitoring Well, Site 16, Locations, including optional Monitoring Wells at the Longhorn Army Ammunition Plant, Karnack, Texas
Group(s): 2

Site(s): 16 (Old Landfill)
Location: Longhorn Army Ammunition Plant
Agency: Department of the Army, Tulsa District, Corps of Engineers
Author(s): Mr. Burl D. Ragland, Lead Project Mgr., Army Team
Recipient: Mr. David Tolbert, Project Mgr.
Date: February 3, 1997
Bate Stamp: 018525-018527

J. Title: Letter - Subject: Remediation of Landfill 12 at LHAAP
Group(s): 2
Site(s): Landfill 12
Location: Longhorn Army Ammunition Plant
Agency: Department of The Army, Doyline, LA
Author(s): Mr. Ira C. Nathan
Recipient: Dr. James Bruseth, Deputy State Historic Preservation Officer, Texas Historical Commission, Austin, TX
Date: February 4, 1997
Bate Stamp: 018528

K. Title: Letter - Subject: Longhorn Army Ammunition Plant, Group 2 - Landfill Site 16, Disposal of Water Treatment Plant Sludge
Group(s): 2
Site(s): 16 ((Old Landfill)
Location: Longhorn Army Ammunition Plant
Agency: Texas Natural Resource Conservation Commission
Author(s): Ms. Diane R. Poteet, Superfund Investigation Section, Texas Natural Resource Conservation Commission
Recipient: Mr. James A. McPherson, Commander's Representative
Date: February 6, 1997
Bate Stamp: 018529-018530

L. Title: Letter - Subject: Final Revised Air Monitoring Plan at the Longhorn Army Ammunition Plant, Karnack, Texas
Group(s): 2
Site(s): 18, 24 (Burning Ground No. 3)
Location: Longhorn Army Ammunition Plant
Agency: Department of The Army, Marshall, Texas
Author(s): Mr. James McPherson
Recipient: Ms. Diane Poteet, Superfund Investigation Section, Texas Natural Resource Conservation Commission
Date: February 6, 1997
Bate Stamp: 018531

M. Title: Letter - Subject: Final Revised Air Monitoring Plan at the Longhorn Army Ammunition Plant, Karnack, Texas
Location: Longhorn Army Ammunition Plant
Group(s): 2
Site(s): 18, 24 (Burning Ground No. 3)

Agency: Department of The Army
Author(s): Mr. James A. McPherson, Commander's Representative
Recipient: Mr. Chris Villarreal, U.S. Environmental Protection Agency
Date: February 6, 1997
Bate Stamp: 018532

N. Title: Minutes - Subject: Monthly Manager's Meeting
Group(s): All
Site(s): All
Location: Longhorn Army Ammunition Plant
Date: February 11, 1997
Bate Stamp: 018533-018534

O. Title: Minutes - Subject: Army Team Management Meeting
Group(s): All
Site(s): All
Location: Longhorn Army Ammunition Plant
Date: February 11, 1997
Bate Stamp: 018535-018536

P. Title: Memorandum - Subject: Longhorn Army Ammunition Plant Ground Water Remediation Activities
Group(s): 2
Site(s): 16
Location: Longhorn Army Ammunition Plant
Agency: Texas Natural Resource Conservation Commission
Author(s): Mr. Stephen Ligon, Industrial Permits Team, TNRCC
Recipient: Ms. Diane Poteet, Investigation Unit, Pollution Cleanup Division
Date: February 19, 1997
Bate Stamp: 018537

Q. Title: Letter - Subject: Standard Exemption, Registration No. 34480, Soil and Groundwater Remediation System, Longhorn Army Ammunition Plant, Marshall, Harrison County, Account ID No. 93-4480-R (w/enclosure)
Group(s): 2
Site(s): Burning Ground No. 3 (Sites 18/24)
Location: Longhorn Army Ammunition Plant
Agency: Texas Natural Resource Conservation Commission
Author(s): Ms. Tammy Villarreal, Manager, Chemical Section, New Source Review Permits Division, Texas Natural Resource Conservation Commission
Recipient: Mr. James A. McPherson, Commander's Representative
Date: February 26, 1997
Bate Stamp: 018538-018545

R. Title: Memorandum - Subject: Cost Estimates for Accelerated RI/FS With Treatability Study and Transportation of Produced Water from Site 16, Longhorn Army Ammunition Plant, Karnack, Texas (w/enclosures)
Group(s): 2
Site(s): Site 16
Location: Longhorn Army Ammunition Plant
Agency: Department of The Army, Doyline, LA
Author(s): Mr. James A. McPherson, Commander's Representative
Recipient: U.S. Army, Industrial Operations Command, Mr. Cyril Onewokae
Date: February 27, 1997
Bate Stamp: 018546-018550

S. Title: Minutes - Subject: Technical Review Committee Meeting
Group(s): All
Site(s): All
Location: Longhorn Army Ammunition Plant
Date: March 11, 1997
Bate Stamp: 018551-018552

T. Title: Minutes - Subject: Technical Review Committee Meeting (Amended) (w/enclosure)
Group(s): All
Site(s): All
Location: Longhorn Army Ammunition Plant
Date: March 11, 1997
Bate Stamp: 018553-018578

U. Title: Minutes - Subject: Monthly Manager's Meeting (w/enclosure)
Group(s): All
Site(s): All
Location: Longhorn Army Ammunition Plant
Date: March 11, 1997
Bate Stamp: 018579-018587

V. Title: Memorandum - Subject: Guidelines
Location: Longhorn Army Ammunition Plant
Agency: Texas Natural Resource Conservation Commission
Author(s): Mr. Stephen Ligon, Industrial Permits Team
Recipient: Ms. Diane Poteet, TNRCC
Date: March 17, 1997
Bate Stamp: 018588

W. Title: Letter - Subject: Longhorn Army Ammunition Plant, Draft Work Plan for the Site 16 Phase III Remedial Investigation/Feasibility Study and Groundwater Treatability Study (w/enclosure)
Group(s): 2
Site(s): 16 (Old Landfill)

Location: Longhorn Army Ammunition Plant
Agency: United States Environmental Protection Agency
Author(s): Mr. Chris G. Villarreal, Project Mgr.
Recipient: Mr. James A. McPherson, Commander's Representative
Date: April 4, 1997
Bate Stamp: 018589-018595

X. Title: Letter - Subject: Longhorn Army Ammunition Plant, Early Interim Remedial Action at Burning Ground No. 3, Disposal of Treated Source Material (w/enclosure)
Group(s): 2
Site(s): Burning Ground No. 3 (Sites 18/24)
Location: Longhorn Army Ammunition Plant
Agency: United States Environmental Protection Agency
Author(s): Mr. Chris G. Villarreal, Project Mgr.
Recipient: Mr. James A. McPherson, Commander's Representative
Date: April 7, 1997
Bate Stamp: 018596-018598

Y. Title: Minutes - Subject: Meeting with Texas' Trustees
Group(s): All
Site(s): All
Location: Longhorn Army Ammunition Plant
Date: April 8, 1997
Bate Stamp: 018599

Z. Title: Letter - Subject: Longhorn Army Ammunition Plant, Group 2, Landfill Site 16, Draft Work Plan (Part I) and Sampling and Analysis Plan (Part II), Phase III Remedial Investigation/Feasibility Study and Groundwater Treatability Study (w/enclosures)
Group(s): 2
Site(s): 16
Location: Longhorn Army Ammunition Plant
Agency: Texas Natural Resource Conservation Commission
Author(s): Ms. Diane R. Poteet, Project Mgr., RI/FS II Unit, Superfund Investigation Section, Pollution Cleanup Division
Recipient: Mr. James A. McPherson, Commander's Representative
Date: April 14, 1997
Bate Stamp: 018600-018603

Title: Letter, Subject: Closure of Sumps at Longhorn Army Ammunition Plant
Group(s): 4
Site(s): 35
Location: Longhorn Army Ammunition Plant
Agency: US Dept of Army
Author(s): James A. McPherson
Recipient: Ms. Lila Beckley, Texas Natural Resource Conservation Commission
Date: February 19, l997
Bate Stamp: 19496

Title: Technical Review Workgroup for Lead
Group(s): All
Site(s): All
Location: Longhorn Army Ammunition Plant
Agency: United States Environmental Protection Agency
Author(s): Mark Maddaloni, Chairperson
Recipient: Cmdr Reo, James A. McPherson, LHAAP
Date: Received February 21, l997
Bate Stamp: 19497 - 19552

018431

# TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

*Protecting Texas by Reducing and Preventing Pollution*

January 8, 1997

Mr. Ira C. Nathan, Chief, Operations Review Division
Longhorn Army Ammunition Plant
Attn: SIOLH-OR
P.O. Box 658
Doyline, LA 71023

Re: Longhorn Army Ammunition Plant (LHAAP)
Solid Waste Registration No. 30990
Agreed Order effective December 4, 1995; Ordering Provision No. 17
Annual Groundwater Monitoring Reports

Dear Mr. Nathan:

The staff of the Texas Natural Resource Conservation Commission (TNRCC) has completed a review of the report entitled *Perimeter Well Groundwater Monitoring Report for 1995* (U.S. Army Corps of Engineers, July 1996). This report was submitted as the first of continuing annual reports required by Ordering Provision No. 17 of the above-referenced Agreed Order.

Information provided in the report satisfies the requirements of this Ordering Provision. The report, therefore, is approved.

Additionally, with respect to this Ordering Provision, LHAAP submitted a letter dated December 23, 1996 to the TNRCC in lieu of the annual report due January 25, 1997. The letter provides a brief discussion of the status of groundwater monitoring, which is being conducted under the Federal Facility Agreement. The letter indicates that the next annual groundwater monitoring report will be combined with the annual report required by Ordering Provision No. 12 of the Agreed Order. The next annual report for Ordering Provision No. 12 is due December 4, 1997.

If you or your representatives have any questions regarding this matter, please contact Lila Beckley of I&HW Team I at (512) 239-2130 or at Mail Code 128 at the letterhead address.

Sincerely,

Cathy Rennert

Cathy Rennert, Senior Coordinator
I&HW Team I, Waste Section
Enforcement Division

CR/lmb

cc: Michael Brashear, Waste Program Manager, TNRCC Tyler Regional Office

**Monthly Manager's Meeting**
**Longhorn Army Ammunition Plant**
**January 14, 1997**
**Offices of TNRCC - Austin, TX**

1. The following is a list of participants:

Ira Nathan - LHAAP
Chris Villarreal - EPA
Jonna Polk - Tulsa District, USACE
Oscar Linebaugh - USACE, EAO
Cliff Murray - Tulsa District, USACE
Glen Turney - OHM
Bob Norris - Eckenfelder
Bob Vandegriff - Tulsa District, USACE
David Tolbert - LHAAP
Diane Poteet - TNRCC
Frank Meleton - USACE, EAO
Dave Bockelmann - Sverdrup
Amine Bou Onk - Dow
Jim Bob Owens - Radian
Laura Mahoney - Eckenfelder

2. The following is a list of topics discussed (in order of discussion):

**Opening Remarks and Review and Transmittal of Meeting Minutes:** On behalf of LHAAP, Ira Nathan and David Tolbert welcomed all attendees to the Monthly Manager's Meeting held at the TNRCC offices in Austin, TX. The December 1996 meeting minutes were reviewed and accepted without revision or comment.

**Sumps Testing and Removal:** Glen Turney of OHM reported on the progress of the sumps testing and removal. A summary report was provided. Concrete sampling has been completed. Of the 80 concrete sumps, 29 have been removed and demolished. As approved by TNRCC concrete from sumps was placed on Landfill 16. Two sumps were metal, and were sampled with wipe samples. After receipt of wipe sample results, the sumps were sent to a recovery facility. Based on the total sump sampling results, surrounding soils at 25 of the sump locations will be sampled. The final report is scheduled for submission the first week of March 1997.

**Landfill-16 Groundwater Biotoxicity Test:** Complete biotoxicity test reports from both Espey Houston and Radian (Louisiana) labs were submitted to and reviewed by TNRCC. TNRCC stated that they will allow treatment and discharge of the Site 16 water (premixed at a 15:1 ratio of burning ground or potable water to Site 16 water) at the Burning Ground Treatment Plant. TNRCC will require toxicity testing again when discharge of the treated water begins, and again at a later date prior to treatment of the Burning Ground water. TNRCC will send a letter detailing the directions.

**Scope of Work for Site 16 Remedial Investigation:** The Scope of Work (SOW) for the Site 16 Remedial Investigation was reviewed by the LHAAP team. It was noted that surface water samples collected from Harrison Bayou should be included in the Risk Assessment evaluation, and that will be added to the SOW. It was also noted that semivolatile analysis for groundwater should be deleted from Section 3.4.12. This parameter will be deleted.

**Site 16 RI Schedule**: The schedule for the Site 16 RI was reviewed and discussed. AEC's comment regarding a Risk Assessment Scoping meeting was discussed, and the team agreed to hold that meeting in conjunction with the May 1997 Monthly Manager's Meeting at the offices of EPA in Dallas, TX.

**Safety Award Presentation to Dow Environmental:** A Safety Award for three years of work without a lost time accident was presented by Tulsa District Safety Officer Bob Vandegriff to Amine Bou Onk, Project Manager, Dow Environmental. Dow was praised for the safe and excellent work which they have done at the Burning Ground in the last three years. Mr. Vandegriff also extended praise from COL Sanford, Commander, Tulsa District, USACE, to Mr. Oscar Linebaugh, Eastern Area Office, Fort Worth District, for his management of Dow's contract and daily field work over the past three years.

**Burning Ground No. 3 Low Temperature Thermal Desorber (LTTD) Proof of Performance (POP) Test:** The POP Test is scheduled for 10 February. Eastern Area Office will prepare a letter to send through LHAAP to TNRCC to provide 14 day notice prior to running the POP test.

Regarding the Catalytic Oxidizer for the LTTD, the configuration will be different than previously shown in the 1995 Work Plan due to improvements in technology since that time. The configuration will now consist of two LTTD units with two catalytic oxidizers with one combined stack for the oxidizers. Dow will run 10 hr. treatment days until approval by EPA and TNRCC, then will begin running the LTTDs 24 hr. per day.

**Burning Ground No. 3 Groundwater Treatment Plant:** An on-site lab will not be used for analysis of water and soil samples, rather, a Radian chemist will be dedicated in Austin, TX specifically to support sample analysis needs for the Burning Ground. Turnaround times will remain as previously committed.

All present at the meeting, as listed above, agreed that the POP test for the groundwater treatment plant should be deferred until the extraction system for the Burning Ground is in place and running, so that water running through the plant will have similar concentrations of VOCs to water which will be processed throughout the operation of the plant. All present also agreed that the IDW water collected during the Pilot Study in May 1994, as well as the IDW water stored in drums at Site 16, could be processed through the plant prior to the POP test.
TNRCC and EPA will provide direction as to whether the Site 16 water can also be treated prior to the POP test.

**Monthly Meeting Schedule:** The next monthly managers meeting will be held on 11 February at LHAAP at 8:00 a.m. (at the time these minutes were prepared, the meeting schedule had been adjusted to 9:30 a.m.).

018434

# TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

*Protecting Texas by Reducing and Preventing Pollution*

January 21, 1997

James A. McPherson, Commander's Representative
Longhorn/Louisiana Army Ammunition Plant
Attn: SIOLH-CR
P. O. Box 658
Doyline, LA 71023

**CERTIFIED MAIL**
**Z 746 032 748**
**RETURN RECEIPT REQUESTED**

Re: Longhorn Army Ammunition Plant
Group 2 - Aesthetic Treatment Criteria and Biomonitoring for the Treated Ground Water from Landfill Site 16

Dear Mr. McPherson:

The Texas Natural Resource Conservation Commission (TNRCC) staff has completed its review of the Army's request to blend potable water with treated groundwater from Landfill Site 16, prior to discharge, in order to meet the aesthetic criteria for color. After conferring with the Standards Team and the Toxicity Team of the Water Planning and Assessment Division, it was decided that some amount of flexibility could be allowed. The blending of water with the effluent would only be conducted as necessary for aesthetic concerns and would be acceptable, in this instance, only under the following conditions: 1) The Army must treat the contaminated ground water to the levels which are appropriate for discharge as specified in the Work Plan for the Interim Remedial Action at Burning Ground No. 3; and 2) Monitoring of the treated effluent to determine compliance with the allowable levels of pollutants must be conducted PRIOR to mixing of the treated ground water with any other water (such as prior to mixing with potable water or prior to discharge to the bayou). This will ensure that potable water will only be used to alleviate potential color problems and not allow reduction of the level of treatment.

For biomonitoring tests, samples must be collected of the final effluent. Therefore, if the discharge is blended with potable water, or any other water, then biomonitoring must be conducted on the resultant mixture. This will ensure that the conditions of the final discharge do not demonstrate instream toxicity. Due to the ambiguity of the 1996 toxicity test results, a minimum of two additional biotoxicity tests (to include both *Ceriodaphnia* and *Pimephales*) will be required. The first tests must occur within the first week of that the discharge is initiated, and the second must occur between three to six months after the first. Should failure of any of the tests occur, two more confirmation tests will be performed per original testing event. The decision to cease or to continue the discharge will be made based on the results of the two additional confirmation tests.

If you have any questions or comments regarding this matter, please call me at (512) 239-2502.

Sincerely,

Diane R. Poteet

Diane R. Poteet, Project Manager
RI/FS II Unit
Superfund Investigation Section (MC-143)
Pollution Cleanup Division

cc: Chris Villarreal, EPA Region 6 (6SF-AT)
Jonna Polk, COE Tulsa District (CESWT-PP-EA)
Warren Sayes, COE Eastern Area Office (CESWF-AD-E)

018436

# TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

*Protecting Texas by Reducing and Preventing Pollution*

January 30, 1997

Mr. James A. McPherson
Commander's Representative
U.S. Army
P.O. Box 658
Doyline, Louisiana 71023

Re: Standard Exemption
Registration No. 34480
Soil and Groundwater Remediation
Longhorn Army Ammunition Plant
Marshall, Harrison County
Account ID No. 93-4480-R

Dear Mr. McPherson:

This is in response to your request to register a soil and groundwater remediation system under Standard Exemption at Burning Ground No. 3 at the Longhorn Army Ammunition Plant in Harrison County. We have evaluated the information you have submitted in support of your request, and we find that a number of unresolved questions prevents us from determining whether you have met all the requirements of the standard exemption claimed in your registration request and/or of 30 TAC Section 116.211 (Regulation VI). Therefore, we cannot confirm your claim of this exemption at this time.

These questions, as detailed in a fax to Mr. Amine BouOnk on January 28, 1997, are as follows:

Please provide a process description, calculations, a worst-case data discussion, a to-scale site map showing off-site receptors, and a detailed discussion of the project's conformity to Standard Exemption 68 criteria.

Please submit any new information or modification proposals as a new standard exemption registration request. To expedite the process at that time, please include a copy of this letter. We remind you that Sections 382.0518(a) and 382.057 of the Texas Clean Air Act, Texas Health and Safety Code, Chapter 382, provide that you must obtain a construction permit or fully comply with a standard exemption before you begin work on the construction of a new facility or modify an existing facility that may emit air contaminants.

Re: Standard Exemption
Registration No. 34480

Your cooperation in this matter is appreciated. If you have further questions, please contact Mr. Terry Murphy of our Office of Air Quality, New Source Review Permits Division at (512) 239-1587.

Sincerely,

Tammy Villarreal
Manager, Chemical Section
New Source Review Permits Division
Texas Natural Resource Conservation Commission

TV/TM/al

cc: Mr. Charles Murray, Air Program Manager, Tyler

Record No. 48513

# INSTALLATION ACTION PLAN

## Longhorn Army Ammunition Plant Marshall, Texas

## FEBRUARY 1997

## U.S. ARMY INDUSTRIAL OPERATIONS COMMAND

## U.S. ARMY MATERIEL COMMAND

Execution Agency:
U.S. Army Corps of Engineers
Southwestern Division

## LONGHORN ARMY AMMUNITION PLANT

018439

1. **STATUS:** NPL Installation, HRS - 39.83, Listed August 1990. Confirmed Soil and Ground Water Contamination on Installation. No off-post contamination identified.

2. **TOTAL NUMBER OF DSERTS SITES:** 50

3. **DIFFERENT SITE TYPES:**
   - 4 OB/OD Areas
   - 13 Industrial Areas
   - 5 Burial Pits
   - 5 Sumps/Tanks Areas
   - 4 Treatment Plants
   - 16 Storage Areas
   - 3 Landfills

4. **MOST WIDESPREAD CONTAMINANTS OF CONCERN:**
   Trichloroethylene, Methylene Chloride, Explosives

5. **MEDIA OF CONCERN:**
   Groundwater, Surface Water, Soil

6. **COMPLETED REM/IRA/RA:**
   Sludge removed and ponds capped, 1986
   Total Cost: Unavailable, non-DERA funds

7. **CURRENT INSTALLATION RESTORATION PROGRAM PHASE:**
   Remedial Investigation/Feasibility Study at 11 Sites
   Remedial Investigation/Feasibility Study of Waste Sumps
   Removal Action for Waste Sumps (removal began in FY 96)
   Interim Remedial Action for two Landfill Caps (Constuction began in FY 96)
   Interim Remedial Action for groundwater treatment at Burning Ground No. 3 (IRA Construction began in FY 95)

   **PROJECTED IRP PHASE:**
   RI/FS at 11 sites
   NFA at 6 sites
   Remedial Design/Remedial Action at 11 Sites
   Long Term Monitoring at 5 sites

9. **IDENTIFIED POSSIBLE REM/IRA/RA:**
   Note IRAs listed above. Ras at Group 2 and Group 4 sites, and Site 16 Landfill.

10. **FUNDING:**

| | |
|---|---|
| Prior Years Funds | $ 48,407.0K |
| FY 97 Funds | 2,580.0 K |
| Future Requirements (FY 98 - FY 03) | 52,800.0 K |
| Total | $ 103,787.0 K |

11. **DURATION:**

| | |
|---|---|
| Year of IRP Inception | 1988 |
| Year of RA Completion | 2004 |
| Year of IRP Completion (including LTM) | 2034 |

## ABBREVIATIONS AND ACRONYMS

018440

| | |
|---|---|
| CERCLA | Comprehensive Environmental, Response, Compensation and Liability Act |
| DERA | Defense Environmental Restoration Account |
| DERP | Defense Environmental Restoration Program |
| DERPMIS | Defense Environmental Restoration Program Management Information System |
| DRMS | Defense Reutilization and Marketing Service |
| DSERTS | Defense Site Environmental Restoration Tracking System |
| EPA | Environmental Protection Agency |
| FFA | Federal Facility Agreement |
| FS | Feasibility Study |
| FY | Fiscal Year |
| GOCO | Government Owned, Contractor Operated |
| IAG | Interagency Agreement |
| IAP | Installation Action Plan |
| INF | Intermediate-Range Nuclear Force |
| IRA | Interim Remedial Action |
| IRP | Installation Restoration Program |
| LAP | Load, Assemble, and Pack |
| LTM | Long-Term Monitoring |
| LHAAP | Longhorn Army Ammunition Plant |
| NPL | National Priority List |
| OB/OD | Open Burn/Open Detonation |
| PA | Preliminary Assessment |
| PCB | Polychlorinated Biphenyls |
| PVC | Polyvinyl Chloride |
| Qtr. | Quarter |
| RA | Remedial Action |
| RAB | Restoration Advisory Board |
| RC | Response Complete |
| RCRA | Resource Conservation and Recovery Act |
| RD | Remedial Design |
| RFA | RCRA Facility Assessment |
| RI | Remedial Investigation |
| RMIS | Restoration Management Information System |
| SI | Site Investigation |
| SWMU | Solid Waste Management Unit |
| TNRCC | Texas Natural Resource Conservation Commission |
| TNT | Trinitrotoluene |
| TRC | Technical Review Committee |
| TWC | Texas Water Commission |
| UEP | Unlined Evaporation Pond |
| U.S. | United States |
| UST | Underground Storage Tank |

**INSTALLATION ACTION PLAN**
**FOR**
**LONGHORN ARMY AMMUNITION PLANT** 018441

## I. INSTALLATION INFORMATION

### A. LOCALE

Longhorn Army Ammunition Plant (LHAAP) is located in central east Texas in the northeast corner of Harrison County, approximately 14 miles northeast of Marshall, Texas, and approximately 40 miles west of Shreveport, Louisiana. The installation occupies 8,493 acres between State Highway 43 and the western shore of Caddo Lake. Approximately 1,700 to 2,000 personnel are employed at LHAAP. The area surrounding LHAAP is primarily rural and consists of forest lands; the small town of Karnack, Texas; Caddo Lake; and Caddo Lake State Park.

### B. COMMAND ORGANIZATION

- Major Command: U.S. Army Materiel Command, Environmental Quality Division
- Subcommand: U.S. Industrial Operations Command, Environmental Quality Directorate
- Installation: LHAAP, Environmental Office

### C. INSTALLATION RESTORATION PROGRAM (IRP) EXECUTING AGENCY

- Investigation Phase Executing Agency: U.S. Army Corps of Engineers, Tulsa District
- Remedial Design/Action Phase Executing Agency: U.S. Army Corps of Engineers, Tulsa District and Fort Worth District
- Federal: U.S. Environmental Protection Agency, Region VI
- State: Texas Natural Resource Conservation Commission

### D. REGULATORY STATUS

- National Priority List Installation with Interagency Agreement (IAG)
- Technical Review Committee, March 1992
- Interagency Agreement, December 1991
- Federal Facility Agreement, 1991

### E. MAJOR CHANGES TO ACTION PLAN FROM THE PREVIOUS YEAR (FY 96)

- Time Critical Removal Action at Site 16 was not initiated in FY 96, rather, a decision was made to accelerate the RI/FS and include a treatability study as part of the RI. Removal Action for sumps will be completed in FY97.

## II. INSTALLATION DESCRIPTION

### A. CURRENT ACTIVITY

LHAAP was a government-owned, contractor-operated Army Armament, Munitions, and Chemical Command Facility. The primary mission of LHAAP was to load, assemble, and pack (LAP) pyrotechnic and illuminating/signal ammunition and solid propellant rocket motors. The Longhorn Division of Thiokol Corporation signed a Facilities Contract with the U.S Army to operated LHAAP beginning 1 October, 1993, and was the operating contractor until July 1996 when the contract expired. Thiokol is expected to vacate the facility by June 1997. The plant is scheduled to be inactive in July 1997.

### B. HISTORIC ACTIVITY

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

Current operations consist of compounding pyrotechnic and propellant mixtures, LAP activities, accommodating receipt and shipment of containerized cargo, and maintenance and/or layaway of standby facilities and equipment as they apply to mobilization planning. The installation has also been responsible for static firing and elimination of Pershing I and II rocket motors in compliance with the Intermediate-Range Nuclear Force (INF) Treaty in effect between the United States and the former USSR.

### C. REGULATORY STATUS

LHAAP was placed on the National Priority List (NPL) on August 9, 1990, as a result of a contaminant release to the environment at the installation. After being listed on the NPL, the LHAAP, the U.S. Environmental Protection Agency (EPA), and the Texas Water Commission (TWC) (now called the Texas Natural Resource Conservation Commission [TNRCC]) entered into a Comprehensive Environmental, Response, Compensation and Liability Act (CERCLA) Section 120 Agreement for remedial activities at LHAAP. The CERCLA Section 120 Agreement, referred to as the

Federal Facility Agreement (FFA), became effective December 30, 1991. The FFA specifies that remedial activities be conducted at 13 areas on LHAAP, and any others which are identified during investigations. The locations of the sites which have been and are being investigated and remediated are shown on Figure 1.

In addition to the site listing of the FFA, a RCRA Facility Assessment (RFA) and study by Weston identified 55 potential sites of concern. The RFA conducted in April 1988 by the Texas Water Commission identified 31 Solid Waste Management Units for further investigation. A 1990 Weston Report identified 24 additional sites for a total of 55 sites warranting further consideration or investigation at LHAAP. Two additional sites have been added since these investigations, bringing the total to 57 sites. These 57 sites have been listed in the Defense Environmental Restoration Program Management Information System (DERPMIS) and are included on the installation's Restoration Management Information System (RMIS) list. Since that time, scrubbing of the list (removal of non-DERA eligible sites, redundancies, etc.) has resulted in the current Defense Site Environmental Restoration Tracking System (DSERTS) list of 50 sites.

While the Army leads the IRP at LHAAP, a close working relationship with the regulatory community has been developed. Remedial Project Managers from TNRCC and EPA Region 6 work closely with Army personnel in planning and implementing IRP goals and activities. A cooperative teamwork environment rather than an antagonistic relationship has proven helpful in accelerating IRP activities and focusing energies of all the stakeholders on achieving restoration goals.

Of the 50 listed sites, only 18 are being actively carried through the IRP process and are listed on A-106 reports for LHAAP. However, one of these "sites" actually consists of over 100 wastewater sumps being investigated as a single operable unit. The major operable units and projects are listed below.

**GROUP 1 SITES**

| SITE NUMBER | DESCRIPTION |
|---|---|
| LHAAP-001 | INERT BURNING GROUNDS |
| LHAAP-011 | SUSPECTED TNT BURIAL SITE AT AVENUES P & Q |
| LHAAP-027 | SOUTH TEST AREA |
| LHAAP-054 | GROUND SIGNAL TEST AREA |
| (LHAAP-XX) | |

**GROUP 2 SITES**

| | |
|---|---|
| LHAAP-012 | ACTIVE LANDFILL |
| LHAAP-017 | BURNING GROUND NO. 2 / FLASHING AREA |
| LHAAP-018 & LHAAP-024 | BURNING GROUND NO. 3 / WASHOUT POND AND UNLINED EVAPORATION PIT |

| | |
|---|---|
| LHAAP-029 | FORMER TNT PRODUCTION AREA |
| LHAAP-032 | FORMER TNT DISPOSAL AREA |

**GROUP 3 (FORMER GROUP 1 SITES WITH NO FURTHER ACTION)**

| | |
|---|---|
| LHAAP-013 | SUSPECTED TNT BURIAL SITE BETWEEN ACTIVE AND OLD LANDFILLS |
| LHAAP-014 | AREA 54 BURIAL GROUND |

**GROUP 4**

| | |
|---|---|
| LHAAP-035 | PROCESS WASTEWATER SUMPS (PRODUCTION AREA) |

**GROUP 5**

| | |
|---|---|
| LHAAP-50 | FORMER WASTE DISPOSAL FACILITY |
| LHAAP-52 | MAGAZINE WASHOUT AREA |
| LHAAP-60 | FORMER STORAGE BUILDING 411 AND 714 |
| LHAAP-63 | BURIAL PITS |

**ACCELERATED RI AT OLD LANDFILL (FORMER GROUP 2 SITE)**

| | |
|---|---|
| LHAAP-16 | OLD LANDFILL |

**EARLY INTERIM ACTION AT BURNING GROUND NO. 3**

| | |
|---|---|
| LHAAP-018 & LHAAP-024 | BURNING GROUND NO. 3 / WASHOUT POND AND UNLINED EVAPORATION PIT |

**LANDFILL CAPS INTERIM REMEDIAL ACTION**

| | |
|---|---|
| LHAAP 12 | ACTIVE LANDFILL |
| LHAAP 16 | OLD LANDFILL |

**REMOVAL ACTION**

| | |
|---|---|
| LHAAP-035 | PROCESS WASTEWATER SUMPS |

As noted, both interim actions involve Group 2 sites. The IRAs are also inter-related as treated soil from the Early Interim Action at Burning Ground Number 3 will be placed at the landfills prior to cap construction. The Burning Ground IRA is a groundwater treatment for removal of trichloroethylene and methylene chloride. As part of its construction, contaminated soil will be excavated, treated and placed at the landfills. Additionally, the groundwater extracted from Site 16, as part of the RI Treatability Study, is planned to be transported to the Burning Ground groundwater treatment plant. All the IRA sites are specifically listed in the FFA.

## III. CONTAMINATION ASSESSMENT

### A. STUDIES TO DATE

Many studies have been conducted at LHAAP concerning waste management, groundwater and soil contamination, and hazardous waste. The most extensive studies have been conducted on the burning ground and landfill areas. Table 1 provides a list of all studies conducted to date at LHAAP.

**TABLE 1**

**PREVIOUS STUDIES/TECHNICAL DELIVERABLES AT LONGHORN ARMY AMMUNITION PLANT**

1. The Robert H. Balter Co., 1 April 1979, Assessment of Contaminant Migration, Longhorn Army Ammunition Plant, Harrison County, Texas.

2. U.S. Army Toxic and Hazardous Materials Agency, Aberdeen Proving Ground, MD, February 1980, Installation Assessment of Longhorn Army Ammunition Plant, Report No. 150.

3. USAEHA, Aberdeen Proving Ground, February 1980, Land Disposal No. 38-26-0104-81, Longhorn Army Ammunition Plant.

4. USAEHA, 26 May 1980, Land Disposal Study No. 38-26-0104-81, Longhorn Army Ammunition Plant, Marshall, Texas, 23 January - 8 February 1980.

5. USAEHA, Regional Div., South, September 1981, Wastewater Engineering Special Study No. 32-62-0182-82.

6. USAEHA, 2-6 November 1981, Hazardous Waste Management Survey No. 37-26-0172-82, Longhorn Army Ammunition Plant, Marshall, Texas.

7. USAEHA, Aberdeen Proving Ground, MD, November 1982, Hazardous Waste Special Study No. 39-26-0215-83.

8. Larry M. Jacobs and Associates, Inc., 27 August 1982, Geotechnical Interim Report for Longhorn Army Ammunition Plant, Marshall, Texas.

9. USAEHA, Aberdeen Proving Ground, MD, November 1982, Hazardous Waste Special Study No. 37-26-0291-84.

10. USAEHA, September 1983, Phase II, Hazardous Waste Management Special Study No. 39-26-0147-83, DARCOM Open-Burning/Open-

Detonation Grounds Evaluation, Longhorn Army Ammunition Plant, Marshall, Texas, 31 July - 3 August 1981.

11. Environmental Projection Systems, Inc., March 1983 - May 1984, Contamination Analysis Report for Environmental Contamination Survey of Longhorn Army Ammunition Plant.

12. Kindle, Stone and Associates, Longview, Texas, 15 June 1984, Closure of Unlined Evaporation Pond, Marshall, Texas.

13. Environmental Protection Systems, Inc., June 1984, Longhorn Army Ammunition Plant Contamination Survey, Contract No. DAAA09-78-C-3004.

14. Camp, Dresser and McKee, Inc., 15 May 1985, Groundwater Quality Assessment, Longhorn Army Ammunition Plant, Marshall, Texas, Groundwater Contamination Related to Seepage from an Unlined Evaporation Pond, Contract No. DAC87-830-C-0091, Vol. I, II, and III.

15. EPA, January 1986, EPA Groundwater Monitoring Evaluation, Longhorn Army Ammunition Plant, Marshall, Texas.

16. U.S. Army Corps of Engineers, Fort Worth, June 1986, Closure Report, Unlined Evaporation Pond, Longhorn Army Ammunition Plant, Karnack, Texas.

17. USAEHA, 29 October 1986, Hazardous Waste Consultation No. 37-26-1348-87, AMC Hazardous Waste Minimization Assessment, July - September 1986.

18. USAEHA, 12-22 May 1987, Groundwater Contamination Survey No. 38-26-0851-88, Evaluation of SWMU's, LHAAP, Marshall, Texas.

19. Morton Thiokol, 1988, Longhorn Army Ammunition Plant, Groundwater Analytical Data.

20. Texas Water Commission, 8 April 1988, RCRA Facility Assessment (RFA).

21. Environmental Protection Systems, May 1988, A Study of Suspected TNT Burial Sites of Longhorn Army Ammunition Plant.

22. U.S. Army corps of Engineers, Fort Worth, February 1989, Groundwater Quality Assessment, Phase I, 4 Volumes.

23. U.S. Army Corps of Engineers, Fort Worth, July 1989, RCRA Facility Investigation, Active Burning Ground and Unlined Evaporation Pond, Phase I, Longhorn Army Ammunition Plant, Karnack, Texas, 5 Volumes.

24. U.S. Army Corps of Engineers, Fort Worth, September 1989, RCRA Facility Investigation, Active Burning Ground and Unlined Evaporation Pond, Phase II, Field Data.

25. Texas Water Commission, November 1989, Longhorn Army Ammunition Plant, Karnack, Texas, Proposed Permit No. HW-50195, Industrial Solid Waste Registration No. 30090.

26. USATHMA, March 1990, USATHMA Installation Restoration Program, Project Management Plan, RCRA Facility Investigation.

27. Weston, 7 August 1990, Weston Report: Longhorn Army Ammunition Plant.

28. Longhorn Army Ammunition Plant, 13 June 1991, 1990 Annual Groundwater Report.

29. U.S. Army Corps of Engineers, March 1992, LHAAP-Initial Remedial Action/Data Quality Objectives.

30. U.S. Army Corps of Engineers, Fort Worth, January 1993, Results of Chemical Analyses, Burning Grounds, Longhorn Army Ammunition Plant, 4 Volumes.

31. U.S. Army Corps of Engineers, 18 Jan 94, Interim Risk Assessment for Burning Ground 3 and Unlined Evaporation Pond Sites (18 & 24)

32. U.S. Army Corps of Engineers, 24 Jan 94, Final Project Plan Phase II Pilot Study for IRA Site LHAAP 18 & 24 Burning Ground 3 and the Unlined Evaporation Pond

33. U.S. Army Corps of Engineers, 24 Jan 94, Interim Risk Assessment for Longhorn Army Ammunition Plant

34. U.S. Army Corps of Engineers, 26 Jan 94, Documentation in Support of Background Levels

35. U.S. Army Corps of Engineers, 8 Feb 94, Installation Action Plan

36. U.S. Army Corps of Engineers, 16 Feb 94, Draft Final Phase I Field Investigation Summary Report for Group II

37. U.S. Army Corps of Engineers, 16 Feb 94, Draft Final Report Phase I Investigations of 125 Waste Process Sumps and 20 Waste Rack Sumps

38. U.S. Army Corps of Engineers, 15 Mar 94, Draft Phase II Recommendations for Group II Sites Remedial Investigations

39. U.S. Army Corps of Engineers, 18 Mar 94, Draft Field Investigation Summary Report for Area LHAAP - 1

40. U.S. Army Corps of Engineers, 21 Mar 94, Draft Initial Screening of Alternatives

41. U.S. Army Corps of Engineers, 18 Apr 94, Restoration Management Information System

42. U.S. Army Corps of Engineers, 19 Apr 94, Draft Remedial Design Workplan for Landfill Caps

43. U.S. Army Corps of Engineers, 20 Apr 94, Final Workplan Phase II (Pilot Study) Interim Remedial Action at Burning Ground No. 3, and Unlined Evaporation Pond

44. U.S. Army Corps of Engineers, 11 May 94, Draft Workplan Addendum for the Remedial Investigation Sites 11, 1/1A, XX, 27

45. U.S. Army Corps of Engineers, 12 May 94, Draft Final Field Investigation Summary Report for Area 1A

46. U.S. Army Corps of Engineers, 12 May 94, Soil and Groundwater Background Concentration Study

47. U.S. Army Corps of Engineers, 23 May 94, Draft Workplan Phase II Sumps Investigations

48. U.S. Army Corps of Engineers, 1 Jun 94, Remedial Investigation /Feasibility Study Report for Areas 13 & 14

49. U.S. Army Corps of Engineers, 6 Jun 94, Draft Final Initial Screening of Alternatives Workplan

50. U.S. Army Corps of Engineers, 28 Jun 94, Draft Final Workplan and Chemical Data Acquisition Plan Addendum for Phase II Group 1 (LHAAP 11, 1/1A, XX, 27)

51. U.S. Army Corps of Engineers, 28 Jul 94, Draft Final Phase II - Workplan of 125 Waste Process Sumps and 20 Waste Rack Sumps

52. U.S. Army Corps of Engineers, 29 Jun 94, Draft Final Workplan Addendum Soil and Groundwater Background Concentration Study

53. U.S. Army Corps of Engineers, 29 Jul 94, Preliminary Draft Proposed Plan for Burning Ground No. 3

54. U.S. Army Corps of Engineers, 1 Aug 94, Draft Final Remedial Investigation/Feasibility Study Report for Sites 13 & 14

55. U.S. Army Corps of Engineers, 16 Aug 94, Final Landfill Caps Remedial Design Investigation Workplan LHAAP 12 (active landfill) and 16 (old landfill)

56. U.S. Army Corps of Engineers, 12 Sep 94, Final Chemical Data Acquisition Plan Addendum for the Remedial Investigation sites 11, 1, XX, 27

57. U.S. Army Corps of Engineers, 24 Oct 94, Draft Final Phase II Group II Workplans

58. U.S. Army Corps of Engineers, 28 Nov 94, Draft Hydrogeological Assessment

59. U.S. Army Corps of Engineers, 14 Dec 94, Draft Soil Background Concentration Report

60. U.S. Army Corps of Engineers, 15 Dec 94, Draft Final Remedial Investigation/Feasibility Study Report

61. U.S. Army Corps of Engineers, 21 Dec 94, Phase II Group 2 final Workplans

62. U.S. Army Corps of Engineers, 22 Dec 94, Revised Proposed Plan Landfills Interim Remedial Action

63. U.S. Army Corps of Engineers, 3 Jan 95, Draft Soil Background Concentration Report

65. U.S. Army Corps of Engineers, 16 Jan 95, Draft Final Hydrogeological Assessment

66. U.S. Army Corps of Engineers, 23 Jan 95, Draft 1995 Installation Action Plan

67. U.S. Army Corps of Engineers, 27 Jan 95, Draft Final Remedial Investigation Feasibility Report Sites 13 & 14 (Group 3)

68. U.S. Army Corps of Engineers, 21 Feb 95, Sampling and Data Results Report for the Remedial Investigation at Group 1 Sites

69. U.S. Army Corps of Engineers, 1 Mar 95, Early Interim Action Record of Decision (ROD) for Sites 18 & 24 (Burning Ground No. 3)

70. U.S. Army Corps of Engineers, 17 Mar 95, Analytical Results for Sampling of 15 Monitoring Wells at Burning Ground No. 3

71. U.S. Army Corps of Engineers, 17 Mar 95, Final Soil Background Concentration Report

72. U.S. Army Corps of Engineers, 27 Mar 95, Proposed Plan of Action for Group 3, Sites 13 and 14

73. U.S. Army Corps of Engineers, 30 Mar 95, Final Soil Background Concentration Report (Revised)

74. U.S. Army Corps of Engineers, 9 May 95, Final Groundwater Background Concentration Report

75. U.S. Army Corps of Engineers, 11 May 95, Final Hydrogeologic Assessment Report

76. U.S. Army Corps of Engineers, 23 May 95, Draft Record of Decision for Early Interim Remedial Action at Landfill Sites 12 & 16

77. U.S. Army Corps of Engineers, 13 Jun 95, Final DERPMIS/RMIS Resolution Document

78. U.S. Army Corps of Engineers, 21 Jun 95, Final Proposed Plan of Action for Sites 13 and 14

79. U.S. Army Corps of Engineers, 26 Jun 95, Groundwater Sampling Results-May 95, Interim Remedial Action-Phase III, Burning Ground 3 and UEP, LHAAP 18 & 24

80. U.S. Army Corps of Engineers, 28 Jun 95, Final Remedial Investigation/Feasibility Study Report for Sites 13 & 14

81. U.S. Army Corps of Engineers, 29 Jun 95, Draft Work Plan for Phase III of the Interim Remedial Action, Burning Ground 3 and UPE, LHAAP 18 & 24

82. U.S. Army Corps of Engineers, 10 Jul 95, Final Record of Decision for Early Interim Remedial Action at Landfill Sites 12 & 16

83. U.S. Army Corps of Engineers, 25 Jul 95, Revised Air Monitoring Plan, Appendix C to Draft Chemical Data Acquisition Plan, Phase III Interim Remedial Action at Burning Ground 3

84. U.S. Army Corps of Engineers, 27 Jul 95, Preliminary Design for the Interim Remedial Action at Landfill Sites 12 & 16

85. U.S. Army Corps of Engineers, 9 Aug 95, Draft Final Phase II Sumps Investigation Sample and Data Report Volume I-V

86. U.S. Army Corps of Engineers, 25 Aug 95, Site Characterization Summary for Group 1

87. U.S. Army Corps of Engineers, 28 Aug 95, Group 5 Draft

Work Plan for the Preliminary Assessment Site Investigations

88. U.S. Army Corps of Engineers, 28 Aug 95, Group 5 Draft Chemical Data Acquisition Plan for the Preliminary Assessment Site Investigations

89. U.S. Army Corps of Engineers, 6 Sep 95, Group 3 Record of Decision for No Further Action at LHAAP 13 & 14

90. U.S. Army Corps of Engineers, 21 Sep 95, Draft Project Work Plan Interim Remedial Action, Landfill Sites 12 & 16

91. U.S. Army Corps of Engineers, 28 Sep 95, Draft Phase II Investigations of 125 Waste Process Sumps and 20 Waste Rack Sumps

92. U.S. Army Corps of Engineers, 5 Oct 95, Final Work Plan for the Preliminary Assessment Site Investigations, Group 5 Sites

93. U.S. Army Corps of Engineers, 5 Oct 95, Final Record of Decision and Request for Concurrence Letter, Sites 13 & 14 No Further Action

94. U.S. Army Corps of Engineers, 16 Oct 95, Draft Final Site Characterization Summary for Group 1

95. U.S. Army Corps of Engineers, 25 Oct 95, Draft Baseline Risk Assessments Group 1 Sites (Sites 1, 11, 27, and XX)

96. U.S. Army Corps of Engineers, 14 Dec 95, Draft Final Baseline Risk Assessments Group 1 Sites (Sites 1, 11, 27, and XX)

97. U.S. Army Corps of Engineers, 3 Jan 96, Final Work Plan for Phase III Interim Remedial Action at Burning Ground 3

98. U.S. Army Corps of Engineers, 9 Jan 96, Volume II-V of the Final Workplan for the Phase III Interim Remedial Action at the Burning Ground 3 and Air Monitoring Plan

99. U.S. Army Corps of Engineers, 5 Feb 96, Group 4 Baseline Risk Assessment Work Plan

100. U.S. Army Corps of Engineers, 20 Feb 96, Draft Work Plans for Interim Remedial Action Landfill Caps at Sites 12 & 16

101. U.S. Army Corps of Engineers, 26 Feb 96, Harrison Bayou Sediment and Surface Water Chemical Data, August and September 1995, and Data Validation Report

102. U.S. Army Corps of Engineers, 6 Mar 96, Draft Data Summary Report for Group 2, Phase II Remedial Investigations

103. U.S. Army Corps of Engineers, 28 Mar 96, Pre-Phase III Groundwater Investigation Work Plan

104. U.S. Army Corps of Engineers, 15 Apr 96, Draft Final Group 1 Remedial Investigation Report

105. U.S. Army Corps of Engineers, 24 Apr 96, Draft Final Group 4 Risk Assessment Workplan

106. U.S. Army Corps of Engineers, 30 Apr 96, Draft Final Project Work Plans and Final Air Monitoring Plan

107. U.S. Army Corps of Engineers, 17 May 96, Draft Design Analysis Report, Site 16 Time Critical Removal Action

108. U.S. Army Corps of Engineers, 10 June 96, Final Project Work Plans, Interim Remedial Action Landfills 12 & 16 Caps

109. U.S. Army Corps of Engineers, 13 June 96, Group 4 Sumps Groundwater Monitoring Quarterly Report

110. U.S. Army Corps of Engineers, 28 June 96, Draft Final Design Analysis Report for the Site 16 Time Critical Removal Action

111. U.S. Army Corps of Engineers, 3 July 96, Draft Final Comprehensive Chemical Data Acquisition Plan for the RI/FS

112. U.S. Army Corps of Engineers, 17 July 96, Draft Final Field Summary Report for the Phase II, Group 2 Sites Remedial Investigation

113. U.S. Army Corps of Engineers, 8 August 96, Treatment Simulation and Toxicity Testing Results of Site 16 Groundwater

114. U.S. Army Corps of Engineers, 21 August 96, Final Project Construction Drawings, Interim Remedial Action, Landfill 12 & 16 Caps

115. U.S. Army Corps of Engineers, 3 Oct 96, Draft Final Site Characterization Investigation Report for the Group 5 Sites

116. U.S. Army Corps of Engineers, 19 Dec 96, Schedule for Site 16 RI/FS and Treatability Study

117. U.S. Army Corps of Engineers, 6 Feb 97, Final Revised Air Monitoring Plan

## B. SITE DESCRIPTIONS

LHAAP currently has 50 sites in the DSERTS. A summary of all 50 sites listed is given below and provided in the site summary chart. Site locations are shown on Figure 1.

**LHAAP-1 INERT BURNING GROUNDS**

This site is used for the burning of trash, ashes, scrap lumber, and waste from burned TNT. Universal Match Corporation used this site during the 1950s for burning photoflash powder and other discarded materials. In 1982, investigations at this site included completion and sampling of one groundwater well and three surface soil samples. Contamination by metals, chloride, sulfate, and two explosive compounds was detected. Very low-level explosive contamination was detected in a downgradient well in 1988. This site is included in the FFA.

Contaminant of concern: Explosive chemicals/inert materials
Media of concern: Soil/Groundwater
Relative Risk Site Evaluation Rating: 1A
Completed IRP Phase: PA/SI
Current IRP Phase: RI/FS (A-106# 91-010)
Future IRP Phase: None - response complete

**LHAAP-2 VACUUM TRUCK OVERNIGHT PARKING LOT**

This site is a vacuum truck overnight parking lot. Tanker trucks containing industrial wastewater are sometimes left at this location overnight. This parking lot is located next to Building 704D. This site was identified as a Solid Waste Management Unit (SWMU) in the RFA. If any future actions are found necessary, they will be addressed as part of Group 4.

Contaminant of concern: Unknown (industrial wastewaters)
Media of concern: Surface Water/Groundwater
Completed IRP Phase: PA
Current IRP Phase: Response Complete (RC)
Future IRP Phase: RC

**LHAAP-3 BUILDING 722 - PAINT SHOP**

This site is used for collection of waste produced from the paint shop. Wastes may include paint thinner, paints, and kerosene. The site consists of one 55-gallon drum set on a gravel pad in an open-sided shed, with a galvanized metal roof. Waste is put into the 55-gallon drum until the drum is full. The drum is then taken to Building 31-W. This site has been active since the early 1970's. This site was identified as a SWMU in the RFA. If any future actions are found necessary, they will be addressed as part of Group 4.

Contaminant of concern: Paint and solvents
Media of concern: Soil/Groundwater/Surface Water
Completed IRP Phase: PA
Current IRP Phase: RC
Future IRP Phase: RC

**LHAAP-4 PILOT WASTEWATER TREATMENT PLANT**

This plant receives all the wastewater from all sumps on the installation. After settlement, the wastewater is transferred to one of two storage tanks and then pumped through a heat exchanger to an evaporation tower. Solids are shipped off-site, and sludges from the settling tank are blown down and drummed on a weekly basis and burned at Burning Ground No. 3. Although this site was identified as a SWMU in the RFA, the TNRCC determined that there were no additional investigations required at this site. This is an active unit, therefore it is not eligible for DERA funding. If any future actions are found necessary, they will be addressed under RCRA.

Contaminant of concern: Ordnance Comp./Industrial Wastewater
Media of concern: Groundwater/Surface Water/Air
Completed IRP Phase: PA
Current IRP Phase: RC
Future IRP Phase: RC

**LHAAP-5 POWER HOUSE BOILER POND**

This site has been in operation since 1978. It consists of a 4-foot-deep earthen lagoon lined with a polyvinyl chloride (PVC) liner. The lagoon receives approximately 3,000 gallons per day of backwash water from zeolite treatment units at the Building 401 Powerhouse. Water is either evaporated from the lagoon or discharged to the sewage treatment plant. Although this site was identified as a SWMU in the RFA, the TNRCC determined that there were no additional investigations required at this site. This is an active unit, therefore it is not eligible for DERA funding. If any future actions are found necessary, they will be addressed under RCRA.

Contaminant of concern: Unknown (backwash from zeolite treatment)
Media of concern: Groundwater/Surface Water
Completed IRP Phase: PA
Current IRP Phase: RC
Future IRP Phase: RC

**LHAAP-6 BUILDING 54F**

This site serves as a collection point for waste solvents from production processes. The site consists of a single 55-gallon drum stored in a three-sided shed, approximately 8 by 10 feet in size, with fiberglass siding and a roof of galvanized metal and fiberglass. The shed is set on a curbless concrete pad. Full drums are taken to Building 31-W. This site has been in operation since mid-1985 and is currently active. This site was identified as a SWMU in the RFA. If any future actions are found necessary, they will be addressed as part of Group 4.

Contaminant of concern: Acid
Media of concern: Soil/Groundwater
Completed IRP Phase: PA
Current IRP Phase: RC
Future IRP Phase: RC

**LHAAP-7 BUILDING 50G - DRUM PROCESSING**

This site is a washdown area for empty drums used in production. The site consists of a wooden frame building 30 by 100 feet in size, set on concrete and having transite walls. Main washdown takes place in a separate bay, 20 by 30 feet in size. All washdown water drains to a 3,000-gallon sump outside, Sump No. 70. Empty drums are either reused or flashed at the Air Curtain Destructor and sent to Building 49-W for disposal as scrap. This site was identified as a SWMU in the RFA. If any future actions are found necessary, they will be addressed as part of Group 4.

Contaminant of concern: Petroleum/Oil Lubricants
Media of concern: Soil/Groundwater
Completed IRP Phase: PA
Current IRP Phase: RC
Future IRP Phase: RC

**LHAAP-8 SEWAGE TREATMENT PLANT**

This site is a sewage treatment plant consisting of an Imhoff tank, a sand filter, and three inactive sludge beds. Sludge is dried on sand beds then shipped to the active landfill. This site has been active from 1942 to the present. Although this site was identified as a SWMU in the RFA, the TNRCC determined that there were no additional investigations required at this site. This is an active unit, therefore it is not eligible for DERA funding. If any future actions are found necessary, they will be addressed under RCRA.

Contaminant of concern: Residues from production material
Media of concern: Groundwater/Soil/Air
Completed IRP Phase: PA
Current IRP Phase: RC
Future IRP Phase: RC

**LHAAP-9 BUILDING 31-W - DRUM STORAGE**

Building 31-W is a storage area for containers of liquid hazardous waste. The building consists of two adjoining areas. The original area is a 100 by 50 foot structure with transite siding. The building has been in existence since at least the 1950's. The newer area consists of a structure approximately 80 by 50 feet in size, enclosed with galvanized metal siding that was completed in April 1987. Within the older area are three concrete troughs, 6 feet by 31 feet with 6-inch curbs, that were used for polychlorinated biphenyls (PCB) storage. No PCB is presently being stored there, but the area is used for various chemicals held in the lab pack for disposal. The newer area consists of eight concrete pads enclosed by 6-inch concrete curbs, 20 feet 1 inch x 25 feet 10 inches in size. Drums on pallets are stored on the pads. This site was used for liquid waste storage during the early 1950's and has been used for hazardous waste storage since 1984. Although this site was identified as a SWMU in the RFA, the TNRCC determined that there were no additional investigations required at this site. This is an active unit, therefore it is not eligible for DERA funding. If any future actions are found necessary, they will be addressed under RCRA.

Contaminant of concern: Petroleum/Oil/Lubricants and Unknown
Media of concern: Soil/Groundwater
Completed IRP Phase: PA
Current IRP Phase: RC
Future IRP Phase: RC

**LHAAP-11 SUSPECTED TNT BURIAL SITE AT AVENUES P AND Q**

Burial of contaminated wastes occurred in the general area just north of Avenue Q, bounded by Avenue P on the west and the explosive burning ground on the east. An area near the intersection of Avenues Q and P was identified as a possible TNT disposal site in use during the 1940's. A concrete block was discovered in this area during an assessment conducted in 1980, but its purpose is unknown. There is an area a few hectares in size located just west of the intersection of track 3-A and Avenue Q. This area was used during the late 1940's and early 1950's for the disposal of acids, building rubble, and other

trash. Surface and subsurface soil samples were collected in 1984 and 1988. Low levels of explosive contamination were detected in both soil sampling events. This site is included in the FFA. Site investigations conducted in 1993 concluded that further field investigation is needed at this site to complete the site characterization report.

Contaminant of concern: Unknown (TNT residues)
Media of concern: Soil/Groundwater
Relative Risk Site Evaluation Rating: 1A
Completed IRP Phase: PA/SI
Current IRP Phase: RI/FS (A-106# 91-010)
Future IRP Phase: Response Complete

**LHAAP-12 ACTIVE LANDFILL**

The Active Landfill is currently used for disposal of non-hazardous industrial waste. The landfill has been used intermittently since 1963. Continuous use of the landfill began in approximately 1978. Four groundwater wells were installed in 1980 and two in 1982. Groundwater analyses showed some metals, chlorides, and an explosive compound were present. In 1991, surface water and sediment samples were collected from one location near the landfill. These samples contained elevated levels of metals and trace amounts of some explosive and volatile organic compounds. This site is included in the FFA. Site investigations conducted in 1993 concluded that an Early Interim Remedial Action (Landfill Cap) is necessary to reduce further contamination to the groundwater. Additional field investigation (Phase II, RI/FS) is also required at this site.

Contaminant of concern: Asbestos/Refuse without Hazardous Waste/Unknown
Media of concern: Soil/Groundwater/Surface Water
Relative Risk Site Evaluation Rating: 1A
Completed IRP Phase: PA/SI
Current IRP Phase: RI/FS (A-106# 94-021), IRA (A-106# 94-003)
Future IRP Phase: RD/RA (A-106# 94-021)

**LHAAP-13 SUSPECTED TNT BURIAL BETWEEN ACTIVE LANDFILL AND OLD LANDFILL**

The Suspected TNT Burial Site/Acid Dump is an undocumented location where it is suspected that TNT or waste acids may have been disposed sometime during the history of the installation. Other than this suspected one-time disposal, no other activities have taken place at this site. Evidence of possible TNT burial or acid waste disposal at the site consists of several areas of little or no vegetation which is consistent with the suspicion that some form of waste disposal has occurred at this location.

Examination of aerial photographs dated 1963 show these same locations stripped of vegetation with some type of activity being performed at the site. These locations are not evident in 1954 photos, and most of the area appears to be revegetated and inactive in 1970 photos. This site is included in the FFA. Completion of remedial investigation fieldwork conducted in 1993 concluded that no further investigation is needed at this site. The Final RI/FS Report was submitted June 1995, and the ROD was approved February 1996.

Contaminant of concern: Unknown/Waste Acid
Media of concern: Soil/Groundwater
Completed IRP Phase: ROD
Current IRP Phase: RC
Future IRP Phase: RC

**LHAAP-14 AREA 54 BURIAL GROUND**

The Area 54 Burial Ground is an undocumented location where it is suspected that demolition debris, building rubble, explosives, and acidic wastes were disposed during the 1940's and early 1950's. The disposal site is reportedly beneath the asphalt parking area adjacent to Building 49-W. Other than this period of operation, no other waste activities have taken place at the site. This site is included in the FFA. Completion of remedial investigation fieldwork conducted in 1993 concluded that no further investigation is needed at this site. The Final RI/FS Report was submitted June 1995, and the ROD was approved February 1996.

Contaminant of concern: Acid/Ordnance Components
Media of concern: Soil/Groundwater
Completed IRP Phase: ROD
Current IRP Phase: RC
Future IRP Phase: RC

**LHAAP-15 AREA 49W DRUM STORAGE**

This site is a drummed waste storage shed containing solid and hazardous waste. It consists of a metal building 50 feet by 100 feet by 10/16 feet (sloped), with a concrete floor. Drums are stacked three high on pallets and held for shipment to the Defense Reutilization and Marketing Service (DRMS). This site has been in operation since 1984 and is still active today. Although this site was identified as a SWMU in the RFA, the TNRCC determined that there were no additional investigations required at this site. This is an active unit, therefore it is not eligible for DERA funding. If any future actions are found necessary, they will be addressed under RCRA.

Contaminant of concern: Oil/Ash
Media of concern: Soil/Groundwater
Completed IRP Phase: PA
Current IRP Phase: RC
Future IRP Phase: RC

**LHAAP-16 OLD LANDFILL**

The Old Landfill was originally used for disposal of products generated from the TNT Waste Disposal Plant. However, a variety of waste was disposed of in the landfill until the 1980's. Burned rocket motor casings, substandard TNT, barrels of chemicals, oil, paint, scrap iron, and wood may have been disposed of in the Old Landfill. Contamination from explosives, solvents, and metals is suspected in the soil, surface water, and groundwater around the Old Landfill.

Investigations were conducted at this site in 1980, 1982, and 1988. Five monitoring wells were installed in 1980. One well installation, well sampling, sediment and surface water sampling, and soil sampling were conducted in 1982. In 1988, wells were sampled and additional soil sampling was conducted. Explosive contamination was detected in the groundwater, sediments, and soil samples. Vinyl chloride was also detected in one monitoring well. This site is no longer in operation and is included in the FFA. Site investigations conducted in 1993 concluded that an Early IRA (Landfill Cap) is necessary to reduce further contamination to the groundwater. Additional field investigation (Phase II, RI/FS) is also required at this site.

Contaminant of concern: Ordnance Components and Unknown
Media of concern: Soil/Groundwater
Relative Risk Site Evaluation Rating: 1A
Completed IRP Phase: PA/SI
Current IRP Phase: RI/FS (A-106# 94-021)
Future IRP Phase: RA (A-106# 94-003, RD/RA(A-106# 94-021)

**LHAAP-17 NO. 2 FLASHING AREA/BURNING GROUND**

This site was used for burning bulk TNT, photoflash powder, and reject material from Universal Match Corporation's production processes. The site was operated as a burning ground from 1959 until 1980. There is evidence of bulk burial of TNT prior to 1954. Two burning pads are enclosed in a 2-acre fenced area surrounded by a flat grass area. Burning Ground No. 2 is situated approximately 400-500 feet southwest of Burning Ground No. 3, on adjoining property. Waste residues were removed in 1984 and the area grassed over. This site is no longer active and is included in the FFA.

This site was investigated in 1984, 1986, and 1988. Contamination of the groundwater was found in the first two sampling events, and explosive compounds were detected in the soil sampling event in 1988. Site investigations conducted in 1993 concluded that further field investigation is needed at this site to complete the site characterization report.

Contaminant of concern: Explosives and Unknown
Media of concern: Soil/Groundwater
Relative Risk Site Evaluation Rating: 1A
Completed IRP Phase: PA/SI
Current IRP Phase: RI/FS (A-106# 94-021)
Future IRP Phase: RD/RA (A-106# 94-021)

**LHAAP-18 & 24 BURNING GROUND/WASHOUT POND & UNLINED EVAPORATION POND**

Burning Ground No. 3 has been in operation since 1955. It has been used for the treatment, storage, and disposal of solid and liquid explosives, pyrotechnics, and combustible solvent wastes by open burning, incineration, evaporation, and burial. The Unlined Evaporation Pond (UEP) was constructed in 1963 in Burning Ground No. 3. Various types of waste have been disposed of in the UEP since 1963. Explosive waste, solvents, metallic materials, and nitrogen and phosphorous compounds are the suspected contaminants. In 1986, waste from the UEP was removed and the UEP capped. Burning of waste is still conducted in the Burning Ground No. 3 area.

Several investigations have been conducted at this site. In 1980, 13 monitoring wells were completed. In 1981, samples were collected to characterize the waste in portions of the site. Nine additional wells were installed in 1982. Explosives, metals, and organic solvents contamination was detected in groundwater at the site. In 1984, eight additional wells were installed around the UEP. To further characterize the UEP, 10 additional wells were installed around the area. In 1987, a soil gas survey, soil sampling, installation and sampling of 15 new groundwater wells, and sampling of 10 existing wells were conducted to identify additional contamination sources in the area. Contamination by volatile organic compounds, metals, chlorides, nitrates, and some explosives was found in the area. In 1989, additional wells were completed, along with soil and surface water sampling to determine the extent of groundwater contamination. Quarterly monitoring has been conducted at the site since closure of the UEP. This site is included in the FFA. Based on the results of the latest round of water sampling which indicated the zone of contaminated groundwater is expanding, a Proposed Plan of an Early IRA was issued to the public in September 1994. The purpose of this IRA is to extract, treat, and contain contaminated groundwater underneath this site.

Additional field investigation (Phase II, RI/FS) is also required at this site.

Contaminant of concern: Petroleum/Oil/Lubricants/Unknown Solvents and Heavy Metals
Media of concern: Soil/Groundwater/Surface Water
Relative Risk Site Evaluation Rating: 1A
Completed IRP Phase: PA/SI
Current IRP Phase: IRA, RI/FS (A-106# 94-021)
Future IRP Phase: RD/RA(A-106# 94-021)

**LHAAP-19 CONSTRUCTION MATERIALS LANDFILL**

This site is used as a landfill. It is a fenced area 400 by 800 feet in size. Operation is trench and burial. This site has been in operation from 1985 until the present. Although this site has been identified as a SWMU in the RFA, the TNRCC determined that there were no additional investigations required at this site. Disposal at the site is construction material only. There is no apparent contamination. This is an active site, and therefore not eligible for DERA funding. If any future actions are found necessary, they will be addressed under RCRA.

Contaminant of concern: Refuse without hazardous waste
Media of concern: Soil/Groundwater
Completed IRP Phase: PA/SI
Current IRP Phase: RC
Future IRP Phase: RC

**LHAAP-22 TNT RED WATER PIPELINE**

This site is being investigated under LHAAP 29 and 32 which are under RI/FS phases.

Contaminant of concern: Ordnance Components
Media of concern: Soil/Groundwater/Surface Water/Sediment
Relative Risk Site Evaluation Rating: 1A
Completed IRP Phase: PA/SI
Current IRP Phase: RI/FS (A-106# 94-021)
Future IRP Phase: RD/RA (A-106# 94-021)

**LHAAP-23 BUILDING 707 - STORAGE AREA FOR PCBs**

This site consists of a wooden storage building, 30 by 150 feet in size, with shingle siding and a concrete floor. Drums or transformers containing PCB-contaminated oil were stored in galvanized steel cattle watering troughs inside the building. The building was empty except for the used cattle troughs. This

site was in operation from 1980 until March 1986. Although this site was identified as a SWMU in the RFA, the TNRCC determined that there were no additional investigations required at this site. A Preliminary Assessment was conducted by the Army in March 1996, and there was no visible evidence of contamination at the site. Therefore, the Army has placed this site in a No Further Action category.

Contaminant of concern: Unknown
Media of concern: Contamination of Building
Completed IRP Phase: PA
Current IRP Phase: RC
Future IRP Phase: RC

**LHAAP-27 SOUTH TEST AREA**

The South Test Area was constructed in 1954 for testing of photoflash bombs. During the late 1950's, illuminating signal devices were also demilitarized within pits at the site. In the early 1980's, photoflash cartridges were demilitarized in the area. In 1982, investigations included installation and sampling of two wells and three shallow soil samples. Metals above background levels, explosives, and chloride and sulfate were detected in the soil samples. Metals, chloride, and sulfate were detected above background levels in the groundwater. This site is no longer in operation and is included in the FFA. Site investigations conducted in 1993 concluded that further field investigation is needed at this site to complete the site characterization report.

Contaminant of concern: Ordnance Components
Media of concern: Soil/Groundwater
Relative Risk Site Evaluation Rating: 1A
Completed IRP Phase: PA/SI
Current IRP Phase: RI/FS (A-106# 91-010)
Future IRP Phase: Response Complete

**LHAAP-29 FORMER TNT PRODUCTION AREA**

The Former TNT Production Area was in operation from April 1943 to August 1945 as a six-line plant with a supporting acid plant. The plant produced 180 million kilograms of TNT throughout the period of operation. A bulk toluene storage area servicing the TNT Production Area was located adjacent to the production area. TNT wastewater (red water) from the production of the TNT was sent through wooden pipelines to a storage tank and pumphouse, and then to the TNT Disposal Plant. Cooling water (blue water) from the production area ran through main lines and into an open ditch. Acidic waste were neutralized and discharged into a drainage ditch. The entire site, except for the foundations, was demolished and removed in 1959.

Six groundwater wells were completed and sampled in 1984 along with surface water/sediment samples from four locations. In 1988, the 6 wells, additional surface water, and 35 soil borings were sampled. Explosive contamination was detected in soil and surface water/sediment samples. This site is no longer in operation and is included in the FFA. Site investigations conducted in 1993 concluded that further field investigation is needed at this site to complete the site characterization report.

Contaminant of concern: Ordnance Components
Media of concern: Soil/Groundwater/Surface Water/Sediment
Completed IRP Phase: PA/SI
Relative Risk Site Evaluation Rating: 1A
Current IRP Phase: RI/FS (A-106# 94-021)
Future IRP Phase: RD/RA (A-106# 94-021)

## LHAAP-32 FORMER TNT WASTE DISPOSAL PLANT

The TNT Waste Disposal Plant was constructed in 1942 to treat and dispose of wastewaters generated at the TNT Production Area. The plant was in operation from April 1943 until August 1945. In 1959, most of the facilities at the Disposal Plant were removed. The suspected contaminants are explosive compounds and metals contained in explosive manufacturing residues.

One groundwater well was completed and sampled in 1982. Surface water and sediment samples were also collected in the area. One explosive compound was detected along with some elevated levels of metals. A surface water sample was collected in 1991, and the analyses detected low levels of explosive compounds. This site is no longer active and is included in the FFA. Site investigations conducted in 1993 concluded that further field investigation is needed at this site to complete the site characterization report.

Contaminant of concern: Ordnance Components
Media of concern: Groundwater/Surface Water/Sediment
Completed IRP Phase: PA/SI
Relative Risk Site Evaluation Rating: 1A
Current IRP Phase: RI/FS (A-106# 94-021)
Future IRP Phase: RD/RA (A-106# 94-021)

## LHAAP-34 BUILDING 701 - PCB STORAGE

This site consists of a building formerly used for storage of PCB-contaminated material from the cleanup of transformer spills in 30- and 55-gallon drums. The site consists of a wooden framed building with shingles and a concrete floor, approximately 25 x 110 feet in dimension. Only the north half of the building was used for storage. This site was in operation from 1980 until 1984. Although this site was identified as a SWMU in the RFA,

the TNRCC determined that there were no additional investigations required at this site. Based on this determination, historical information, and finding no visible evidence of contamination, the Army has placed this site into a No Further Action category.

Contaminant of concern: Polychlorinated Biphenyls
Media of concern: Contamination of Building
Completed IRP Phase: PA/SI
Current IRP Phase: RC
Future IRP Phase: RC

**LHAAP-35 PROCESS WASTEWATER SUMPS - VARIOUS**

This site consists of 24 industrial wastewater sumps. These sumps are located in different locations within LHAAP. Site investigations conducted in 1993 concluded that further field investigation is needed at this site to complete the site characterization report.

Contaminant of concern: Heavy Metals, Solvents
Media of concern: Groundwater
Relative Risk Site Evaluation Rating: 1A
Completed IRP Phase: PA/SI
Current IRP Phase: IRA, RI/FS (A-106# 92-001)
Future IRP Phase: RD/RA (A-106# 92-001)

**LHAAP-36 EXPLOSIVE WASTE PADS**

This site is a compilation of approximately 20 waste pads. These wastes pads consist of a galvanized metal roof set over a concrete 4- by 8-foot pad with a 6-inch curb. The waste pads are drained by concrete troughs into sumps. Explosive waste is desensitized with diesel fuel and placed in 5-gallon, galvanized, lidded, metal garbage pails with plastic bag liners. Full garbage pails are stored in a metal rack approximately 1.5 feet above the ground. The site has been in operation from 1985 until the present. Although this site was identified as a SWMU in the RFA, the TNRCC determined that there were no additional investigations required at this site. Based on a Preliminary Assessment conducted by the Army in March 1996, historical information, and finding no visual evidence of contamination, the Army has placed this site into a No Further Action category.

Contaminant of concern: Heavy Metals
Media of concern: Soil
Completed IRP Phase: PA/SI
Current IRP Phase: RC
Future IRP Phase: RC

**LHAAP-37 QUALITY ASSURANCE LABORATORY - BUILDING 29A**

This site serves as a collection point for spent solvents from the Quality Assurance Laboratory. The site consists of one 55-gallon, plastic, DOT-approved drum set on a concrete pad. Each full drum is sent to Building 31-W. This site began operation in 1985. It was identified as a SWMU in the RFA conducted by TNRCC. If any future actions are found necessary, they will be addressed as part of Group 4.

Contaminant of concern: Solvent
Media of concern: Soil/Groundwater/Surface Water/Air
Completed IRP Phase: PA
Current IRP Phase: RC
Future IRP Phase: RC

**LHAAP-38 24X HOLDING AREA,**
**LHAAP-39 25X WASHOUT PAD,**
**LHAAP-40 AIR CURTAIN DESTRUCTOR,**
**LHAAP-41 OPEN BURNING CAGE,**
**LHAAP-42 OPEN BURNING PAN,**
**LHAAP-43 FORMER UNLINED EVAPORATION POND,**
**LHAAP-44 BULIDNG**

These sites are located within LHAAP 18 and LHAAP- 24 which is under IRA and RI/FS phases.

Contaminant of concern: Petroleum/Oil/Lubricants/Unknown Solvents and Heavy Metals
Media of concern: Soil/Groundwater/Surface Water
Completed IRP Phase: PA/SI
Relative Risk Site Evaluation Rating: 1A
Current IRP Phase: RI/FS (A-106# 94-021)
Future IRP Phase: IRA and RD/RA (A-106# 92-011)

**LHAAP-45 MAGAZINE AREA**

This site has been used for the storage of munitions. The total enclosed area is over 800 acres. Located within this area are 58 bunkers and 2 buildings. Each bunker consists of three concrete walls and a concrete-floored structure 26 by 60 by 10 feet in size, with a wooden roof and doors. If stored munitions are designated for disposal, they are taken to Building 811-1 where they are processed out. In operation since 1942, this site is still active. Although this site was identified as a SWMU in the RFA, the TNRCC determined that there were no additional investigations required at this site. This is an active site and therefore not eligible for DERA funding. If any future actions are found necessary, they will be addressed under RCRA.

Contaminant of concern: Unexploded Ordnance
Media of concern: Soil/Building
Completed IRP Phase: PA
Current IRP Phase: RC
Future IRP Phase: RC

**LHAAP-46 PLANT 2/PYROTECHNIC OPERATION**

Plant 2 is the main site of pyrotechnic operations. The plant operated from June 1952 to 1956 and from April 1963 until the present. Wastewater from washdown activities is collected in 44 waste sumps and transferred to the pilot wastewater treatment plant. Site investigations conducted in 1993 concluded that further field investigation is needed at this site to complete the site characterization report. Site is being addressed as part of Site 35.

Contaminant of concern: Heavy Metals
Media of concern: Groundwater
Relative Risk Site Evaluation Rating: 1A
Completed IRP Phase: PA/SI
Current IRP Phase: RI/FS (A-106# 92-001)
Future IRP Phase: RD/RA (A-106# 92-001)

**LHAAP-47 PLANT 3/PRODUCES MOTOR ASSEMBLIES - SUMPS**

This site exists for the production of simulator and illuminating motor assemblies. Polysulfide polymer solid propellant rocket motors have been produced in the Plant 3 Area since 1955. Operations integral to this activity are vapor degreasing, grit blasting, particle size reduction, mixing and blending, teflon coating, and vacuum and pressure casting of solid fuel rocket motors. Wastewater from washdown activities is collected in the 48 waste sumps and transferred to the pilot wastewater treatment plant. Site investigations conducted in 1993 concluded that further field investigation is needed at this site to complete the site characterization report. Site is being addressed under Site 35.

Contaminant of concern: Heavy Metals
Media of concern: Groundwater
Relative Risk Site Evaluation Rating: 1A
Completed IRP Phase: PA/SI
Current IRP Phase: RI/FS (A-106# 92-001)
Future IRP Phase: RD/RA (A-106# 92-001)

**LHAAP-48 Y AREA/PRODUCES HAND SIGNAL ASSEMBLIES - SUMPS**

This site is a former rocket motor igniter facility. Wastewater is collected in nine waste sumps and transferred to

the pilot wastewater treatment plant. Site investigations conducted in 1993 concluded that further field investigation is needed at this site to complete the site characterization report. Site is being addressed under Site 35.

Contaminant of concern: Heavy Metals
Media of concern: Groundwater
Relative Risk Site Evaluation Rating: 1A
Completed IRP Phase: PA/SI
Current IRP Phase: RI/FS (A-106# 92-001)
Future IRP Phase: RD/RA (A-106# 92-001)

**LHAAP-49 FORMER ACID PLANT**

This site is being investigated under LHAAP 29 and 32 which are under RI/FS phases.

Contaminant of concern: Ordnance Components
Media of concern: Soil/Groundwater/Surface Water/Sediment
Relative Risk Site Evaluation Rating: 1A
Completed IRP Phase: PA/SI
Current IRP Phase: RI/FS (A-106# 94-021)
Future IRP Phase: RD/RA (A-106# 94-021)

**LHAAP-50 FORMER WASTE DISPOSAL FACILITY**

This site has received wastewaters from several sumps at Plants 3 and 2 during periods of sufficient flow from 1955 to the early 1970's. Washout of ammonium perchlorate containers was performed on site. Findings from the Army's preliminary assessment and recent re-evaluation concluded that an SI should be initiated in FY 95.

Contaminant of concern: Industrial Liquid Waste/Heavy Metals/Chlorinated Solvents
Media of concern: Soil/Groundwater
Completed IRP Phase: PA
Relative Risk Site Evaluation Rating: NE
Current IRP Phase: SI (A-106# 94-023)
Future IRP Phase: RI/FS (A-106# 94-023)

**LHAAP-51 PHOTOGRAPHIC LABORATORY/BUILDING 60B**

Building 60B is the location for processing of x-ray film. The building has a concrete floor without a floor drain. Spent developing waste is drummed and transferred to Building 31-W. Findings from the Army's preliminary assessment concluded that no further action is necessary at this time.

Contaminant of concern: Acid/Base
Media of concern: Soil/Building
Completed IRP Phase: PA
Current IRP Phase: RC
Future IRP Phase: RC

**LHAAP-52 MAGAZINE AREA**

The Plant 1 Magazine Area contains 58 Richmond-type magazines and two aboveground magazines, all of which had been used for the storage of TNT. A standpipe near the intersection of Avenue E and 19th Street was used to wash out trucks used for the transport of TNT. Waste waters from this operation may have flowed onto the ground. Findings from the Army's preliminary assessment and recent re-evaluation concluded that an SI should be initiated in FY 95.

Contaminant of concern: Explosive Chemicals
Media of concern: Soil
Completed IRP Phase: PA
Relative Risk Site Evaluation Rating: NE
Current IRP Phase: SI (A-106# 94-023)
Future IRP Phase: RI/FS (A-106# 94-023)

**LHAAP-53 STATIC TEST AREA**

This static test area also has a candle test area. The site was formerly used for rocket motor, red phosphorus smoke wedge, and illuminating candle testing. The current activity of this site is demilitarization by ignition of Pershing rocket motors performed on test stands. Findings from the Army's preliminary assessment concluded that no further action is necessary at this site.

Contaminant of concern: Propellant/Explosive Chemicals
Media of concern: Soil/Groundwater
Completed IRP Phase: PA
Current IRP Phase: RC
Future IRP Phase: RC

**LHAAP-54 GROUND SIGNAL TEST AREA**

The Ground Signal Test Area is currently used for aerial and on-ground testing of pyrotechnic, illuminators, and signal devices manufactured at the facility. Since 1988, burnout of Pershing missiles has been conducted at this site in accordance with the Intermediate-Range Nuclear Forces Treaty. The site has been used intermittently since 1963 for various types of testing

and destruction of many explosive devices. In 1982, investigations included installation and sampling of two groundwater wells and three surface samples. Elevated levels of some metals were detected in the soil and groundwater. Elevated levels of chloride and sulfate were detected in the groundwater. This site is included in the FFA. Site investigations conducted in 1993 concluded that further field investigation is needed at this site to complete the site characterization report.

Contaminant of concern: Propellant/Explosive Chemicals
Media of concern: Soil/Groundwater
Relative Risk Site Evaluation Rating: 1A
Completed IRP Phase: PA/SI
Current IRP Phase: RI/FS (A-106# 91-010)
Future IRP Phase: RD/RA (A-106# 91-010)

**LHAAP-55 SEPTIC TANK**

This site contains ten septic tanks which serve outlying areas, with outfalls to ditches. The effluent is chlorinated prior to discharge. Contents of septic tanks are pumped out and transferred to the sewage treatment plant as needed. There is no history of industrial waste being put into these septic tanks. Findings from the Army's preliminary assessment concluded that no further action is necessary at this site.

Contaminant of concern: Refuse without hazardous waste
Media of concern: Soil/Groundwater
Completed IRP Phase: PA
Current IRP Phase: RC
Future IRP Phase: RC

**LHAAP-56 VEHICLE WASH RACK & OIL SEPARATOR**

This site consists of a concrete wash rack sloped to drain, connected to an oil/water separtor. The site does have permitted discharge to a drainage ditch. The extent of separator maintenance is unknown. Although this site will require further investigations, response is complete under DERA since the site is still active. The sumps on this site are being investigated under LHAAP 35.

Contaminant of concern: Heavy Metals
Media of concern: Groundwater
Completed IRP Phase: PA/SI
Relative Risk Site Evaluation Rating: 1A
Current IRP Phase: RI/FS (A-106# 92-001)
Future IRP Phase: RD/RA (A-106# 92-001)

## LHAAP-57 RUBBLE BURIAL SITE

This site is used for burial of inert materials that were cleared from property after acquisition. Findings from the Army's preliminary assessment concluded that no further action is necessary at this site.

Contaminant of concern: Unknown
Media of concern: Soil
Completed IRP Phase: PA
Current IRP Phase: RC
Future IRP Phase: RC

## LHAAP-58 MAINTENANCE COMPLEX

This site is a maintenance complex with concrete floors and no curbs at the doorways. Floor drains are connected to the sanitary sewer. Lubricants are stored on drum racks outside over a gravel surface. No curbing or other containment is present. Waste oil and solvents are transferred to Building 31-W. Findings from the Army's preliminary assessment concluded that no further action is necessary at this site.

Contaminant of concern: Petroleum/Oil/Lubricants/Solvents
Media of concern: Soil
Completed IRP Phase: PA
Current IRP Phase: RC
Future IRP Phase: RC

## LHAAP-59 STORAGE BUILDING NO. 725

This site is a building used for storage of pesticides and herbicides. Building 725 has a concrete floor that slopes to floor drains discharging to a nearby sump. Contents of the sump are pumped out as required and transferred to the pilot wastewater treatment system via vacuum truck. This site is still active. The sumps on this site are being investigated under LHAAP-35.

Contaminant of concern: Heavy Metals
Media of concern: Groundwater
Relative Risk Site Evaluation Rating: 1A
Completed IRP Phase: PA/SI
Current IRP Phase: RI/FS (A-106# 92-001)
Future IRP Phase: RD/RA (A-106# 92-001)

## LHAAP-60 FORMER STORAGE BUILDING 411 AND 714

This site is comprised of two buildings formerly used for storage of pesticides and herbicides (Buildings 411 and 714).

Pesticides were originally stored in Building 714. In 1970, the stock was moved to Building 411. Both buildings have concrete floors with no curbs present at the doorways. Findings from the Army's preliminary assessment and recent re-evaluation concluded that an SI should be initiated in FY 95.

Contaminant of concern: Pesticides
Media of concern: Soil
Relative Risk Site Evaluation Rating: NE
Completed IRP Phase: PA
Current IRP Phase: SI (A-106# 94-023)
Future IRP Phase: RI (A-106# 94-023)

**LHAAP-61 WATER TREATMENT PLANT EFFLUENT SETTLING POND**

This facility consists of two adjacent ponds each 0.1 hectare by 1.5 meters deep. The ponds are located just north of the shops area. Synthetic waterproof sheeting with soil cover constitutes the pond liner. The purpose of the facility is to settle out solids from backwashing water treatment sand filters. Drainage is to Goose Prairie Bayou. Findings from the Army's preliminary assessment concluded that no further action is necessary at this site.

Contaminant of concern: Industrial Sludge
Media of concern: Soil/Groundwater
Completed IRP Phase: PA
Current IRP Phase: RC
Future IRP Phase: RC

**LHAAP-62 BUILDING 43X**

This site known as Building 43X is a shed used for storage of materials prior to incineration. The shed has a concrete floor but has no curb or other containment. This site is located within LHAAP 18 which is under IRA and RI/FS phases.

Contaminant of concern: Petroleum/Oil/Lubricants/Unknown Solvents and Heavy Metals
Media of concern: Soil/Groundwater/Surface Water
Relative Risk Site Evaluation Rating: 1A
Completed IRP Phase: PA/SI
Current IRP Phase: RI/FS (A-106#, 94-021)
Future IRP Phase: IRA and RD/RA (A-106#, 94-021)

**LHAAP-63 BURIAL PITS**

Pits are located along Bobby Jones Road (location 14) approximately 30 meters north of Long Point Road and east of the explosive burning ground. These pits were used in the late

1950's for the detonation of Plant 3 reject materials of unknown composition. Findings from the Army's preliminary assessment and recent re-evaluation concluded that an SI will be initiated in FY95.

Contaminant of concern: Explosives
Media of concern: Soil/Groundwater
Relative Risk Site Evaluation Rating: NE
Completed IRP Phase: PA
Current IRP Phase: SI (A-106# 94-023)
Future IRP Phase: RI/FS (A-106# 94-023)

**LHAAP-64 TRANSFORMER STORAGE**

This site is used for storage of transformer oil. Approximately 20 out-of-service non-PCB transformers are stored on pallets outside, with no curb or other containment. Site investigation is being planned. This site is still active. Findings from the Army's preliminary assessment concluded that no further action is necessary at this site.

Contaminant of concern: Petroleum/Oil/Lubricants
Polychlorinated Biphenyls
Media of concern: Soil/Groundwater
Completed IRP Phase: PA
Current IRP Phase: RC
Future IRP Phase: RC

**LHAAP-65 BUILDING NO. 209**

Building 209 is used for chemical storage for items such as paint and solvents. This building has a concrete floor with floor drains connected to sumps. The sumps on this site are being investigated under LHAAP 35.

Contaminant of concern: Heavy Metals
Media of concern: Groundwater
Relative Risk Site Evaluation Rating: 1A
Completed IRP Phase: PA/SI
Current IRP Phase: RI/FS (A-106#, 92-001)
Future IRP Phase: RD/RA (A-106#, 92-001)

**LHAAP-66 TRANSFORMER AT BUILDING 401**

A transformer at Building 401 dripped oil continuously for approximately 1 year. The transformer did not contain any polychlorinated biphenyls. Findings from the Army's preliminary assessment concluded that no action is necessary at this site.

Contaminant of concern: Oil

Media of concern: Soil
Completed IRP Phase: PA
Current IRP Phase: RC
Future IRP Phase: RC

**LHAAP-67 ABOVEGROUND STORAGE TANK**

This site consists of seven aboveground storage tanks containing Number 2 fuel oil and kerosene. Tanks have earthen dikes sufficient to contain potential spill. Motor fuel tanks are registered with the state. There is no history of spills at this location. Findings from the Army's preliminary assessment concluded that no further action is necessary at this site.

Contaminant of concern: Petroleum/Oil Lubricants/Other
Media of concern: Soil
Completed IRP Phase: PA
Current IRP Phase: RC
Future IRP Phase: RC

**LHAAP-68 MOBILE STORAGE TANK PARKING AREA**

This site contains two mobile storage tank (600 gallon) compartments on a tank truck. These vehicles are used throughout the facility and are parked on the asphalt surface at the maintenance complex. No curb or other containment is present at the parking facility. Mobile storage tanks contain Number 2 diesel and gasoline. Findings from the Army's preliminary assessment concluded that no further action is necessary at this site.

Contaminant of concern: Petroleum/Oil/Lubricants
Media of concern: Soil
Completed IRP Phase: PA
Current IRP Phase: RC
Future IRP Phase: RC

**LHAAP-69 SERVICE STATION UNDERGROUND STORAGE TANKS**

This site has six leaking underground storage tanks (USTs) that were leak tested in 1989. These tanks contained gasoline. The tanks were replaced in 1993, and the site has been remediated. No further action is needed at this site.

Contaminant of concern: Petroleum/Oil/Lubricants
Media of concern: Soil/Groundwater
Completed IRP Phase: RD/RA
Current IRP Phase: RC
Future IRP Phase: RC

## IV. IRP SITE SUMMARY CHART

The DSERT Phase Summary Report and IAP Summary Chart are included in the following pages.

018475

# Defense Site Environmental Restoration Tracking System

**Phase Summary Report** 02-20-1997

**Programs:** IRP, OHW, BD/DR, BRAC I, BRAC II, BRAC III, and BRAC IV

**Installation count for Programs:** 1

**NPL Options:** NO, PROPOSED, YES, and DELISTED

**Installations count for Programs and NPL:** 1

**Site count for Programs and NPL:** 50

## Phase / Status / Sites

| PA | | | | SI | | | |
|---|---|---|---|---|---|---|---|
| C | U | F | RC | C | U | F | RC |
| 50 | 0 | 0 | 19 | 26 | 4 | 0 | 9 |

| RI / FS | | | | RD | | |
|---|---|---|---|---|---|---|
| C | U | F | RC | C | U | F |
| 2 | 15 | 2 | 2 | 0 | 3 | 10 |

| RA(C) | | | | RA(O) | | | |
|---|---|---|---|---|---|---|---|
| C | U | F | RC | C | U | F | RC |
| 1 | 0 | 13 | 1 | 0 | 0 | 5 | 0 |

| LTM | | | |
|---|---|---|---|
| C | U | F | M |
| 0 | 0 | 9 | 39 |

## Remedy / Status / Sites (Actions)

| IRA | | |
|---|---|---|
| C | U | F |
| 2 ( 2 ) | 2 ( 2 ) | 2 ( 3 ) |

| PRA | | |
|---|---|---|
| C | U | F |
| 1 ( 1 ) | 0 ( 0 ) | 8 ( 8 ) |

**RIP Total:** 0

**RC Total:** 31

# DEFENSE SITE ENVIRONMENTAL RESTORATION TRACKING SYSTEM

02-20-1997

SITE SUMMARY

Installation: LONGHORN AAP
Major Command: AMC
RPID: TX213820529
Subcommand: IOC

| Site | Description | Type | Score | Agreement | Phase Status | | | | | | | IRA FRA | Actn Type | RIP | RC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | PA | SI | RI | RD | RA(C) | RA(O) | L/TM | | | | |
| LHAAP-001 | INERT BURNING GROUNDS (SWMU 1) | AB | 3A | A | C | C | U | | | N | N | | | | 199709 |
| LHAAP-002 | VACCUM TRUCK OVERNITE PARKING LOT | SA | NE | | C | | | | | N | N | | | | 198705 |
| LHAAP-003 | BUILDING 722-PAINT SHOP | SA | NE | | C | | | | | N | N | | | | 198705 |
| LHAAP-004 | LHAAP PILOT WASTEWATER TREATMENT PLANT | WT | NE | | C | | | | | N | N | | | | 198705 |
| LHAAP-005 | POWER HOUSE BOILER POND | SI | NE | | C | | | | | N | N | | | | 198705 |
| LHAAP-006 | BUILDING 54F SOLVENT | SA | NE | | C | | | | | N | N | | | | 198705 |
| LHAAP-007 | BUILDING 50G DRUM PROCESSING | SA | NE | | C | | | | | N | N | | | | 198705 |
| LHAAP-008 | SEWAGE TREATMENT PLANT | WT | NE | | C | | | | | N | N | | | | 198705 |
| LHAAP-009 | BUILDING 31-W DRUM STORAGE | SA | NE | | C | | | | | N | N | | | | 198705 |
| LHAAP-011 | SUS TNT BURIAL SITE AT AVE P&Q(SWMU 11) | LF | 3A | A | C | C | U | | | N | N | | | | 199709 |
| LHAAP-012 | ACTIVE LANDFILL (SWMU 12) | LF | 1A | A | C | C | U | F | F | N | F | F | F1 | | 200306 |
| | | | | | | | | | | | | I | I1 | | |
| LHAAP-013 | SUS TNT BET ACTIVE&OLD LANDFILL(SWMU 13) | LF | 3A | A | C | C | C | | | N | | | | | 199512 |
| LHAAP-014 | AREA 54 BURIAL GRND (SWMU 14) | LF | 3A | A | C | C | C | | | N | | | | | 199512 |
| LHAAP-015 | AREA 49W DRUM STORAGE | SA | NE | | C | | | | | N | N | | | | 198705 |
| LHAAP-016 | OLD LANDFILL (SWMU 16) | LF | 1A | A | C | C | U | U | F | N | F | F | F1 | | 200306 |
| | | | | | | | | | | | | I | I1 | | |
| LHAAP-017 | NO 2 FLASHING AREA BRN GROUND(SWMU 17) | AB | 1A | A | C | C | U | F | F | N | F | F | F1 | | 200512 |
| LHAAP-018 | BURNING GROUND/WASHOUT POND(SWMU 18) | AB | 1A | A | C | C | U | U | F | F | F | I | E1 | | 200309 |
| | | | | | | | | | | | | F | F1 | | |
| | | | | | | | | | | | | I | F1 | | |
| | | | | | | | | | | | | I | I1 | | |
| LHAAP-019 | CONSTRUCTION MATERIALS LANDFILL | LF | NE | | C | C | | | | N | N | | | | 198705 |
| LHAAP-023 | BUILDING 707-STORAGE AREA PCBS | SA | NE | | C | C | | | | N | N | | | | 198705 |
| LHAAP-024 | FORMER UNLINED EVAP POND (SWMU 24) | SI | 1A | A | C | C | U | U | F | F | F | I | E1 | | 200309 |
| | | | | | | | | | | | | F | F1 | | |

# DEFENSE SITE ENVIRONMENTAL RESTORATION TRACKING SYSTEM

02-20-1997

SITE SUMMARY

**Installation:** LONGHORN AAP
**Major Command:** AMC
**FFID:** TX213820529
**Subcommand:** IOC

| Site | Description | Type | Score | Agreement | Phase Status | | | | | | | IRA PRA | Actn Type | RIP | RC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | PA | SI | RI | RD | RA(C) | RA(O) | LTM | | | | |
| LHAAP-024 | | | | | | | | | | | | I | I1 | | |
| LHAAP-027 | SOUTH TEST AREA/BOMB TEST AREA(SWMU 27) | SS | 3A | A | C | C | U | | | N | N | | | | 199709 |
| LHAAP-029 | FORMER TNT PRODUCTION AREA(SWMU 29) | WL | 1A | A | C | C | U | F | F | N | F | F | E1 | | 200512 |
| LHAAP-032 | FORMER TNT WASTE DISPOSAL PLT(SWMU 32) | DP | 3A | A | C | C | U | F | F | N | F | F | E1 | | 200512 |
| LHAAP-034 | BUILDING 701 PCB STORAGE | SA | NE | | C | C | | | | N | N | | | | 198705 |
| LHAAP-035 | SUMPS (145) VARIOUS | TU | 1A | A | C | C | U | F | F | F | N | | | | 202804 |
| LHAAP-036 | EXPLOSIVE WASTE PADS (27) | SA | NE | | C | C | | | | N | N | | | | 198705 |
| LHAAP-037 | QUALITY ASSURANCE LABORATORY-BLDG 29-A | SA | NE | | C | | | | | N | N | | | | 199008 |
| LHAAP-039 | 25X WASHOUT PAD | SA | NE | | C | | | | | N | N | | | | 199008 |
| LHAAP-045 | MAGAZINE AREA | SA | NE | | C | | | | | N | N | | | | 199008 |
| LHAAP-046 | PLANT 2/PYRO OP SUMPS | TU | 1A | A | C | C | U | F | F | F | N | | | | 202806 |
| LHAAP-047 | PLANT 3 MOTOR ASSEMBLIES SUMPS | TU | 1A | A | C | C | U | F | F | F | N | | | | 202806 |
| LHAAP-048 | Y AREA/SUMPS | TU | 1A | A | C | C | U | F | F | N | N | | | | 199907 |
| LHAAP-050 | FORMER WASTE DISPOSAL FACILITY | WL | NE | A | C | U | F | F | F | N | F | F | P1 | | 200408 |
| LHAAP-051 | PHOTOGRAPHIC LABORATORY/BLDG #608 | SS | NE | | C | | | | | N | N | | | | 199008 |
| LHAAP-052 | MAGAZINE AREA WASHOUT | SS | 3A | A | C | U | | | | N | N | | | | 199806 |
| LHAAP-053 | STATIC TEST AREA | ZZ | NE | | C | | | | | N | N | | | | 199008 |
| LHAAP-054 | GRD SIGNAL TEST AREA (LHAAP-XX) | SS | 3A | A | C | C | U | | | N | N | | | | 199709 |
| LHAAP-055 | SEPTIC TANK (10) | WT | NE | | C | | | | | N | N | | | | 199008 |
| LHAAP-057 | RUBBLE BURIAL SITE | LF | NE | | C | | | | | N | N | | | | 199008 |
| LHAAP-058 | MAINTENANCE COMPLEX | SS | NE | A | C | C | | | | N | N | | | | 199506 |
| LHAAP-060 | FORMER STORAGE BUILDING #411 & #714 | SA | 3A | A | C | U | F | F | F | N | F | | | | 200408 |
| LHAAP-061 | POTABLE WTP SEDIMENT POND | WT | NE | | C | | | | | N | N | | | | 199008 |
| LHAAP-063 | BURIAL PITS | DP | 3A | A | C | U | | | | N | N | | | | 199608 |
| LHAAP-064 | TRANSFORMER STORAGE | SA | NE | A | C | C | | | | N | N | | | | 199506 |
| LHAAP-066 | TRANSFORMER AT BLDG 401 | SS | NE | A | C | C | | | | N | N | | | | 199506 |

# DEFENSE SITE ENVIRONMENTAL RESTORATION TRACKING SYSTEM

02-20-1997

SITE SUMMARY

**Installation:** LONGHORN AAP
**Major Command:** AMC
**EPID:** TX213820529
**Subcommand:** IOC

| Site | Description | Type | Score | Agreement | Phase Status | | | | | | | IRA FRA | Actn Type | RIP | RC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | PA | SI | RI | RD | RA(C) | RA(O) | L/TM | | | | |
| LHAAP-067 | ABOVE GROUND STORAGE TANK | TA | NE | | C | | | | | N | N | | | | 199008 |
| LHAAP-068 | MOBILE STORAGE TANK PARKING AREA | SS | NE | | C | | | | | N | N | | | | 199008 |
| LHAAP-069 | SERVICE STATION UST'S | TU | NE | A | C | | | | C | | N | | | | 199306 |
| LHAAP-070 | LOADING DOCK-MAGAZINE AREA | SS | NE | A | C | C | | | | N | N | | | | 199506 |
| LHAAP-071 | OIL SPILL, BLDG 813 | SS | NE | A | C | C | | | | N | N | | | | 199506 |

## V. SCHEDULE

Various environmental investigations, studies, and reports have been conducted since 1980 to address possible contamination at LHAAP. LHAAP was progressing towards a RCRA permit when the installation was listed on the National Priority List (NPL). An FFA was signed in December 1991, and the RCRA permit was signed in February 1992. A summary of the current project milestones, based on funding availability, for the remedial activities is given below. Approved regulatory schedules which are part of the FFA are included on the following pages to summarize submittal dates for primary and secondary documents. Projected cost estimates and a funding profile for these activities is included in Attachment I.

### A. PAST MILESTONES BY PHASE

| | |
|---|---|
| Interim Remedial Action (Capping LHAAP-18) | 1986 |
| Interim Remedial Action (Soil Removal and Capping LHAAP-24) | 1986 |
| RFA Installation | April 1988 |
| Groundwater Monitoring System installed at LHAAP 18 & 24 | 1989 |
| IRP PA Initiation | May 1992 |
| RI/FS Initiated (Group 1 and other sites) | 1993 |
| IRA 18 & 24 Design Initiated | Oct 1994 |
| SI Initiated (Group 5) | Jan 1995 |
| SI Completed (Group 5) | Jan 1997 |
| RI/FS Completed (Group 3) | Jul 1995 |
| ROD (Group 3, NFA) | Feb 1996 |
| ROD (Early Interim Action, LHAAP 18&24) | Mar 1995 |
| ROD (Interim Action, LHAAP 12&16) | Jul 1995 |

### B. PROJECTED MILESTONES BY PHASE

| | |
|---|---|
| RI Initiated (Group 5) | Jan 1998 |
| RI/FS Completed (Group 1) | Jul 1997 |
| RI/FS Completed (Group 2) | Jan 2000 |
| RI/FS Completed (Group 4) | Jan 2000 |
| ROD (Group 1) | Oct 1997 |
| ROD (Group 2) | Jun 2000 |
| ROD (Group 4) | Dec 2000 |
| IRA Initiated LHAAP 18&24 | Oct 1994 |
| Completed | Jan 1998 |
| IRA Initiated LHAAP 12&16 | Jul 1996 |
| Completed | Sep 1998 |
| IRA 12 & 16 Design initiated | Feb 1995 |
| Group 2 RD/RA Initiated | 2000 |
| Group 4 RD/RA Initiated | 2000 |
| Group 2 and Group 4 RA completed | 2004 |
| IRP Completion (including LTM) | 2034 |

## VI. REMOVAL/INTERIM REMEDIAL ACTION/REMEDIAL ACTION ASSESSMENT

### A. Past REM/IRA/RA/LTM

* LHAAP 18 & 24 - Burning Ground No. 3 and Unlined Evaporation Pond, Long-Term Monitoring (LTM) System installed in 1989.

* LHAAP 18 & 24 - Burning Ground No. 3 and Unlined Evaporation Pond, Interim Remedial Action, Waste Removal and Capping accomplished in 1986.

### B. Current REM/IRA/LTM

* LHAAP 18 & 24 - Burning Ground No. 3 and Unlined Evaporation Pond, Long-Term Monitoring System installed in 1989.

Early Interim Action at Burning Ground No. 3 - Installation of Groundwater Treatment System for organic contamination. Treatment of excavated soil is included. Construction projected for March, 1995. Estimated Cost FY 93 through FY 97 $ 23,433,000.00.

Interim Action at LHAAP 12 & 16, Landfill Caps - Treated soil from Burning Ground will be placed on landfills prior to cap construction. Caps are planned to mitigate groundwater contamination from landfill leachate. Estimated cost FY 95 through FY 98 is $5,500,000.00.

Sump Removal - Waste sumps are being sampled and removed as necessary and disposed in accordance with regulatory standards. Estimated cost FY95 through FY97 is $2,400,000.

### C. Future REM/IRA/LTM Possibilities

Interim Actions can be evaluated for the TNT Pipelines (Group 2).

VII. CONCURRENCE

018481

INSTALLATION ACTION PLAN
LHAAP - FEBRUARY 1997

James A. McPherson

JAMES A. McPHERSON
Commander's Representative
Louisiana and Longhorn Army
Ammunition Plants

MACOM

**ATTACHMENT I**

**Cost Estimates**

**ATTACHMENT I**
**COST ESTIMATES**

An estimate of past, present, and projected funding has been broken down by fiscal year. Each phase is listed below.

| | | |
|---|---|---|
| **PRIOR YEAR FUNDS:** | | |
| FY 80: | Record Search | 50.0K |
| FY 81: | RI/FS | 263.7K |
| FY 87: | RI/FS | 152.2K |
| FY 88: | RI/FS | 223.8K |
| FY 89: | RI/FS | 315.0K |
| FY 90: | RI/FS | 311.9K |
| FY 91: | RI | 687.0K |
| FY 92: | RI | 170.0K |
| FY 93: | RI/FS | 8,090.0K |
| FY 94: | RI/FS | 5,353.6K |
| | RD (LANDFILL CAPS) | 92.9K |
| | RD (BURNING GROUNDS) | 196.0K |
| | IRA (BURNING GROUNDS) | 16,902.6K |
| FY 95: | RI/FS | 2,982.0K |
| | RD | 200.0K |
| | IRA (LANDFILL CAPS, BURNING GROUNDS) | 7,112.9K |
| FY 96: | PA/SI | 24.1K |
| | RI/FS | 2,227.5K |
| | IRA (LANDFILL CAPS, BURNING GROUNDS, SUMPS) | 3,052.2K |
| | TOTAL | 48,407.4K |

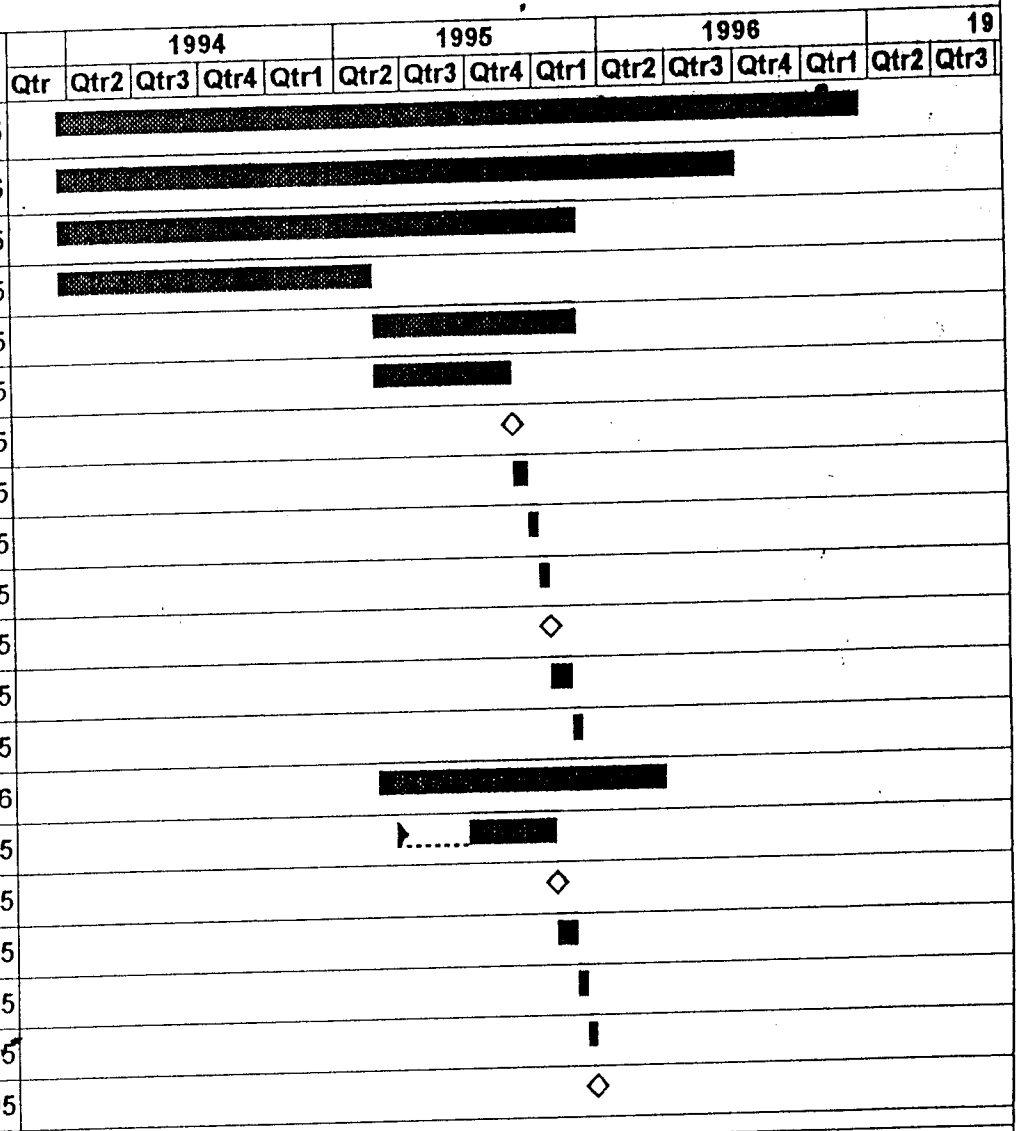
| | |
|---|---|
| **CURRENT YEAR FUNDS: (FY 97)** | |
| PA/SI | 0.0K |
| RI/FS | 1,576.0K |
| RA/IRA (LANDFILLS,BURNING GROUNDS, AND SUMPS) | 1,004.0K |

| | |
|---|---|
| **FUNDS REQUIRED BY FISCAL YEAR TO COMPLETION:** | |
| FY 98: | |
| RI | 6,500.0K |
| IRA | 200.0K |
| O&M | 500.0K |
| FY 99: | |
| RD/RA | 6,685.0K |
| O&M | 400.0K |
| FY 00: | |
| RD/RA | 15,925.0K |
| LTM | 50.0K |
| O&M | 400.0K |
| FY 01: | |
| RD/RA | 13,170.0K |
| LTM | 250.0K |
| O&M | 400.0K |

| | |
|---|---|
| FY 02: | |
| RD/RA | 6,050.0K |
| LTM | 680.0K |
| O&M | 400.0K |
| FY 03: | |
| RD/RA | 110.0K |
| LTM | 680.0K |
| O&M | 400.0K |
| TOTAL FY 98 THROUGH FY 03 | 52,800.0K |

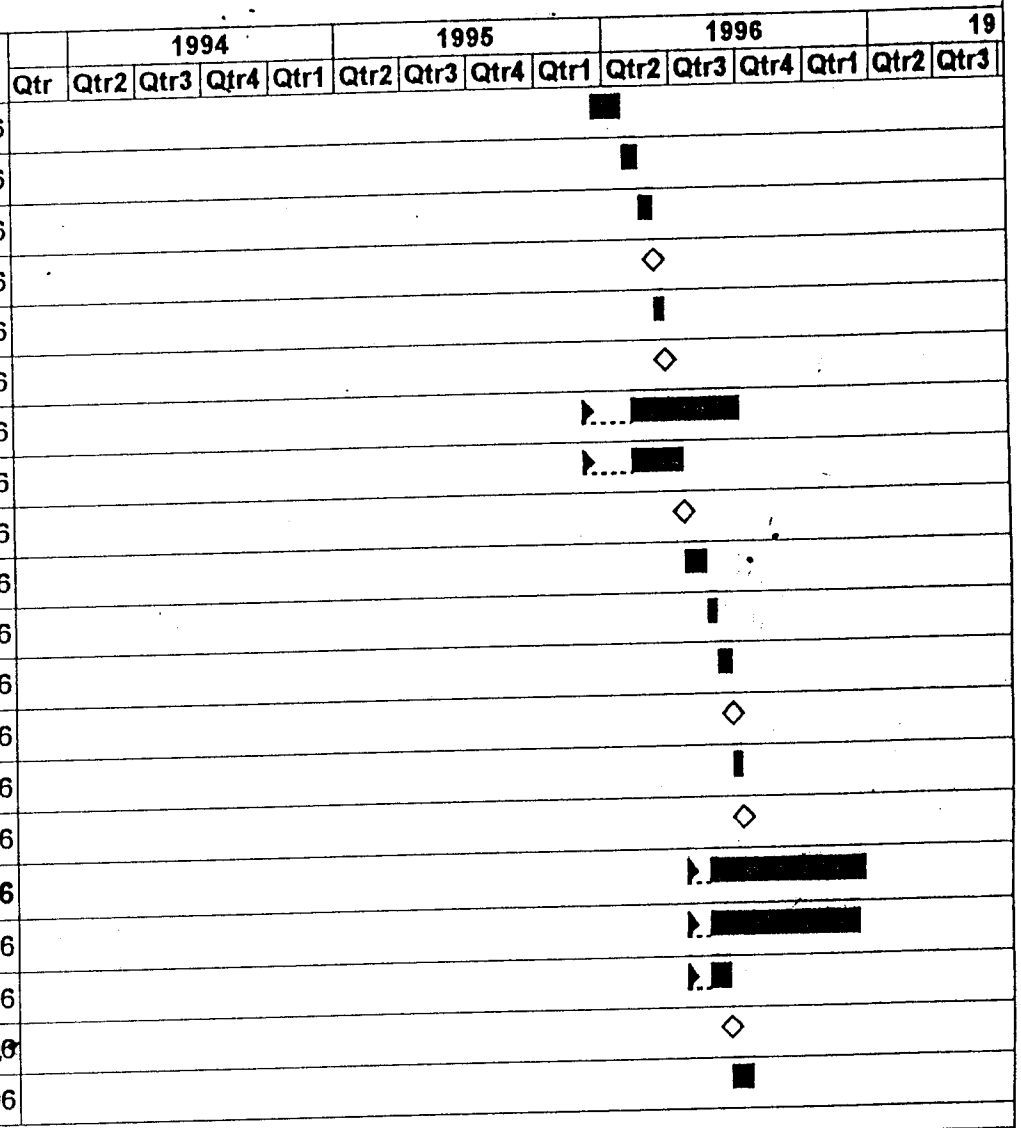
# LHAAP GROUP 1 RI as of 2-27-96

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| LHAAP GROUP 1 | 1100d | 12/16/93 | 12/19/96 |
| ASSESSMENT | 931d | 12/16/93 | 07/03/96 |
| REMEDIAL INVESTIGATION | 714d | 12/16/93 | 11/29/95 |
| INVESTIGATION/ANALYSIS | 431d | 12/16/93 | 02/19/95 |
| SITE CHARAC. SUMMARY | 281d | 02/20/95 | 11/27/95 |
| PREP DFT SCS | 190d | 02/20/95 | 08/28/95 |
| SUBMIT DFT SCS | 0d | 08/28/95 | 08/28/95 |
| ARMY REVIEW | 21d | 08/29/95 | 09/18/95 |
| COMMENT RESOLUTION | 14d | 09/19/95 | 10/02/95 |
| PREP DF SCS | 14d | 10/03/95 | 10/16/95 |
| SUBMIT DF SCS | 0d | 10/16/95 | 10/16/95 |
| AGENCY REVIEW | 30d | 10/17/95 | 11/15/95 |
| COMMENT RESOLUTION | 14d | 11/16/95 | 11/29/95 |
| RISK ASSESSMENT | 397d | 02/20/95 | 03/22/96 |
| PREP DFT RSK ASS | 120d | 06/24/95 | 10/21/95 |
| SUBMIT DFT RA | 0d | 10/21/95 | 10/21/95 |
| ARMY REVIEW | 30d | 10/22/95 | 11/20/95 |
| COMMENT RESOL. | 14d | 11/21/95 | 12/04/95 |
| PREP DF RA | 12d | 12/05/95 | 12/16/95 |
| SUBMIT DF RA | 0d | 12/16/95 | 12/16/95 |



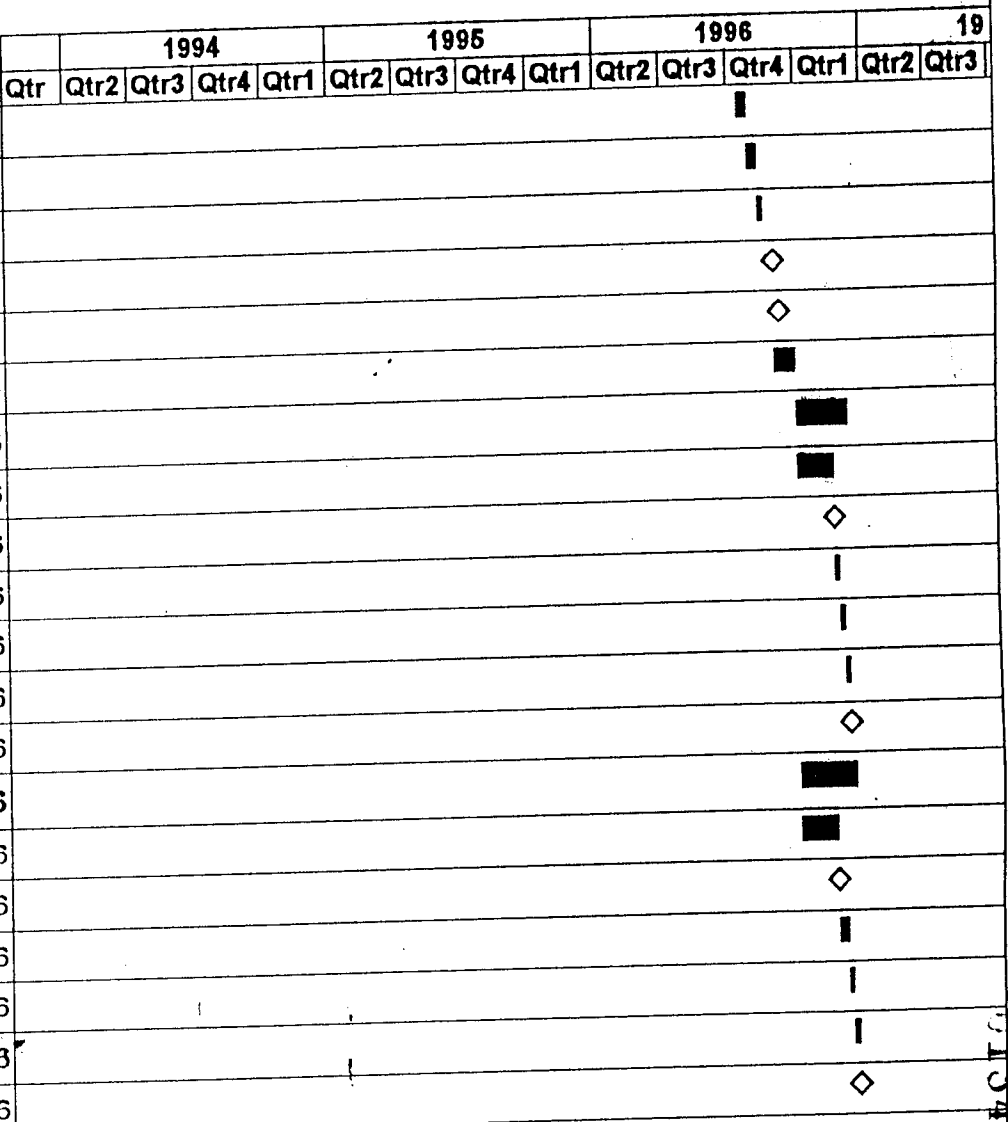
# LHAAP GROUP 1 RI as of 2-27-96

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| AGENCY REVIEW | 41d | 12/17/95 | 01/26/96 |
| COMMENT RESOLUTION | 21d | 01/27/96 | 02/16/96 |
| PREP FIN RA | 21d | 02/17/96 | 03/08/96 |
| SUBMIT FIN RA | 0d | 03/08/96 | 03/08/96 |
| ACCEPTANCE REV | 14d | 03/09/96 | 03/22/96 |
| RA FINAL | 0d | 03/22/96 | 03/22/96 |
| RI REPORT | 150d | 02/05/96 | 07/03/96 |
| PREP DFT RI RPT | 71d | 02/05/96 | 04/15/96 |
| SUBMIT DF RI RPT | 0d | 04/15/96 | 04/15/96 |
| AGENCY REVIEW | 30d | 04/16/96 | 05/15/96 |
| COMMENT RESOLUTION | 14d | 05/16/96 | 05/29/96 |
| PREP FIN RI RPT | 21d | 05/30/96 | 06/19/96 |
| SUBMIT FIN RI RPT | 0d | 06/19/96 | 06/19/96 |
| ACCEPTANCE REVIEW | 14d | 06/20/96 | 07/03/96 |
| RI REPORT FINAL | 0d | 07/03/96 | 07/03/96 |
| **PROPOSED PLAN AND ROD** | **217d** | **05/17/96** | **12/19/96** |
| PROPOSED PLAN | 210d | 05/17/96 | 12/12/96 |
| Prepare Drft Proposed Plan | 30d | 05/17/96 | 06/15/96 |
| Submit Draft Proposed Plan | 0d | 06/15/96 | 06/15/96 |
| Combined Review of Prop Plan | 30d | 06/16/96 | 07/15/96 |



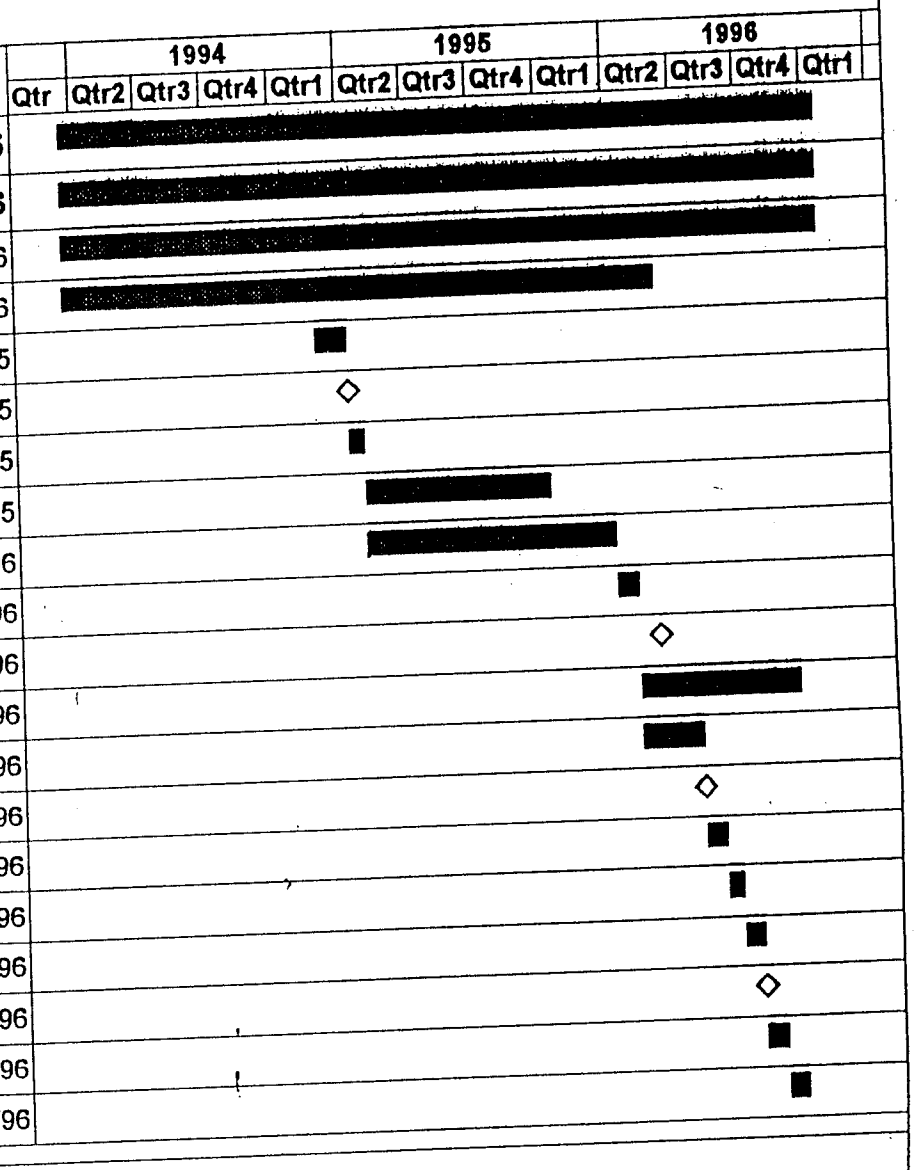
# LHAAP GROUP 1 RI as of 2-27-96

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| Comment Resolution | 14d | 07/16/96 | 07/29/96 |
| Prepare Final Proposed Plan | 14d | 07/30/96 | 08/12/96 |
| Acceptance Review of Prop Plan | 7d | 08/13/96 | 08/19/96 |
| Submit Prop Plan to Public | 0d | 09/01/96 | 09/01/96 |
| Public Meeting | 0d | 09/08/96 | 09/08/96 |
| Public Comment Period | 30d | 09/02/96 | 10/01/96 |
| **Responsiveness Summary** | **72d** | **10/02/96** | **12/12/96** |
| Prepare Draft Resp. Summary | 51d | 10/02/96 | 11/21/96 |
| Submit Draft Resp. Summary | 0d | 11/21/96 | 11/21/96 |
| Combined Review of Resp. Sum | 7d | 11/22/96 | 11/28/96 |
| Comment Resolution | 7d | 11/29/96 | 12/05/96 |
| Prepare Final Resp. Summary | 7d | 12/06/96 | 12/12/96 |
| Resp. Summary Finalized | 0d | 12/12/96 | 12/12/96 |
| **RECORD OF DECISION** | **79d** | **10/02/96** | **12/19/96** |
| Prepare Draft ROD | 51d | 10/02/96 | 11/21/96 |
| Submit Draft ROD | 0d | 11/21/96 | 11/21/96 |
| Combined Review of ROD | 14d | 11/22/96 | 12/05/96 |
| Comment Resolution | 7d | 12/06/96 | 12/12/96 |
| Prepare Final ROD | 7d | 12/13/96 | 12/19/96 |
| Submit Final ROD to EPA | 0d | 12/19/96 | 12/19/96 |



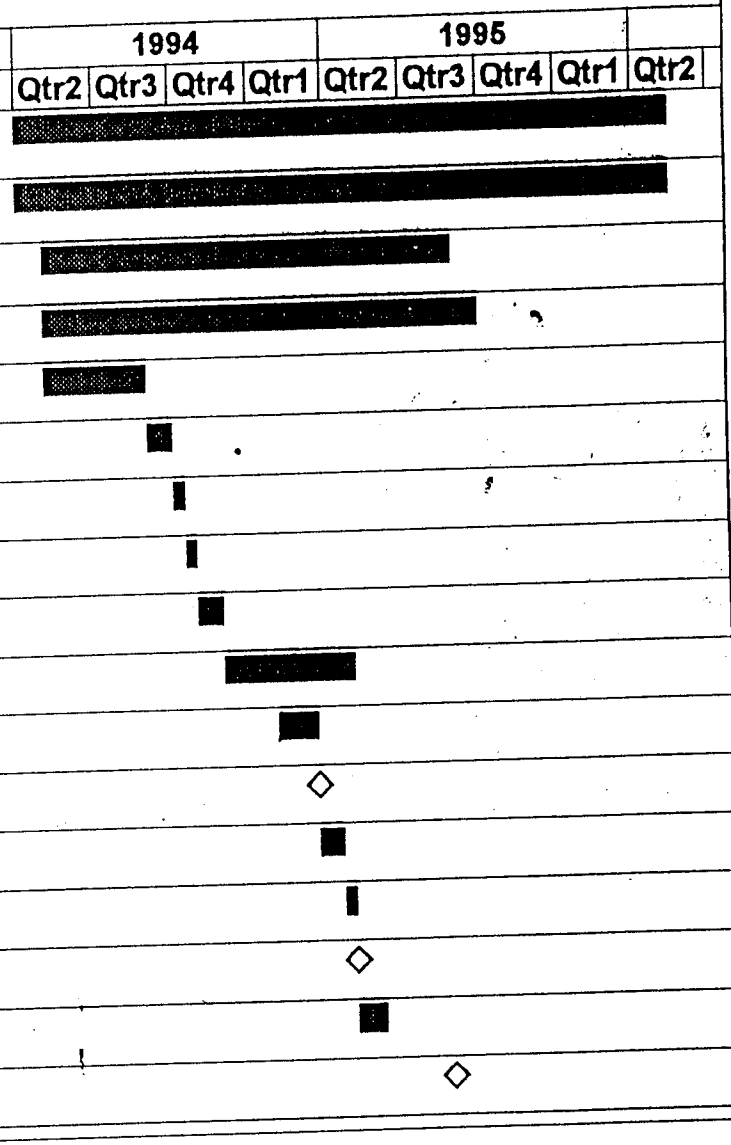
# LHAAP GROUP 2 RI as of 2-27-96

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| **LHAAP GROUP 2** | **1039d** | **12/16/93** | **10/19/96** |
| **ASSESSMENT** | **1039d** | **12/16/93** | **10/19/96** |
| REMEDIAL INVESTIGATION | 1039d | 12/16/93 | 10/19/96 |
| INVESTIGATION/ANALYSIS | 813d | 12/16/93 | 03/07/96 |
| PHASE II WP COM RESOLN | 45d | 11/27/94 | 01/10/95 |
| PHASE II WP APPROVAL | 0d | 01/10/95 | 01/10/95 |
| PHASE II FIELDWORK MOB | 20d | 01/11/95 | 01/30/95 |
| PHASE II FIELDWORK | 255d | 01/31/95 | 10/12/95 |
| PHASE II SAMPLE ANALYSIS | 340d | 02/03/95 | 01/08/96 |
| REVIEW/SUMMARIZE DATA | 30d | 01/09/96 | 02/07/96 |
| SUBMIT DATA RPT AGENCIES | 0d | 03/07/96 | 03/07/96 |
| PHASE II FIELD SUMMARY REPT | 221d | 02/08/96 | 09/15/96 |
| PREP DFT FSR | 84d | 02/08/96 | 05/01/96 |
| SUBMIT DFT FSR | 0d | 05/01/96 | 05/01/96 |
| ARMY REVIEW | 30d | 05/02/96 | 05/31/96 |
| COMMENT RESOLUTION | 21d | 06/01/96 | 06/21/96 |
| PREP DFT FIN FSR | 28d | 06/22/96 | 07/19/96 |
| SUBMIT DF FSR | 0d | 07/19/96 | 07/19/96 |
| AGENCY REVIEW | 30d | 07/20/96 | 08/18/96 |
| COMMENT RESOLUTION | 28d | 08/19/96 | 09/15/96 |



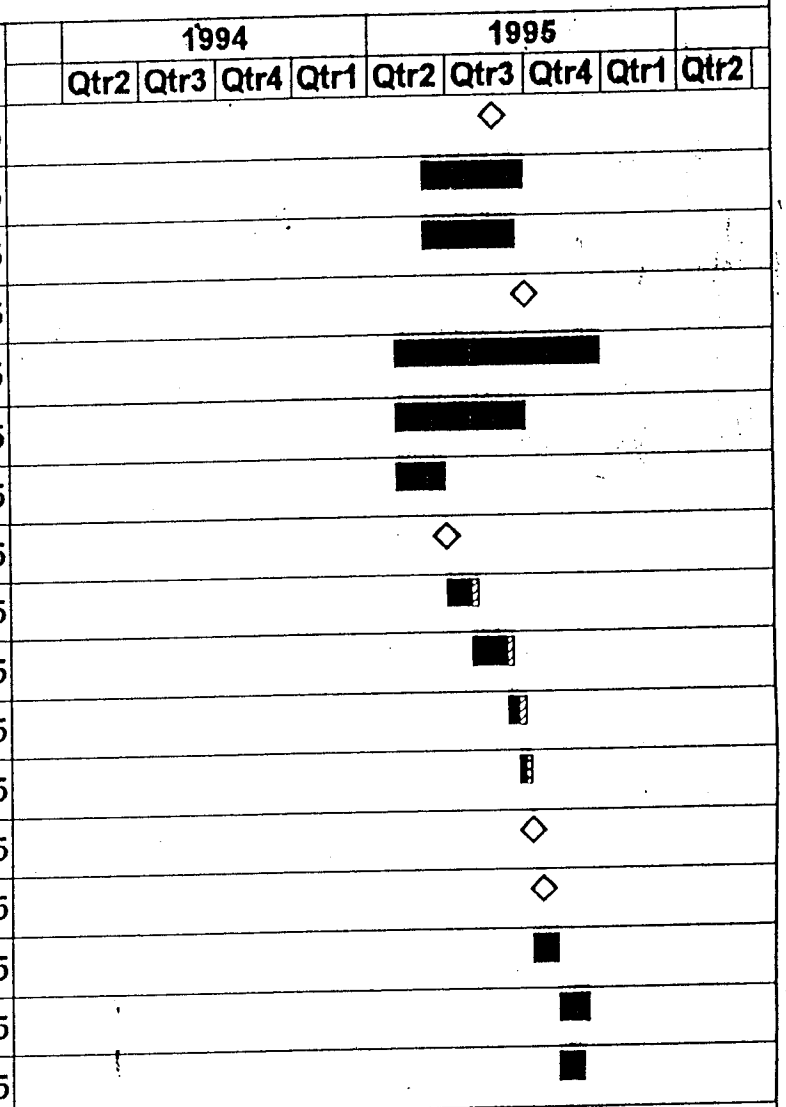
# LHAAP Group 3 as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| LHAAP GROUP 3 | 775d | 01/01/94 | 02/14/96 |
| ASSESSMENT | 775d | 01/01/94 | 02/14/96 |
| RI/FS | 484d | 02/01/94 | 05/30/95 |
| RI/FS REPORT | 514d | 02/01/94 | 06/29/95 |
| Pre Draft RI Report | 120d | 02/01/94 | 05/31/94 |
| Army Review Draft RI Report | 30d | 06/01/94 | 06/30/94 |
| Comment Resolution | 14d | 07/01/94 | 07/14/94 |
| Pre Draft Final RI Report | 14d | 07/15/94 | 07/28/94 |
| Reg Review Draft Final RI Rpt | 30d | 07/29/94 | 08/27/94 |
| Comment Resolution | 156d | 08/28/94 | 01/30/95 |
| Prep. "Final" RI/FS w Rsk Assm | 47d | 10/31/94 | 12/16/94 |
| Submit"Final"RI/FS Rpt to Army | 0d | 12/16/94 | 12/16/94 |
| Army Review "Final" RI/FS Rpt | 30d | 12/17/94 | 01/15/95 |
| Comment Resolution/Revision | 14d | 01/16/95 | 01/29/95 |
| Submit "Final" RI/FS Rp to Reg | 0d | 01/29/95 | 01/29/95 |
| Reg Review "Final" RI/FS Rpt | 33d | 01/30/95 | 03/03/95 |
| GW BG REPORT FINAL | 0d | 05/24/95 | 05/24/95 |



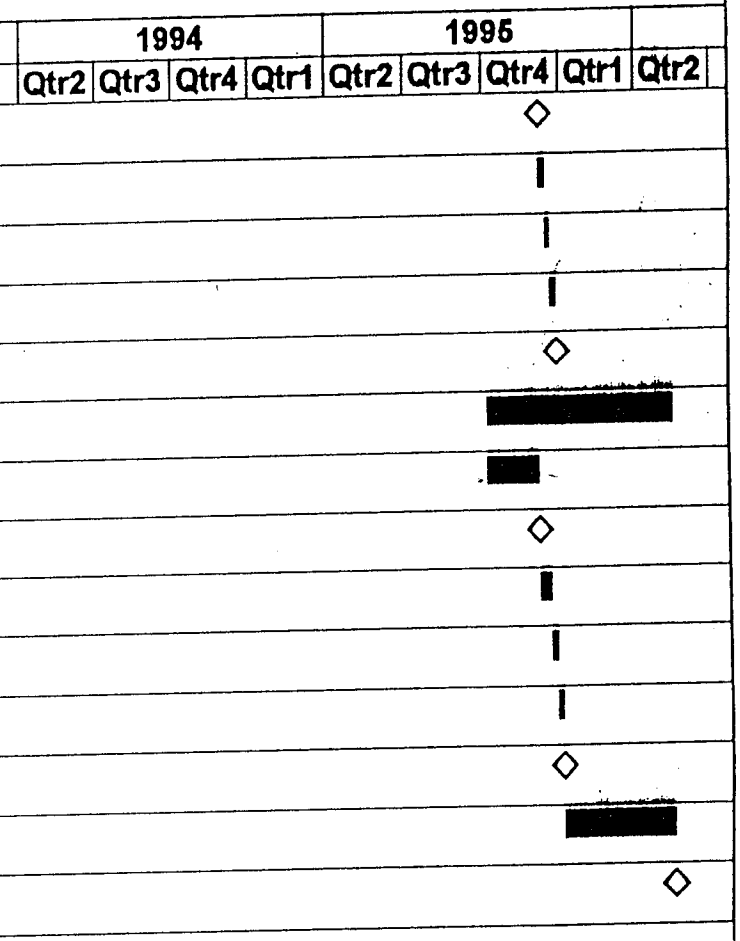
# LHAAP Group 3 as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| SOIL BG REPORT FINAL | 0d | 05/26/95 | 05/26/95 |
| Comment Resolution/Revision | 118d | 03/04/95 | 06/29/95 |
| Comment Annotations | 109d | 03/04/95 | 06/20/95 |
| RI/FS Report Approved | 0d | 06/29/95 | 06/29/95 |
| PROPOSED PLAN AND ROD | 241d | 01/30/95 | 09/27/95 |
| PROPOSED PLAN | 153d | 01/30/95 | 07/01/95 |
| Prepare Drft Proposed Plan | 58d | 01/30/95 | 03/28/95 |
| Submit Draft Proposed Plan | 0d | 03/28/95 | 03/28/95 |
| Combined Review Draft Prp Plan | 30d | 03/29/95 | 04/27/95 |
| Comment Resolution | 41d | 04/28/95 | 06/07/95 |
| Prepare Final Proposed Plan | 14d | 06/08/95 | 06/21/95 |
| Acceptance Review of Prop Plan | 7d | 06/22/95 | 06/28/95 |
| Submit Prop Plan to Public | 0d | 07/06/95 | 07/06/95 |
| Public Meeting | 0d | 07/18/95 | 07/18/95 |
| Public Comment Period | 30d | 07/07/95 | 08/05/95 |
| RESPONSIVENESS SUMMARY | 37d | 08/08/95 | 09/11/95 |
| Prepare Draft Resp. Summary | 32d | 08/06/95 | 09/06/95 |



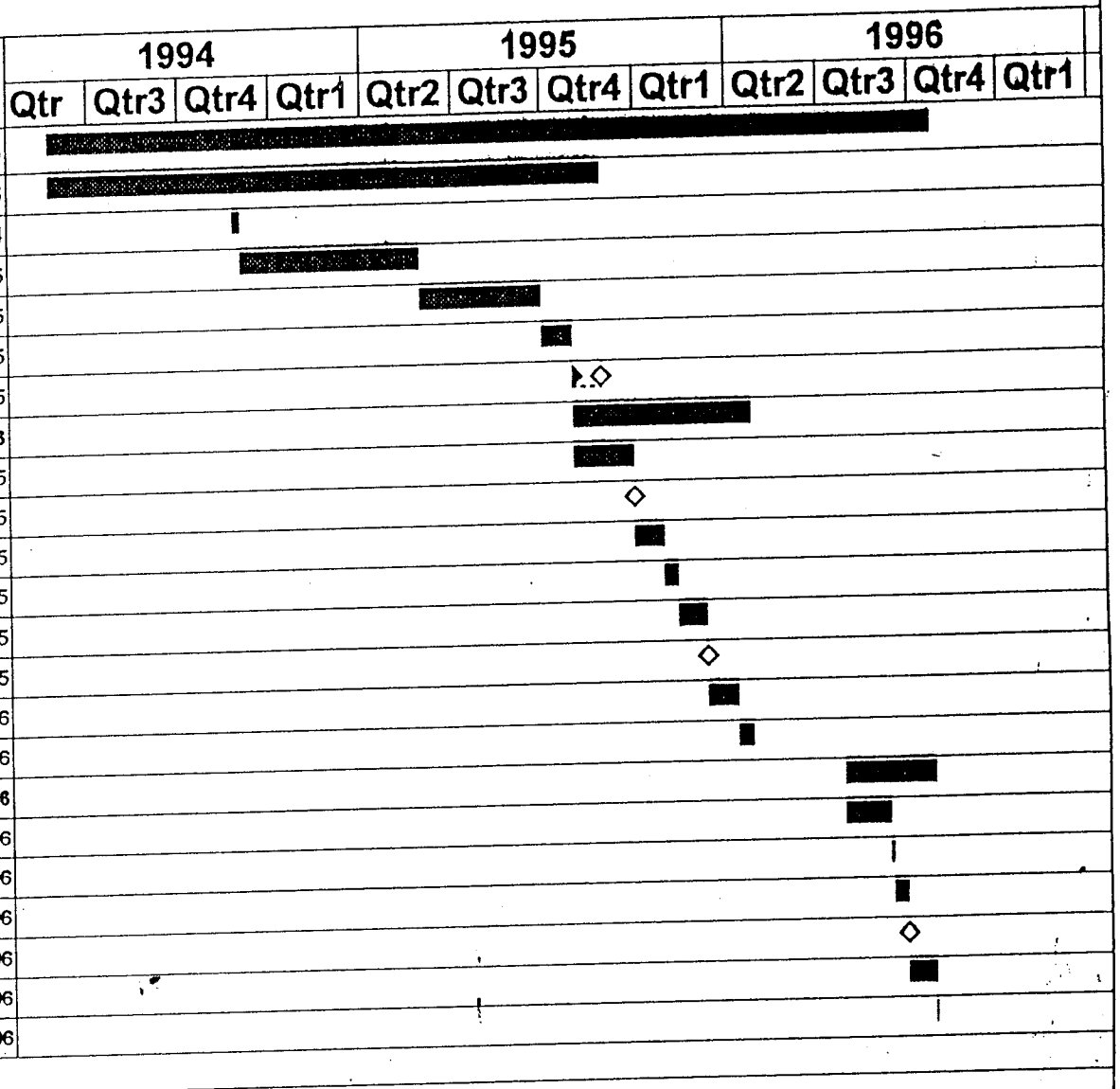
# LHAAP Group 3 as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| Submit Draft Resp. Summary | 0d | 09/06/95 | 09/06/95 |
| Combined Review of Resp. Summ. | 7d | 09/07/95 | 09/13/95 |
| Comment Resolution | 7d | 09/14/95 | 09/20/95 |
| Prepare Final Resp. Summary | 7d | 09/21/95 | 09/27/95 |
| Resp. Summary Finalized | 0d | 09/27/95 | 09/27/95 |
| RECORD OF DECISION | 223d | 07/07/95 | 02/14/96 |
| Prepare Draft ROD | 62d | 07/07/95 | 09/06/95 |
| Submit Draft ROD | 0d | 09/06/95 | 09/06/95 |
| Combined Review of ROD | 14d | 09/07/95 | 09/20/95 |
| Comment Resolution | 7d | 09/21/95 | 09/27/95 |
| Prepare Final ROD | 7d | 09/28/95 | 10/04/95 |
| Submit ROD for Signatures | 0d | 10/04/95 | 10/04/95 |
| Obtain ROD Signatures | 133d | 10/05/95 | 02/14/96 |
| ROD Final | 0d | 02/14/96 | 02/14/96 |



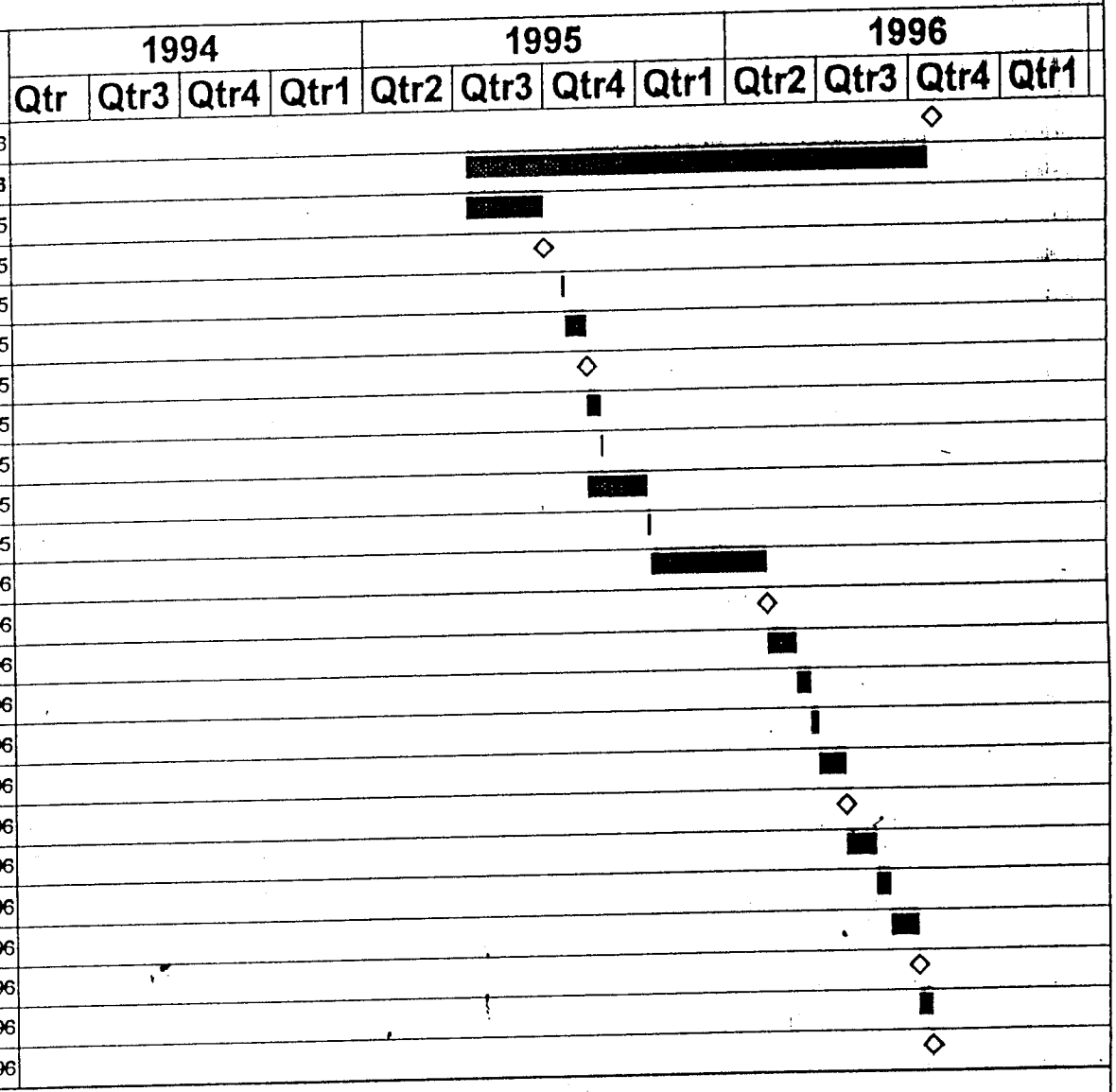
# LHAAP GROUP 4 SUMPS as of 2-27-96

| Task Name | Dura | Sched St | Sched Fi |
|---|---|---|---|
| **GROUP 4 SUMPS RI** | **884d** | **02/22/94** | **07/24/96** |
| **PH II INVESTIG/ANALYSIS** | **553d** | **02/22/94** | **08/28/95** |
| MOBILIZATION | 7d | 08/25/94 | 08/31/94 |
| FIELDWORK | 180d | 09/01/94 | 02/27/95 |
| SAMPLE ANALY | 123d | 02/28/95 | 06/30/95 |
| SUMM PH II DATA | 30d | 07/01/95 | 07/30/95 |
| SUBMIT DATA RPT AGENCIES | 0d | 08/28/95 | 08/28/95 |
| **PHASE II FIELD SUMMARY Rpt** | **176d** | **07/31/95** | **01/22/96** |
| PREP DFT FSR | 60d | 07/31/95 | 09/28/95 |
| SUBMIT DFT FSR | 0d | 09/28/95 | 09/28/95 |
| ARMY REVIEW | 30d | 09/29/95 | 10/28/95 |
| COMMENT RESOLUTION | 14d | 10/29/95 | 11/11/95 |
| PREP DFT FIN FSR | 28d | 11/12/95 | 12/09/95 |
| SUBMIT DF FSR | 0d | 12/09/95 | 12/09/95 |
| AGENCY REVIEW | 30d | 12/10/95 | 01/08/96 |
| COMMENT RESOLUTION | 14d | 01/09/96 | 01/22/96 |
| **FUTURE SCOPE DEVELOPMENT** | **91d** | **04/25/96** | **07/24/96** |
| REV DATA/DEVLP RECOMM. | 45d | 04/25/96 | 06/08/96 |
| SCOPE DVLPMT MTG | 3d | 06/09/96 | 06/11/96 |
| PREP WRITTEN SCOPE DOC | 14d | 06/12/96 | 06/25/96 |
| SUBMIT SCOPE DOC (COMBINE | 0d | 06/25/96 | 06/25/96 |
| CONCURRENCE REVIEW | 28d | 06/26/96 | 07/23/96 |
| RECOMMENDATION APPROVAL | 1d | 07/24/96 | 07/24/96 |



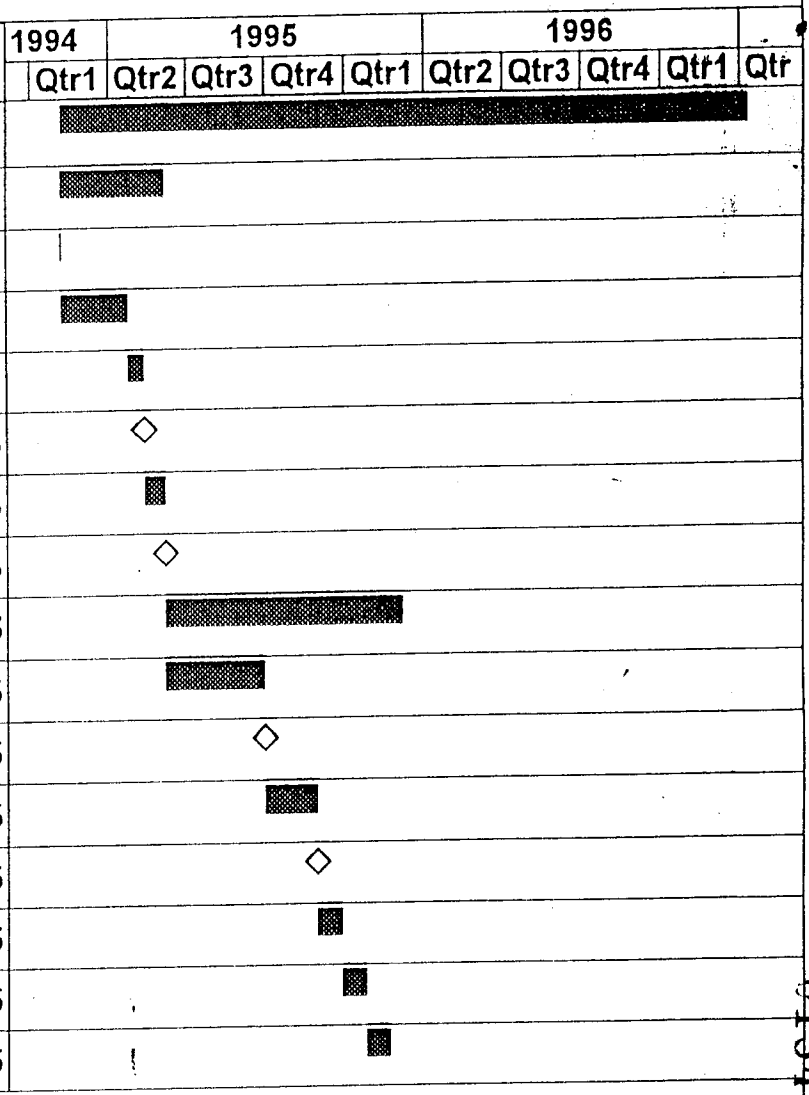
# LHAAP GROUP 4 SUMPS as of 2-27-96

| Task Name | Dura | Sched St | Sched Fi |
|---|---|---|---|
| INITIATE NEXT PROJECT PHAS | 0d | 07/24/96 | 07/24/96 |
| RISK ASSESSMENT WP | 483d | 04/14/95 | 07/19/96 |
| CONTRACT ACTIONS | 78d | 04/14/95 | 06/30/95 |
| AWARD CONTRACT | 0d | 06/30/95 | 06/30/95 |
| LHAAP TEAM CONCEPT MTG | 3d | 07/18/95 | 07/20/95 |
| PREP WRITTEN CONCEPT DOC | 21d | 07/21/95 | 08/10/95 |
| SUBMIT CONCEPT DOC (COMBI | 0d | 08/10/95 | 08/10/95 |
| CONCURRENCE REVIEW | 14d | 08/11/95 | 08/24/95 |
| APPROVE WP CONCEPT | 1d | 08/25/95 | 08/25/95 |
| SUMMARIZE DATA | 60d | 08/11/95 | 10/09/95 |
| LHAAP TEAM SCOPE MTG | 3d | 10/10/95 | 10/12/95 |
| PREPARE DFT RSK ASS WP | 116d | 10/13/95 | 02/05/96 |
| SUBMIT DFT TO ARMY | 0d | 02/05/96 | 02/05/96 |
| ARMY REVIEW | 30d | 02/06/96 | 03/06/96 |
| PREP COMM RESPONSES | 14d | 03/07/96 | 03/20/96 |
| RESOLVE COMMENTS | 7d | 03/21/96 | 03/27/96 |
| PREP FIN DFT RSK ASS WP | 28d | 03/28/96 | 04/24/96 |
| SUBMIT FDFT TO AGENCIES | 0d | 04/24/96 | 04/24/96 |
| AGENCY REVIEW | 30d | 04/25/96 | 05/24/96 |
| COMMENT RESOLUTION | 14d | 05/25/96 | 06/07/96 |
| PREP FINAL RISK ASS WP | 28d | 06/08/96 | 07/05/96 |
| SUBMIT FINAL | 0d | 07/05/96 | 07/05/96 |
| CONCURRENCE REVIEW | 14d | 07/06/96 | 07/19/96 |
| WP APPROVED | 0d | 07/19/96 | 07/19/96 |



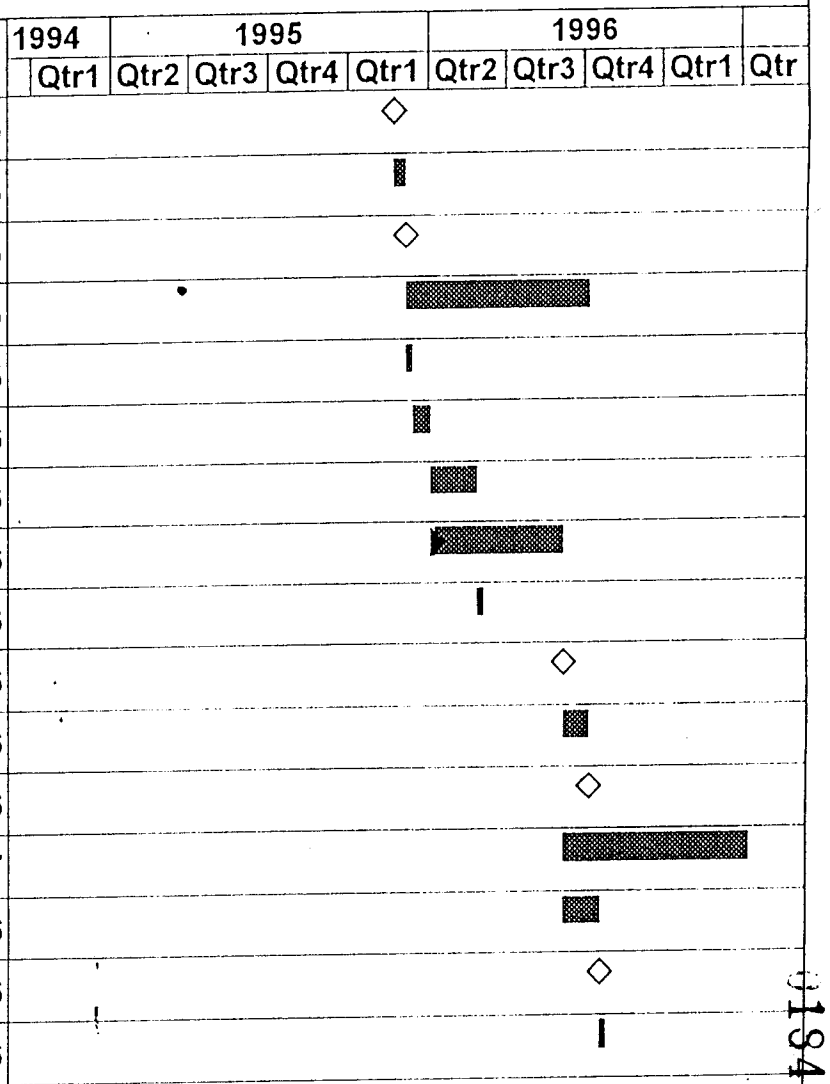
# LHAAP Group 5 as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| **GROUP 5 SITE INV** | **796d** | **11/07/94** | **01/10/97** |
| **SCOPE DEFINITION** | **120d** | **11/07/94** | **03/06/95** |
| SCOPING MEETING | 1d | 11/07/94 | 11/07/94 |
| SITE VISITS/RESEARCH | 77d | 11/08/94 | 01/23/95 |
| PREP DFT SCOPE DOC | 18d | 01/24/95 | 02/10/95 |
| SUBMIT DFT SCP DOC | 0d | 02/10/95 | 02/10/95 |
| SCOPE REV/AGREEMENT | 24d | 02/11/95 | 03/06/95 |
| SCOPE FINAL | 0d | 03/06/95 | 03/06/95 |
| **WORKPLAN** | **275d** | **03/07/95** | **12/06/95** |
| CONTRACT ACT | 116d | 03/07/95 | 06/30/95 |
| AWARD CONTRACT | 0d | 06/30/95 | 06/30/95 |
| PREP DFT WP | 59d | 07/01/95 | 08/28/95 |
| SUBMIT DFT WP | 0d | 08/28/95 | 08/28/95 |
| COMBIN REV DFT WP | 30d | 08/29/95 | 09/27/95 |
| COMMENT RESOLUTION | 28d | 09/28/95 | 10/25/95 |
| PREP FIN WP | 28d | 10/26/95 | 11/22/95 |



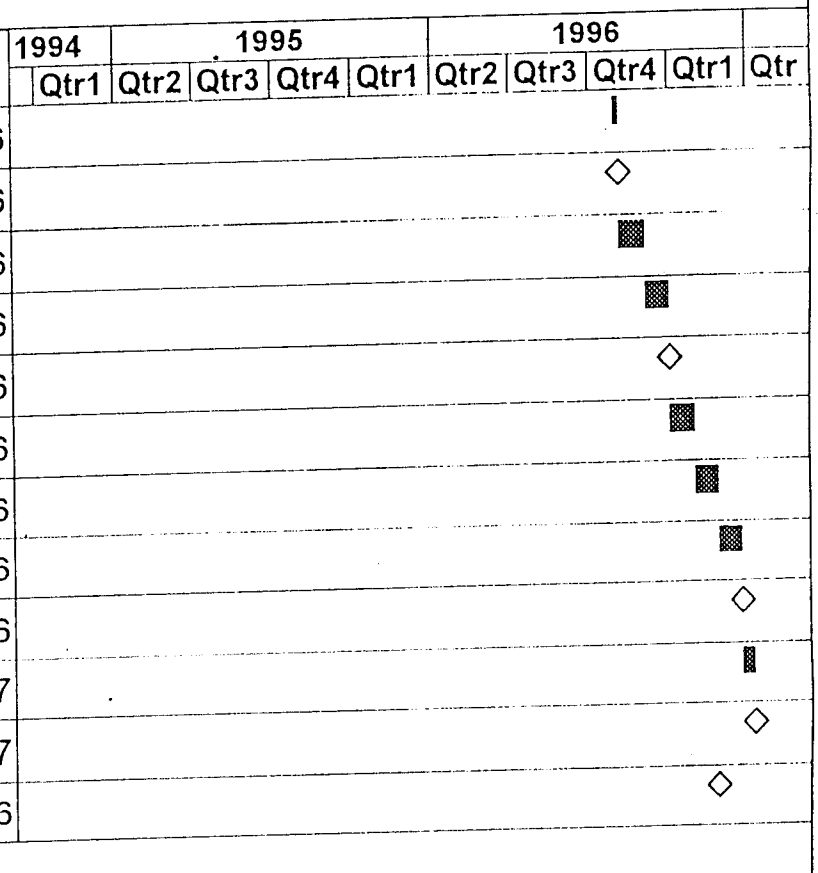
# LHAAP Group 5 as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| SUBMIT FIN WP | 0d | 11/22/95 | 11/22/95 |
| ACCEPTANCE REV | 14d | 11/23/95 | 12/06/95 |
| WP FINAL | 0d | 12/06/95 | 12/06/95 |
| **SITE INVEST FW/ANAL** | **214d** | **12/07/95** | **07/07/96** |
| MOBILIZE | 7d | 12/07/95 | 12/13/95 |
| UXO CLEARANCE | 21d | 12/14/95 | 01/03/96 |
| FIELD INV | 56d | 01/04/96 | 02/28/96 |
| ANAL/VALIDATION | 151d | 01/09/96 | 06/07/96 |
| DEMOBILIZE | 7d | 02/29/96 | 03/06/96 |
| SUBMIT VAL RPT | 0d | 06/07/96 | 06/07/96 |
| COE QA REVIEW | 30d | 06/08/96 | 07/07/96 |
| SUBMIT DATA REPORT TO AGE | 0d | 07/07/96 | 07/07/96 |
| **SITE INV REPORT** | **217d** | **06/08/96** | **01/10/97** |
| PREP PRLM SI RPT | 45d | 06/08/96 | 07/22/96 |
| SUBMIT PRLM SI RPT | 0d | 07/22/96 | 07/22/96 |
| COE REV SI RPT | 7d | 07/23/96 | 07/29/96 |



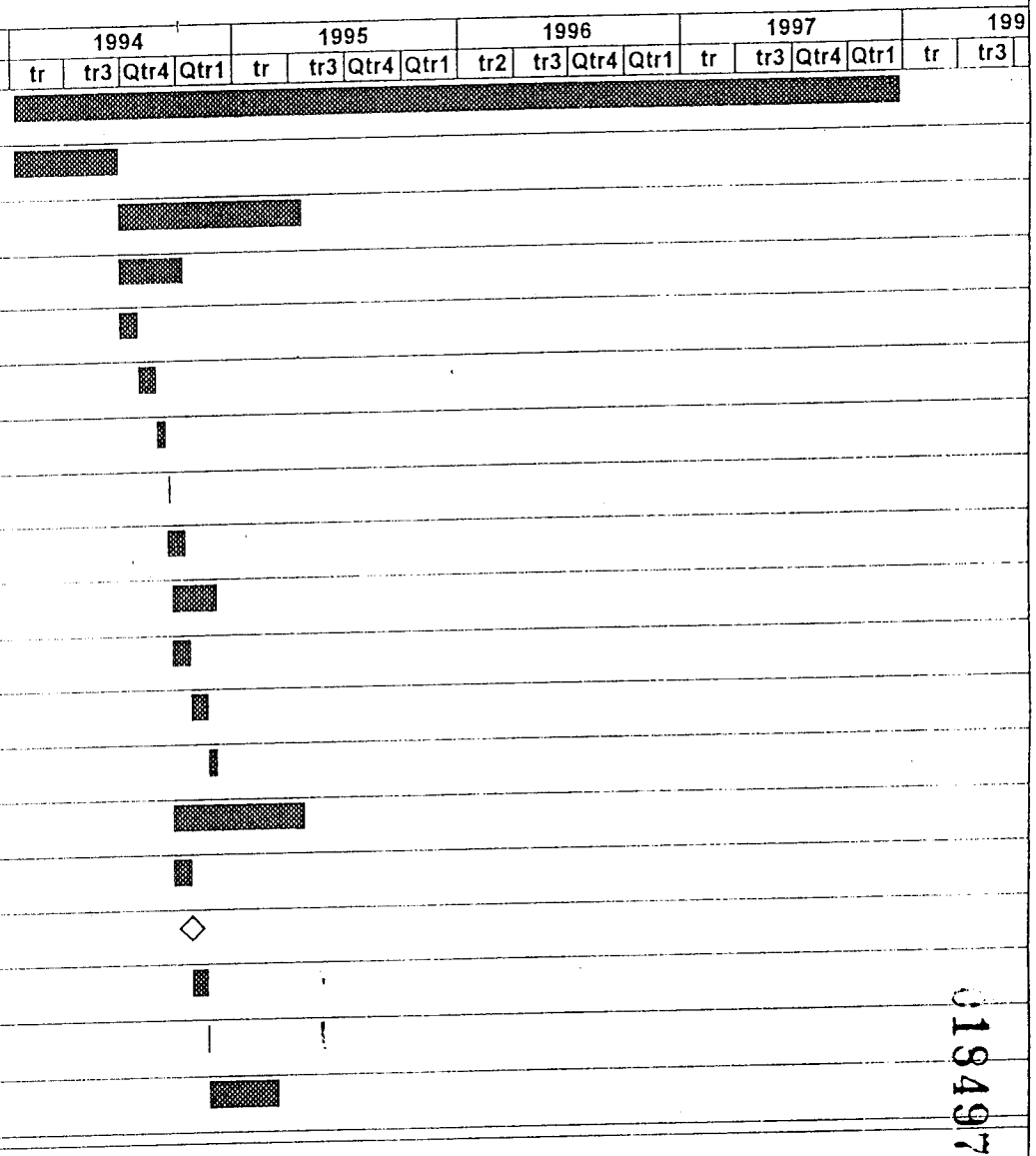
# LHAAP Group 5 as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| PREP DFT SI RPT | 7d | 07/30/96 | 08/05/96 |
| SUBMIT DFT SI RPT | 0d | 08/05/96 | 08/05/96 |
| ARMY REV DFT SI RPT | 30d | 08/06/96 | 09/04/96 |
| PREP DF SI RPT | 28d | 09/05/96 | 10/02/96 |
| SUBMIT DF SI RPT | 0d | 10/02/96 | 10/02/96 |
| AGENCY REV DF SI RPT | 30d | 10/03/96 | 11/01/96 |
| COMMENT RESOLUTION | 28d | 11/02/96 | 11/29/96 |
| PREP FIN SI RPT | 28d | 11/30/96 | 12/27/96 |
| SUBMIT FIN SI RPT | 0d | 12/27/96 | 12/27/96 |
| ACCEPTANCE REV | 14d | 12/28/96 | 01/10/97 |
| SI RPT FINAL | 0d | 01/10/97 | 01/10/97 |
| SCOPE NEXT PROJ PHASE OR | 0d | 11/29/96 | 11/29/96 |



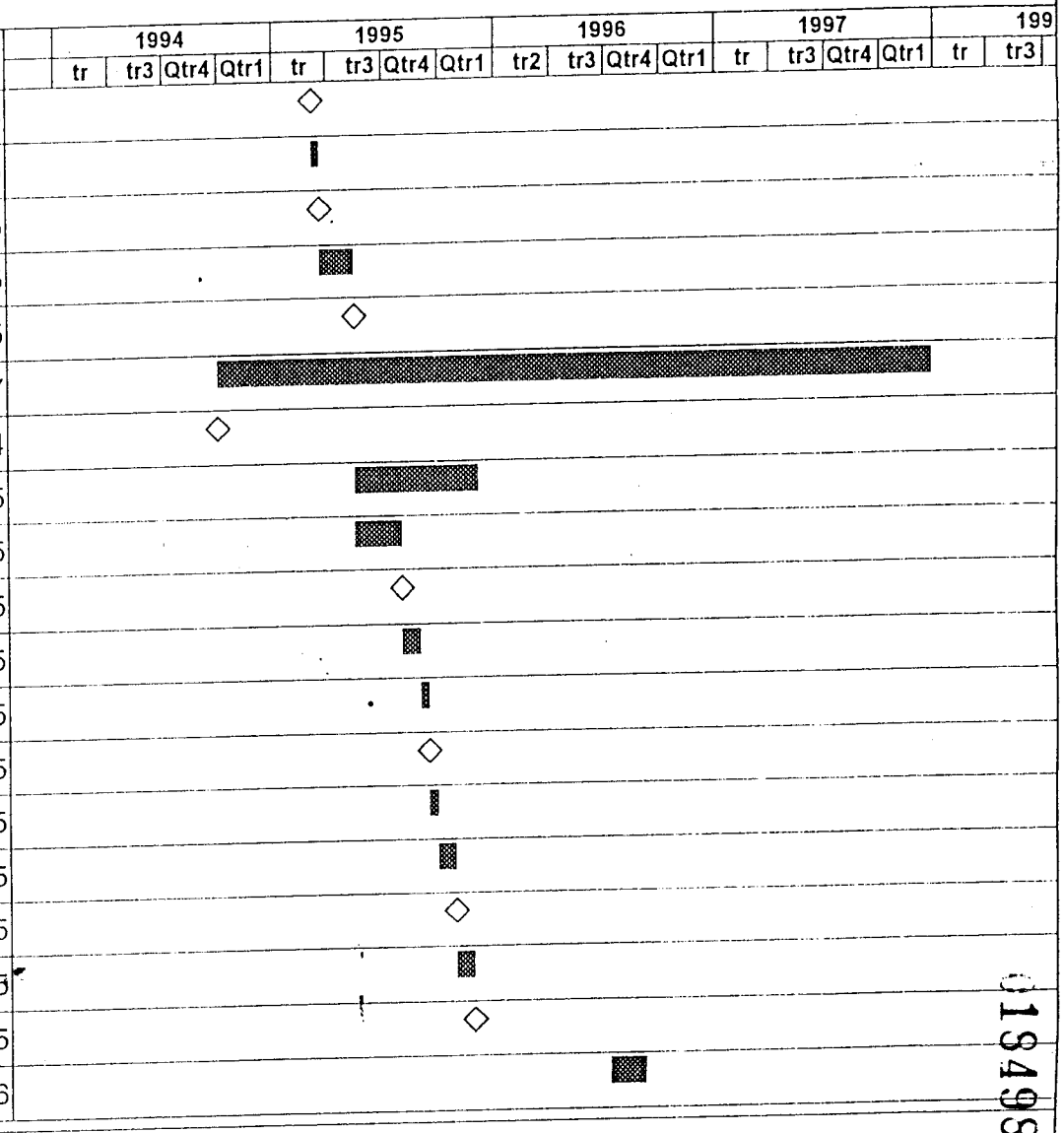
# LHAAP BG No. 3 IRA as of 2-27-95

| Task.Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| IRA AT 18 & 24 | 1450d | 01/09/94 | 12/28/97 |
| INVESTIGATION/ANALYSIS | 171d | 01/09/94 | 06/28/94 |
| IRA PROP PLAN AND ROD | 298d | 06/28/94 | 04/21/95 |
| PROPOSED PLAN | 105d | 06/28/94 | 10/10/94 |
| PREPARE DRAFT PP | 30d | 06/28/94 | 07/27/94 |
| REVIEW DRAFT PP | 30d | 07/28/94 | 08/26/94 |
| COMMENT RES/FINAL PP | 14d | 08/27/94 | 09/09/94 |
| PUBLIC MEETING | 1d | 09/15/94 | 09/15/94 |
| PUBLIC COMMENT PERIOD | 30d | 09/11/94 | 10/10/94 |
| RESPONSIVENESS SUMMARY | 74d | 09/18/94 | 11/30/94 |
| PREPARE DRAFT RESP SUM | 30d | 09/18/94 | 10/17/94 |
| REVIEW DRAFT RS | 30d | 10/18/94 | 11/16/94 |
| COMMENT RES/FINAL RS | 14d | 11/17/94 | 11/30/94 |
| RECORD OF DECISION | 215d | 09/18/94 | 04/20/95 |
| PREPARE DRAFT ROD | 30d | 09/18/94 | 10/17/94 |
| SUBMIT DRAFT ROD | 0d | 10/18/94 | 10/18/94 |
| REVIEW DRAFT ROD | 27d | 10/19/94 | 11/14/94 |
| COMMENT RESOLUTION MEETI | 1d | 11/15/94 | 11/15/94 |
| PREP FINAL ROD | 112d | 11/16/94 | 03/07/95 |



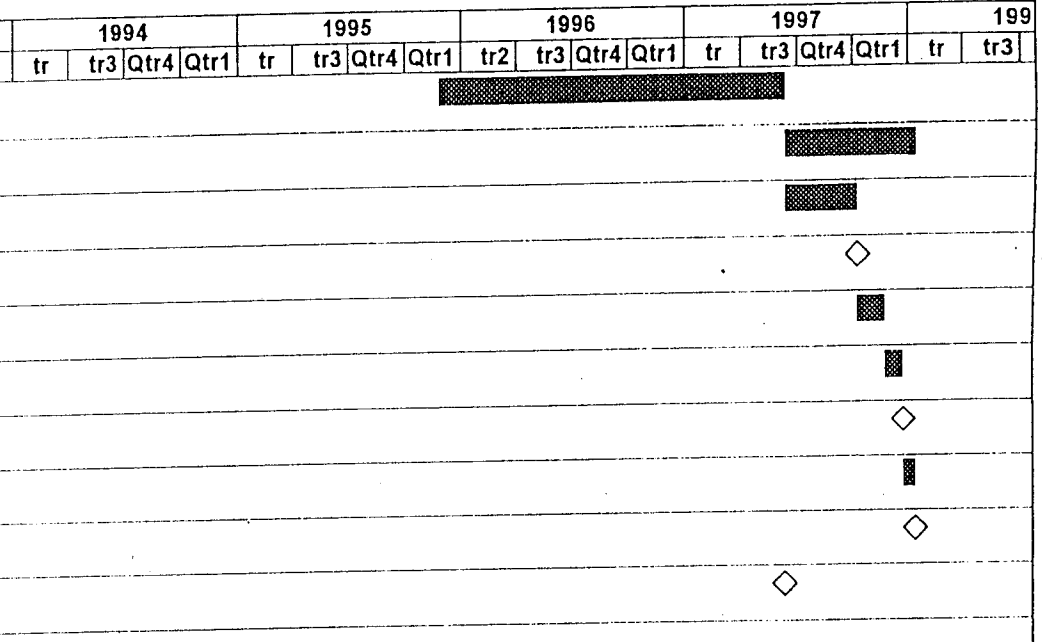
# LHAAP BG No. 3 IRA as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| SUBMIT FINAL ROD | 0d | 03/07/95 | 03/07/95 |
| ACCEPTANCE REVIEW | 14d | 03/08/95 | 03/21/95 |
| SUBMIT ROD FOR SIGNATURES | 0d | 03/21/95 | 03/21/95 |
| OBTAIN ROD SIGNATURES | 55d | 03/22/95 | 05/15/95 |
| ROD FINAL | 0d | 05/15/95 | 05/15/95 |
| IRA IMPLEMENTATION | 1186d | 09/30/94 | 12/28/97 |
| CONTRACT AWARD | 0d | 09/30/94 | 09/30/94 |
| IRA WORKPLAN | 202d | 05/16/95 | 12/03/95 |
| COMPL DRAFT IRA WP | 77d | 05/16/95 | 07/31/95 |
| SUBMIT DRAFT IRA WP | 0d | 07/31/95 | 07/31/95 |
| COMB REV DFT WP | 30d | 08/01/95 | 08/30/95 |
| PREP COMM RESP | 14d | 08/31/95 | 09/13/95 |
| SUB MIT COMM RESP | 0d | 09/13/95 | 09/13/95 |
| COMMENT RESOLUTION | 14d | 09/14/95 | 09/27/95 |
| PREP FIN IRA WP | 30d | 09/28/95 | 10/27/95 |
| SUBMIT FINA IRA WP | 0d | 10/27/95 | 10/27/95 |
| ACCEPTANCE REVIEW | 30d | 10/28/95 | 11/26/95 |
| IRA WP FINAL | 0d | 11/26/95 | 11/26/95 |
| PROOF OF PERFORMANCE RE | 60d | 07/12/96 | 09/09/96 |



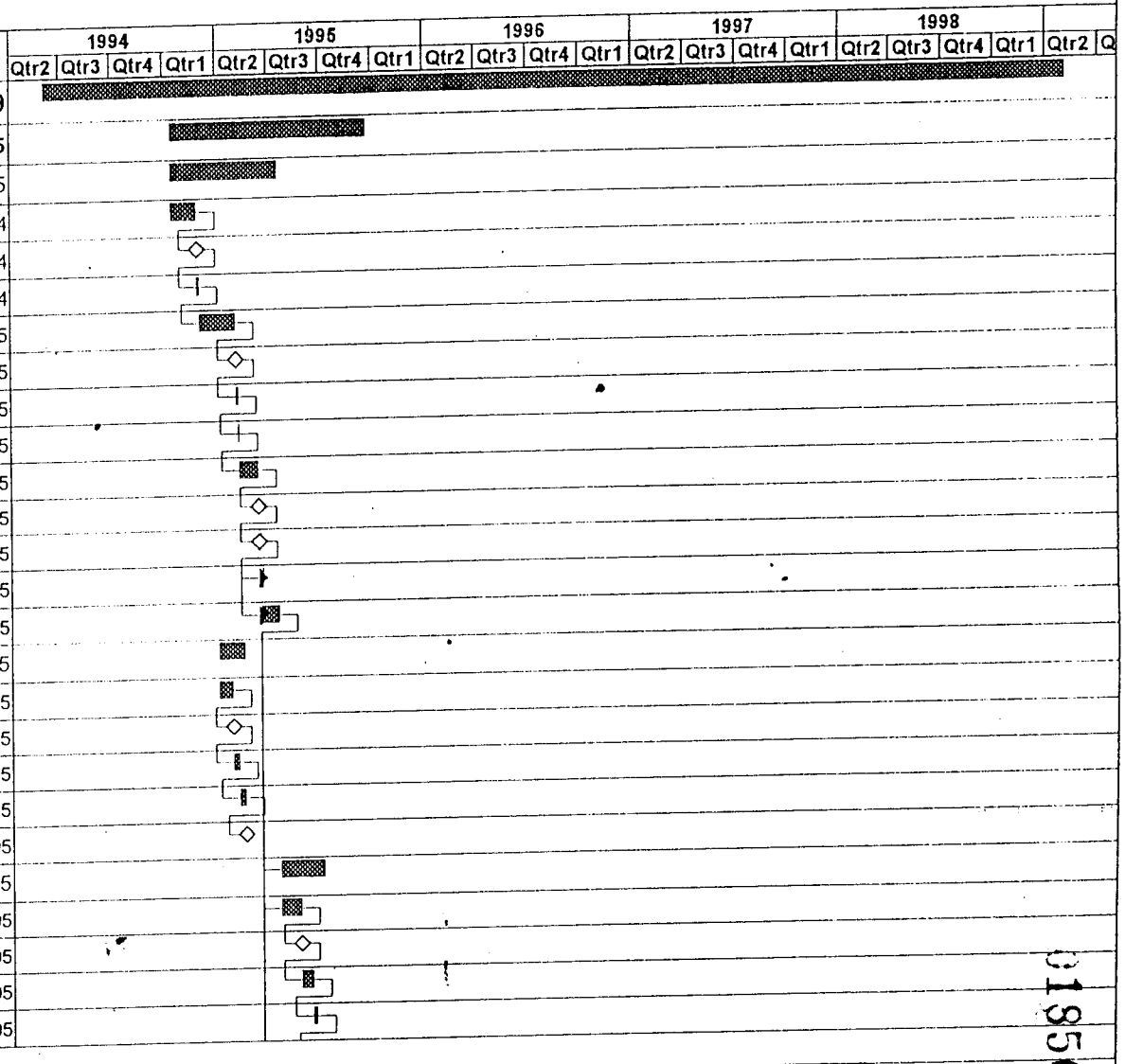
# LHAAP BG No. 3 IRA as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| IRA CONSTRUCTION | 564d | 11/27/95 | 06/12/97 |
| IRA IMPL REPORT | 216d | 06/13/97 | 01/14/98 |
| PREP DFT IMPL RPT | 120d | 06/13/97 | 10/10/97 |
| SUBMIT DFT IMPL RPT | 0d | 10/10/97 | 10/10/97 |
| REV DFT IMPL RPT | 45d | 10/11/97 | 11/24/97 |
| PREP FIN IMPL RPT | 30d | 11/25/97 | 12/24/97 |
| SUBMIT FIN IMPL RPT | 0d | 12/24/97 | 12/24/97 |
| ACCEPTANCE REVIEW | 21d | 12/25/97 | 01/14/98 |
| IRA IMPL RPT FINAL | 0d | 01/14/98 | 01/14/98 |
| IRA LONG TRM O&M BEGINS | 0d | 06/12/97 | 06/12/97 |



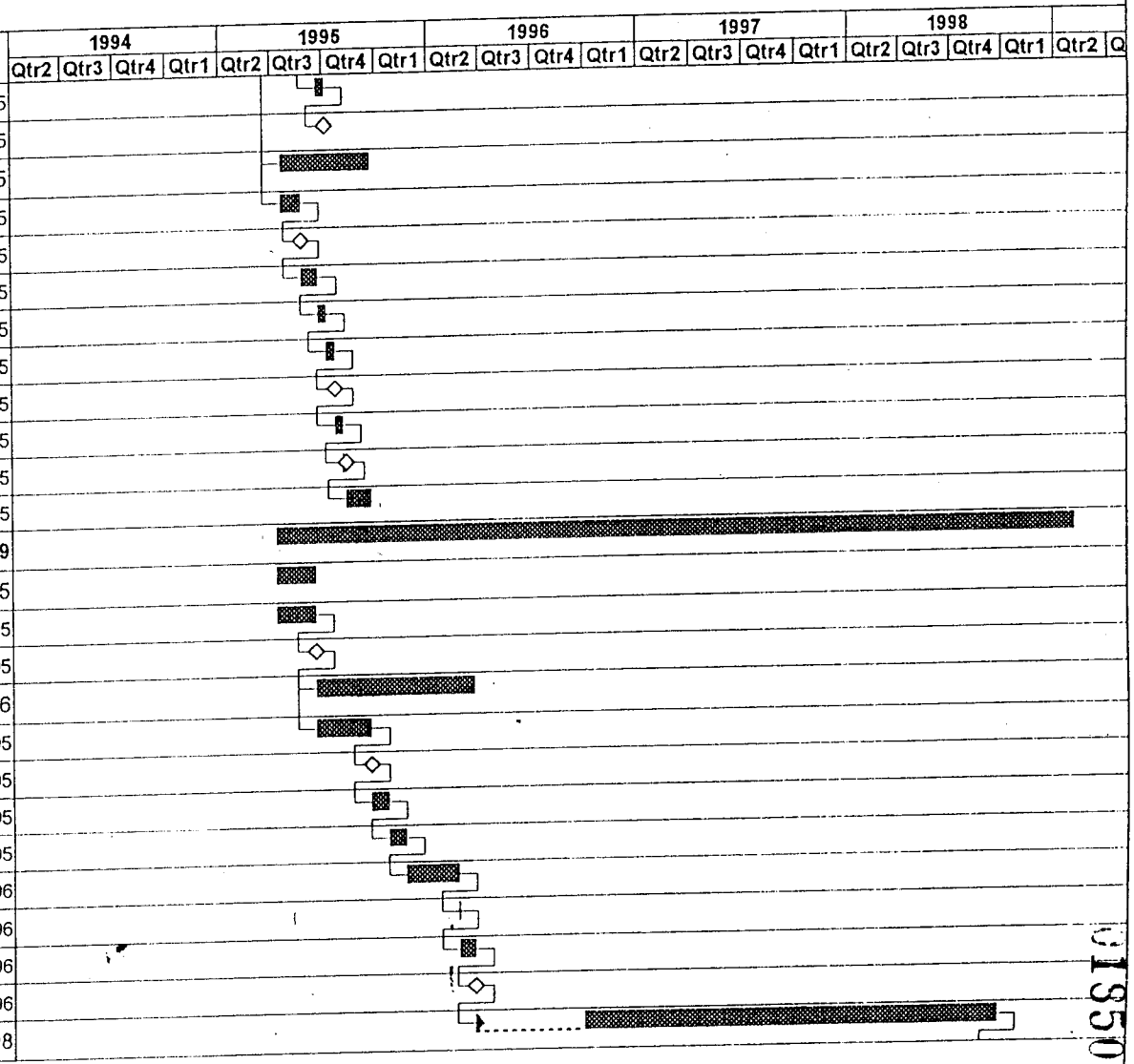
# LHAAP LANDFILL CAPS IRA as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| **LANDFILLS IRA** | **1798d** | **03/07/94** | **02/06/99** |
| **PROPOSED PLAN & ROD** | **344d** | **10/15/94** | **09/23/95** |
| PROPOSED PLAN | 187d | 10/15/94 | 04/19/95 |
| PREP. PRELIM. DRAFT PROP PLAN | 45d | 10/15/94 | 11/28/94 |
| SUBMIT PD PRP PLN FOR REVIEW | 0d | 11/28/94 | 11/28/94 |
| COMB. REVIEW PD PROP. PLAN | 4d | 11/29/94 | 12/02/94 |
| PREPARE DRAFT PROP. PLAN | 63d | 12/03/94 | 02/03/95 |
| SUBMIT DRAFT PROP. PLAN | 0d | 02/03/95 | 02/03/95 |
| REVIEW DRAFT PROPOSED PLAN | 4d | 02/04/95 | 02/07/95 |
| PROP PLAN RESOLUTION MEETIN | 2d | 02/08/95 | 02/09/95 |
| PREPARE FINAL PROP PLAN | 33d | 02/10/95 | 03/14/95 |
| PROPOSED PLAN FINAL | 0d | 03/14/95 | 03/14/95 |
| RELEASE PP TO PUBLIC | 0d | 03/16/95 | 03/16/95 |
| PUBLIC MEETING | 1d | 03/23/95 | 03/23/95 |
| PUBLIC COMMENT PERIOD | 30d | 03/21/95 | 04/19/95 |
| FOCUSED FEASIBILITY STUDY | 46d | 01/03/95 | 02/17/95 |
| PREP DRFT FOC FEAS STUDY | 25d | 01/03/95 | 01/27/95 |
| SUBMIT FFS TO ARMY | 0d | 01/27/95 | 01/27/95 |
| ARMY REVIEW FFS | 10d | 01/28/95 | 02/06/95 |
| REVISE FFS | 11d | 02/07/95 | 02/17/95 |
| SUBMIT FINAL FFS | 0d | 02/17/95 | 02/17/95 |
| RESPONSIVENESS SUMMARY | 77d | 04/20/95 | 07/05/95 |
| PREPARE DRAFT RESPONSIVENE | 35d | 04/20/95 | 05/24/95 |
| SUBMIT DRAFT RESP. SUMM. | 0d | 05/24/95 | 05/24/95 |
| COMBINED REV. DRF RESP SUMM | 21d | 05/25/95 | 06/14/95 |
| COMMENT RESOLUTION | 7d | 06/15/95 | 06/21/95 |



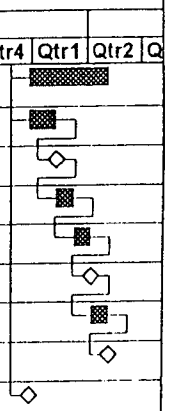
# LHAAP LANDFILL CAPS IRA as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| PREP FIN RESP SUMM | 14d | 06/22/95 | 07/05/95 |
| SUBMIT FIN RESP SUMM | 0d | 07/05/95 | 07/05/95 |
| RECORD OF DECISION | 157d | 04/20/95 | 09/23/95 |
| PREP DRAFT ROD | 35d | 04/20/95 | 05/24/95 |
| SUBMIT DRAFT ROD | 0d | 05/24/95 | 05/24/95 |
| COMBINED REV DRF ROD | 30d | 05/25/95 | 06/23/95 |
| COMMENT RESOLUTION | 14d | 06/24/95 | 07/07/95 |
| PREP FINAL ROD | 14d | 07/08/95 | 07/21/95 |
| SUBMIT FIN ROD | 0d | 07/21/95 | 07/21/95 |
| ACCEPTANCE REVIEW | 14d | 07/22/95 | 08/04/95 |
| SUBMIT ROD FOR SIGNATURES | 0d | 08/10/95 | 08/10/95 |
| OBTAIN ROD SIGNATURES | 45d | 08/10/95 | 09/23/95 |
| **IRA IMPLEMENTATION** | **1399d** | **04/10/95** | **02/06/99** |
| CONTRACT ACTIONS | 68d | 04/10/95 | 06/16/95 |
| NEGOTIATE/AWARD IRA CONTRA | 68d | 04/10/95 | 06/16/95 |
| AWARD IRA CONTRACT | 0d | 06/16/95 | 06/16/95 |
| IRA WORKPLAN | 279d | 06/17/95 | 03/21/96 |
| PREP DRFT IRA WP | 97d | 06/17/95 | 09/21/95 |
| SUBMIT DFT IRA WP | 0d | 09/21/95 | 09/21/95 |
| COMB REVIEW D IRA WP | 30d | 09/22/95 | 10/21/95 |
| COMMENT RESOLUTION | 30d | 10/22/95 | 11/20/95 |
| PREP FIN IRA WP | 93d | 11/21/95 | 02/21/96 |
| SUBMIT FIN IRA WP | 1d | 02/22/96 | 02/22/96 |
| ACCEPTANCE REVIEW | 28d | 02/23/96 | 03/21/96 |
| IRA WP FINAL | 0d | 03/21/96 | 03/21/96 |
| IRA CONSTRUCTION | 726d | 10/01/96 | 09/26/98 |



# LHAAP LANDFILL CAPS IRA as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| IRA IMPLEMENTATION REPORT | 133d | 09/27/98 | 02/06/99 |
| PREP DFT IMPL RPT | 45d | 09/27/98 | 11/10/98 |
| SUBMIT DFT IMPL RPT | 0d | 11/10/98 | 11/10/98 |
| REVIEW DFT IMPL RPT | 30d | 11/11/98 | 12/10/98 |
| PREP FIN IMPL RPT | 28d | 12/11/98 | 01/07/99 |
| SUBMIT FIN IMPL RPT | 0d | 01/07/99 | 01/07/99 |
| ACCEPTANCE REVIEW | 30d | 01/08/99 | 02/06/99 |
| IRA IMPL RPT FINAL | 0d | 02/06/99 | 02/06/99 |
| IRA MAINTENANCE BEGINS | 0d | 09/26/98 | 09/26/98 |




015502

**ATTACHMENT II**

**A-106 Reports**

ARMY A-106 REPORT PROJECT SIT (LHAP94-004)

Installation Name: LONGHORN AAP
Street Address: HWY. 134 & HWY. 43
City: KARNACK
Congressional District:
Abbreviation: LHAAP
Local Information: HARRISON C
ASG:
Agency Project Number: LHAP94-004
Project Name: FORMER TNT OPERATIONS - RMIS 29 & 32
Date of Initial Entry: 10/28/1993
Reason for Initiation: OTHER
P2 Category:
Pillar: CLEANUP
Construction/Work Start: 12/2000
Progress Code: Preliminary Planning; Not yet under design
Project Contact Name: DAVID TOLBERT
Geographic Initiative:
Program Area: ACTIVE - INSTALL. RESTORATION
Other Project ID Type:
Local Priority:

FFID: TX-213820529
Property No: 20529
State: TX
Country: USA
Ownership Type: GOCO

BSB:
Multiple Installations (Y/N): N

Class: 1

Must Fund: Y
Construction/Work Complete: 12/2001

Major Command: AMC
Support Installation:
Zip: 75661-
NPL: N
Installation Type: MANUFACTURING
Subcommand: IOC
Date of Last Revision: 02/10/1997
Law/Reg Area: SFND
Environmental Category: RINV
Compliance Status: CMPA
Project Assessment: H
Operable Unit:
Design/Plan Completion: 10/2000
Final Compliance Required: 06/2002
Year Funding Required: 1996
Contact Telephone: (903)679-2728
Total Cost Estimate: 4576000
Project Type:
Other Project ID:
Command Priority:

DERA Priority code:

Fund Code: DERA-OMA DEF ENVR RESTORATION ACCT, O&M

| Budget Code | FY | Required | Prg/Bdgt | Obligated |
|---|---|---|---|---|
| 439008.11 | 1997 | 356000 | 0 | 0 |
| 439008.11 | 1998 | 10000 | 0 | 0 |
| 439008.11 | 1999 | 900000 | 0 | 0 |
| 439008.11 | 2000 | 2250000 | 0 | 0 |
| 439008.11 | 2001 | 210000 | 0 | 0 |
| 439008.11 | 2002 | 50000 | 0 | 0 |
| 439008.11 | 2003 | 50000 | 0 | 0 |
| 439008.11 | 2004 | 50000 | 0 | 0 |
| 439008.11 | 2005 | 50000 | 0 | 0 |
| 439008.11 | 2006 | 50000 | 0 | 0 |
| 439008.11 | 2007 | 50000 | 0 | 0 |
| 439008.11 | 2008 | 50000 | 0 | 0 |
| 439008.11 | 2009 | 50000 | 0 | 0 |
| 439008.11 | 2010 | 50000 | 0 | 0 |
| 439008.11 | 2011 | 50000 | 0 | 0 |
| 439008.11 | 2012 | 50000 | 0 | 0 |
| 439008.11 | 2013 | 50000 | 0 | 0 |
| 439008.11 | 2014 | 50000 | 0 | 0 |
| 439008.11 | 2015 | 50000 | 0 | 0 |
| 439008.11 | 2016 | 50000 | 0 | 0 |
| 439008.11 | 2017 | 50000 | 0 | 0 |
| 439008.11 | 2018 | 50000 | 0 | 0 |

EPA Required Narrative:
RMIS = 29,32. PERFORMER - CESWT.

FY97-$356K RI; FY98-$900K RI; FY99-$100K S&A,; FY2000 $2200K RD/RA
$50K LTM; FY2001 $160K S&A, $50K LTM; FY2002-FY2018 $50K
LTM. FY19-FY30 INCLUDED IN LHAP-011

REQ'D BY FFA 12/91.
Comments:

015504

# ARMY A-106 REPORT PROJE .BIT (LHAP92-011)

Installation Name: LONGHORN AAP
Street Address: HWY. 134 & HWY. 43
City: KARNACK
Congressional District:
Abbreviation: LHAAP
Local Information: HARRISON C
ASG:
Agency Project Number: LHAP92-011
Project Name: BURNING GROUND NO. 3 - RMIS 18 & 24
Date of Initial Entry: 04/15/1992
Reason for Initiation: POTENTIAL HUMAN HEALTH HAZARD
P2 Category:
Pillar: CLEANUP
Construction/Work Start: 03/1996
Progress Code: Under Construction
Project Contact Name: DAVID TOLBERT
Geographic Initiative:
Program Area: ACTIVE - INSTALL. RESTORATION
Other Project ID Type: 93LO040
Local Priority:

FID: TX-213820529
Property No: 20529
State: TX
Country: USA
Ownership Type: GOCO
BSB:
Multiple Installations (Y/N): N
Class: 1
Must Fund: Y
Construction/Work Complete: 12/1997
DERA Priority code:

Major Command: AMC
Support Installation:
Zip: 75661-
NPL: N
Installation Type: MANUFACTURING
Subcommand: IOC
Date of Last Revision: 02/10/1997
Law/Reg Area: SFND
Environmental Category: REMA
Compliance Status: CMPA
Project Assessment: H
Operable Unit:
Design/Plan Completion: 10/1995
Final Compliance Required: 06/1997
Year Funding Required: 1994
Contact Telephone: (903)679-2728
Total Cost Estimate: 32683100
Project Type: Remediation
Other Project ID: LHAP92-011
Command Priority:

Fund Code: DERA-OMA DEF ENVR RESTORATION ACCT, O&M

| Budget Code | FY | Required | Prg/Bdgt | Obligated |
|---|---|---|---|---|
| 788008.11 | 1993 | 2000000 | 2621000 | 2629000 |
| 439008.11 | 1994 | 17555000 | 17555000 | 17650000 |
| 439008.11 | 1995 | 2275000 | 2734000 | 2275000 |
| 439008.11 | 1996 | 555000 | 468680 | 0 |
| 439008.11 | 1997 | 667000 | 0 | 0 |
| 439008.11 | 1998 | 1550000 | 0 | 0 |
| 439008.11 | 1999 | 500000 | 0 | 0 |
| 439008.11 | 2000 | 400000 | 0 | 0 |
| 439008.11 | 2001 | 5400 | 0 | 0 |
| 439008.11 | 2002 | 5800 | 0 | 0 |
| 439008.11 | 2003 | 900 | 0 | 0 |
| 439008.11 | 2004 | 500000 | 0 | 0 |
| 439008.11 | 2005 | 500000 | 0 | 0 |
| 439008.11 | 2006 | 500000 | 0 | 0 |
| 439008.11 | 2007 | 500000 | 0 | 0 |
| 439008.11 | 2008 | 500000 | 0 | 0 |
| 439008.11 | 2009 | 500000 | 0 | 0 |
| 439008.11 | 2010 | 500000 | 0 | 0 |
| 439008.11 | 2011 | 500000 | 0 | 0 |
| 439008.11 | 2012 | 500000 | 0 | 0 |
| 439008.11 | 2013 | 500000 | 0 | 0 |
| 439008.11 | 2014 | 500000 | 0 | 0 |
| 439008.11 | 2015 | 500000 | 0 | 0 |
| 439008.11 | 2016 | 500000 | 0 | 0 |
| 439008.11 | 2017 | 500000 | 0 | 0 |

EPA Required Narrative:

RMIS NO. 18 & 24.
PERFORMER: CESWT.

FY94-$15,942K IRA, $955K R&D, $300K PS&A; FY95-1600 RD, $535K PS&A, $145K PILOT STUDY; FY96-$440K RD, $30K FOR INSTALL. SUPPORT; $85 IN-HOUSE FY97-$667K S&A; FY98-$900K RI, $150K S&A, $500 O&M; FY99-$100K S&A, $500K O&M; FY00-$400K O&M $5000K RD/RA; FY01-$5000K RD/RA, $400 O&M $400K S&A; FY02-$400K S&A, $100K LTM, $400K O&M FY03-$100K LTM, $400K O&M FY04-17 $100K LTM, $400K O&M. FY18-FY29 INCLUDED IN LHAP95-014.

REQ'D BY FED. FACILITY AGREEMENT
DATED 12/91, NPL-IAG.

ARMY A-106 REPORT PROJEC .BIT (LHAAP91010)

Installation Name: LONGHORN AAP
Street Address: HWY. 134 & HWY. 43
City: KARNACK
Congressional District:
Abbreviation: LHAAP
Local Information: HARRISON C
ASG:
Agency Project Number: LHAAP91010
Project Name: GROUP I SITES - INSTALLATION RESTORATION
Date of Initial Entry: 02/13/1991
Reason for Initiation: OTHER
P2 Category:
Pillar: CLEANUP
Construction/Work Start: 08/1996
Progress Code: Preliminary Planning; Not yet under design
Project Contact Name: DAVID TOLBERT
Geographic Initiative:
Program Area:
Other Project ID Type: 93LO032
Local Priority:

FFID: TX-213820529
Property No: 20529
State: TX
Country: USA
Ownership Type: GOCO
BSB:
Multiple Installations (Y/N): N
Class: 1
Must Fund: Y
Construction/Work Complete: 08/1996
DERA Priority code:

Major Command: AMC
Support Installation:
Zip: 75661-
NPL: N
Installation Type: MANUFACTURING
Subcommand: IOC
Date of Last Revision: 02/10/1997
Law/Reg Area: SFND
Environmental Category: RINV
Compliance Status: CMPA
Project Assessment: H
Operable Unit:
Design/Plan Completion: 06/1991
Final Compliance Required: 02/2003
Year Funding Required: 1995
Contact Telephone: (903)679-2728
Total Cost Estimate: 7280000
Project Type:
Other Project ID: LH-91-44
Command Priority:

Fund Code: DERA-OMA DEF ENVR RESTORATION ACCT, O&M

| Budget Code | FY | Required | Prg/Bdgt | Obligated |
|---|---|---|---|---|
| 788008.11 | 1991 | 662000 | 662000 | 0 |
| 788008.11 | 1992 | 1900000 | 0 | 0 |
| 788008.11 | 1993 | 3520000 | 3166000 | 3166000 |
| 439008.11 | 1994 | 3990000 | 3990000 | 3949000 |
| 439008.11 | 1995 | 65000 | 241000 | 58000 |
| 439008.11 | 1996 | 180000 | 180000 | 107000 |

| Budget Code | FY | Required | Prg/Bdgt | Obligated |
|---|---|---|---|---|

| Budget Code | FY | Required | Prg/Bdgt | Obligated |
|---|---|---|---|---|

EPA Required Narrative:

EXECUTING AGENCY = CEWST; RMIS = 1,11,27,54; FY94-$3380K RI, $360K S&A; FY95-$65K CONTRACT MGMT AND RISK ASS.; FY96-$180 FINALIZE RI AND ROD. REQ'D BY FED. FACILITY AGREEMENT DATED 12/91.

Comments:

018506

ARMY A-106 REPORT PROJECT SHEET (LHAAP92001)

Installation Name: LONGHORN AAP
Street Address: HWY. 134 & HWY. 43
City: KARNACK
Congressional District:
Abbreviation: LHAAP
Local Information: HARRISON C
ASG:
Agency Project Number: LHAAP92001
Project Name: GROUP 4 SUMPS - RMIS 35,46,47,48 FY92-FY16
Date of Initial Entry: 10/08/1991
Reason for Initiation: POTENTIAL HUMAN HEALTH HAZARD
P2 Category:
Pillar: CLEANUP
Construction/Work Start: 10/1997
Progress Code: Preliminary Planning; Not yet under design
Project Contact Name: DAVID TOLBERT
Geographic Initiative:
Program Area: ACTIVE - INSTALL. RESTORATION
Other Project ID Type: 93LO033
Local Priority:

FFID: TX-213820529
Property No: 20529
State: TX
Country: USA
Ownership Type: GOCO

BSB:
Multiple Installations (Y/N): N

Class: 1

Must Fund: Y
Construction/Work Complete: 10/2001

Major Command: AMC
Support Installation:
Zip: 75661-
NPL: N
Installation Type: MANUFACTURING
Subcommand: IOC
Date of Last Revision: 02/10/1997
Law/Reg Area: SFND
Environmental Category: RINV
Compliance Status: CMPA
Project Assessment: H
Operable Unit:
Design/Plan Completion: 02/1996
Final Compliance Required: 04/2003
Year Funding Required: 1997
Contact Telephone: (903)679-2728
Total Cost Estimate: 25569000
Project Type: Remediation
Other Project ID:
Command Priority:

DERA Priority code:

Fund Code: DERA-OMA DEF ENVR RESTORATION ACCT, O&M

| Budget Code | FY | Required | Prg/Bdgt | Obligated |
|---|---|---|---|---|
| 788008.11 | 1992 | 180000 | 110000 | 110000 |
| 788008.11 | 1993 | 1700000 | 50000 | 1290000 |
| 439008.11 | 1994 | 1443000 | 1443000 | 1443000 |
| 439008.11 | 1995 | 799000 | 641000 | 766000 |
| 439008.11 | 1996 | 3150000 | 3150000 | 2845000 |
| 439008.11 | 1997 | 170000 | 0 | 0 |
| 439008.11 | 1998 | 3000000 | 0 | 0 |
| 439008.11 | 1999 | 320000 | 0 | 0 |
| 439008.11 | 2001 | 12500000 | 0 | 0 |

| Budget Code | FY | Required | Prg/Bdgt | Obligated |
|---|---|---|---|---|
| 439008.11 | 2002 | 1250000 | 0 | 0 |
| 439008.11 | 2003 | 250000 | 0 | 0 |
| 439008.11 | 2004 | 125000 | 0 | 0 |
| 439008.11 | 2005 | 125000 | 0 | 0 |
| 439008.11 | 2006 | 125000 | 0 | 0 |
| 439008.11 | 2007 | 125000 | 0 | 0 |
| 439008.11 | 2008 | 125000 | 0 | 0 |
| 439008.11 | 2009 | 125000 | 0 | 0 |
| 439008.11 | 2010 | 125000 | 0 | 0 |

| Budget Code | FY | Required | Prg/Bdgt | Obligated |
|---|---|---|---|---|
| 439008.11 | 2011 | 125000 | 0 | 0 |
| 439008.11 | 2012 | 125000 | 0 | 0 |
| 439008.11 | 2013 | 125000 | 0 | 0 |
| 439008.11 | 2014 | 125000 | 0 | 0 |
| 439008.11 | 2015 | 125000 | 0 | 0 |
| 439008.11 | 2016 | 125000 | 0 | 0 |

EPA Required Narrative:

PERFORMER: CESWT. RMIS = 35,46,47,48.

FY94 $1443K RI; FY95 $799K REMEDIAL INVESTIGATION/RISK ASSESSMENT; FY96 $2,250K SUMP REMOVAL,$800 IN-HOUSE $100K S&A; FY97 $170K IN-HOUSE; FY98 $3000K RI; FY99 $320K S&A; FY 2001 $12,500K RD/RA, FY2002 $1,000 S&A, $250 LTM); FY2003 $250K LTM; FY2004-016 $125K LTM (FY2017-2032 INCLUDED IN LHAP95-013).

REQ'D BY FED. FACILITY AGREEMENT DATED 12/91.

Comments:

018507

# ARMY A-106 REPORT PROJECT EXHIBIT (LHAP95-013)

Installation Name: LONGHORN AAP
Street Address: HWY. 134 & HWY. 43
City: KARNACK
Congressional District:
Abbreviation: LHAAP
Local Information: HARRISON C
ASG:
Agency Project Number: LHAP95-013
Project Name: GROUP 4 SITES - LTM FY17-FY29
Date of Initial Entry: 06/05/1995
Reason for Initiation: OTHER
P2 Category:
Pillar: CLEANUP
Construction/Work Start: 10/1997
Progress Code: Preliminary Planning; Not yet under design
Project Contact Name: DAVID TOLBERT
Geographic Initiative:
Program Area:
Other Project ID Type:
Local Priority:

FFID: TX-213820529
Property No: 20529
Country: USA
State: TX
Ownership Type: GOCO

BSB:
Multiple Installations (Y/N): Y
Class: 1
Must Fund: Y
Construction/Work Complete: 10/2000

Major Command: AMC
Support Installation:
Zip: 75661-
NPL: N
Installation Type: MANUFACTURING
Subcommand: IOC
Date of Last Revision: 06/05/1995
Law/Reg Area: SFND
Environmental Category: OPLM
Compliance Status: CMPA
Project Assessment: H
Operable Unit:
Design/Plan Completion: 02/1996
Final Compliance Required: 04/2001
Year Funding Required: 2017
Contact Telephone: (903)679-2728
Total Cost Estimate: 1625000
Project Type:
Other Project ID:
Command Priority:

DERA Priority code:

Fund Code: DERA-OMA DEF ENVR RESTORATION ACCT, O&M

| Budget Code | FY | Required | Prg/Bdgt | Obligated |
|---|---|---|---|---|
| 439008.11 | 2017 | 125000 | 0 | 0 |
| 439008.11 | 2018 | 125000 | 0 | 0 |
| 439008.11 | 2019 | 125000 | 0 | 0 |
| 439008.11 | 2020 | 125000 | 0 | 0 |
| 439008.11 | 2021 | 125000 | 0 | 0 |
| 439008.11 | 2022 | 125000 | 0 | 0 |
| 439008.11 | 2023 | 125000 | 0 | 0 |
| 439008.11 | 2024 | 125000 | 0 | 0 |
| 439008.11 | 2025 | 125000 | 0 | 0 |
| 439008.11 | 2026 | 125000 | 0 | 0 |
| 439008.11 | 2027 | 125000 | 0 | 0 |
| 439008.11 | 2028 | 125000 | 0 | 0 |
| 439008.11 | 2029 | 125000 | 0 | 0 |

EPA Required Narrative:
EXECUTING AGENCY = CEWST; RMIS = 35,46,47,48. COMPLETION OF LHAAP92001. FUNDING REQUIREMENTS FOR LTM $125K/YR FY17-FY29.
Comments:

# ARMY A-106 REPORT PROJECT EXHIBIT (LHAP95-014)

Installation Name: LONGHORN AAP
Street Address: HWY. 134 & HWY. 43
City: KARNACK
Congressional District:
Abbreviation: LHAAP
Local Information: HARRISON C
ASG:
Agency Project Number: LHAP95-014
Project Name: BURNING GROUD NO. 3 - RAOP FY18-FY29
Date of Initial Entry: 06/12/1995
Reason for Initiation: OTHER
P2 Category:
Pillar: CLEANUP
Construction/Work Start: 02/1997
Progress Code: Preliminary Planning; Not yet under design
Project Contact Name: DAVID TOLBERT
Geographic Initiative:
Program Area: ACTIVE - INSTALL. RESTORATION
Other Project ID Type:
Local Priority:

FFID: TX-213820529
Property No: 20529
Country: USA
State: TX
Ownership Type: GOCO

BSB:
Multiple Installations (Y/N): N
Class: 1
Must Fund: Y
Construction/Work Complete: 02/2001

Major Command: AMC
Support Installation:
Zip: 75661-
NPL: N
Installation Type: MANUFACTURING
Subcommand: IOC
Date of Last Revision: 06/12/1995
Law/Reg Area: SFND
Environmental Category: OPLM
Compliance Status: CMPA
Project Assessment: H
Operable Unit:
Design/Plan Completion: 10/1995
Final Compliance Required: 06/2002
Year Funding Required: 2018
Contact Telephone: (903)679-2728
Total Cost Estimate: 6000000
Project Type:
Other Project ID:
Command Priority:

DERA Priority code:

Fund Code: DERA-OMA DEF ENVR RESTORATION ACCT, O&M

| Budget Code | FY | Required | Prg/Bdgt | Obligated |
|---|---|---|---|---|
| 439008.11 | 2018 | 500000 | 0 | 0 |
| 439008.11 | 2019 | 500000 | 0 | 0 |
| 439008.11 | 2020 | 500000 | 0 | 0 |
| 439008.11 | 2021 | 500000 | 0 | 0 |
| 439008.11 | 2022 | 500000 | 0 | 0 |
| 439008.11 | 2023 | 500000 | 0 | 0 |
| 439008.11 | 2024 | 500000 | 0 | 0 |
| 439008.11 | 2025 | 500000 | 0 | 0 |
| 439008.11 | 2026 | 500000 | 0 | 0 |
| 439008.11 | 2027 | 500000 | 0 | 0 |
| 439008.11 | 2028 | 500000 | 0 | 0 |
| 439008.11 | 2029 | 500000 | 0 | 0 |

EPA Required Narrative:
RMIS 18 &24 RAOP(O&M) FOR TREATMENT SYSTEM FOR FY18 - FY27
Comments:

ARMY A-106 REPORT PROJEC 3IT (LHAP94-021)

Installation Name: LONGHORN AAP
Street Address: HWY. 134 & HWY. 43
City: KARNACK
Congressional District:
Abbreviation: LHAAP
Local Information: HARRISON C
ASG:
Agency Project Number: LHAP94-021
Project Name: GROUP 2 SITES - INSTALLATION RESTORATION FY95-FY19
Date of Initial Entry: 03/29/1994
Reason for Initiation: OTHER
P2 Category:
Pillar: CLEANUP
Construction/Work Start: 10/1998
Progress Code: Preliminary Planning; Not yet under design
Project Contact Name: DAVID TOLBERT
Geographic Initiative:
Program Area: IRP
Other Project ID Type:
Local Priority:

FFID: TX-213820529
Property No: 20529
State: TX
Country: USA
Ownership Type: GOCO

BSB:
Multiple Installations (Y/N): N
Class: 1
Must Fund: Y
Construction/Work Complete: 10/2002

Major Command: AMC
Support Installation:
Zip: 75661-
NPL: N
Installation Type: MANUFACTURING
Subcommand: IOC
Date of Last Revision: 02/10/1997
Law/Reg Area: SFND
Environmental Category: RINV
Compliance Status: CMPA
Project Assessment: H
Operable Unit:
Design/Plan Completion: 10/1994
Final Compliance Required: 04/2003
Year Funding Required: 1995
Contact Telephone: (903)679-2728
Total Cost Estimate: 5664000
Project Type:
Other Project ID:
Command Priority:

DERA Priority code:

Fund Code: DERA-OMA DEF ENVR RESTORATION ACCT, O&M

| Budget Code | FY | Required | Prg/Bdgt | Obligated |
|---|---|---|---|---|
| 439008.11 | 1995 | 816000 | 612000 | 814000 |
| 439008.11 | 1996 | 878000 | 728644 | 0 |
| 439008.11 | 1997 | 225000 | 0 | 0 |
| 439008.11 | 1998 | 450000 | 0 | 0 |
| 439008.11 | 1999 | 50000 | 0 | 0 |
| 439008.11 | 2002 | 3325000 | 0 | 0 |
| 439008.11 | 2003 | 50000 | 0 | 0 |
| 439008.11 | 2004 | 50000 | 0 | 0 |
| 439008.11 | 2005 | 50000 | 0 | 0 |
| 439008.11 | 2006 | 50000 | 0 | 0 |
| 439008.11 | 2007 | 50000 | 0 | 0 |
| 439008.11 | 2008 | 50000 | 0 | 0 |
| 439008.11 | 2009 | 50000 | 0 | 0 |
| 439008.11 | 2010 | 50000 | 0 | 0 |
| 439008.11 | 2011 | 50000 | 0 | 0 |
| 439008.11 | 2012 | 50000 | 0 | 0 |
| 439008.11 | 2013 | 50000 | 0 | 0 |
| 439008.11 | 2014 | 50000 | 0 | 0 |
| 439008.11 | 2015 | 50000 | 0 | 0 |
| 439008.11 | 2016 | 50000 | 0 | 0 |
| 439008.11 | 2017 | 50000 | 0 | 0 |
| 439008.11 | 2018 | 50000 | 0 | 0 |

EPA Required Narrative:
EXECUTING AGENCY = CEWST. RMIS = 12,16,17,18,24,29,32.
FY95-$816K RI; FY96-$485K RA, $350K IN-HOUSE, $43K S&A; FY97-$225; RFY98-$450K RI; FY99-$50K S&A; FY2002 $275K S&A, $3000K RD/RA, $50K LTM;
F2003-FY2018 $50K LONG TERM MONITORING (FY19 - FY30 INCLUDED ON LHAP95-011).

REQUIRED BY FFA DATED 12/91.
Comments:

018510

ARMY A-106 REPORT PROJEC SIT (LHAP94-003)

Installation Name: LONGHORN AAP
Street Address: HWY. 134 & HWY. 43
City: KARNACK
Congressional District:
Abbreviation: LHAAP
Local Information: HARRISON C
ASG:
Agency Project Number: LHAP94-003
Project Name: LANDFILLS - RMIS 12 & 16
Date of Initial Entry: 10/28/1993
Reason for Initiation: POTENTIAL HUMAN HEALTH HAZARD
P2 Category:
Pillar: CLEANUP
Construction/Work Start: 06/1996
Progress Code: Work On-going
Project Contact Name: DAVID TOLBERT
Geographic Initiative:
Program Area: ACTIVE - INSTALL. RESTORATION
Other Project ID Type:
Local Priority:

FFID: TX-213820529
Property No: 20529
State: TX
Country: USA
Ownership Type: GOCO
BSB:
Multiple Installations (Y/N): N
Class: 0
Must Fund: Y
Construction/Work Complete: 06/1998
DERA Priority code:

Major Command: AMC
Support Installation:
Zip: 75661-
NPL: N
Installation Type: MANUFACTURING
Subcommand: IOC
Date of Last Revision: 02/10/1997
Law/Reg Area: SFND
Environmental Category: REMA
Compliance Status: PGMT
Project Assessment: H
Operable Unit:
Design/Plan Completion: 12/1995
Final Compliance Required: 09/1998
Year Funding Required: 1995
Contact Telephone: (903)679-2728
Total Cost Estimate: 19991225
Project Type: Construction
Other Project ID:
Command Priority:

Fund Code: DERA-OMA DEF ENVR RESTORATION ACCT, O&M

| Budget Code | FY | Required | Prg/Bdgt | Obligated |
|---|---|---|---|---|
| 439008.11 | 1994 | 100000 | 100000 | 100000 |
| 439008.11 | 1995 | 5066000 | 7094000 | 5019000 |
| 439008.11 | 1996 | 3247000 | 3247000 | 1128225 |
| 439008.11 | 1997 | 1244000 | 0 | 0 |
| 439008.11 | 1998 | 500000 | 0 | 0 |
| 439008.11 | 1999 | 6050000 | 0 | 0 |
| 439008.11 | 2000 | 2350000 | 0 | 0 |
| 439008.11 | 2001 | 200000 | 0 | 0 |
| 439008.11 | 2002 | 200000 | 0 | 0 |

| Budget Code | FY | Required | Prg/Bdgt | Obligated |
|---|---|---|---|---|
| 439008.11 | 2003 | 200000 | 0 | 0 |
| 439008.11 | 2004 | 200000 | 0 | 0 |
| 439008.11 | 2005 | 200000 | 0 | 0 |
| 439008.11 | 2006 | 200000 | 0 | 0 |
| 439008.11 | 2007 | 200000 | 0 | 0 |
| 439008.11 | 2008 | 200000 | 0 | 0 |
| 439008.11 | 2009 | 200000 | 0 | 0 |
| 439008.11 | 2010 | 200000 | 0 | 0 |
| 439008.11 | 2011 | 200000 | 0 | 0 |

| Budget Code | FY | Required | Prg/Bdgt | Obligated |
|---|---|---|---|---|
| 439008.11 | 2012 | 200000 | 0 | 0 |
| 439008.11 | 2013 | 200000 | 0 | 0 |
| 439008.11 | 2014 | 200000 | 0 | 0 |
| 439008.11 | 2015 | 200000 | 0 | 0 |
| 439008.11 | 2016 | 200000 | 0 | 0 |
| 439008.11 | 2017 | 200000 | 0 | 0 |
| 439008.11 | 2018 | 200000 | 0 | 0 |

EPA Required Narrative:

RMIS = 12,16 FINAL DATA FROM RI INDICATES CONTAMINATION AT TWO LANDFILLS. PERFORMER = CESWT.
FY95-$129 S&A, $4881K IRA, $54 RD; FY96-$2565K GROUND WATER CONTROL,
$448K IN-HOUSE SUPPORT, $30K FOR INSTALLATION SUPPORT $204K S&A; FY97-$162K IN-HOUSE; $167 S&A $915K TREATABLILITY STUDY (ADD'L FUNDING WILL BE REQUIRED ONCE
ESTIMATES HAVE BEEN RECIEVED); FY98-$450K RI,$50K S&A; FY99-$50K S&A, $6000K RD/RA LDFL 16; FY00-$350K S&A, $2000K RD/RA LDFL 12; FY01-FY18 $200K LTM; FY19-FY30
INCLUDED IN LHAP-011

REQ'D BY FFA 12/91.

Comments:

018511

ARMY A-106 REPORT PROJEC IT (LHAP95-011)

Installation Name: LONGHORN AAP
Street Address: HWY. 134 & HWY. 43
City: KARNACK
Congressional District:
Abbreviation: LHAAP
Local Information: HARRISON C
ASG:
Agency Project Number: LHAP95-011
Project Name: GROUP 2 SITES - LTM FY2019 - FY2030
Date of Initial Entry: 06/05/1995
Reason for Initiation: OTHER
P2 Category:
Pillar: CLEANUP
Construction/Work Start: 10/2000
Progress Code: Preliminary Planning; Not yet under design
Project Contact Name: DAVID TOLBERT
Geographic Initiative:
Program Area: IRP
Other Project ID Type:
Local Priority:

Fr... TX-213820529
Property No: 20529
Country: USA
State: TX
Ownership Type: GOCO

BSB:
Multiple Installations (Y/N): Y
Class: 1
Must Fund: Y
Construction/Work Complete: 10/2002

Major Command: AMC
Support Installation:
Zip: 75661-
NPL: N
Installation Type: MANUFACTURING
Subcommand: IOC
Date of Last Revision: 02/10/1997
Law/Reg Area: SFND
Environmental Category: OPLM
Compliance Status: CMPA
Project Assessment: H
Operable Unit:
Design/Plan Completion: 10/1994
Final Compliance Required: 04/2003
Year Funding Required: 2020
Contact Telephone: (903)679-2728
Total Cost Estimate: 2400000
Project Type:
Other Project ID:
Command Priority:

DERA Priority code:

Fund Code: DERA-OMA DEF ENVR RESTORATION ACCT, O&M

| Budget Code | FY | Required | Prg/Bdgt | Obligated |
|---|---|---|---|---|
| 439008.11 | 2019 | 200000 | 0 | 0 |
| 439008.11 | 2020 | 200000 | 0 | 0 |
| 439008.11 | 2021 | 200000 | 0 | 0 |
| 439008.11 | 2022 | 200000 | 0 | 0 |
| 439008.11 | 2023 | 200000 | 0 | 0 |
| 439008.11 | 2024 | 200000 | 0 | 0 |
| 439008.11 | 2025 | 200000 | 0 | 0 |
| 439008.11 | 2026 | 200000 | 0 | 0 |
| 439008.11 | 2027 | 200000 | 0 | 0 |
| 439008.11 | 2028 | 200000 | 0 | 0 |
| 439008.11 | 2029 | 200000 | 0 | 0 |
| 439008.11 | 2030 | 200000 | 0 | 0 |

| Budget Code | FY | Required | Prg/Bdgt | Obligated |
|---|---|---|---|---|

EPA Required Narrative:
EXECUTING AGENCY = CEWST; RMIS=12,16,17,29,32
COMPLETION OF LHAP94-021. FUNDING REQUIREMENTS FOR LTM $200K/YR FY19-FY30.

Comments:

218512

ARMY A-106 REPORT PROJE BIT (LHAP94-023)

Installation Name: LONGHORN AAP
Street Address: HWY. 134 & HWY. 43
City: KARNACK
Congressional District:
Abbreviation: LHAAP
Local Information: HARRISON C
ASG:
Agency Project Number: LHAP94-023
Project Name: GROUP 5 SITES - RI/FS (FY95 - FY2019)
Date of Initial Entry: 03/29/1994
Reason for Initiation: OTHER
P2 Category:
Pillar: CLEANUP
Construction/Work Start: 10/2000
Progress Code: Preliminary Planning; Not yet under design
Project Contact Name: DAVID TOLBERT
Geographic Initiative:
Program Area: IRP
Other Project ID Type:
Local Priority:

FrID: TX-213820529
Property No: 20529
State: TX
Country: USA
Ownership Type: GOCO

BSB:
Multiple Installations (Y/N): N
Class: 1
Must Fund: Y
Construction/Work Complete: 10/2003

Major Command: AMC
Support Installation:
Zip: 75661-
NPL: N
Installation Type: MANUFACTURING
Subcommand: IOC
Date of Last Revision: 01/25/1996
Law/Reg Area: SFND
Environmental Category: RINV
Compliance Status: CMPA
Project Assessment: H
Operable Unit:
Design/Plan Completion: 10/1994
Final Compliance Required: 12/2003
Year Funding Required: 1995
Contact Telephone: (903)679-2728
Total Cost Estimate: 5544000
Project Type:
Other Project ID:
Command Priority:

DERA Priority code:

Fund Code: DERA-OMA DEF ENVR RESTORATION ACCT, O&M

| Budget Code | FY | Required | Prg/Bdgt | Obligated |
|---|---|---|---|---|
| 439008.11 | 1995 | 390000 | 1500000 | 449000 |
| 439008.11 | 1996 | 40000 | 24147 | 0 |
| 439008.11 | 1998 | 800000 | 0 | 0 |
| 439008.11 | 1999 | 65000 | 0 | 0 |
| 439008.11 | 2000 | 1375000 | 0 | 0 |
| 439008.11 | 2001 | 110000 | 0 | 0 |
| 439008.11 | 2002 | 1405000 | 0 | 0 |
| 439008.11 | 2003 | 140000 | 0 | 0 |
| 439008.11 | 2004 | 75000 | 0 | 0 |
| 439008.11 | 2005 | 75000 | 0 | 0 |
| 439008.11 | 2006 | 75000 | 0 | 0 |
| 439008.11 | 2007 | 75000 | 0 | 0 |
| 439008.11 | 2008 | 75000 | 0 | 0 |
| 439008.11 | 2009 | 75000 | 0 | 0 |
| 439008.11 | 2010 | 75000 | 0 | 0 |
| 439008.11 | 2011 | 75000 | 0 | 0 |
| 439008.11 | 2012 | 75000 | 0 | 0 |
| 439008.11 | 2013 | 75000 | 0 | 0 |
| 439008.11 | 2014 | 75000 | 0 | 0 |
| 439008.11 | 2015 | 75000 | 0 | 0 |
| 439008.11 | 2016 | 75000 | 0 | 0 |
| 439008.11 | 2017 | 75000 | 0 | 0 |
| 439008.11 | 2018 | 75000 | 0 | 0 |
| 439008.11 | 2019 | 75000 | 0 | 0 |

EPA Required Narrative:

EXECUTING AGENCY = CEWST. RMIS =50,52,60,63,.
FY95-$390K SI; FY96-$40K SI; FY97-$0; FY98-$800K RI; FY99 $65K S&A; FY00-$1375K RD/RA,; FY01 $110K S&A; FY02 $1375
RD/RA, $15K LTM; FY03 $110 S&A, 30 LTM; FY04-FY20 $75K LTM; (FY2020-FY2030 INCLUDED IN LHAP95-010). REQ'D BY FFA DATED 12/91.

Comments:

ARMY A-106 REPORT PROJEC. .BIT (LHAP95-010)

Installation Name: LONGHORN AAP
Street Address: HWY. 134 & HWY. 43
City: KARNACK
Congressional District:
Abbreviation: LHAAP
Local Information: HARRISON C
ASG:
Agency Project Number: LHAP95-010
Project Name: GROUP 5 SITES - LTM FY2020 -FY2030
Date of Initial Entry: 06/05/1995
Reason for Initiation: OTHER
P2 Category:
Pillar: CLEANUP
Construction/Work Start: 10/1997
Progress Code: Preliminary Planning; Not yet under design
Project Contact Name: DAVID TOLBERT
Geographic Initiative:
Program Area: IRP
Other Project ID Type:
Local Priority:

FFID: TX-213820529
Property No: 20529
State: TX
Country: USA
Ownership Type: GOCO

BSB:
Multiple Installations (Y/N): Y

Class: 1

Must Fund: Y
Construction/Work Complete: 10/1997

DERA Priority code:

Major Command: AMC
Support Installation:
Zip: 75661-
NPL: N
Installation Type: MANUFACTURING
Subcommand: IOC
Date of Last Revision: 06/05/1995
Law/Reg Area: SFND
Environmental Category: OPLM
Compliance Status: CMPA
Project Assessment: H
Operable Unit:
Design/Plan Completion: 10/1994
Final Compliance Required: 04/1998
Year Funding Required: 2020
Contact Telephone: (903)679-2728
Total Cost Estimate: 825000
Project Type:
Other Project ID:
Command Priority:

Fund Code: DERA-OMA DEF ENVR RESTORATION ACCT, O&M

| Budget Code | FY | Required | Prg/Bdgt | Obligated |
|---|---|---|---|---|
| 439008.11 | 2020 | 75000 | 0 | 0 |
| 439008.11 | 2021 | 75000 | 0 | 0 |
| 439008.11 | 2022 | 75000 | 0 | 0 |
| 439008.11 | 2023 | 75000 | 0 | 0 |
| 439008.11 | 2024 | 75000 | 0 | 0 |
| 439008.11 | 2025 | 75000 | 0 | 0 |
| 439008.11 | 2026 | 75000 | 0 | 0 |
| 439008.11 | 2027 | 75000 | 0 | 0 |
| 439008.11 | 2028 | 75000 | 0 | 0 |
| 439008.11 | 2029 | 75000 | 0 | 0 |
| 439008.11 | 2030 | 75000 | 0 | 0 |

EPA Required Narrative:
FUNDING REQUIREMENTS OF $75K/YR FOR LTM FOR FY2020 - FY2030. RMIS=50,52,60,63

Comments:

01514

**ATTACHMENT III**

**RAB Information**

## ATTACHMENT 2

## RESTORATION ADVISORY BOARD

In April 1996 (FY96), Longhorn Army Ammunition Plant (LHAAP) canvassed its surrounding communities for potential interest in establishing a Restoration Advisory Board (RAB). After all efforts were completed, the Installation's Commander's Representative determined that there was not enough sustainable community interest to establish a RAB.

The surrounding community for LHAAP includes the town of Karnack, TX and Uncertain, TX (total population of 532). LHAAP has a Technical Review Committee (TRC) which meets quarterly.

### *Efforts Taken To Determine Interest*

LHAAP conducted the following to determine potential interest in establishing a RAB:

(1) Asked the community members what their thoughts were in converting the TRC to a RAB.
(2) Mailed out fact sheets explaining what a RAB is and included Interest Surveys. LHAAP mailed to residents in the area's two zip codes and the list of people listed in the Community Relations Plan.
(3) Placed advertisements every day for one week in the *Marshal Messenger, Longview Tribune, and The Shreveort Times* explaining what a RAB is and the time for the public meeting
(4) Held a public meeting at the Karnack High School in April 1996.

### *Results*

(1) The TRC community members avidly expressed their disapproval in forming a RAB.
(2) Twelve community members attended the Public Meeting. Five responses were received from the meeting.

### *Conclusions*

Based on the results of LHAAP's efforts to determine interest in forming a RAB, the installation's commander's representative determined that there was not enough interest to establish and sustain a RAB at this time.

### *Follow-up Procedures*

LHAAP is committed to involving the public in its restoration program and recognizes that interest in restoration activities can change. LHAAP will monitor community interest every two years. In 1998, LHAAP will again canvas the community for interest in RABs.

# LHAAP, GR2, SITE 16, accelerated; as of 12/19/96

| Task# | Task Name | Duration | Predecessors | Calendar | Sched Start | Sched Fin | Compl Dat | Actual Start | Actual Fin | Base Start | Base Fin |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | CONTRACT | 56d | | LHAAP.C | 12/16/96 | 02/05/97 | | 12/16/96 | | | |
| 2 | Workplan Prep | 28d | 1 FS | | 02/05/97 | 03/02/97 | | | | | |
| 3 | Resistivity Survey Plan Letter | 21d | | | 01/22/97 | 02/10/97 | | | | | |
| 5 | Mobilize/Fieldwork | 7d | 3 FS | | 02/10/97 | 02/16/97 | | | | | |
| 7 | COE Review Workplan | 7d | 2 FS | | 03/02/97 | 03/08/97 | | | | | |
| 25 | Comment Resolution | 7d | 7 FS | | 03/08/97 | 03/15/97 | | | | | |
| 8 | Draft Workplan Combined Review | 30d | 25 FS | | 03/15/97 | 04/10/97 | | | | | |
| 9 | Resolve Comments | 7d | 8 FS | | 04/10/97 | 04/16/97 | | | | | |
| 10 | Revise Workplan | 7d | 9 FS | | 04/17/97 | 04/23/97 | | | | | |
| 11 | Final Regulatory Review/Appvl | 7d | 10 FS | | 04/23/97 | 04/29/97 | | | | | |
| 12 | Mobilize | 7d | 10 FS | | 04/23/97 | 04/29/97 | | | | | |
| 13 | Fieldwork | 45d | 12 FS | | 04/29/97 | 06/08/97 | | | | | |
| 22 | EW Start-up | 7d | 13 FS | | 06/08/97 | 06/14/97 | | | | | |
| 23 | EW Data Collection | 7d | 22 FS | | 11/21/97 | 11/27/97 | | | | | |
| 14 | Sampling & Analysis | 45d | 13 FS | | 06/08/97 | 07/18/97 | | | | | |
| 15 | Data Validation | 28d | 14 FS | | 07/18/97 | 08/12/97 | | | | | |
| 16 | Data Summary/Validation Rpt | 28d | 23 FS | | 11/27/97 | 12/22/97 | | | | | |
| 17 | Combined Review | 30d | 16 FS | | 12/22/97 | 01/18/98 | | | | | |
| 18 | Data Review Mtg | 0d | 17 FS | | 01/18/98 | 01/18/98 | | | | | |
| 24 | Modeling/Risk Assessment Scoping Mtg | 0d | 18 FS | | 01/19/98 | 01/19/98 | | | | | |
| 19 | Modeling Report | 150d | 18 FS | | 01/18/98 | 05/31/98 | | | | | |
| 20 | COE Review | 14d | 19 FS | | 05/31/98 | 06/13/98 | | | | | |
| 26 | Comment Resolution | 7d | 20 FS | | 06/13/98 | 06/19/98 | | | | | |
| 27 | Combined Review | 30d | 26 FS | | 06/19/98 | 07/16/98 | | | | | |
| 28 | Comment Resolution | 14d | 27 FS | | 07/16/98 | 07/28/98 | | | | | |
| 29 | Draft Risk Assessment Rpt | 180d | 18 FS | | 01/18/98 | 06/27/98 | | | | | |
| 30 | COE Review | 14d | 29 FS | | 06/27/98 | 07/09/98 | | | | | |
| 31 | Comment Resolution | 7d | 30 FS | | 07/09/98 | 07/16/98 | | | | | |
| 32 | Army Review | 30d | 31 FS | | 07/16/98 | 08/11/98 | | | | | |

# LHAAP, GR2, SITE 16, accelerated; as of 12/19/96

| Task# | Task Name | Duration | Predecessors | Calendar | Sched Start | Sched Fin | Compl Dat | Actual Start | Actual Fin | Base Start | Base Fin |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 33 | Comment Resolution | 10d | 32 FS | | 08/11/98 | 08/20/98 | | | | | |
| 34 | Revise RA Rpt | 7d | 33 FS | | 08/20/98 | 08/26/98 | | | | | |
| 21 | Regulatory Review | 30d | 34 FS | | 08/26/98 | 09/22/98 | | | | | |
| 35 | Comment Resolution | 14d | 21 FS | | 09/22/98 | 10/04/98 | | | | | |
| 36 | Prepare RI/FS Rpt | 90d | 35 FS | | 10/05/98 | 12/23/98 | | | | | |
| 37 | Army Review | 10d | 36 FS | | 12/24/98 | 01/01/99 | | | | | |
| 38 | Comment Resolution | 7d | 37 FS | | 01/01/99 | 01/08/99 | | | | | |
| 39 | Draft RI/FS | 7d | 38 FS | | 01/08/99 | 01/14/99 | | | | | |
| 40 | Regulatory Review | 30d | 39 FS | | 01/14/99 | 02/09/99 | | | | | |

DEPARTMENT OF THE ARMY
LONGHORN/LOUISIANA army AMMUNITION PLANTS
MARSHALL, TEXAS 75671-1059

REPLY TO
ATTENTION OF

February 3, 1997

SIOLH-CR

018519

Ms. Diane Poteet
Superfund Investigation Section
Texas Natural Resource Conservation Commission
Post Office Box 13087
Austin, TX 78711-3087

SUBJECT: Proposed Phase III Monitoring Well, Site 16, Locations, including optional Monitoring Wells at the Longhorn Army Ammunition Plant, Karnack, Texas

Dear Ms. Poteet:

This letter is intended to provide regulatory notification of impending field operations as a prelude to the accelerated Remedial Investigation (RI/FS) Phase III at Site 16 (Old Landfill) at Longhorn Army Ammunition Plant. Operations for a surface resistivity survey at Site 16 are currently scheduled to begin February 17, 1997. Advanced Geosciences, Inc. (AGI) will perform the field operations and data processing as a subcontractor to Sverdrup Environmental, Inc.

The purpose of the surface resistivity survey is to better define the subsurface environment in order to locate a subsurface zone or zones of higher permeability. The location of zones of higher permeability will allow for the effective placement, horizontally and vertically, of monitoring wells so that the suspected contaminant plume will be intersected and monitored as well as provide valuable information for remediation of the site, if needed.

A surface resistivity survey is a non-invasive method for defining subsurface strata in which a continuous source of electrical current is passed through the ground by use of ground contacting electrodes. The resulting returning current is measured at varying distances and recorded. Through analysis of the signals, the subsurface resistivity of subsurface units will be presented as color cross-sections of the subsurface, i.e. a 2-D reistivity image.

As shown on Figure 1 of the enclosure, the resistivity surveys will be conducted along four lines running approximately northwest-southeast and transecting the approximate volatile organic compound (VOC) plume. Each line will be 700' in length. The more northeasterly line, labeled Line D, extends off the map boundary but will also be 700' long.

018520

Since these surveys are non-intrusive and require no drilling procedures, level D personal protective equipment will be worning during the performance of this investigation. All safety precautions in accordance with site and weather conditions will be observed.

As stated earlier, field operations requiring approximately three days are scheduled to begin 17 February 1997. Processing of the aquired data will require three to four days and will be performed either on-site or at the operator's office.

If you have any questions, please contact Mr. David Tolbert at 318-459-5109.

Sincerely,

James McPherson
Commander's Representative

Enclosure

DEPARTMENT OF THE ARMY
LONGHORN/LOUISIANA ARMY AMMUNITION PLANTS
MARSHALL, TEXAS 75671-1059

REPLY TO
ATTENTION OF

February 3, 1997

SIOLH-CR

018521

Mr. H.L. Jones
Texas Natural Resource Conservation
Commission
2916 Teague Drive
Tyler, TX 75701

SUBJECT: Proposed Phase III Monitoring Well, Site 16, Locations, including optional Monitoring Wells at the Longhorn Army Ammunition Plant, Karnack, Texas

Dear Mr. Jones:

This letter is intended to provide regulatory notification of impending field operations as a prelude to the accelerated Remedial Investigation (RI/FS) Phase III at Site 16 (Old Landfill) at Longhorn Army Ammunition Plant. Operations for a surface resistivity survey at Site 16 are currently scheduled to begin February 17, 1997. Advanced Geosciences, Inc. (AGI) will perform the field operations and data processing as a subcontractor to Sverdrup Environmental, Inc.

The purpose of the surface resistivity survey is to better define the subsurface environment in order to locate a subsurface zone or zones of higher permeability. The location of zones of higher permeability will allow for the effective placement, horizontally and vertically, of monitoring wells so that the suspected contaminant plume will be intersected and monitored as well as provide valuable information for remediation of the site, if needed.

A surface resistivity survey is a non-invasive method for defining subsurface strata in which a continuous source of electrical current is passed through the ground by use of ground contacting electrodes. The resulting returning current is measured at varying distances and recorded. Through analysis of the signals, the subsurface resistivity of subsurface units will be presented as color cross-sections of the subsurface, i.e. a 2-D reistivity image.

As shown on Figure 1 of the enclosure, the resistivity surveys will be conducted along four lines running approximately northwest-southeast and transecting the approximate volatile organic compound (VOC) plume. Each line will be 700' in length. The more northeasterly line, labeled Line D, extends off the map boundary but will also be 700' long.

018522

Since these surveys are non-intrusive and require no drilling procedures, level D personal protective equipment will be worning during the performance of this investigation. All safety precautions in accordance with site and weather conditions will be observed.

As stated earlier, field operations requiring approximately three days are scheduled to begin 17 February 1997. Processing of the aquired data will require three to four days and will be performed either on-site or at the operator's office.

If you have any questions, please contact Mr. David Tolbert at 318-459-5109.

Sincerely,

James McPherson
Commander's Representative

Enclosure

DEPARTMENT OF THE ARMY
LONGHORN/LOUISIANA ARMY AMMUNITION PLANTS
MARSHALL, TEXAS 75671-1059

REPLY TO ATTENTION OF

February 3, 1997

SIOLH-CR

01S523

Mr. Chris Villareal
Superfund Division (6SF-AT)
U.S. Environmental Protection Agency
1445 Ross Avenue
Dallas, TX 75202-2733

SUBJECT: Proposed Phase III Monitoring Well, Site 16, Locations, including optional Monitoring Wells at the Longhorn Army Ammunition Plant, Karnack, Texas

Dear Mr. Villareal:

This letter is intended to provide regulatory notification of impending field operations as a prelude to the accelerated Remedial Investigation (RI/FS) Phase III at Site 16 (Old Landfill) at Longhorn Army Ammunition Plant. Operations for a surface resistivity survey at Site 16 are currently scheduled to begin February 17, 1997. Advanced Geosciences, Inc. (AGI) will perform the field operations and data processing as a subcontractor to Sverdrup Environmental, Inc.

The purpose of the surface resistivity survey is to better define the subsurface environment in order to locate a subsurface zone or zones of higher permeability. The location of zones of higher permeability will allow for the effective placement, horizontally and vertically, of monitoring wells so that the suspected contaminant plume will be intersected and monitored as well as provide valuable information for remediation of the site, if needed.

A surface resistivity survey is a non-invasive method for defining subsurface strata in which a continuous source of electrical current is passed through the ground by use of ground contacting electrodes. The resulting returning current is measured at varying distances and recorded. Through analysis of the signals, the subsurface resistivity of subsurface units will be presented as color cross-sections of the subsurface, i.e. a 2-D reistivity image.

As shown on Figure 1 of the enclosure, the resistivity surveys will be conducted along four lines running approximately northwest-southeast and transecting the approximate volatile organic compound (VOC) plume. Each line will be 700' in length. The more northeasterly line, labeled Line D, extends off the map boundary but will also be 700' long.

018524



Since these surveys are non-intrusive and require no drilling procedures, level D personal protective equipment will be worning during the performance of this investigation. All safety precautions in accordance with site and weather conditions will be observed.

As stated earlier, field operations requiring approximately three days are scheduled to begin 17 February 1997. Processing of the aquired data will require three to four days and will be performed either on-site or at the operator's office.

If you have any questions, please contact Mr. David Tolbert at 318-459-5109.

Sincerely,

James McPherson
Commander's Representative

Enclosure

**DEPARTMENT OF THE ARMY**
TULSA DISTRICT, CORPS OF ENGINEERS
POST OFFICE BOX 61
TULSA, OKLAHOMA 74121-0061

018525

REPLY TO
ATTENTION OF:

CESWT-PP-ME (200-1c) 3 February 1997

MEMORANDUM FOR Commander, Longhorn/Louisiana Army Ammunition Plants, ATTN: SIOLH-OR (Mr. David Tolbert), Post Office Box 658, Doyline, LA 71023

SUBJECT: Proposed Phase III Monitoring Well, Site 16, Locations, including optional Monitoring Wells at the Longhorn Army Ammunition Plant, Karnack, Texas

1. This letter is intended to provide regulatory notification of impending field operations as a prelude to the accelerated Remedial Investigation (RI/FS) Phase III at Site 16 (Old Landfill) at Longhorn Army Ammunition Plant. Operations for a surface resistivity survey at Site 16 are currently scheduled to begin February 17, 1997. Advanced Geosciences, Inc. (AGI) will perform the field operations and data processing as a subcontractor to Sverdrup Environmental, Inc.

2. The purpose of the surface resistivity survey is to better define the subsurface environment in order to locate a subsurface zone or zones of higher permeability. The location of zones of higher permeability will allow for the effective placement, horizontally and vertically, of monitoring wells so that the suspected contaminant plume will be intersected and monitored as well as provide valuable information for remediation of the site, if needed.

3. A surface resistivity survey is a non-invasive method for defining subsurface strata in which a continuous source of electrical current is passed through the ground by use of ground contacting electrodes. The resulting returning current is measured at varying distances and recorded. Through analysis of the signals, the subsurface resistivity of subsurface units will be presented as color cross-sections of the subsurface, i.e. a 2-D reistivity image.

4. As shown on Figure 1 of the enclosure, the resistivity surveys will be conducted along four lines running approximately northwest-southeast and transecting the approximate volatile organic compound (VOC) plume. Each line will be 700' in length. The more northeasterly line, labeled Line D, extends off the map boundary but will also be 700' long.

CESWT-PP-ME
SUBJECT: Proposed Phase III Monitoring Well, Site 16, Locations, including optional Monitoring Wells at the Longhorn Army Ammunition Plant, Karnack, Texas

5. Since these surveys are non-intrusive and require no drilling procedures, level D personal protective equipment will be worning during the performance of this investigation. All safety precautions in accordance with site and weather conditions will be observed.

6. As stated earlier, field operations requiring approximately three days are scheduled to begin 17 February 1997. Processing of the aquired data will require three to four days and will be performed either on-site or at the operator's office.

7. If you have any questions, please contact Ms. Jonna Polk at 918-669-7480.

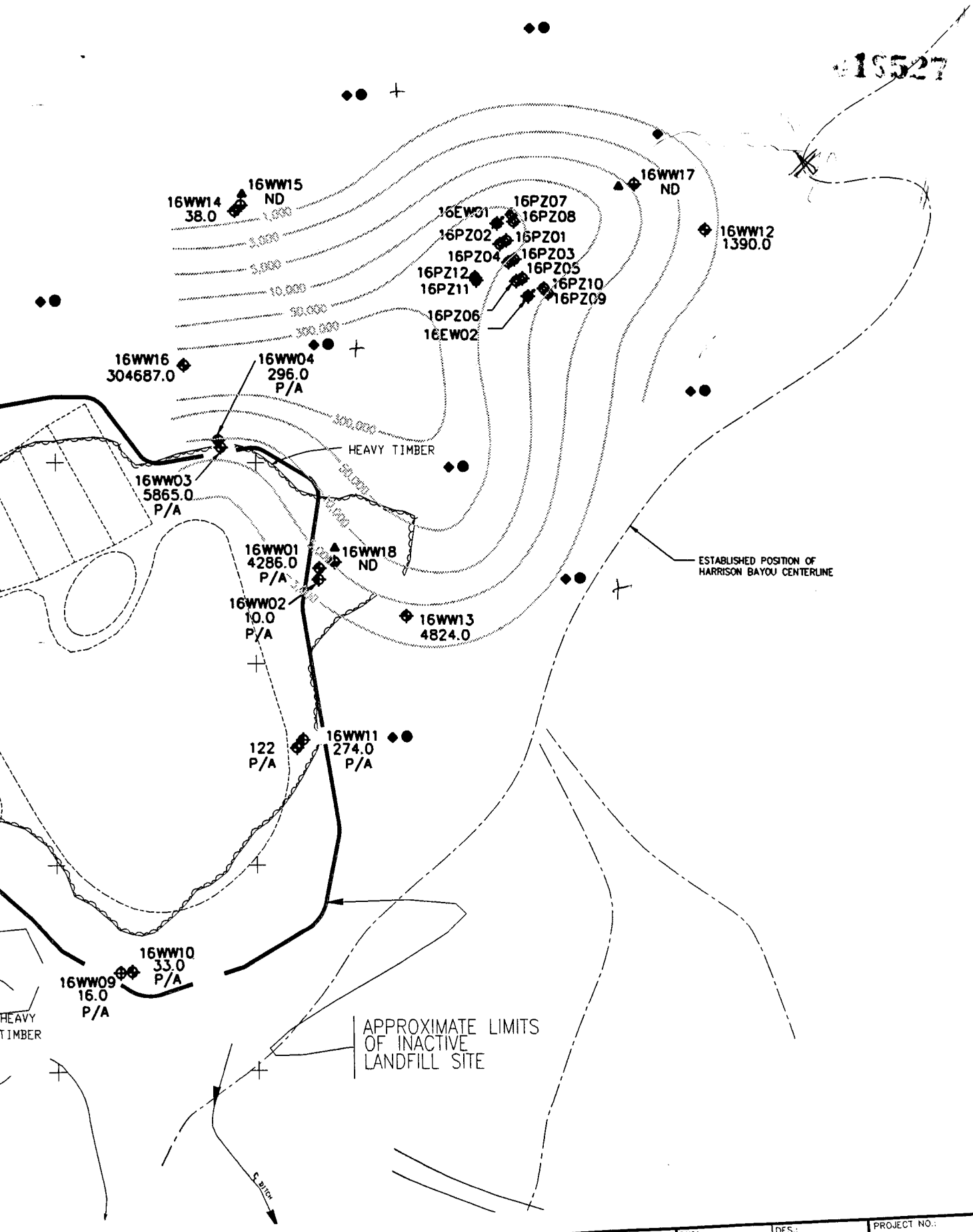
Sincerely,

Burl D Ragland

BURL D. RAGLAND
Lead Project Manager
Army Team

Enclosure

#19527




SI. 3 - PROPOSED PHASE III MONITORING WELL
OCATIONS, INCLUDING OPTIONAL MONITORING WELLS
LONGHORN ARMY AMMUNITION PLANT

| | | | |
|---|---|---|---|
| DWN: BGC | DES.: | PROJECT NO.: 000086 | |
| CHKD: | APPD: | FIGURE NO.: 1 | |
| DATE: OCTOBER 96 | REV.: | | |

DEPARTMENT OF THE ARMY
LONGHORN/LOUISIANA ARMY AMMUNITION PLANTS
P.O. BOX 658
DOYLINE, LOUISIANA 71023-0658



REPLY TO
ATTENTION OF
SIOLH-OR

4 February 1997

018528

Dr. James Bruseth
Deputy State Historic Preservation Officer
Texas Historical Commission
PO Box 12276, Capitol Station
Austin, TX 78711-2276

Dear Dr. Bruseth:

The Army is performing environmental remediation of Landfill 12 at Longhorn Army Ammunition Plant. This work will involve placing an impermeable cap over the old landfill and constructing a earthen drainage ditch at the perimeter of the landfill cap. The Longhorn Cultural Resources Management Plan (CRMP) does not depict the landfill area as disturbed but this is an obvious omission. However, the landfill area is characterized as contaminated with hazardous and toxic waste in the Longhorn CRMP (Figure II-1, page II-3).

We have determined that the proposed environmental work will cause no effect to cultural resources at Longhorn Army Ammunition Plant. If you do not object to our determination within 15 days, we will assume your concurrence. We would appreciate documentation of your concurrence, however, for your convenience, if you concur in our determination you can simply sign the concurrence line below and return a copy of this letter to me. Copies of this letter and its enclosures are being provided to Mr. Frank Meleton of the Ft. Worth District, Corps of Engineers.

Please contact Mr. Paul Hagerty of this office at (318) 371-0809 if you need further information, or to discuss our request or conclusions.

Sincerely,

Ira C Nathan

IRA C. NATHAN
Chief, Operations Review Division

Concurrence:

for State Historic Preservation Officer — Date: 2-12-97

# TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

*Protecting Texas by Reducing and Preventing Pollution*

018529

February 6, 1997

**CERTIFIED MAIL**
**Z 746 032 745**
**RETURN RECEIPT REQUESTED**

James A. McPherson, Commander's Representative
Longhorn/Louisiana Army Ammunition Plant
Attn: SIOLH-CR
P. O. Box 658
Doyline, LA 71023

Re: Longhorn Army Ammunition Plant
Group 2 - Landfill Site 16
Disposal of Water Treatment Plant Sludge

Dear Mr. McPherson:

The Texas Natural Resource Conservation Commission (TNRCC) staff has completed its review of the Army's letter, which was received on January 30, 1997, requesting to dispose of lagoonal sludge from Longhorn's Water Treatment Plant onto Landfill 16. The TNRCC concurs with the Army's decision to dispose of the subject sludge by first dewatering and then spreading it on Landfill 16 prior to the landfill being capped. As you cited in your request letter, the sludge should be analyzed and classified in accordance with 30 TAC Chapter 335 Subchapter R. If you have any questions or comments regarding this matter, please call me at (512) 239-2502.

Sincerely,

Diane R. Poteet

Diane R. Poteet, Project Manager
RI/FS II Unit
Superfund Investigation Section (MC-143)
Pollution Cleanup Division

cc: Chris Villarreal, EPA Region 6 (6SF-AT)
Jonna Polk, COE Tulsa District (CESWT-PP-EA) ✓
Warren Sayes, COE Eastern Area Office (CESWF-AD-E)

**bcc:**

Bud Jones, OCE/F.O./Region 5 - Tyler
Bill O'Sullivan, OCE/F.O./Region 5 - Tyler
Mark Weegar, WASTE/IHW - Corrective Action (MC-127)
Alvie Nichols, WASTE/PC/Engineering (MC-144)

018530

DEPARTMENT OF THE ARMY
LONGHORN/LOUISIANA ARMY AMMUNITION PLANTS
MARSHALL, TEXAS 75671-1059

REPLY TO ATTENTION OF

February 6, 1997

SIOLH-CR

Ms. Diane Poteet
Superfund Investigation Section
Texas Natural Resource Conservation Commission
Post Office Box 13087
Austin, TX 78711-3087

18531

SUBJECT: Final Revised Air Monitoring Plan at the Longhorn Army Ammunition Plant, Karnack, Texas

Dear Ms. Poteet:

Please find enclosed the Final Revised Section 5 of the Air Monitoring Plan (AMP). Also included is a Final Revised Cover Page and Table of Contents. The copies are made on three hole punched paper in order to facilitate the replacement of previously issued Secitons of the AMP.

If you have any questions, please contact Mr. David Tolbert, at 318-459-5109.

Sincerely,

James McPherson
Commander's Representative

Enclosure

DEPARTMENT OF THE ARMY
LONGHORN/LOUISIANA ARMY AMMUNITION PLANTS
MARSHALL, TEXAS 75671-1058

REPLY TO ATTENTION OF

February 6, 1997

SIOLH-CR

018532

Mr. Chris Villareal
U.S. Environmental Protection Agency
1445 Ross Avenue
Dallas, TX 75202-2733

SUBJECT: Final Revised Air Monitoring Plan at the Longhorn Army Ammunition Plant, Karnack, Texas

Dear Mr. Villareal:

Please find enclosed the Final Revised Section 5 of the Air Monitoring Plan (AMP). Also included is a Final Revised Cover Page and Table of Contents. The copies are made on three hole punched paper in order to facilitate the replacement of previously issued Secitons of the AMP.

If you have any questions, please contact Mr. David Tolbert, at 318-459-5109.

Sincerely,

James McPherson
Commander's Representative

**Monthly Managers' Meeting**
**Longhorn Army Ammunition Plant**
**11 February 1997**
**Longhorn Army Ammunition Plant, Karnack, Texas**

018533

1. The following is a list of participants:

James McPherson - LHAAP
Oscar Linebaugh - USACE, EAO
Vic Heister - USACE, Tulsa District
Dudley Beene - USACE, EAO
Cyril Onewokae - HQ, IOC, AMSIO-EQE
Bill Corrigan - Radian
Cliff Murray - USACE, Tulsa District
Ira Nathan - LHAAP
Earney Funderburg - OHM
Wilma Subra - Uncertain Audubon
Ruth Culver - Uncertain Audubon
H. L. "Bud" Jones - TNRCC
David Tolbert - LHAAP
Yolane Hartsfield - USACE, Tulsa District
Chris Villarreal - EPA, Region 6
Diane Poteet - TNRCC
Amine Bou Onk - Radian
Glen Turney - OHM
Frank Meleton - USACE, EAO
Jeff Armstrong (by telephone) --AEC

2. The following is a list of topics discussed (in order of discussion):

**Opening Remarks, Review and Transmittal of Meeting Minutes:** On behalf of LHAAP, James McPherson welcomed all attendees to the Monthly Managers' Meeting held at the LHAAP administration trailer on LHAAP, Karnack, Texas. Mr. McPherson introduced Ms. Yolane Hartsfield, Tulsa District COE, as the new project manager. The January 1997 meeting minutes were reviewed and accepted with revisions (Revised January 1997 meeting minutes attached).

**Future Land Use:** The Army has declared that LHAAP totally excessed to the Army's need and requirements with the intent to divest its interest to the property. The determination as to future land use (i.e. industrial, residential, etc.) is in process. Mr. McPherson outlined the normal process the Army uses to divest its interest in such properties and provided a general overview of the time involved to complete the process. Currently plans are to remediate to industrial use standards, with the Army acknowledging there may be some areas that the Army will retain interest to and ownership thereto. LHAAP has begun process to excess property and will keep regulators fully informed as to progress. COE prepared map is being completed.

**Landfill 16 Water Treatment:** The disposal plan for produced water was presented. Produced water will be conveyed to the GWTP at BG3, treated and discharged. TNRCC is to provide effluent concentration standards for explosives. Current high flow in Harrison Bayou is optimal for discharge of treated effluent. The addition of a carbon unit to the process was discussed with purchase/use dependent upon funding.

**Proposed Change in Disposal Method for Landfill Tree Stumps:** A change in the disposal

on the highly contaminated and low temperature desorption on the less contaminated soils

plan for tree stumps at the landfills was presented. Originally the SOW called for chipping the stumps into mulch. The contractor proposes piling the stumps and burning same. This approach will be effective and efficient and save the government ± $168,000. Mr. Onewokae requested written documentation of the change. Mr. Nathan to provide.

**Sumps Update:** The contractor stated that they had demolished 62 of the 80 sumps and were down to the larger sumps. Smaller sumps had been removed whole, moved to the landfill, and demolished on site. The larger sumps will be demolished in-place and then the debris will be moved to the landfill. When sumps were removed, associated trough "leg-outs" were also removed. Discussion of the schedule to remove the remaining troughs was conducted. The consensus reached, with concurrence of the TNRCC, was that these minutes serve as sufficient revision to the work plan (OHM to revise their work plan and distribute) such that the 5 remaining troughs and associated soil will become a part of the Phase III, Group 4, investigation. OHM will place concrete in the trough structures, where to prevent potential releases of fluids from the exposed ends of troughs. A memo will be prepared addressing this change and submitted to the TNRCC (Ms. Hartsfield to prepare).

Mr. McPherson asked for clarification on backfilling the sumps' pits. It was decided to use clean fill or non-contaminated excavated soils (i.e. that soil which meets the Risk Reduction #2 standards). One or 2 sumps' pits will need clean fill according to the contractor. OHM to furnish LHAAP analyses for these 2 sump sites for decision on contaminated soil. No liners will be used in the backfilled pits.

**LTTD POP Test Overview:** The contractor verified that the plant was ready to go ahead with the POP Testing scheduled for 12 February 1997. Testing to include 3 sets of soil samples from highly contaminated sites, 3 sets from less contaminated sites, using high temperature desorption on the highly contaminated and low temperature desorption on the less contaminated soils (allowing ± ½ day to allow unit to cool down between high temperature runs and low temperature runs).

**Executive Summary Review:** The executive summary handout was reviewed and questions regarding projects' status were answered.

**Monthly Meeting Schedule and Location:** The next monthly meeting will be held on 11 March 1997 at LHAAP at 0930.

**Meeting adjourned.**

**Army Team Management Meeting** 01S535
**Longhorn Army Ammunition Plant**
**11 February 1997**
**Longhorn Army Ammunition Plant, Karnack, Texas**

1. The following is a list of participants:

James McPherson
David Tolbert
Cyril Onewokae
Jeff Armstrong (by telephone)
Oscar Linebaugh
Yolane Hartsfield
Amine Bou Onk

2. The meeting was opened and Mr. McPherson asked Mr. Onk to brief the participants on Radian's breakout of options to transport produced water from Site 16 to the GWTP at the Burning Grounds for treatment and disposal.

3. Mr. Onk stated there are two basic options: a) truck water to GWTP, or b) use a pipeline to transport the water to the GWTP. Option "a" has 4 sub-options which he discussed. Option 1 would involve subcontracting trucking service and trucking water twice weekly. Two Radian personnel would be required to provide field assistance to the subcontractor. This option also would require the use of 3 frac tanks (to be used to load out trucks), and some repair to an existing containment berm. Estimated cost for 2 years: $782,000.00. Option 2 would involve using 2 Army owned vacuum trailers onsite at LHAAP and leasing trucks/tractors. This option included repair to the trailers to bring them into service, repair of the existing containment, 2 Radian personnel, and rental on 3 frac tanks. Estimated cost for 2 years: $525,000.00. Option 3 would involve use of Army provided trucks/tractors which Mr. McPherson interjected are not currently available at LHAAP and may not be available to bring to LHAAP for use. This option also requires use of 3 frac tanks and repair to existing containment. Estimated cost for 2 years: $450,000.00.

4. At this point in the discussion it was noted that the rental frac tanks would require containment. Those costs were not included in the 3 above discussed options. A rough estimate of $80,000.00 to $100,000.00 was suggested. The addition of a holding tank at the GWTP (60,000 gallon capacity) would also be required, and its costs were not included in the above 3 options. Road repair costs of an estimated $85,000.00 was provided to the group. Some discussion of bridge repair was held, with an estimate of $80,000.00 to $100,000.00, but no consensus as to whether bridge repair would be required was met.

5. Option 4 involved the use of a double-walled high density polyethylene pipeline. The installation of this pipeline and requisite pumps and tankage was estimated to cost $500,000.00.

Mr. Armstrong requested rough estimated costs (O&M) for continued monitoring of leak detection system in pipeline and pumping.

6. A discussion about the treatment of yellow water was held. Currently have 16 frac tanks filled with produced water at Site 16 (~310,000 gallons). Radian suggested long-term color treatment using carbon filters. Radian proposed using 2 carbon units in series (each holding about 20,000 pounds carbon). Installation costs were estimated at $250,000.00. Carbon recharge was estimated to be about $14,000.00 per unit (roughly $0.70/pound carbon).

7. Treatment issue "B" -- sulfates and chlorides was held. Current high flow conditions in Harrison Bayou would facilitate effluent discharge. In low flow months, plant would not meet effluent concentration standards and would be shut down. Suggested resolution was discussed. Reverse osmosis would be expensive and with the expected water conditions, ineffective. Use of an evaporator to precipitate out the sulfates and chlorides from the influent stream was roughly estimated at $750,000.00 to $850.000.00.

8. Upgrade of the electrical supply unit was discussed. Currently cannot run soil plant and GWTP at the same time. Until upgrade contractor plans to run one plant in the daytime and the other during the night. Sverdrup's anticipated construction will increase electrical demand.

9. Radian stated that about 240,000 gallons of water have been treated and released from the GWTP.

10. Meeting adjourned.

# Texas Natural Resource Conservation Commission

## INTEROFFICE MEMORANDUM

DATE: February 19, 1997

TO : Diane Poteet
Investigation Unit
Pollution Cleanup Division

019537

Thru Pat Radloff, Team Leader
Industrial Permits Team

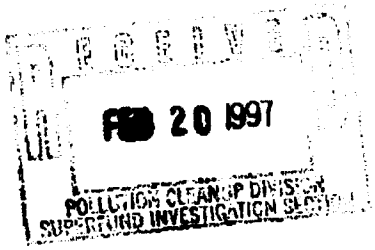
FROM : Stephen Ligon
Industrial Permits Team

SUBJECT : Longhorn Army Ammunition Plant Ground Water Remediation Activities

You requested assistance (in a FAX dated 02/05097) in establishing effluent guidelines for the discharge of treated groundwater from the above-refcrenced facility. The effluent limitations which were previously provided and included within the work plan for this site are also appropriate for this discharge. The following effluent limitations should also be included.

| | Units are (µg/L) | | |
|---|---|---|---|
| METALS | Dly Avg | Dly Max | MAL (µg/L) |
| Mercury, Total | 0.208 | 0.441 | 0.2 |

Not all of the pollutants for which you requested guidance are included in the Texas Surface Water Quality Standards. Effluent guidelines for these pollutants will require additional consideration from the Toxicity Evaluation Team of the Water Planning and Assessment Division. These guidelines will be forwarded to you as soon as is possible.



# TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

*Protecting Texas by Reducing and Preventing Pollution*

February 26, 1997

018538

Mr. James A. McPherson
Commander's Representative
U.S. Army
P.O. Box 658
Doyline, Louisiana 71023

Re: Standard Exemption
Registration No. 34480
Soil and Groundwater Remediation System
Longhorn Army Ammunition Plant
Marshall, Harrison County
Account ID No. 93-4480-R

Dear Mr. McPherson:

This is in response to your request to register a soil and groundwater remediation system under Standard Exemption at Burning Ground No. 3 at the Longhorn Army Ammunition Plant in Harrison County. We understand that you will use a catalytic oxidizer to abate air emissions. You have estimated that emissions of the compound of greatest concern, methylene chloride, will not exceed 3.25 pounds per hour. You have also documented the placement of the emissions points at least 3,000 feet away from any off-site receptors.

Accordingly, and after evaluating the entirety of your submittal, we have determined that your operation conforms to the criteria for permit exemption under Standard Exemptions 68 and 118, if constructed and operated as described in your application. The Executive Director authorized these standard exemptions pursuant to Texas Natural Resource Conservation Commission (TNRCC) 30 TAC Section 116.211 (Regulation VI). We have included copies of the exemptions in effect at the time of this registration. You must operate in accordance with all of their requirements.

We remind you that regardless of whether a permit is required, you must maintain these facilities in compliance with all air quality rules and regulations of the TNRCC and of the U.S. Environmental Protection Agency at all times.

18539

Re: Standard Exemption
Registration No. 34480

If you have any questions concerning this exemption, please contact Mr. Terry Murphy of our Office of Air Quality, New Source Review Permits Division at (512) 239-1587.

Sincerely,

for John C. Stott

Tammy Villarreal
Manager, Chemical Section
New Source Review Permits Division
Texas Natural Resource Conservation Commission

TV/TM/al

Enclosures

cc: Mr. Charles Murray, Air Program Manager, Tyler

Record No. 49193

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

STANDARD EXEMPTION LIST

30 TAC §116.211
Control of Air Pollution By Permits For
New Construction or Modification

018540

ADOPTED MAY 15, 1996
EFFECTIVE JUNE 7, 1996

**********

68. Equipment used to reclaim or destroy chemicals removed from contaminated ground water, contaminated water condensate in tank and pipeline systems, or contaminated soil, for the purpose of remedial action, provided all the following conditions are satisfied:

(a) Applicability shall pertain to soil and water remediation at the property where the original contamination of the ground water or soil occurred or at a nearby property secondarily affected by the contamination, but not to any soil or water treatment facility where soils or water are brought in from another property. Such facilities are subject to §116.1, relating to Permit Requirements.

(b) For treating groundwater or soil contaminated with petroleum compounds, the total emissions of petroleum hydrocarbons shall not exceed 1.0 pound per hour (lb/hr), except that benzene emissions also must meet the conditions of Standard Exemption 118(c) and (d). For purposes of this exemption, petroleum is considered to include: (1) liquids or gases produced from natural formations of crude oil, tar sands, shale, coal and natural gas, or (2) refinery fuel products to include fuel additives.

(c) For treating groundwater or soil contaminated with chemicals other than petroleum, emissions must meet the requirements of Standard Exemption 118(b), (c), and (d). If the groundwater or soil is contaminated with both petroleum and other chemicals, the petroleum compound emissions must meet condition (b) of this exemption and the other chemical emissions must meet the requirements of Standard Exemption 118(b), (c), and (d). The emission of any chemical not having a Limit (L) Value in Table 118A of Standard Exemption 118 is limited to 1.0 lb/hr.

(d) The handling and processing (screening, crushing, etc.) of contaminated soil and the handling and conditioning (adding moisture) of remediated soil shall be controlled such that there are no visible emissions with the exception of moisture.

(e) If abatement equipment is used to meet conditions (b) and (c), the equipment must satisfy one of the following conditions:

(1) The vapors shall be burned in a direct-flame combustion device (incinerator, furnace, boiler, heater, or other enclosed direct-flame device) operated in compliance with Standard Exemption 88(b) and (c).

(2) The vapors shall be burned in a flare which meets the requirements of Standard Exemption 80 and the requirements of 40 Code of Federal Regulations 60.18 which shall take precedence over Standard Exemption 80 in any conflicting requirements whether or not New Source Performance Standards apply to the flare.

(3) The vapors shall be burned in a catalytic oxidizer which destroys at least 90% of the vapors. An evaluation of oxidizer effectiveness shall be made at least weekly using a portable flame or photoionization detector or equivalent instrument to determine the quantity of carbon compounds in the inlet and outlet of the catalytic oxidizer. Records of oxidizer performance shall be maintained in accordance with condition (g).

(4) The vapors shall be routed through a carbon adsorption system (CAS) consisting of at least two activated carbon canisters that are connected in series. The system shall meet the following additional requirements:

(A) The CAS shall be sampled and recorded weekly to determine breakthrough of volatile organic compounds (VOC). Breakthrough is defined as a measured VOC concentration of 50 parts per million by volume (ppmv) in the outlet of the initial canister. The sampling point shall be at the outlet of the initial canister, but before the inlet to the second or final polishing canister. Sampling shall be performed while venting maximum emissions to the CAS. (Example: during loading of tank trucks, during tank filling, during process venting.)

(B) A flame ionization detector (FID) shall be used for VOC sampling. The FID shall be calibrated prior to sampling with certified gas mixtures (propane in air) of 10 ppmv ± 2.0% and of 100 ppmv ± 2.0%.

(C) When the VOC breakthrough is measured, the waste gas flow shall be switched to the second canister immediately. Within four hours of detection of breakthrough, a fresh canister shall be placed as the new final polishing canister. Sufficient fresh activated carbon canisters shall be maintained at the site to ensure fresh polishing canisters are installed within four hours of detection of breakthrough.

(D) Records of the CAS monitoring maintained at the plant site shall include, but are not limited to, the following:

1. sample time and date,
2. monitoring results (ppmv),
3. corrective action taken, including the time and date of the action, and
4. process operations occurring at the time of sampling.

(E) The registration shall include a demonstration that activated carbon is an appropriate choice for control of the organic compounds to be stripped.

(f) Before construction of the facility begins, the facility shall be registered with the Texas Natural Resource Conservation Commission (TNRCC) Office of Air Quality in Austin using Form PI-7. The registration shall contain specific information concerning the basis (measured or calculated) for the expected emissions from the facility. The registration shall also explain details as to why the emission control system can be expected to perform as represented.

(g) Records required by applicable paragraphs of this exemption shall be maintained at the site and made available to personnel from the TNRCC or any local agency having jurisdiction. These records shall be made available to representatives of the TNRCC and local programs upon request and shall be retained for at least two years following the date that the data is obtained.

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

STANDARD EXEMPTION LIST

30 TAC §116.211
Control of Air Pollution By Permits For
New Construction or Modification

018543

ADOPTED MAY 15, 1996
EFFECTIVE JUNE 7, 1996

**********

118. Facilities, or physical or operational changes to a facility, provided that all of the following conditions are satisfied:

(a) This exemption shall not be used to authorize construction or any change to a facility specifically authorized in another standard exemption, but not meeting the requirements of that exemption. However, once the requirements of a specific exemption are met, Exemption 118(c) and (d) may be used to qualify the use of other chemicals at the facility.

(b) Emission points associated with the facilities or changes shall be located at least 100 feet from any off-plant receptor*.

(c) New or increased emissions, including fugitives, of chemicals shall not be emitted in a quantity greater than five tons per year nor in a quantity greater than E as determined using the equation E = L/K and the following table.

| D, Feet | K |
|---|---|
| 100 | 326 |
| 200 | 200 |
| 300 | 139 |
| 400 | 104 |
| 500 | 81 |
| 600 | 65 |
| 700 | 54 |
| 800 | 46 |
| 900 | 39 |
| 1,000 | 34 |
| 2,000 | 14 |
| 3,000 or more | 8 |

E = maximum allowable hourly emission, and never to exceed 6 pounds per hour.

L = value as listed or referenced in Table 118A.

K = value from the table on this page. (interpolate intermediate values)

D = distance to the nearest off-plant receptor.

(d) Notification must be provided using Form PI-7 within 10 days following the installation or modification of the facilities. The notification shall include a description of the project, calculations, and data identifying specific chemical names, L values, D values, and a description of pollution control equipment, if any.

TABLE 118A Cont'd.

| Compound | Limit (L) Milligrams Per Cubic Meter |
|---|---|
| Methylhydrazine | 0.08 |
| Methyl Isoamyl Ketone | 5.8 |
| Methyl Mercaptan | 0.3 |
| Methyl Methacrylate | 34 |
| Methyl Propyl Ketone | 530 |
| Methyl Sulfide | 0.5 |
| Mineral Spirits | 350 |
| Naphtha | 350 |
| Nickel, Inorganic Compounds | 0.015 |
| Nitroglycerine | 0.1 |
| Nitropropane | 36 |
| Octane | 350 |
| Parathion | 0.05 |
| Pentane | 350 |
| Perchloroethylene | 33.5 |
| Petroleum Ether | 350 |
| Phenyl Glycidyl Ether | 5 |
| Phenylhydrazine | 0.6 |
| Phenyl Mercaptan | 0.4 |
| Propionitrile | 14 |
| Propyl Acetate | 281 |
| Propylene Oxide | 5 |
| Propyl Mercaptan | 0.08 |
| Stoddard Solvent | 350 |
| Styrene | 21 |
| Succinonitrile | 20 |
| Tolidine | 0.02 |
| Trichloroethylene | 135 |
| Trimethylamine | 0.1 |
| Valeric Acid | 0.34 |
| Vinyl Acetate | 15 |
| Vinyl Chloride | 2 |

The time weighted average Threshold Limit Value )TLV) published by the American Conference of Governmental Industrial Hygienists (ACGIH), (1985-1986 Edition) shall be used for compounds not included in the table. Standard Exemption 118 cannot be used if the compound is not listed in the table or does not have a published TLV in the ACGIH.

(e) The facilities in which the following chemicals will be handled shall be located at least 300 feet from the nearest property line and 600 feet from any off-plant receptor and the cumulative amount of any of the following chemicals resulting from one or more authorizations under this exemption (but not including permit authorizations) shall not exceed 500 pounds on the plant property and all listed chemicals shall be handled only in unheated containers operated in compliance with the United States Department of Transportation regulations (49 Code of Federal Regulations Parts 171 through 178): acrolein, ammonia, arsine, boron trifluoride, bromine, carbon disulfide, chlorine, chlorine dioxide, chlorine trifluoride, chloroacetaldehyde, chloropicrin, chloroprene, diazomethane, diborane, dimethylhydrazine, ethyl mercaptan, fluorine, formaldehyde, hydrogen bromide, hydrogen chloride, hydrogen cyanide, hydrogen fluoride, hydrogen selenide, hydrogen sulfide, ketene, methylamine, methyl bromide, methylhydrazine, methyl isocyanate, methyl mercaptan, nickel carbonyl, nitric oxide, nitrogen dioxide, oxygen difluoride, ozone, pentaborane, perchloromethyl mercaptan, perchloryl fluoride, phosgene, phosphine, phosphorus trichloride, selenium hexafluoride, stibine, liquified sulfur dioxide, sulfur pentafluoride, and tellurium hexafluoride. Containers of these chemicals may not be vented or opened directly to the atmosphere at any time.

(f) For physical changes or modifications to existing facilities, there shall be no changes or additions of air pollution abatement equipment.

(g) Visible emissions, except uncombined water, to the atmosphere from any point or fugitive source shall not exceed 5.0% opacity in any five-minute period.

* Off-plant receptor means any recreational area or residence or other structure not occupied or used solely by the owner or operator of the facilities or the owner of the property upon which the facilities are located.

DEPARTMENT OF THE ARMY
LONGHORN/LOUISIANA ARMY AMMUNITION PLANTS
P.O. BOX 658
DOYLINE, LOUISIANA 71023-0658

018546

REPLY TO
ATTENTION OF

SIOLA-CA

27 February 1997

MEMORANDUM FOR Commander, U. S. Army, Industrial Operations Command, ATTN: AMSIO-EQE (Mr. Cyril Onewokae), Rock Island, Illinois 61299-6000

SUBJECT: Cost Estimates for Accelerated RI/FS With Treatability Study and Transportation of Produced Water From Site 16, Longhorn Army Ammunition Plant, Karnack, Texas

1. Enclosed are copies of the following cost estimates: Sverdrup Environmental proposal, COE in-house labor costs, and the four (4) options proposed by Radian International which are under consideration to provide for the transport of produced water from Site 16 to the GWTP.

2. Of the 4 options under consideration to provide for the transport of produced water from Site 16 to the GWTP for treatment and disposal, I would recommend that Option 4, "Use holding tank at Site 16 and pump water to GWTP." The reasons are as follows:

a. Options 1, 2, and 3 are significantly more labor intensive than Option 4.

b. Option 3 is viable solely upon the availability of government furnished trucks. Longhorn does not have ready access to these vehicles and the acquisition of same is uncertain.

c. Personnel working around heavy machinery (i.e., trucks and tractors) in all weather conditions poses greater safety risks than a pipeline system which requires minimal manpower.

d. Loading into trucks, hauling over an open road, then off-loading the contaminated produced water provides for the real possibility for the occurrence of a release into the environment of the contaminated water through spillage, leaks, or accidents. The proximity to Harrison Bayou and Caddo Lake is of obvious concern with respect to potential releases.

e. Option 4 is the most cost effective of the 4 proposals and is also the most protective of human health and the environment.

3. The point of contact is Mr. David Tolbert, DSN 637-5109.

James A McPherson

JAMES A. McPHERSON
Commander's Representative

Encl

CESWT-PP-EA 27 February 1997

MEMORANDUM FOR SIOLH-OR (MR. DAVID TOLBERT)

018547

SUBJECT: Funding Request for Contract for Accelerated RI

1. The accelerated RI/FS contract has been negotiated with Sverdrup Environmental, Inc., for a sum of $1,285,519.00 (see attached).

2. In addition to this amount Tulsa District funding needs are as follows:

a) Field operations' oversight -- $15,000.00
b) Contractor oversight -- $25,000.00
c) Risk Assessment -- $17,000.00
d) Chemistry technical support -- $13,500.00.

3. Please use the above to prepare a funding request for a total estimated cost (excluding transport of produced water) of $1,356,019. The point of contact is Ms. Yolane Hartsfield, 918.669.7530.

Yolane Hartsfield
Project Manager

**Breakout of Cost Estimate**
**Sverdrup Environmental, Inc.**
**Accelerated Remedial Investigation/Feasibility Study**

018548

| SOW Task No. | Task Description | Subtask Costs | Task Cost |
|---|---|---|---|
| 1 | Project Support and Pre-RI field work (resistivity survey): | | $77,092 |
| | Resistivity survey | $13,500 | |
| | Project Support | $63,592 | |
| 2 | Phase III RI/FS and Water Treatability Work Plan | | $22,530 |
| 3 | Phase III RI/FS Field Investigations | | $758,422 |
| | Extraction Well Installation | $161,514 | |
| | Monitoring Well Installation | $336,338 | |
| | Piezometers | $119,015 | |
| | Water/Soil/Groundwater Sampling and Analysis | $141,555 | |
| 4 | Sampling and Data Results Report | | $47,680 |
| 5 | Feasibility Study Data Compilation | | $51,635 |
| 6 | Remedial Investigation Report | | $68,790 |
| 7 | Feasibility Study Report | | $81,736 |
| 8 | Remote Surveillance System Installation | | Deleted |
| 9 | Groundwater Modeling | | $99,618 |
| 10 | Risk Assessment Report | | $78,016 |
| | **Total Phase III Site 18 Accelerated RI/FS and Water Treatability Study** | | **$1,285,519** |

**Transportation of Produced Water**
**From Site 16 to GWTP**
**Longhorn AAP**

018549

Background.

Groundwater at Site 16 has been determined to be contaminated. A significant amount of water was produced during investigative phases which included a short-term pumping test to evaluate hydrogeologic conditions. Currently sixteen frac tanks located at Site 16 are retaining produced water. The water, per regulatory direction, must be treated before release into the environment. At the February 1997 Monthly Managers' Meeting held at Longhorn AAP Radian International (Radian) briefed plant and Army personnel on the anticipated costs to transport produced water from Site 16 to the GWTP for treatment and disposal. The duration value for this activity used was two (2) years. Radian's proposal addressed four (4) options.

Three of the 4 options require trucking. Monies are included in each of these 3 options for haul road maintenance, but no money for bridge repair is included in any of the associated cost estimates. Also included is repair and upgrade to the berm around the existing tank at Site 16, rental on three (3) frac tanks (with containment) downstream of existing tank which will be used to load out trailers, and a 60,000 gallon tank at the GWTP to use to control influent feed rates into the GWTP. Radian's cost estimates for each option are as follows.

Option 1. Lease vacuum trucks.

Option 1 would provide for renting or leasing 2 vacuum trucks with non-Radian drivers, hauling produced water on a weekly schedule from Site 16 to the GWTP. The estimate includes Radian personnel to serve as field technicians to assist the vacuum truck drivers and to perform decontamination procedures on the vacuum trucks before the trucks leave the GWTP site. The estimate includes all ancillary charges such as road charges to and from the subcontractor's yard, mobilization charges, and decontamination charges. Cost estimate: $869,458.00

Option 2. Lease truck/tractors and use government furnished water trailers.

Option 2 would provide for using government furnished water trailers (on-site at LHAAP with repair needed to bring them into service). The differences between Option 1 and Option 2 are: 1) there would be no need to decontaminate the trailers after each use since the trailers would not be leaving the site or facility; 2) there would not be any incurred road charges, or mobilization charges from a subcontractor's yard to and from LHAAP; 3) trucks/tractors would be leased or rented; and, 4) Radian personnel would be used as truck/tractor drivers. Cost estimate: $668,441.00

Option 3. Use government furnished trucks/tractors and water trailers.

Option 3 would provide for using government furnished trucks (if such trucks can be found and are available for use) as well as the government furnished water trailers. The

differences between Option 1 and Option 3 are: 1) no leasing or rental charges for truck/tractors or trailers would be incurred; 2) there would be no need to decontaminate the trailers after each use since the trailers would not be leaving the site or facility; 3) there would not be any incurred road charges or mobilization charges from a subcontractor's yard to and from LHAAP; and, 3) there would not be any repetitive mobilization charges. Cost estimate: $626,436.00

Option 4. Use holding tank at Site 16 and pump water to GWTP.

Option 4 would provide for the installation and use of a 4" high density polyethylene (HDPE) double-walled pipe from a 60,000 gallon tank (replacing existing tank on Site 16) to the GWTP (a distance of about ½ mile). The differences in Option 1 and Option 4 are: 1) no trucking would be required since pump(s) would be used, 2) haul road maintenance would be minimized; and, 3) labor requirements would be significantly reduced. Cost estimate: $490,118.00

TRC Meeting
11 March 1997

The following people were in attendance at the March meeting:

David Tolbert, LHAAP
Cyril Onewokae, HQ, IOC, AMSIO-EQE
Amine BouOnk, Radian Int'l.
Wilma Subra, Uncertain Audubon
Ann Montgomery, LHAAP, OHM
Lynn Muckelrath, LHAAP
Glen Turney, OHM
Jonna Polk, COE, Tulsa
Frank & Frances Gadman, Self
Oscar Linebaugh, COE
H. L. "Bud" Jones, TNRCC
Ira Nathan, LHAAP
Jeff Armstrong, USAEC
Vic Heister, COE, Tulsa
Chris Villarreal, EPA
Diane Poteet, EPA
Bill Corrigan, Radian Int'l.
Dave Bockelman, Sverdrup
Yolane Hartsfield, COE, Tulsa
Frank Meleton, COE
Dudley Beene. COE

Opening Remarks: Ira Nathan opened the meeting in the absence of James McPherson. He welcomed everyone to the meeting and extended a special welcome to Jeff Armstrong. He also personally welcomed Jonna Polk, who will be leaving shortly.

Everyone received a copy of the February minutes.

Landfill 16 water color issue was discussed. Jeff Armstrong wanted to know where we are on that now. The Landfill water has a trace amount of explosives. Diane is now working to get standards.

TNRCC will have Risk Reduction Standards December 98. Review completed.

Proof Of Performance (POP) test results. In mid-February did testing over three days. TNRCC and EPA were here for the tests; tests went very well. On February 15 EPA set interim limits to work under. Now running under conditions EPA set. We will be taking soil to Site 12 today and will run on a 24 hour schedule. EPA set limit of 10 cu. yds. per hour. We are at about 8-1/2 to 9 now, close to the limit. We will have final report in two months. We have some emissions data we will provide to EPA today. Getting between 2 to 5-1/2 lbs. per day. The emission rate is very low.

We had good source material, especially on Saturday. Emissions are quite low. Oxidizers quite low. Will segregate material starting next week.

Site 16 Accelerated RI/FS: Last week finished surface resistivity on Site 16. Preliminary data has not been processed yet. Results will be useful but data not processed. Will be finished late this week or early next week. The initial system looks good.

We may propose some changes in how to figure extraction system or how we place monitoring wells. Looked at four options of transporting water to burning ground. Piping will be the best way; cheapest and fastest.

Accelerated RI: Slight delay in cost estimates and funding. Could effect our schedule. Sverdrup plans to be here in April.

OHM will have decon pad ready _____. We will get updated schedule. April 23 date can slide. If we decide to change position of extraction wells we could be in the field by April 1.

Need to call Diane Poteet when we get workplan for Sverdrup to expedite things.

SUMPS: OHM has basically completed sumps. They are in process of final walk through with Frank Meleton. Started on closure report and are 99% done with field work. Currently work on final report to be submitted by March 31, 1997.

Yolane Hartsfield went through the Status Summary for each project.

Put in site investigation report for EPA for their concurrence or no further action. Also need to provide Chris Villarreal 1993 report on treatability study.

If source material can be used as backfill will reduce the amount of soil taken to the landfill. If amount of soil is reduced at Landfill 16 what kind of impact will that have? If we are not getting that volume of treated soil then Landfill 16 could be designed to accept a lesser amount of soil.

Action for Yolane Hartsfield: Cost to change design.

Caps should be finished by October 98. Need to resolve cost analysis. Will leave schedule as is right now. Will have to readjust if we are not getting soil.

Starting on Landfill 12. To be finished in December 97.

The next Monthly Managers' Meeting is April 8, 1997. To be a teleconference. Tulsa will set up. Time is 9:30.

The next TRC Meeting is June 10, 1997 at 9:30 - same location.

**Technical Review Committee Meeting**
**Longhorn Army Ammunition Plant**
**11 March 1997**
**Longhorn Army Ammunition Plant, Karnack, Texas**

**AMENDED**

018553

1. The following is a list of participants:

James McPherson - LHAAP
Oscar Linebaugh - USACE, EAO
Vic Heister - USACE, Tulsa District
Dudley Beene - USACE, EAO
Cyril Onewokae - HQ, IOC, AMSIO-EQE
Bill Corrigan - Radian
Cliff Murray - USACE, Tulsa District
Ira Nathan - LHAAP
Earney Funderburg - OHM
Wilma Subra - Uncertain Audubon
Ruth Culver - Uncertain Audubon
H. L. "Bud" Jones - TNRCC
David Tolbert - LHAAP
Yolane Hartsfield - USACE, Tulsa District
Chris Villarreal - EPA, Region 6
Diane Poteet - TNRCC
Amine Bou Onk - Radian
Glen Turney - OHM
Frank Meleton - USACE, EAO
Jeff Armstrong (by telephone) --AEC

2. The following is a list of topics discussed (in order of discussion):

**Opening Remarks, Review and Transmittal of Meeting Minutes:** On behalf of LHAAP, Ira Nathan welcomed all attendees to the Technical Review Committee/Monthly Managers' Meeting held at the LHAAP administration trailer on LHAAP, Karnack, Texas. Mr. Nathan extended a special welcome to Mr. Jeff Armstong. Mr. Nathan introduced Ms. Jonna Polk, outgoing Tulsa District project manager and wished it noted in these minutes that Ms. Polk will be missed by Longhorn Army Ammunition Plant staff and team. The February 1997 meeting minutes were reviewed and accepted with revisions (Revised February 1997 meeting minutes attached).

**LTTD POP Test Report:** The contractor reported that the plant successfully completed the POP Testing 13-15 February 1997. Plant began 24 hour operation schedule 10 March 1997 treating to comply with EPA's 10/cy/hr limit. Plant operating well below EPA emissions' limit. Emissions are averaging between 2 - 5.5 lb/day (EPA emission limit 6 lb/hr or 144 lb/day). Final report from Radian International due in April 1997.

Radian is adding grist mill-like fingers and screening to reduce soil clod size on inflow into soil thermal desorber units. Bud Jones, TNRCC, agreed to provide David Tolbert, LHAAP, information about a similar process in Longview where the use of a grinder vice screening process to enable Mr. Tolbert to compare costs.

**Resistivity Study:** Sverdrup reported that the resistivity survey was completed on Site 16 as part of the Accelerated RI/FS with Treatability Study. Preliminary data looks useful. Final data should be ready late this week or early next week and will be used to assist in locating planned extraction wells.

TNRCC requested revised schedule to reflect changes due to accelerated work activities. TNRCC noted that they have not concurred on schedule. TNRCC agreed to work to expedite review of work plans and will fax comments and/or conference call comments/resolution through COE.

**Sumps:** Contractor reported all sumps have been removed and demolished. Pits have been backfilled. Final walk-through with EAO anticipated. Have begun preparation of Closure Report which will be submitted by 31 March 1997. Hazardous waste contaminated soils from 2 sumps and 1 trough sediments were being sent off-site this date for proper disposal.

**Executive Summary Review:** The executive summary handout was reviewed and questions regarding projects' status were answered. Group 1 schedule for RI and ROD submittal are included herewith. (It was noted that the Public Meeting, scheduled for this summer, would require a transcriptionist.) Landfill Caps: query as to whether if we use treated soils from BG3 as backfill into the excavation trenches, what impact to LF16 cap design. COE agreed to have cap designer look at design to see if soil volumes can be minimized without jeopardizing cap integrity. OHM to provide COE volume of concrete debris delivered to LF16. Team interested if : 1) redesign possible; 2)total savings expected; and, 3) whether savings would off-set redesign.

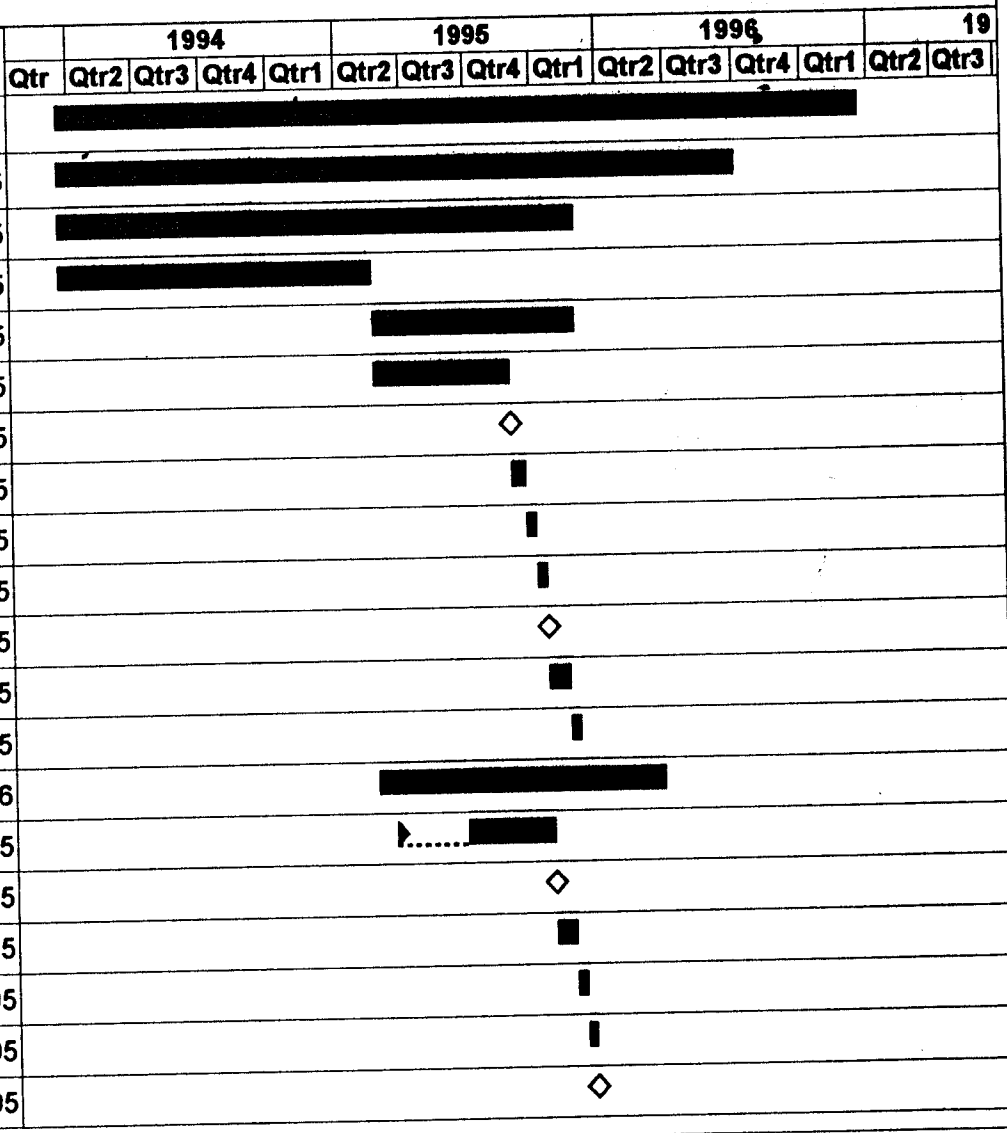
OHM personnel reported that they need cost analysis to update schedule based upon soil availablity. 1 April they will be clearing and grubbing LF 12/16 and by 15 April they should be placing soil cap. By 28 March soil to LF 12 from GWTP will be completed (currently estimate 8000 cy total to go to LF 12).

**Monthly Meeting Schedule and Location:** The next monthly meeting will be held on 11 April 1997 by teleconference starting at 0930.

**Meeting adjourned.**

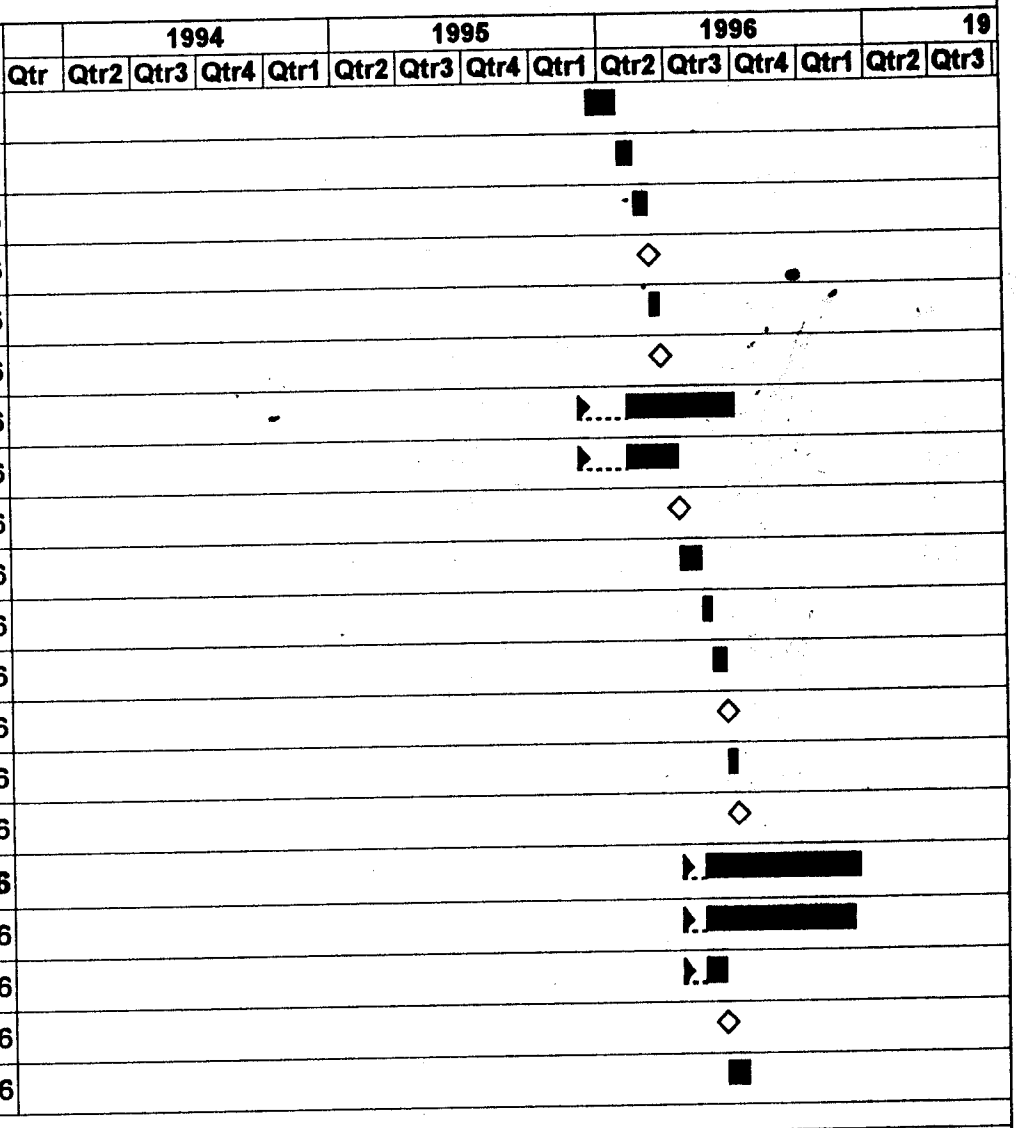
# LHAAP GROUP 1 RI as of 2-27-96

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| **LHAAP GROUP 1** | **1100d** | **12/16/93** | **12/19/96** |
| **ASSESSMENT** | **931d** | **12/16/93** | **07/03/96** |
| REMEDIAL INVESTIGATION | 714d | 12/16/93 | 11/29/95 |
| INVESTIGATION/ANALYSIS | 431d | 12/16/93 | 02/19/95 |
| SITE CHARAC. SUMMARY | 281d | 02/20/95 | 11/27/95 |
| PREP DFT SCS | 190d | 02/20/95 | 08/28/95 |
| SUBMIT DFT SCS | 0d | 08/28/95 | 08/28/95 |
| ARMY REVIEW | 21d | 08/29/95 | 09/18/95 |
| COMMENT RESOLUTION | 14d | 09/19/95 | 10/02/95 |
| PREP DF SCS | 14d | 10/03/95 | 10/16/95 |
| SUBMIT DF SCS | 0d | 10/16/95 | 10/16/95 |
| AGENCY REVIEW | 30d | 10/17/95 | 11/15/95 |
| COMMENT RESOLUTION | 14d | 11/16/95 | 11/29/95 |
| RISK ASSESSMENT | 397d | 02/20/95 | 03/22/96 |
| PREP DFT RSK ASS | 120d | 06/24/95 | 10/21/95 |
| SUBMIT DFT RA | 0d | 10/21/95 | 10/21/95 |
| ARMY REVIEW | 30d | 10/22/95 | 11/20/95 |
| COMMENT RESOL. | 14d | 11/21/95 | 12/04/95 |
| PREP DF RA | 12d | 12/05/95 | 12/16/95 |
| SUBMIT DF RA | 0d | 12/16/95 | 12/16/95 |



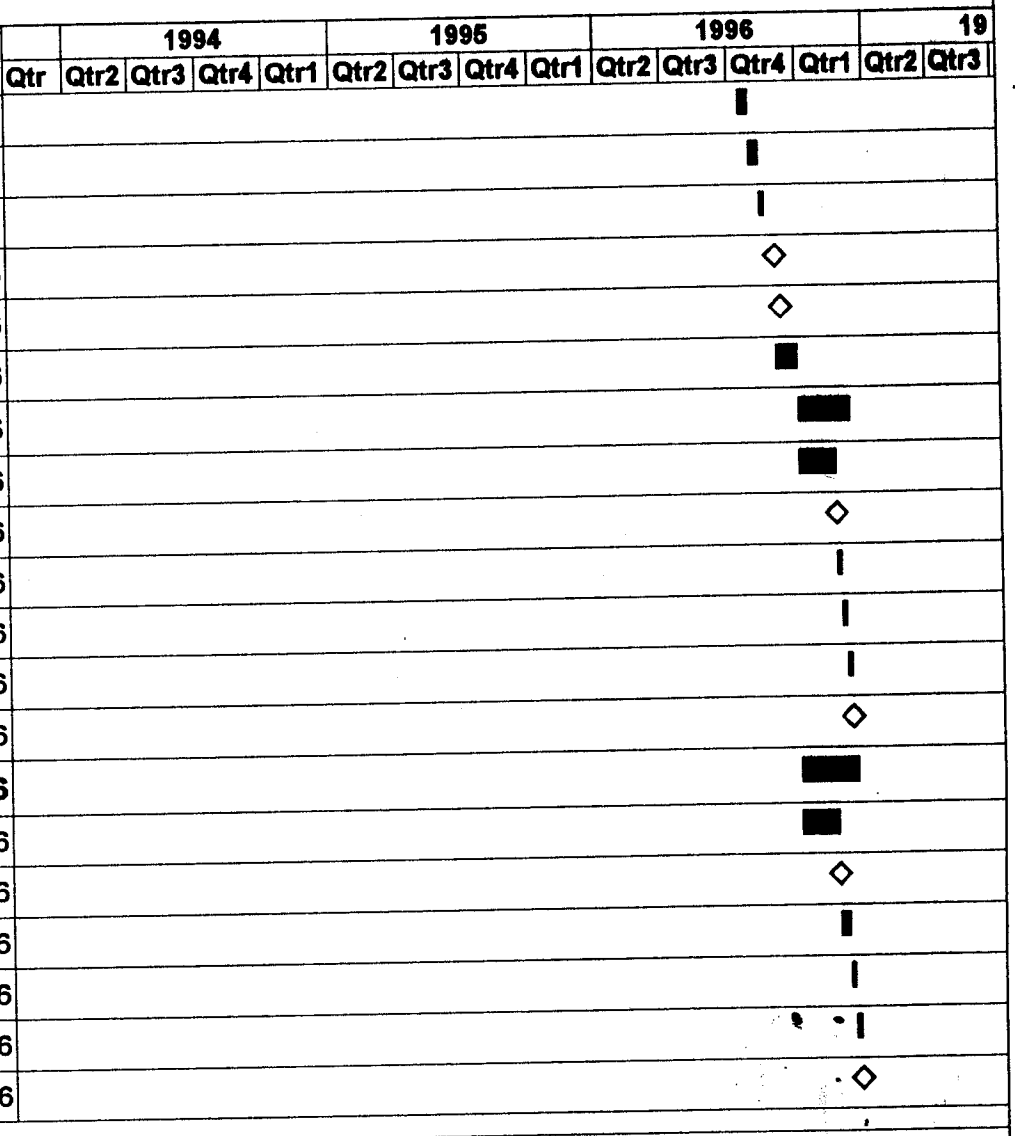
# LHAAP GROUP 1 RI as of 2-27-96

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| AGENCY REVIEW | 41d | 12/17/95 | 01/26/96 |
| COMMENT RESOLUTION | 21d | 01/27/96 | 02/16/96 |
| PREP FIN RA | 21d | 02/17/96 | 03/08/96 |
| SUBMIT FIN RA | 0d | 03/08/96 | 03/08/96 |
| ACCEPTANCE REV | 14d | 03/09/96 | 03/22/96 |
| RA FINAL | 0d | 03/22/96 | 03/22/96 |
| RI REPORT | 150d | 02/05/96 | 07/03/96 |
| PREP DFT RI RPT | 71d | 02/05/96 | 04/15/96 |
| SUBMIT DF RI RPT | 0d | 04/15/96 | 04/15/96 |
| AGENCY REVIEW | 30d | 04/16/96 | 05/15/96 |
| COMMENT RESOLUTION | 14d | 05/16/96 | 05/29/96 |
| PREP FIN RI RPT | 21d | 05/30/96 | 06/19/96 |
| SUBMIT FIN RI RPT | 0d | 06/19/96 | 06/19/96 |
| ACCEPTANCE REVIEW | 14d | 06/20/96 | 07/03/96 |
| RI REPORT FINAL | 0d | 07/03/96 | 07/03/96 |
| **PROPOSED PLAN AND ROD** | **217d** | **05/17/96** | **12/19/96** |
| PROPOSED PLAN | 210d | 05/17/96 | 12/12/96 |
| Prepare Drft Proposed Plan | 30d | 05/17/96 | 06/15/96 |
| Submit Draft Proposed Plan | 0d | 06/15/96 | 06/15/96 |
| Combined Review of Prop Plan | 30d | 06/16/96 | 07/15/96 |



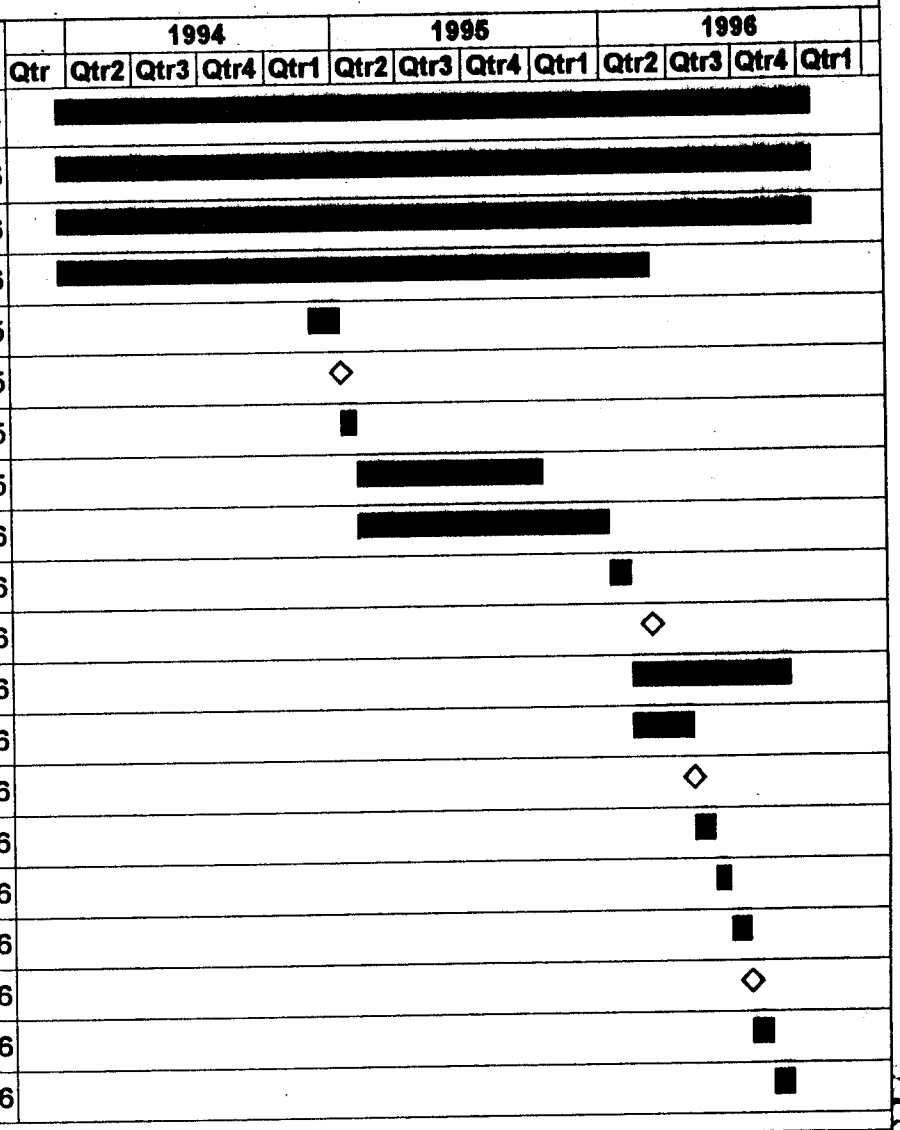
# LHAAP GROUP 1 RI as of 2-27-96

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| Comment Resolution | 14d | 07/16/96 | 07/29/96 |
| Prepare Final Proposed Plan | 14d | 07/30/96 | 08/12/96 |
| Acceptance Review of Prop Plan | 7d | 08/13/96 | 08/19/96 |
| Submit Prop Plan to Public | 0d | 09/01/96 | 09/01/96 |
| Public Meeting | 0d | 09/08/96 | 09/08/96 |
| Public Comment Period | 30d | 09/02/96 | 10/01/96 |
| **Responsiveness Summary** | **72d** | **10/02/96** | **12/12/96** |
| Prepare Draft Resp. Summary | 51d | 10/02/96 | 11/21/96 |
| Submit Draft Resp. Summary | 0d | 11/21/96 | 11/21/96 |
| Combined Review of Resp. Sum | 7d | 11/22/96 | 11/28/96 |
| Comment Resolution | 7d | 11/29/96 | 12/05/96 |
| Prepare Final Resp. Summary | 7d | 12/06/96 | 12/12/96 |
| Resp. Summary Finalized | 0d | 12/12/96 | 12/12/96 |
| **RECORD OF DECISION** | **79d** | **10/02/96** | **12/19/96** |
| Prepare Draft ROD | 51d | 10/02/96 | 11/21/96 |
| Submit Draft ROD | 0d | 11/21/96 | 11/21/96 |
| Combined Review of ROD | 14d | 11/22/96 | 12/05/96 |
| Comment Resolution | 7d | 12/06/96 | 12/12/96 |
| Prepare Final ROD | 7d | 12/13/96 | 12/19/96 |
| Submit Final ROD to EPA | 0d | 12/19/96 | 12/19/96 |



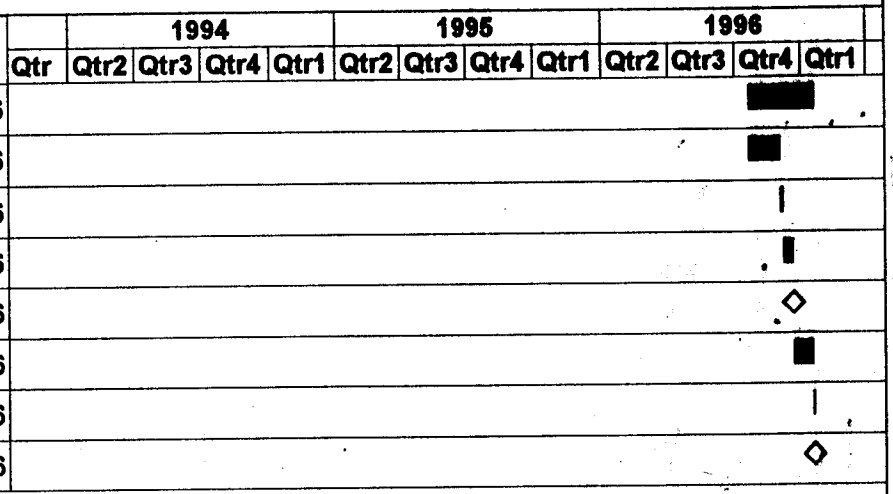
# LHAAP GROUP 2 RI as of 2-27-96

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| **LHAAP GROUP 2** | **1039d** | **12/16/93** | **10/19/96** |
| **ASSESSMENT** | **1039d** | **12/16/93** | **10/19/96** |
| REMEDIAL INVESTIGATION | 1039d | 12/16/93 | 10/19/96 |
| INVESTIGATION/ANALYSIS | 813d | 12/16/93 | 03/07/96 |
| PHASE II WP COM RESOLN | 45d | 11/27/94 | 01/10/95 |
| PHASE II WP APPROVAL | 0d | 01/10/95 | 01/10/95 |
| PHASE II FIELDWORK MOB | 20d | 01/11/95 | 01/30/95 |
| PHASE II FIELDWORK | 255d | 01/31/95 | 10/12/95 |
| PHASE II SAMPLE ANALYSIS | 340d | 02/03/95 | 01/08/96 |
| REVIEW/SUMMARIZE DATA | 30d | 01/09/96 | 02/07/96 |
| SUBMIT DATA RPT AGENCIES | 0d | 03/07/96 | 03/07/96 |
| PHASE II FIELD SUMMARY REPT | 221d | 02/08/96 | 09/15/96 |
| PREP DFT FSR | 84d | 02/08/96 | 05/01/96 |
| SUBMIT DFT FSR | 0d | 05/01/96 | 05/01/96 |
| ARMY REVIEW | 30d | 05/02/96 | 05/31/96 |
| COMMENT RESOLUTION | 21d | 06/01/96 | 06/21/96 |
| PREP DFT FIN FSR | 28d | 06/22/96 | 07/19/96 |
| SUBMIT DF FSR | 0d | 07/19/96 | 07/19/96 |
| AGENCY REVIEW | 30d | 07/20/96 | 08/18/96 |
| COMMENT RESOLUTION | 28d | 08/19/96 | 09/15/96 |



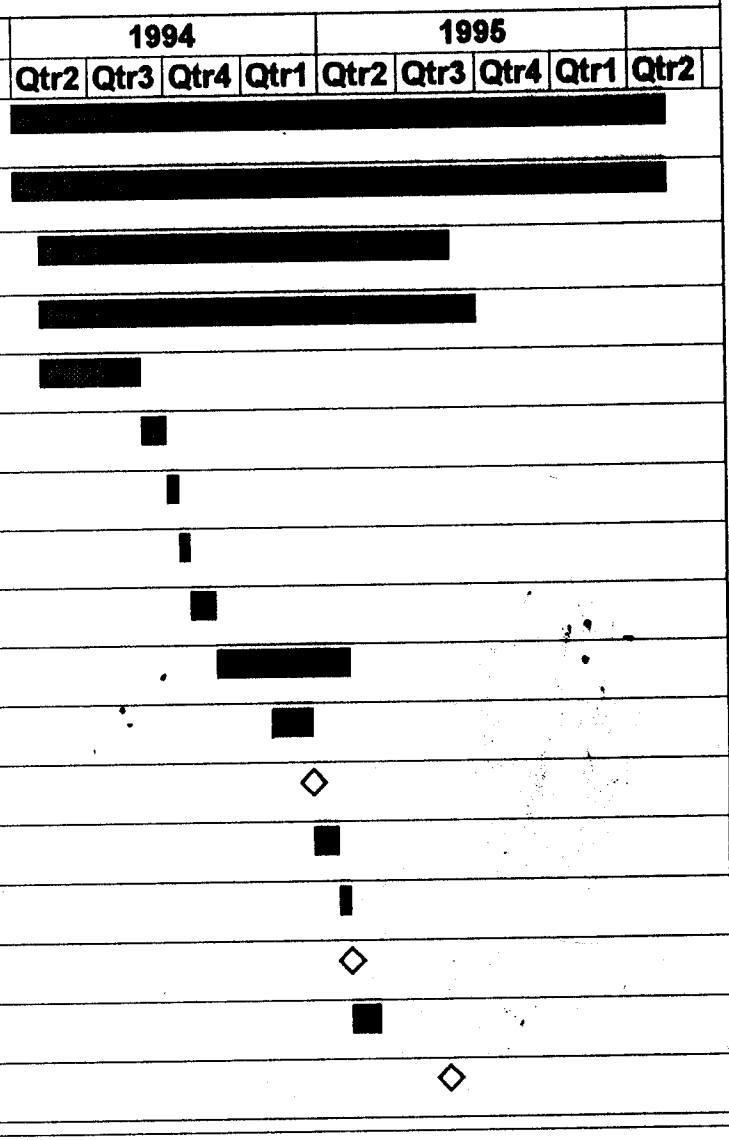
# LHAAP GROUP 2 RI as of 2-27-96

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| FUTURE SCOPE DEVELOPMENT | 92d | 07/20/96 | 10/19/96 |
| REV DATA/DEVLP RECOMM | 45d | 07/20/96 | 09/02/96 |
| SCOPE DVLPMT MTG | 4d | 09/03/96 | 09/06/96 |
| PREP WRITTEN SCOPE DOC | 14d | 09/07/96 | 09/20/96 |
| SUBMIT SCOPE DOC(COMBINED) | 0d | 09/20/96 | 09/20/96 |
| CONCURRENCE REVIEW | 28d | 09/21/96 | 10/18/96 |
| RECOMMENDATION APPROVAL | 1d | 10/19/96 | 10/19/96 |
| INITIATE NEXT PROJECT PHASE | 0d | 10/19/96 | 10/19/96 |



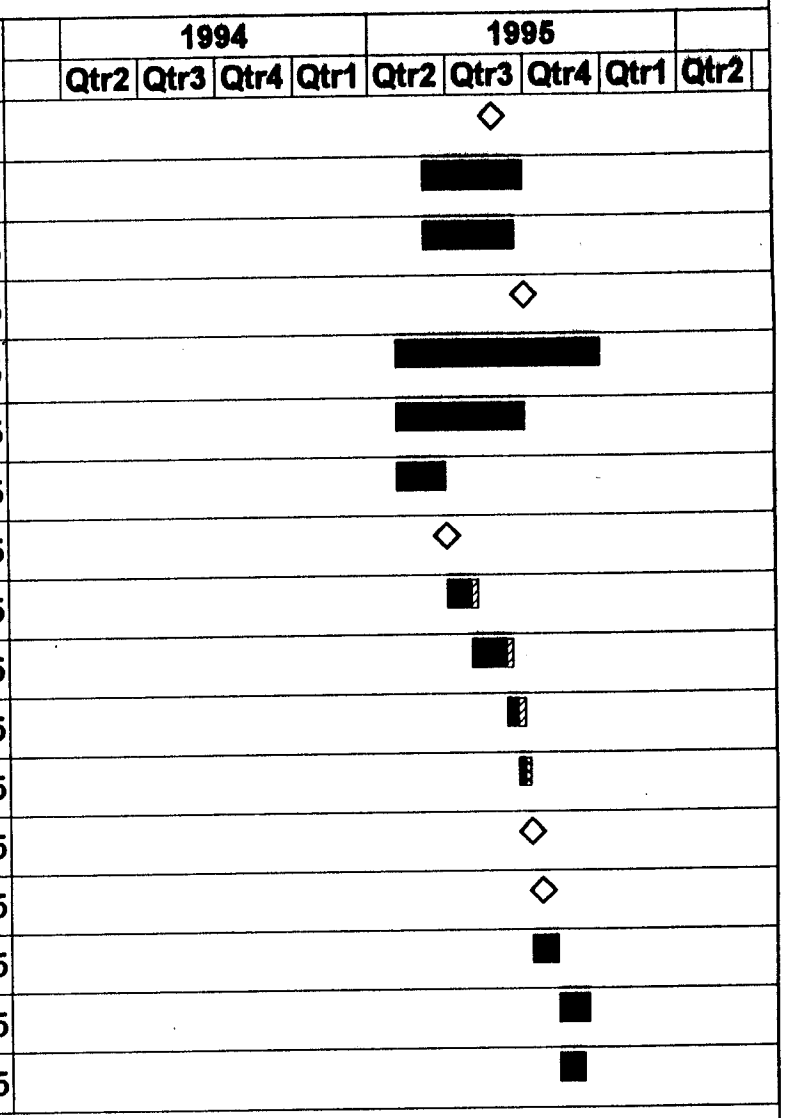
# LHAAP Group 3 as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| **LHAAP GROUP 3** | **775d** | **01/01/94** | **02/14/96** |
| **ASSESSMENT** | **775d** | **01/01/94** | **02/14/96** |
| RI/FS | 484d | 02/01/94 | 05/30/95 |
| RI/FS REPORT | 514d | 02/01/94 | 06/29/95 |
| Pre Draft RI Report | 120d | 02/01/94 | 05/31/94 |
| Army Review Draft RI Report | 30d | 06/01/94 | 06/30/94 |
| Comment Resolution | 14d | 07/01/94 | 07/14/94 |
| Pre Draft Final RI Report | 14d | 07/15/94 | 07/28/94 |
| Reg Review Draft Final RI Rpt | 30d | 07/29/94 | 08/27/94 |
| Comment Resolution | 156d | 08/28/94 | 01/30/95 |
| Prep. "Final" RI/FS w Rsk Assm | 47d | 10/31/94 | 12/16/94 |
| Submit"Final"RI/FS Rpt to Army | 0d | 12/16/94 | 12/16/94 |
| Army Review "Final" RI/FS Rpt | 30d | 12/17/94 | 01/15/95 |
| Comment Resolution/Revision | 14d | 01/16/95 | 01/29/95 |
| Submit "Final" RI/FS Rp to Reg | 0d | 01/29/95 | 01/29/95 |
| Reg Review "Final" RI/FS Rpt | 33d | 01/30/95 | 03/03/95 |
| GW BG REPORT FINAL | 0d | 05/24/95 | 05/24/95 |



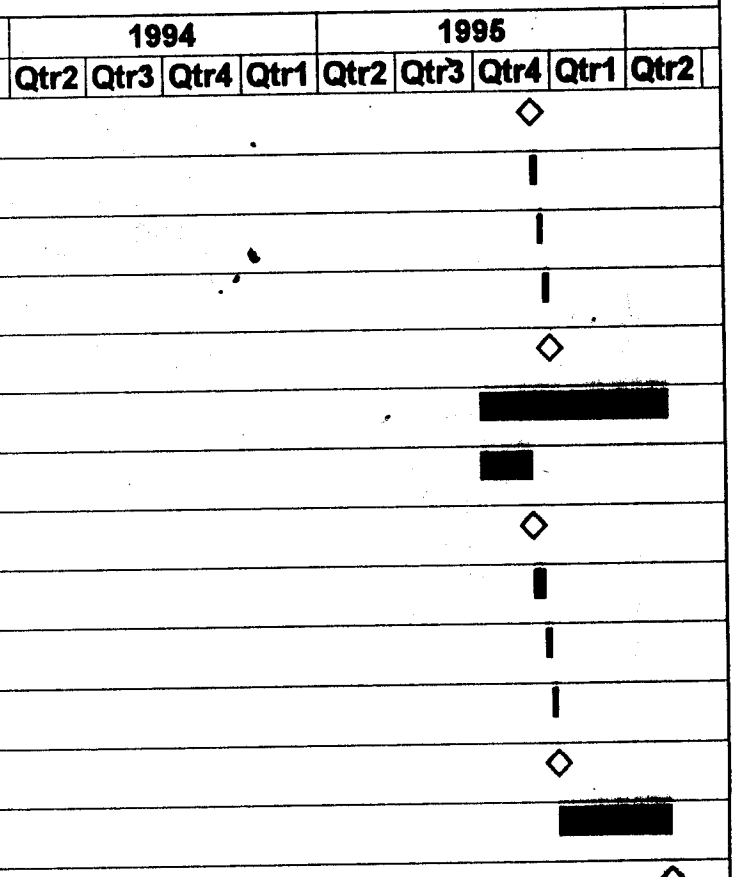
# LHAAP Group 3 as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| SOIL BG REPORT FINAL | 0d | 05/26/95 | 05/26/95 |
| Comment Resolution/Revision | 118d | 03/04/95 | 06/29/95 |
| Comment Annotations | 109d | 03/04/95 | 06/20/95 |
| RI/FS Report Approved | 0d | 06/29/95 | 06/29/95 |
| PROPOSED PLAN AND ROD | 241d | 01/30/95 | 09/27/95 |
| PROPOSED PLAN | 153d | 01/30/95 | 07/01/95 |
| Prepare Drft Proposed Plan | 58d | 01/30/95 | 03/28/95 |
| Submit Draft Proposed Plan | 0d | 03/28/95 | 03/28/95 |
| Combined Review Draft Prp Plan | 30d | 03/29/95 | 04/27/95 |
| Comment Resolution | 41d | 04/28/95 | 06/07/95 |
| Prepare Final Proposed Plan | 14d | 06/08/95 | 06/21/95 |
| Acceptance Review of Prop Plan | 7d | 06/22/95 | 06/28/95 |
| Submit Prop Plan to Public | 0d | 07/06/95 | 07/06/95 |
| Public Meeting | 0d | 07/18/95 | 07/18/95 |
| Public Comment Period | 30d | 07/07/95 | 08/05/95 |
| RESPONSIVENESS SUMMARY | 37d | 08/06/95 | 09/11/95 |
| Prepare Draft Resp. Summary | 32d | 08/06/95 | 09/06/95 |



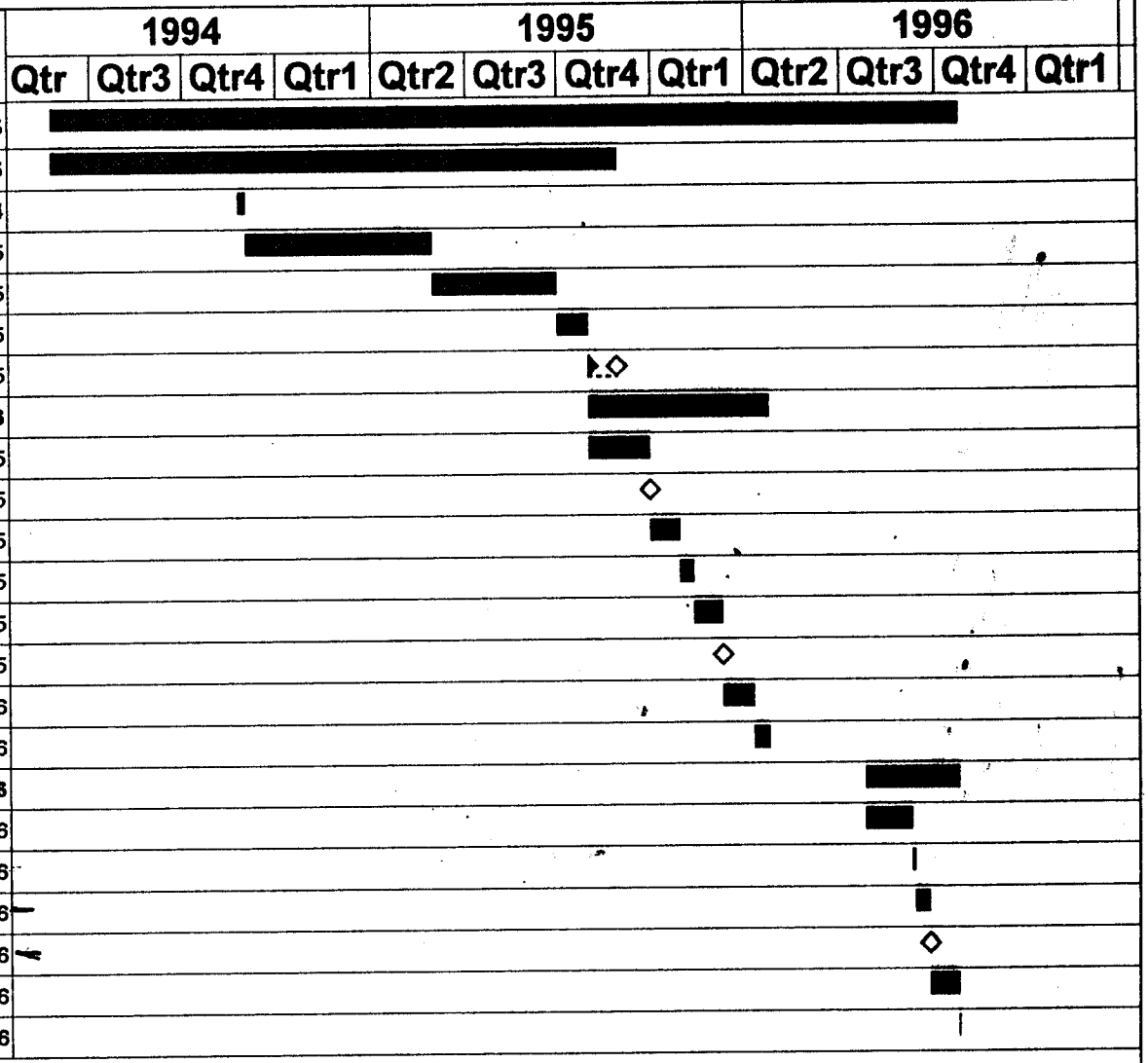
# LHAAP Group 3 as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| Submit Draft Resp. Summary | 0d | 09/06/95 | 09/06/95 |
| Combined Review of Resp. Summ. | 7d | 09/07/95 | 09/13/95 |
| Comment Resolution | 7d | 09/14/95 | 09/20/95 |
| Prepare Final Resp: Summary | 7d | 09/21/95 | 09/27/95 |
| Resp. Summary Finalized | 0d | 09/27/95 | 09/27/95 |
| RECORD OF DECISION | 223d | 07/07/95 | 02/14/96 |
| Prepare Draft ROD | 62d | 07/07/95 | 09/06/95 |
| Submit Draft ROD | 0d | 09/06/95 | 09/06/95 |
| Combined Review of ROD | 14d | 09/07/95 | 09/20/95 |
| Comment Resolution | 7d | 09/21/95 | 09/27/95 |
| Prepare Final ROD | 7d | 09/28/95 | 10/04/95 |
| Submit ROD for Signatures | 0d | 10/04/95 | 10/04/95 |
| Obtain ROD Signatures | 133d | 10/05/95 | 02/14/96 |
| ROD Final | 0d | 02/14/96 | 02/14/96 |



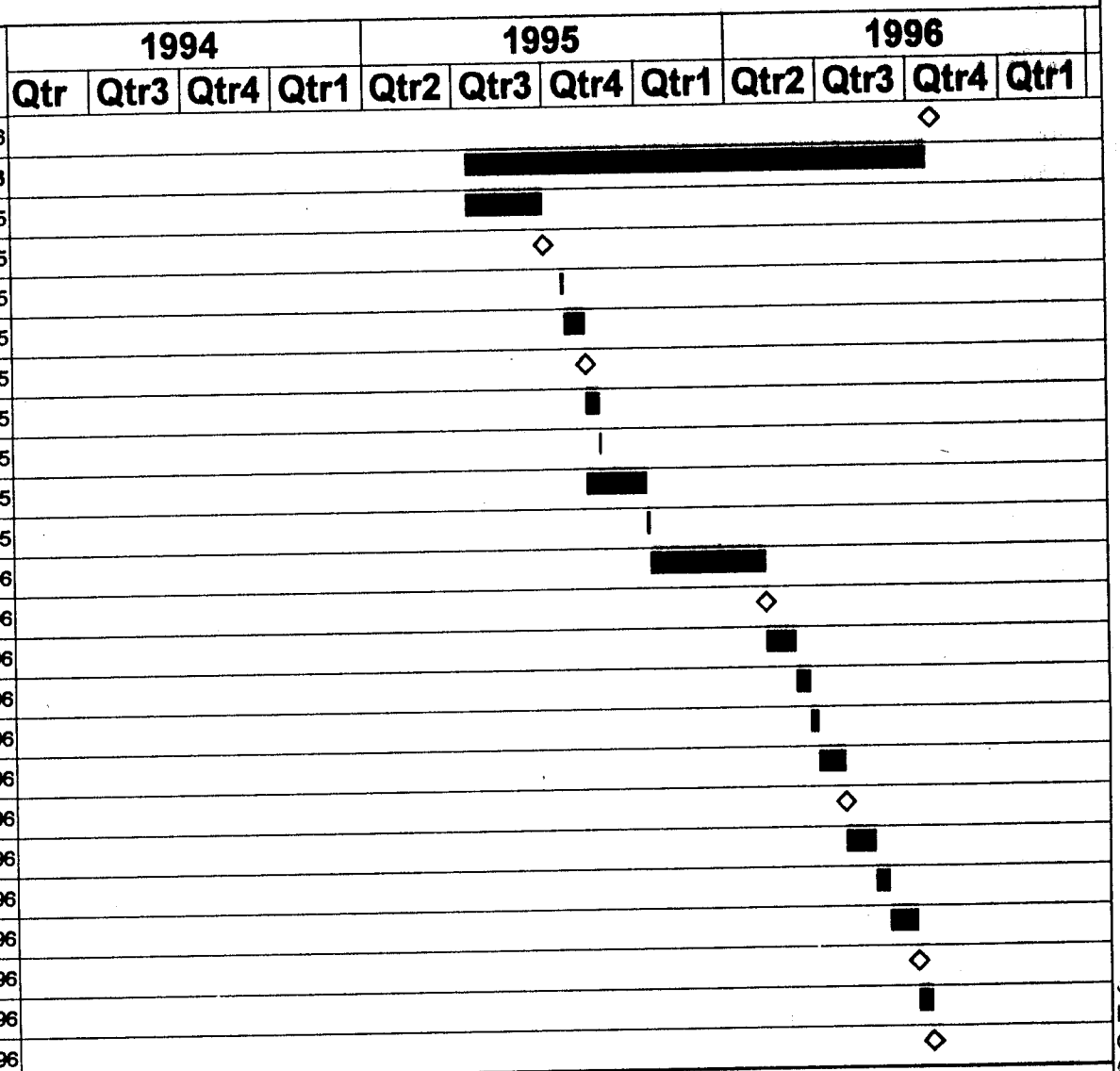
# LHAAP GROUP 4 SUMPS as of 2-27-96

| Task Name | Dura | Sched St | Sched Fi |
|---|---|---|---|
| **GROUP 4 SUMPS RI** | **884d** | **02/22/94** | **07/24/96** |
| **PH II INVESTIG/ANALYSIS** | **553d** | **02/22/94** | **08/28/95** |
| MOBILIZATION | 7d | 08/25/94 | 08/31/94 |
| FIELDWORK | 180d | 09/01/94 | 02/27/95 |
| SAMPLE ANALY | 123d | 02/28/95 | 06/30/95 |
| SUMM PH II DATA | 30d | 07/01/95 | 07/30/95 |
| SUBMIT DATA RPT AGENCIES | 0d | 08/28/95 | 08/28/95 |
| **PHASE II FIELD SUMMARY Rpt** | **176d** | **07/31/95** | **01/22/96** |
| PREP DFT FSR | 60d | 07/31/95 | 09/28/95 |
| SUBMIT DFT FSR | 0d | 09/28/95 | 09/28/95 |
| ARMY REVIEW | 30d | 09/29/95 | 10/28/95 |
| COMMENT RESOLUTION | 14d | 10/29/95 | 11/11/95 |
| PREP DFT FIN FSR | 28d | 11/12/95 | 12/09/95 |
| SUBMIT DF FSR | 0d | 12/09/95 | 12/09/95 |
| AGENCY REVIEW | 30d | 12/10/95 | 01/08/96 |
| COMMENT RESOLUTION | 14d | 01/09/96 | 01/22/96 |
| **FUTURE SCOPE DEVELOPMENT** | **91d** | **04/25/96** | **07/24/96** |
| REV DATA/DEVLP RECOMM. | 45d | 04/25/96 | 06/08/96 |
| SCOPE DVLPMT MTG | 3d | 06/09/96 | 06/11/96 |
| PREP WRITTEN SCOPE DOC | 14d | 06/12/96 | 06/25/96 |
| SUBMIT SCOPE DOC (COMBINE | 0d | 06/25/96 | 06/25/96 |
| CONCURRENCE REVIEW | 28d | 06/26/96 | 07/23/96 |
| RECOMMENDATION APPROVAL | 1d | 07/24/96 | 07/24/96 |



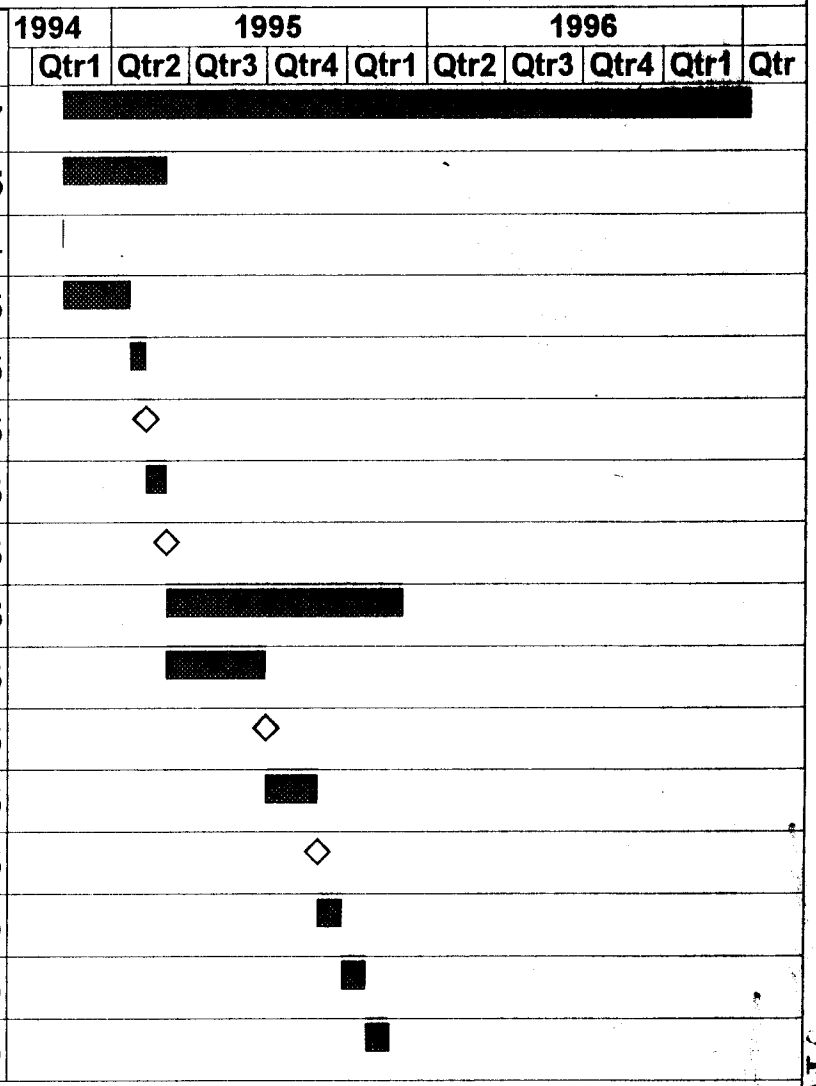
# LHAAP GROUP 4 SUMPS as of 2-27-96

| Task Name | Dura | Sched St | Sched Fi |
|---|---|---|---|
| INITIATE NEXT PROJECT PHAS | 0d | 07/24/96 | 07/24/96 |
| **RISK ASSESSMENT WP** | **463d** | **04/14/95** | **07/19/96** |
| CONTRACT ACTIONS | 78d | 04/14/95 | 06/30/95 |
| AWARD CONTRACT | 0d | 06/30/95 | 06/30/95 |
| LHAAP TEAM CONCEPT MTG | 3d | 07/18/95 | 07/20/95 |
| PREP WRITTEN CONCEPT DOC | 21d | 07/21/95 | 08/10/95 |
| SUBMIT CONCEPT DOC (COMBI | 0d | 08/10/95 | 08/10/95 |
| CONCURRENCE REVIEW | 14d | 08/11/95 | 08/24/95 |
| APPROVE WP CONCEPT | 1d | 08/25/95 | 08/25/95 |
| SUMMARIZE DATA | 60d | 08/11/95 | 10/09/95 |
| LHAAP TEAM SCOPE MTG | 3d | 10/10/95 | 10/12/95 |
| PREPARE DFT RSK ASS WP | 116d | 10/13/95 | 02/05/96 |
| SUBMIT DFT TO ARMY | 0d | 02/05/96 | 02/05/96 |
| ARMY REVIEW | 30d | 02/06/96 | 03/06/96 |
| PREP COMM RESPONSES | 14d | 03/07/96 | 03/20/96 |
| RESOLVE COMMENTS | 7d | 03/21/96 | 03/27/96 |
| PREP FIN DFT RSK ASS WP | 28d | 03/28/96 | 04/24/96 |
| SUBMIT FDFT TO AGENCIES | 0d | 04/24/96 | 04/24/96 |
| AGENCY REVIEW | 30d | 04/25/96 | 05/24/96 |
| COMMENT RESOLUTION | 14d | 05/25/96 | 06/07/96 |
| PREP FINAL RISK ASS WP | 28d | 06/08/96 | 07/05/96 |
| SUBMIT FINAL | 0d | 07/05/96 | 07/05/96 |
| CONCURRENCE REVIEW | 14d | 07/06/96 | 07/19/96 |
| WP APPROVED | 0d | 07/19/96 | 07/19/96 |



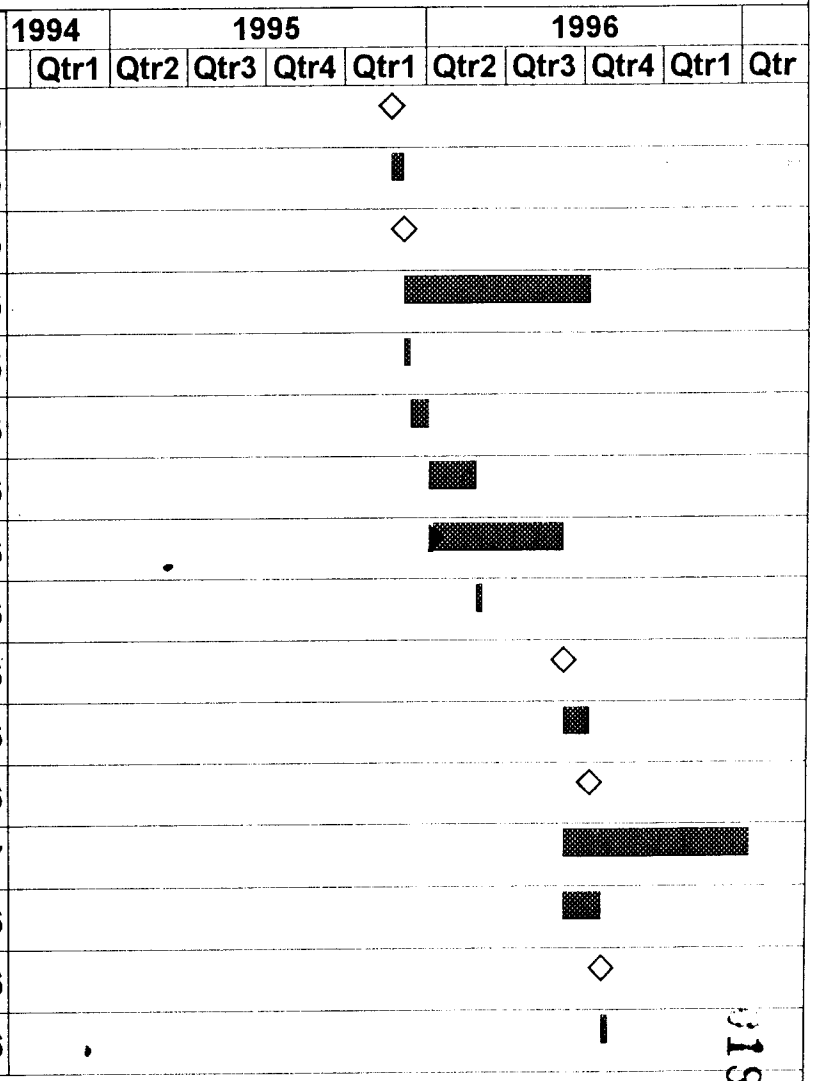
# LHAAP Group 5 as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| **GROUP 5 SITE INV** | **796d** | **11/07/94** | **01/10/97** |
| **SCOPE DEFINITION** | **120d** | **11/07/94** | **03/06/95** |
| SCOPING MEETING | 1d | 11/07/94 | 11/07/94 |
| SITE VISITS/RESEARCH | 77d | 11/08/94 | 01/23/95 |
| PREP DFT SCOPE DOC | 18d | 01/24/95 | 02/10/95 |
| SUBMIT DFT SCP DOC | 0d | 02/10/95 | 02/10/95 |
| SCOPE REV/AGREEMENT | 24d | 02/11/95 | 03/06/95 |
| SCOPE FINAL | 0d | 03/06/95 | 03/06/95 |
| **WORKPLAN** | **275d** | **03/07/95** | **12/06/95** |
| CONTRACT ACT | 116d | 03/07/95 | 06/30/95 |
| AWARD CONTRACT | 0d | 06/30/95 | 06/30/95 |
| PREP DFT WP | 59d | 07/01/95 | 08/28/95 |
| SUBMIT DFT WP | 0d | 08/28/95 | 08/28/95 |
| COMBIN REV DFT WP | 30d | 08/29/95 | 09/27/95 |
| COMMENT RESOLUTION | 28d | 09/28/95 | 10/25/95 |
| PREP FIN WP | 28d | 10/26/95 | 11/22/95 |



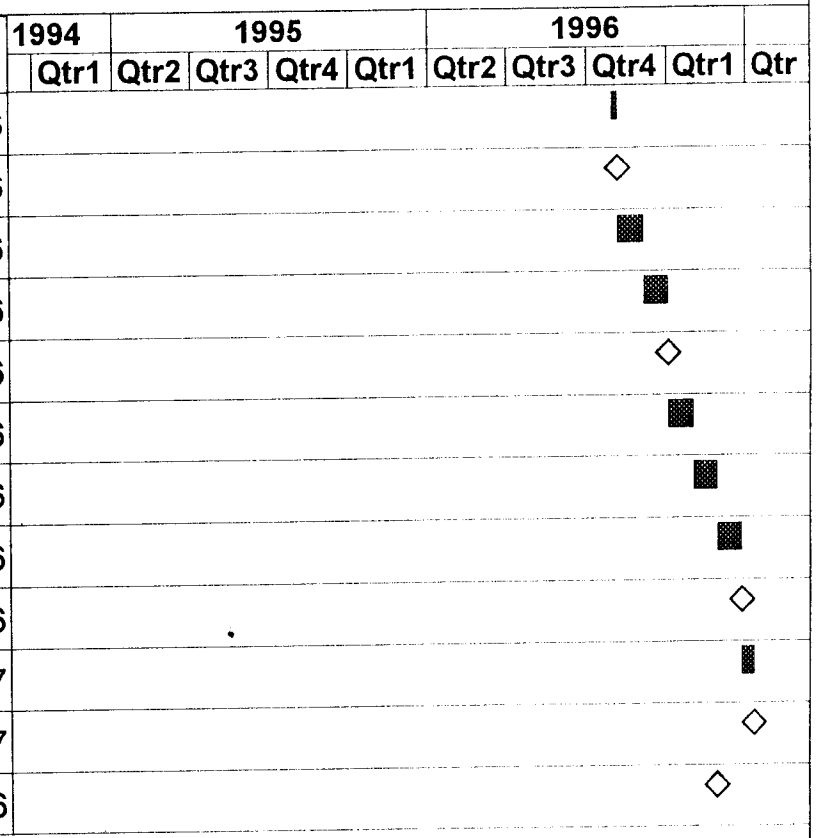
# LHAAP Group 5 as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| SUBMIT FIN WP | 0d | 11/22/95 | 11/22/95 |
| ACCEPTANCE REV | 14d | 11/23/95 | 12/06/95 |
| WP FINAL | 0d | 12/06/95 | 12/06/95 |
| **SITE INVEST FW/ANAL** | **214d** | **12/07/95** | **07/07/96** |
| MOBILIZE | 7d | 12/07/95 | 12/13/95 |
| UXO CLEARANCE | 21d | 12/14/95 | 01/03/96 |
| FIELD INV | 56d | 01/04/96 | 02/28/96 |
| ANAL/VALIDATION | 151d | 01/09/96 | 06/07/96 |
| DEMOBILIZE | 7d | 02/29/96 | 03/06/96 |
| SUBMIT VAL RPT | 0d | 06/07/96 | 06/07/96 |
| COE QA REVIEW | 30d | 06/08/96 | 07/07/96 |
| SUBMIT DATA REPORT TO AGE | 0d | 07/07/96 | 07/07/96 |
| **SITE INV REPORT** | **217d** | **06/08/96** | **01/10/97** |
| PREP PRLM SI RPT | 45d | 06/08/96 | 07/22/96 |
| SUBMIT PRLM SI RPT | 0d | 07/22/96 | 07/22/96 |
| COE REV SI RPT | 7d | 07/23/96 | 07/29/96 |



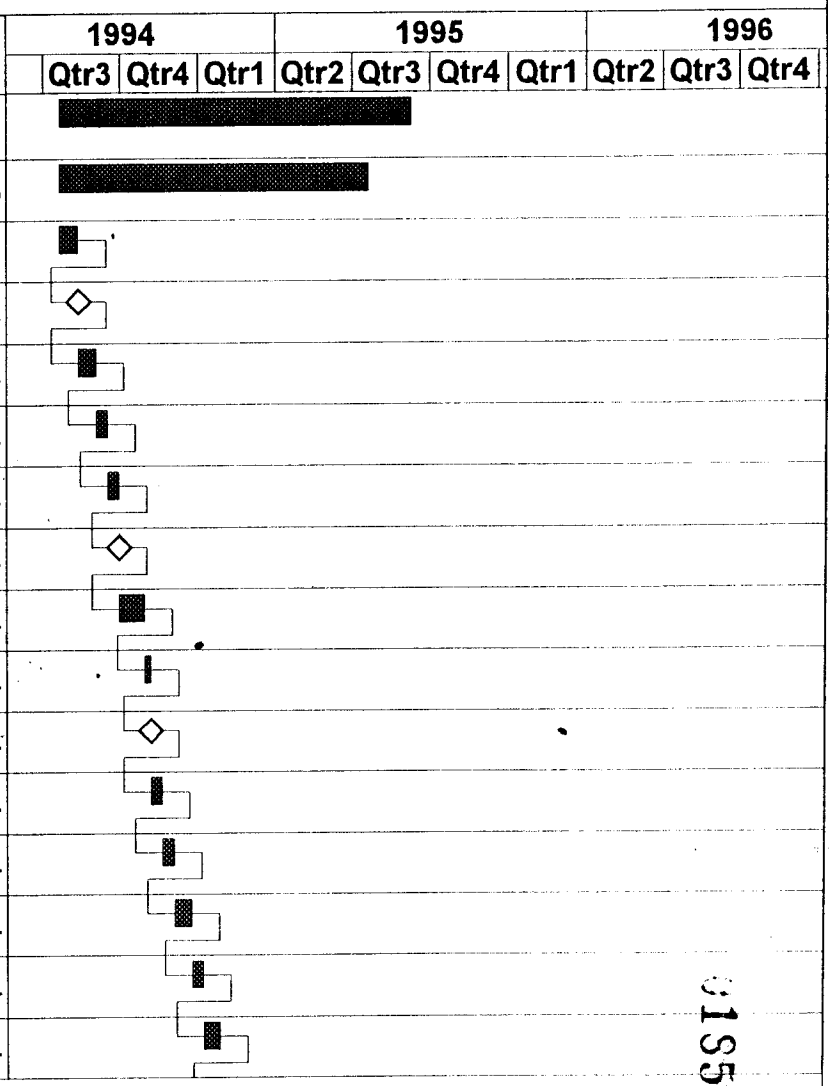
# LHAAP Group 5 as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| PREP DFT SI RPT | 7d | 07/30/96 | 08/05/96 |
| SUBMIT DFT SI RPT | 0d | 08/05/96 | 08/05/96 |
| ARMY REV DFT SI RPT | 30d | 08/06/96 | 09/04/96 |
| PREP DF SI RPT | 28d | 09/05/96 | 10/02/96 |
| SUBMIT DF SI RPT | 0d | 10/02/96 | 10/02/96 |
| AGENCY REV DF SI RPT | 30d | 10/03/96 | 11/01/96 |
| COMMENT RESOLUTION | 28d | 11/02/96 | 11/29/96 |
| PREP FIN SI RPT | 28d | 11/30/96 | 12/27/96 |
| SUBMIT FIN SI RPT | 0d | 12/27/96 | 12/27/96 |
| ACCEPTANCE REV | 14d | 12/28/96 | 01/10/97 |
| SI RPT FINAL | 0d | 01/10/97 | 01/10/97 |
| SCOPE NEXT PROJ PHASE OR | 0d | 11/29/96 | 11/29/96 |



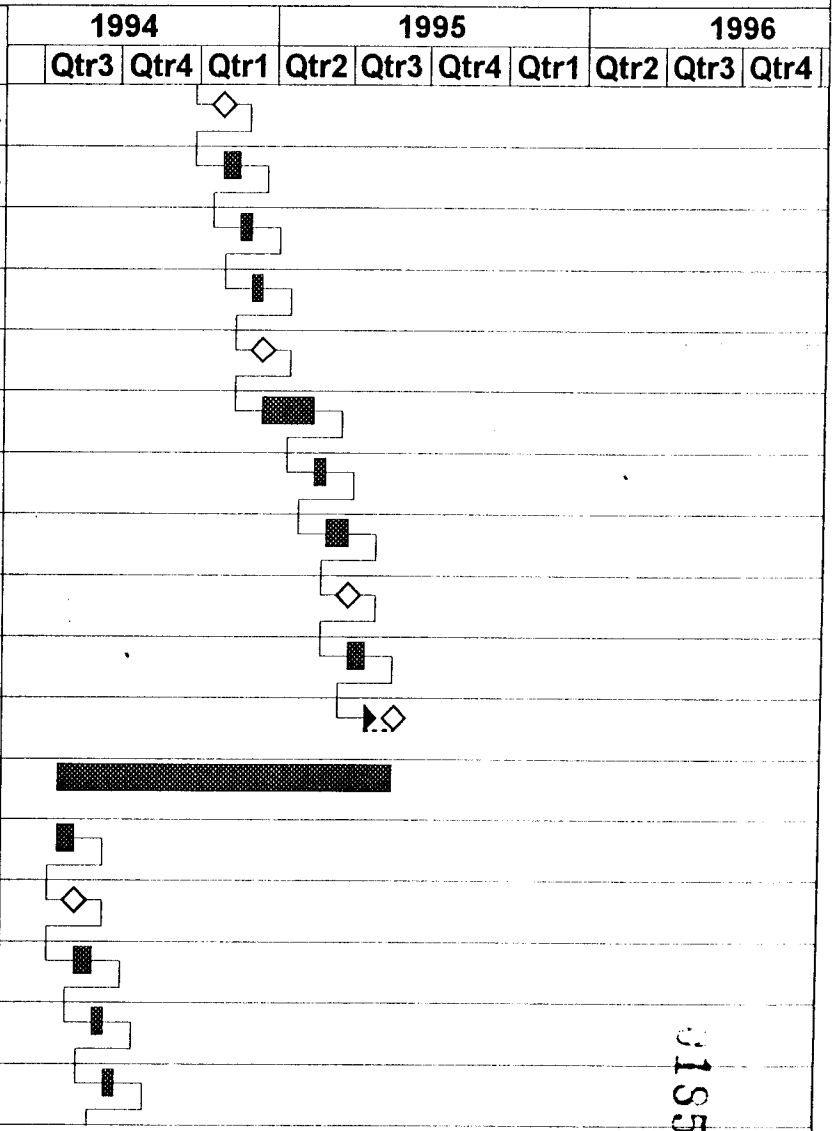
# LHAAP Site Wide Assessments as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| **LHAAP SITEWIDE** | **415d** | **04/21/94** | **06/09/95** |
| **SOIL BACKGROUND STUDY** | **365d** | **04/21/94** | **04/20/95** |
| PREP ADDNL SPLNG WP | 21d | 04/21/94 | 05/11/94 |
| SUBMIT SPLNG WP | 0d | 05/11/94 | 05/11/94 |
| ARMY REVIEW | 21d | 05/12/94 | 06/01/94 |
| COMMENT RESOLUTION | 14d | 06/02/94 | 06/15/94 |
| PREP DF SPLG WP | 14d | 06/16/94 | 06/29/94 |
| SUBMIT DF SPLG WP | 0d | 06/29/94 | 06/29/94 |
| AGENCY REVIEW | 30d | 06/30/94 | 07/29/94 |
| COMMENT RESOL. | 7d | 07/30/94 | 08/05/94 |
| WP FINAL | 0d | 08/05/94 | 08/05/94 |
| FILEDWORK | 14d | 08/06/94 | 08/19/94 |
| LAB ANALYSIS | 14d | 08/20/94 | 09/02/94 |
| DATA VALIDATION | 21d | 09/03/94 | 09/23/94 |
| STATISTICAL EVAL | 14d | 09/24/94 | 10/07/94 |
| PREP DFT SOIL BG RPT | 21d | 10/08/94 | 10/28/94 |



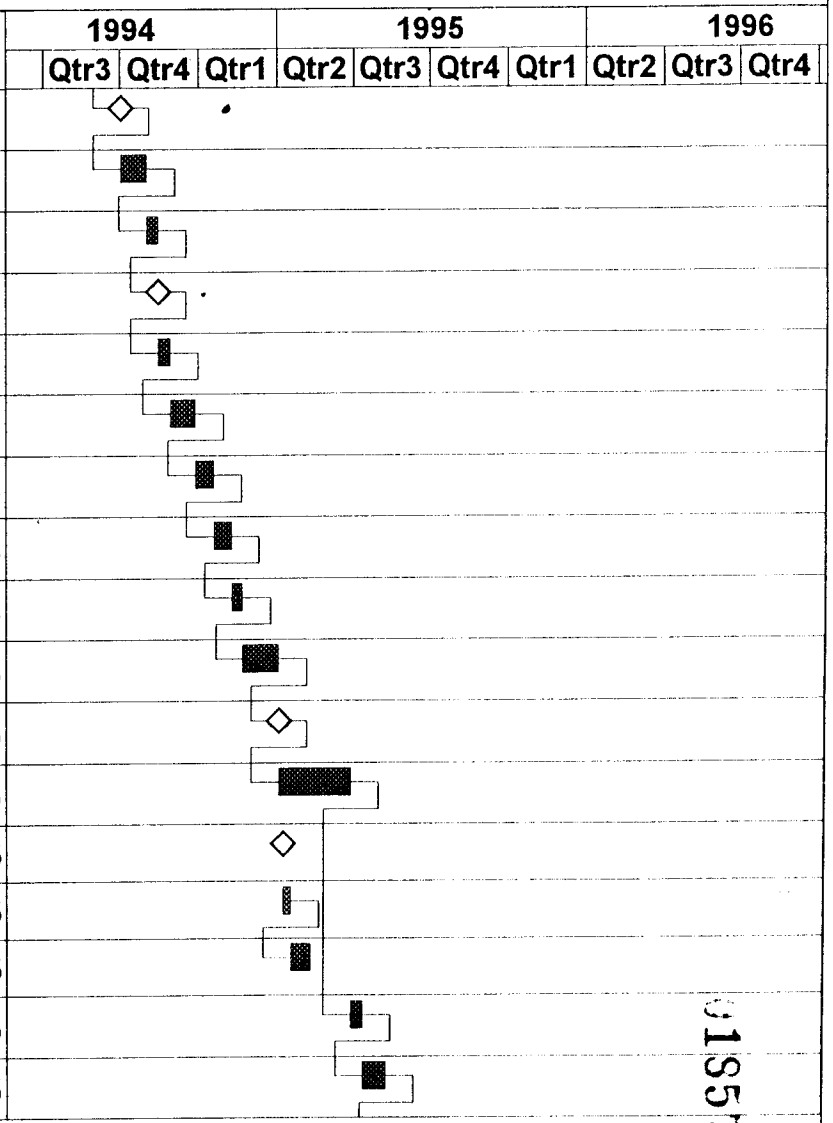
# LHAAP Site Wide Assessments as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| SUBMIT DFT RPT | 0d | 10/28/94 | 10/28/94 |
| ARMY REVIEW | 21d | 10/29/94 | 11/18/94 |
| COMMENT RESOLUTION | 14d | 11/19/94 | 12/02/94 |
| PREP DF SOIL BG RPT | 14d | 12/03/94 | 12/16/94 |
| SUBMIT DF SOIL BG RPT | 0d | 12/16/94 | 12/16/94 |
| AGENCY REVIEW | 62d | 12/17/94 | 02/16/95 |
| COMMENT RESOLUTION | 14d | 02/17/95 | 03/02/95 |
| PREP FINAL SOIL BG RPT | 28d | 03/03/95 | 03/30/95 |
| SUBMIT FIN RPT | 0d | 03/30/95 | 03/30/95 |
| ACCEPTANCE REVIEW | 21d | 03/31/95 | 04/20/95 |
| SOIL BG RPT FINAL | 0d | 05/26/95 | 05/26/95 |
| **GROUNDWATER BG STUDY** | **397d** | **04/23/94** | **05/24/95** |
| PREP FW WP | 21d | 04/23/94 | 05/13/94 |
| SUBMIT DFT WP | 0d | 05/13/94 | 05/13/94 |
| ARMY REVIEW | 21d | 05/14/94 | 06/03/94 |
| COMMENT RESLN | 14d | 06/04/94 | 06/17/94 |
| PREP DF WP | 14d | 06/18/94 | 07/01/94 |



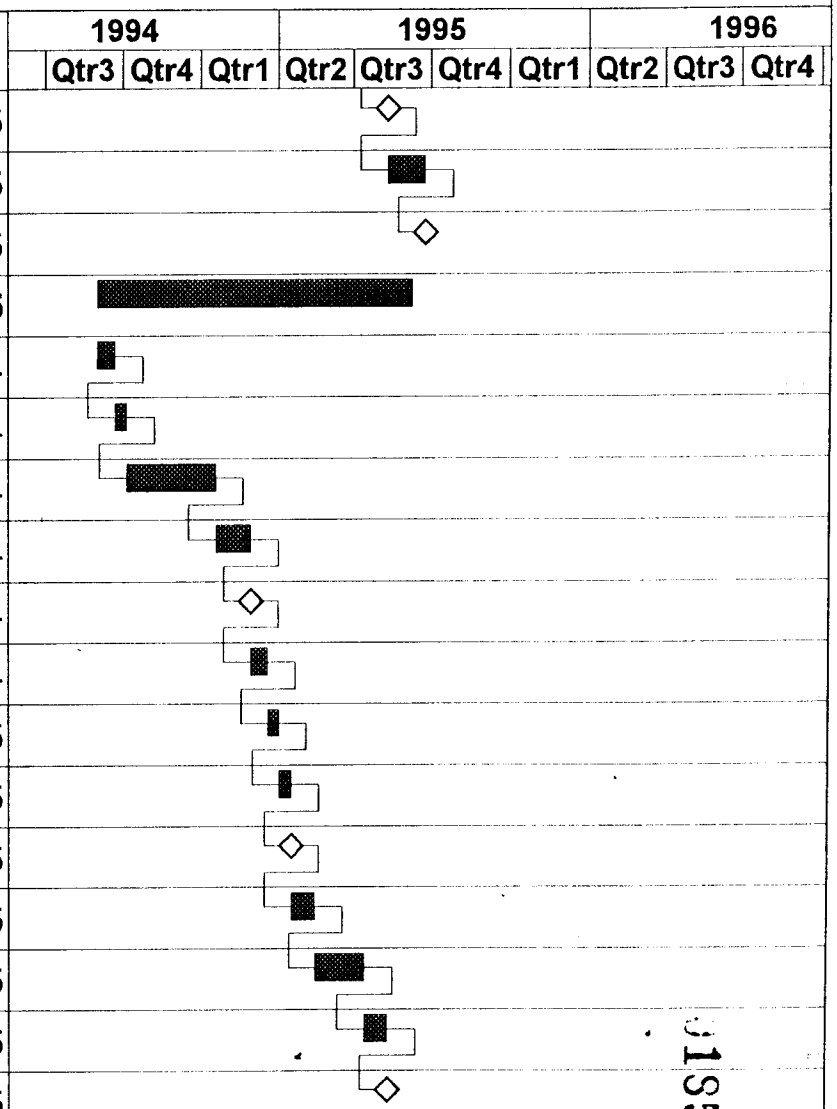
# LHAAP Site Wide Assessments as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| SUBMIT DF WP | 0d | 07/01/94 | 07/01/94 |
| AGENCY REVIEW | 30d | 07/02/94 | 07/31/94 |
| PREP FIN WP | 14d | 08/01/94 | 08/14/94 |
| WP FINAL | 0d | 08/14/94 | 08/14/94 |
| FIELDWORK | 14d | 08/15/94 | 08/28/94 |
| LAB ANALYSIS | 30d | 08/29/94 | 09/27/94 |
| DATA VALIDATION | 21d | 09/28/94 | 10/18/94 |
| REVIEW/INPUT DATA | 21d | 10/19/94 | 11/08/94 |
| STATISTICAL EVALUATION | 14d | 11/09/94 | 11/22/94 |
| PREP DFT GW BG RPT | 42d | 11/23/94 | 01/03/95 |
| SUBMIT DFT GW RPT | 0d | 01/03/95 | 01/03/95 |
| COMBINED REVIEW | 85d | 01/04/95 | 03/29/95 |
| COE DIRECTED TO PERF. CONF S | 0d | 01/09/95 | 01/09/95 |
| CONFIRMATION SPLNG | 10d | 01/09/95 | 01/18/95 |
| LAB ANALYSIS | 22d | 01/19/95 | 02/09/95 |
| COMMENT RESOLUTION | 14d | 03/30/95 | 04/12/95 |
| PREP FIN GW BG RPT | 28d | 04/13/95 | 05/10/95 |



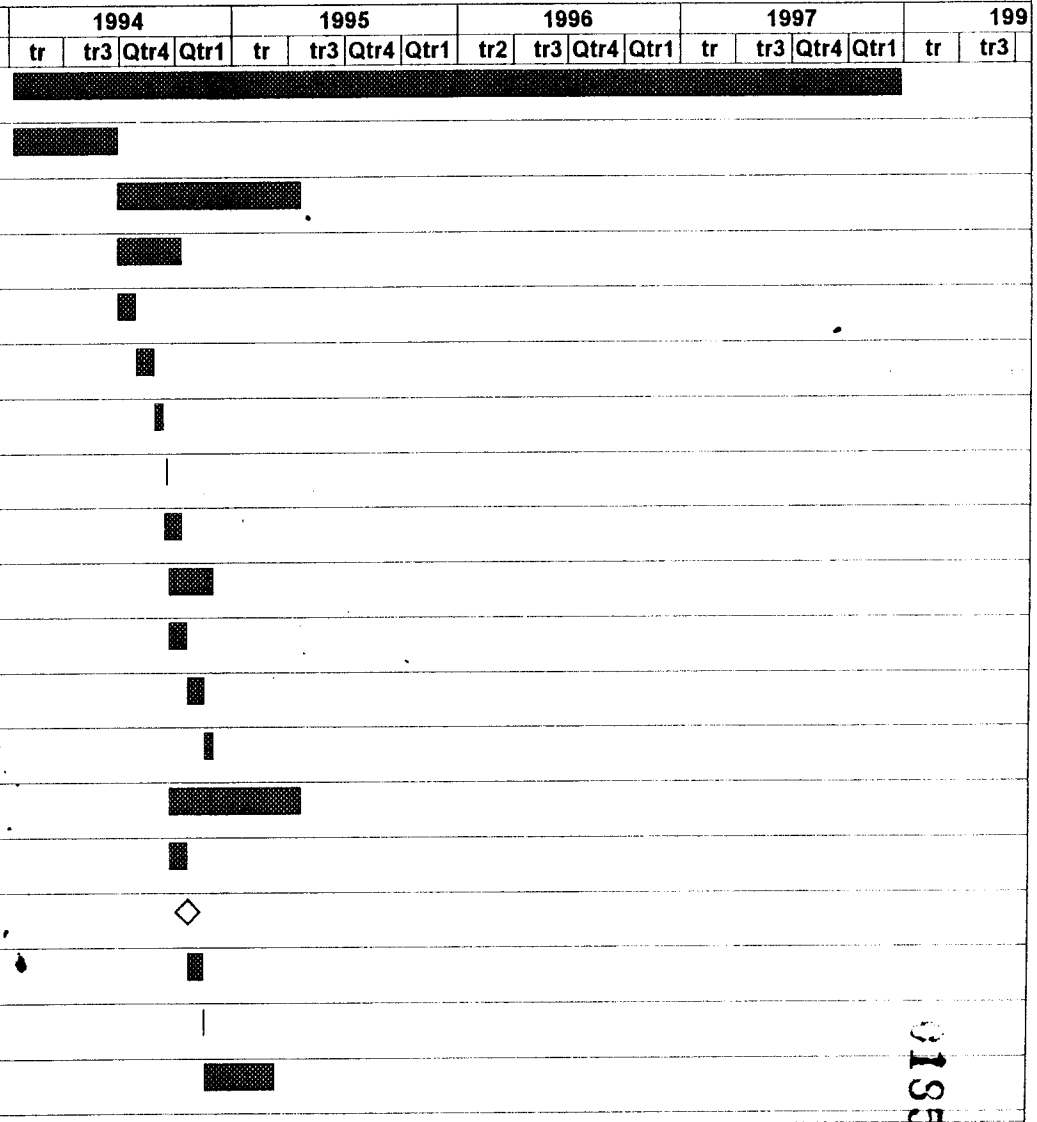
# LHAAP Site Wide Assessments as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| SUBMIT FIN GW BG RPT | 0d | 05/10/95 | 05/10/95 |
| ACCEPTANCE REVIEW | 44d | 05/11/95 | 06/23/95 |
| GW BG RPT APPROVED | 0d | 06/23/95 | 06/23/95 |
| **HYDROGEOLOGIC ASSMT** | **375d** | **05/31/94** | **06/09/95** |
| ACQUIRE/REVIEW DATA | 21d | 05/31/94 | 06/20/94 |
| ACQUIRE FIELD DATA | 14d | 06/21/94 | 07/04/94 |
| DATA ANALYSIS | 105d | 07/05/94 | 10/17/94 |
| PREP DFT HYDRO RPT | 42d | 10/18/94 | 11/28/94 |
| SUBMIT DFT HYDRO RPT | 0d | 11/28/94 | 11/28/94 |
| ARMY REVIEW | 21d | 11/29/94 | 12/19/94 |
| COMMENT RESOLUTION | 14d | 12/20/94 | 01/02/95 |
| PREP DF HYDRO RPT | 14d | 01/03/95 | 01/16/95 |
| SUBMIT DF HYDRO RPT | 0d | 01/16/95 | 01/16/95 |
| AGENCY REVIEW | 30d | 01/17/95 | 02/15/95 |
| COMMENT RESOLUTION | 58d | 02/16/95 | 04/14/95 |
| PREP FINAL RPT | 28d | 04/15/95 | 05/12/95 |
| SUBMIT FINAL RPT | 0d | 05/12/95 | 05/12/95 |



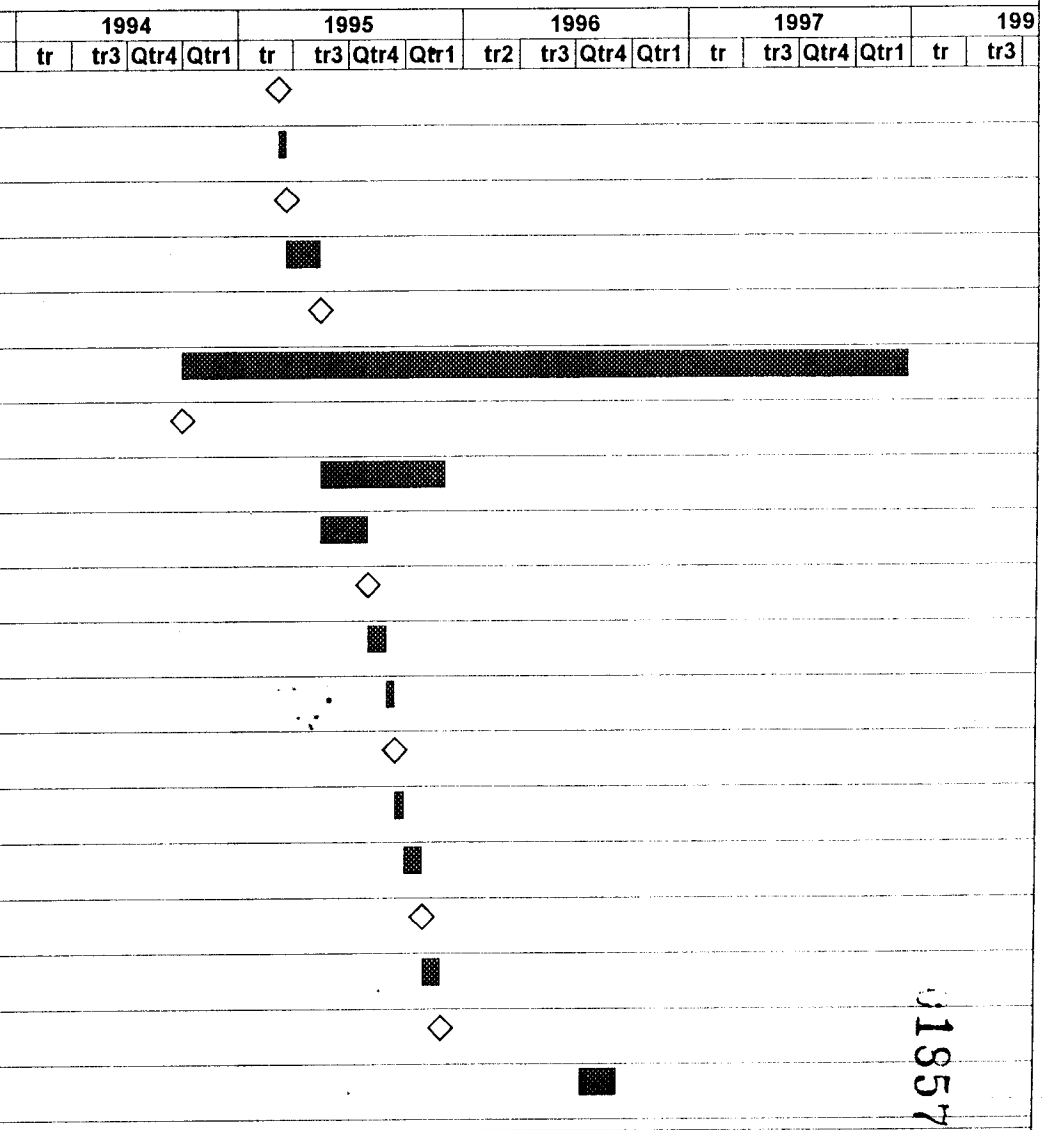
# LHAAP BG No. 3 IRA as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| IRA AT 18 & 24 | 1450d | 01/09/94 | 12/28/97 |
| INVESTIGATION/ANALYSIS | 171d | 01/09/94 | 06/28/94 |
| IRA PROP PLAN AND ROD | 298d | 06/28/94 | 04/21/95 |
| PROPOSED PLAN | 105d | 06/28/94 | 10/10/94 |
| PREPARE DRAFT PP | 30d | 06/28/94 | 07/27/94 |
| REVIEW DRAFT PP | 30d | 07/28/94 | 08/26/94 |
| COMMENT RES/FINAL PP | 14d | 08/27/94 | 09/09/94 |
| PUBLIC MEETING | 1d | 09/15/94 | 09/15/94 |
| PUBLIC COMMENT PERIOD | 30d | 09/11/94 | 10/10/94 |
| RESPONSIVENESS SUMMARY | 74d | 09/18/94 | 11/30/94 |
| PREPARE DRAFT RESP SUM | 30d | 09/18/94 | 10/17/94 |
| REVIEW DRAFT RS | 30d | 10/18/94 | 11/16/94 |
| COMMENT RES/FINAL RS | 14d | 11/17/94 | 11/30/94 |
| RECORD OF DECISION | 215d | 09/18/94 | 04/20/95 |
| PREPARE DRAFT ROD | 30d | 09/18/94 | 10/17/94 |
| SUBMIT DRAFT ROD | 0d | 10/18/94 | 10/18/94 |
| REVIEW DRAFT ROD | 27d | 10/19/94 | 11/14/94 |
| COMMENT RESOLUTION MEETI | 1d | 11/15/94 | 11/15/94 |
| PREP FINAL ROD | 112d | 11/16/94 | 03/07/95 |



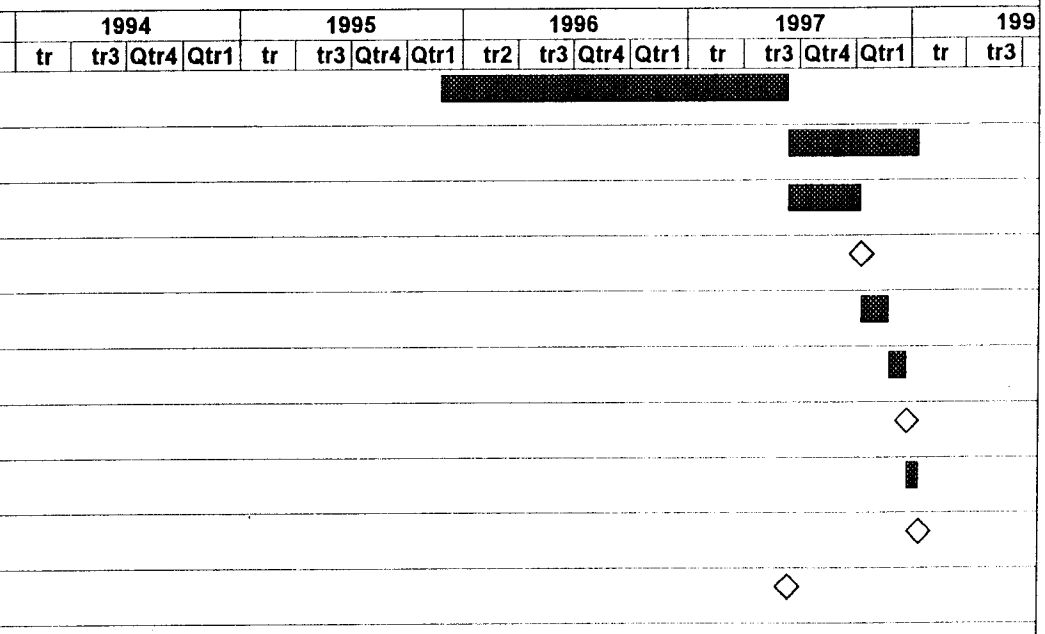
# LHAAP BG No. 3 IRA as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| SUBMIT FINAL ROD | 0d | 03/07/95 | 03/07/95 |
| ACCEPTANCE REVIEW | 14d | 03/08/95 | 03/21/95 |
| SUBMIT ROD FOR SIGNATURES | 0d | 03/21/95 | 03/21/95 |
| OBTAIN ROD SIGNATURES | 55d | 03/22/95 | 05/15/95 |
| ROD FINAL | 0d | 05/15/95 | 05/15/95 |
| IRA IMPLEMENTATION | 1186d | 09/30/94 | 12/28/97 |
| CONTRACT AWARD | 0d | 09/30/94 | 09/30/94 |
| IRA WORKPLAN | 202d | 05/16/95 | 12/03/95 |
| COMPL DRAFT IRA WP | 77d | 05/16/95 | 07/31/95 |
| SUBMIT DRAFT IRA WP | 0d | 07/31/95 | 07/31/95 |
| COMB REV DFT WP | 30d | 08/01/95 | 08/30/95 |
| PREP COMM RESP | 14d | 08/31/95 | 09/13/95 |
| SUB MIT COMM RESP | 0d | 09/13/95 | 09/13/95 |
| COMMENT RESOLUTION | 14d | 09/14/95 | 09/27/95 |
| PREP FIN IRA WP | 30d | 09/28/95 | 10/27/95 |
| SUBMIT FINA IRA WP | 0d | 10/27/95 | 10/27/95 |
| ACCEPTANCE REVIEW | 30d | 10/28/95 | 11/26/95 |
| IRA WP FINAL | 0d | 11/26/95 | 11/26/95 |
| PROOF OF PERFORMANCE RE | 60d | 07/12/96 | 09/09/96 |



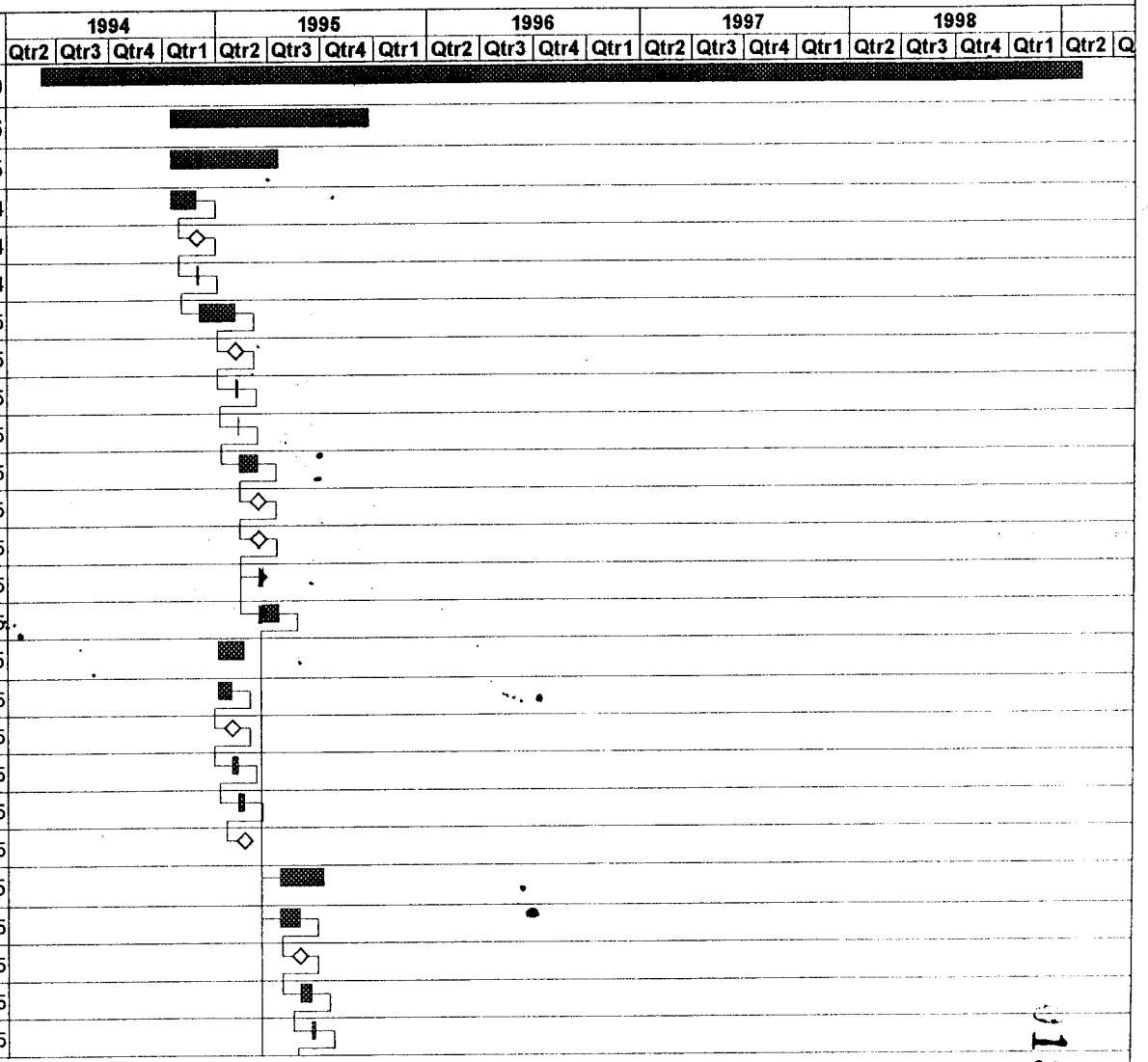
# LHAAP BG No. 3 IRA as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| IRA CONSTRUCTION | 564d | 11/27/95 | 06/12/97 |
| IRA IMPL REPORT | 216d | 06/13/97 | 01/14/98 |
| PREP DFT IMPL RPT | 120d | 06/13/97 | 10/10/97 |
| SUBMIT DFT IMPL RPT | 0d | 10/10/97 | 10/10/97 |
| REV DFT IMPL RPT | 45d | 10/11/97 | 11/24/97 |
| PREP FIN IMPL RPT | 30d | 11/25/97 | 12/24/97 |
| SUBMIT FIN IMPL RPT | 0d | 12/24/97 | 12/24/97 |
| ACCEPTANCE REVIEW | 21d | 12/25/97 | 01/14/98 |
| IRA IMPL RPT FINAL | 0d | 01/14/98 | 01/14/98 |
| IRA LONG TRM O&M BEGINS | 0d | 06/12/97 | 06/12/97 |



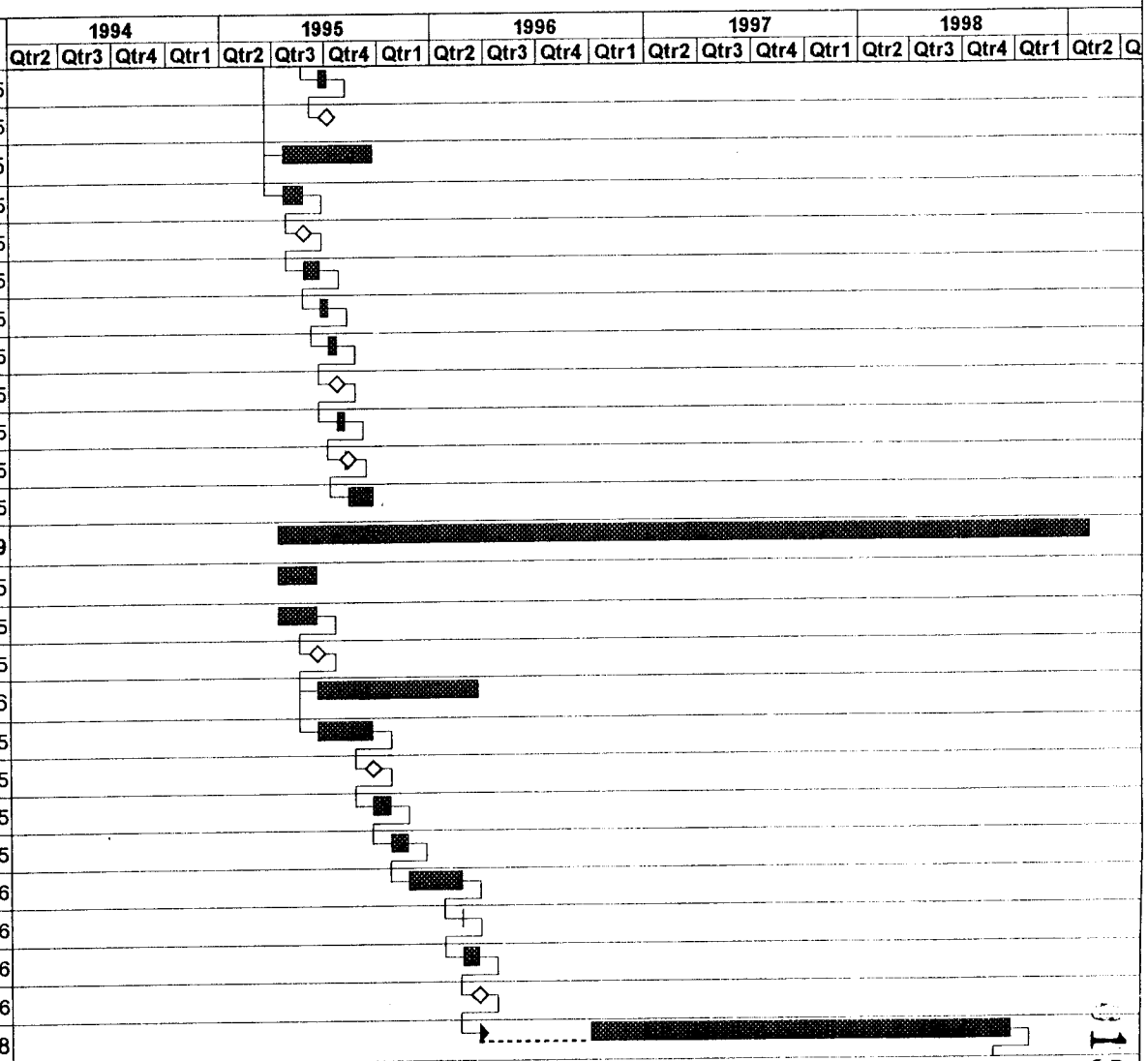
# LHAAP LANDFILL CAPS IRA as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| **LANDFILLS IRA** | **1798d** | **03/07/94** | **02/06/99** |
| **PROPOSED PLAN & ROD** | **344d** | **10/15/94** | **09/23/95** |
| PROPOSED PLAN | 187d | 10/15/94 | 04/19/95 |
| PREP. PRELIM. DRAFT PROP PLAN | 45d | 10/15/94 | 11/28/94 |
| SUBMIT PD PRP PLN FOR REVIEW | 0d | 11/28/94 | 11/28/94 |
| COMB. REVIEW PD PROP. PLAN | 4d | 11/29/94 | 12/02/94 |
| PREPARE DRAFT PROP. PLAN | 63d | 12/03/94 | 02/03/95 |
| SUBMIT DRAFT PROP. PLAN | 0d | 02/03/95 | 02/03/95 |
| REVIEW DRAFT PROPOSED PLAN | 4d | 02/04/95 | 02/07/95 |
| PROP PLAN RESOLUTION MEETIN | 2d | 02/08/95 | 02/09/95 |
| PREPARE FINAL PROP PLAN | 33d | 02/10/95 | 03/14/95 |
| PROPOSED PLAN FINAL | 0d | 03/14/95 | 03/14/95 |
| RELEASE PP TO PUBLIC | 0d | 03/16/95 | 03/16/95 |
| PUBLIC MEETING | 1d | 03/23/95 | 03/23/95 |
| PUBLIC COMMENT PERIOD | 30d | 03/21/95 | 04/19/95 |
| FOCUSED FEASIBILITY STUDY | 46d | 01/03/95 | 02/17/95 |
| PREP DRFT FOC FEAS STUDY | 25d | 01/03/95 | 01/27/95 |
| SUBMIT FFS TO ARMY | 0d | 01/27/95 | 01/27/95 |
| ARMY REVIEW FFS | 10d | 01/28/95 | 02/06/95 |
| REVISE FFS | 11d | 02/07/95 | 02/17/95 |
| SUBMIT FINAL FFS | 0d | 02/17/95 | 02/17/95 |
| RESPONSIVENESS SUMMARY | 77d | 04/20/95 | 07/05/95 |
| PREPARE DRAFT RESPONSIVENE | 35d | 04/20/95 | 05/24/95 |
| SUBMIT DRAFT RESP. SUMM. | 0d | 05/24/95 | 05/24/95 |
| COMBINED REV. DRF RESP SUMM | 21d | 05/25/95 | 06/14/95 |
| COMMENT RESOLUTION | 7d | 06/15/95 | 06/21/95 |



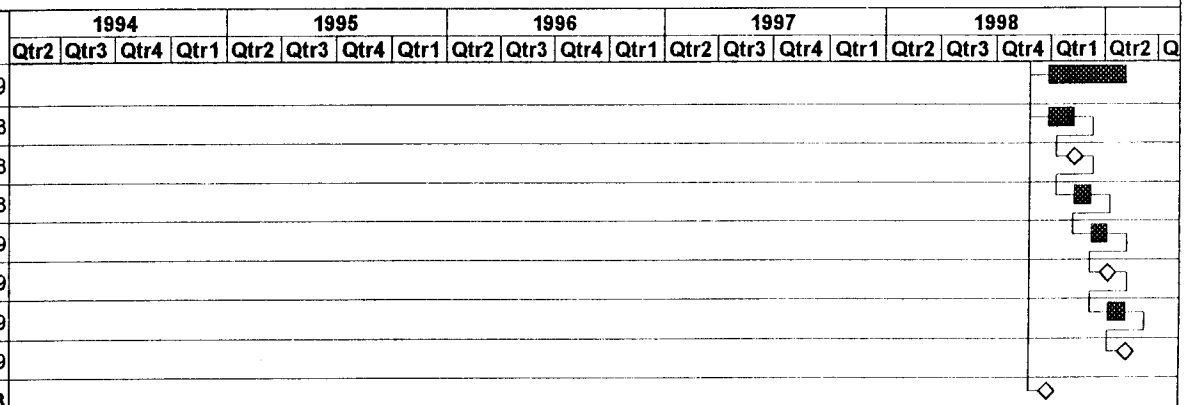
# LHAAP LANDFILL CAPS IRA as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| PREP FIN RESP SUMM | 14d | 06/22/95 | 07/05/95 |
| SUBMIT FIN RESP SUMM | 0d | 07/05/95 | 07/05/95 |
| RECORD OF DECISION | 157d | 04/20/95 | 09/23/95 |
| PREP DRAFT ROD | 35d | 04/20/95 | 05/24/95 |
| SUBMIT DRAFT ROD | 0d | 05/24/95 | 05/24/95 |
| COMBINED REV DRF ROD | 30d | 05/25/95 | 06/23/95 |
| COMMENT RESOLUTION | 14d | 06/24/95 | 07/07/95 |
| PREP FINAL ROD | 14d | 07/08/95 | 07/21/95 |
| SUBMIT FIN ROD | 0d | 07/21/95 | 07/21/95 |
| ACCEPTANCE REVIEW | 14d | 07/22/95 | 08/04/95 |
| SUBMIT ROD FOR SIGNATURES | 0d | 08/10/95 | 08/10/95 |
| OBTAIN ROD SIGNATURES | 45d | 08/10/95 | 09/23/95 |
| **IRA IMPLEMENTATION** | **1399d** | **04/10/95** | **02/06/99** |
| CONTRACT ACTIONS | 68d | 04/10/95 | 06/16/95 |
| NEGOTIATE/AWARD IRA CONTRA | 68d | 04/10/95 | 06/16/95 |
| AWARD IRA CONTRACT | 0d | 06/16/95 | 06/16/95 |
| IRA WORKPLAN | 279d | 06/17/95 | 03/21/96 |
| PREP DRFT IRA WP | 97d | 06/17/95 | 09/21/95 |
| SUBMIT DFT IRA WP | 0d | 09/21/95 | 09/21/95 |
| COMB REVIEW D IRA WP | 30d | 09/22/95 | 10/21/95 |
| COMMENT RESOLUTION | 30d | 10/22/95 | 11/20/95 |
| PREP FIN IRA WP | 93d | 11/21/95 | 02/21/96 |
| SUBMIT FIN IRA WP | 1d | 02/22/96 | 02/22/96 |
| ACCEPTANCE REVIEW | 28d | 02/23/96 | 03/21/96 |
| IRA WP FINAL | 0d | 03/21/96 | 03/21/96 |
| IRA CONSTRUCTION | 726d | 10/01/96 | 09/26/98 |



# LHAAP LANDFILL CAPS IRA as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| IRA IMPLEMENTATION REPORT | 133d | 09/27/98 | 02/06/99 |
| PREP DFT IMPL RPT | 45d | 09/27/98 | 11/10/98 |
| SUBMIT DFT IMPL RPT | 0d | 11/10/98 | 11/10/98 |
| REVIEW DFT IMPL RPT | 30d | 11/11/98 | 12/10/98 |
| PREP FIN IMPL RPT | 28d | 12/11/98 | 01/07/99 |
| SUBMIT FIN IMPL RPT | 0d | 01/07/99 | 01/07/99 |
| ACCEPTANCE REVIEW | 30d | 01/08/99 | 02/06/99 |
| IRA IMPL RPT FINAL | 0d | 02/06/99 | 02/06/99 |
| **IRA MAINTENANCE BEGINS** | **0d** | **09/26/98** | **09/26/98** |

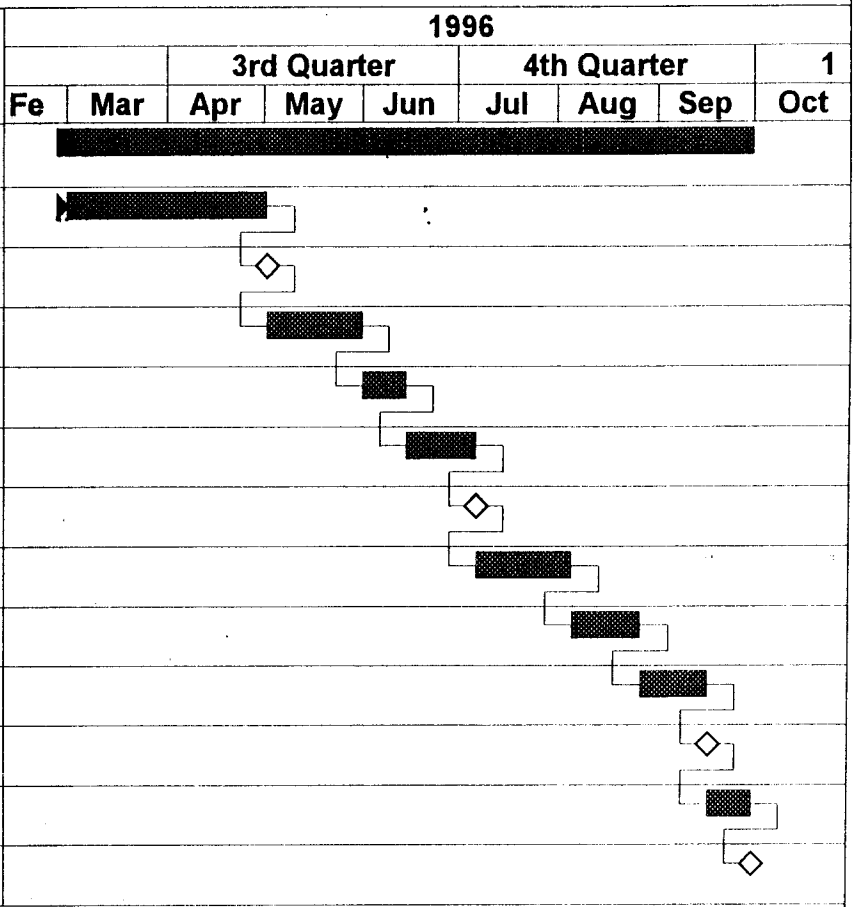





018577

# LHAAP Site-wide Plans (CDAP, HAS, WM, etc.) as of 2-27-95

| Task Name | Dura | Sched Start | Sched Fin |
|---|---|---|---|
| LHAAP SITEWIDE PLANS | 217d | 02/27/96 | 09/30/96 |
| Prepare Draft Plans | 62d | 03/01/96 | 05/01/96 |
| Submit Dft to Army | 0d | 05/01/96 | 05/01/96 |
| Army Review | 30d | 05/02/96 | 05/31/96 |
| Comment Resolution | 14d | 06/01/96 | 06/14/96 |
| Prepare Draft Final Plans | 22d | 06/15/96 | 07/06/96 |
| Submit Draft Final Plans | 0d | 07/06/96 | 07/06/96 |
| Review by Agencies | 30d | 07/07/96 | 08/05/96 |
| Comment Resolution | 21d | 08/06/96 | 08/26/96 |
| Prepare Final Plans | 21d | 08/27/96 | 09/16/96 |
| Submit Final Plans | 0d | 09/16/96 | 09/16/96 |
| Acceptance Review | 14d | 09/17/96 | 09/30/96 |
| Plans Final | 0d | 09/30/96 | 09/30/96 |



**Monthly Managers' Meeting**
**Longhorn Army Ammunition Plant**
**11 March 1997**
**Longhorn Army Ammunition Plant, Karnack, Texas**

018579

1. The following is a list of participants:

Ruth Culver - Uncertain Audubon
Oscar Linebaugh - USACE, EAO
Vic Heister - USACE, Tulsa District
Dudley Beene - USACE, EAO
Cyril Onewokae - HQ, IOC, AMSIO-EQE
Bill Corrigan - Radian
Jonna Polk- USACE, Tulsa District
Ira Nathan - LHAAP
Frank Meleton - USACE, EAO
Wilma Subra - Uncertain Audubon
Frank and Frances Gadman, Self
Dave Bockelman, Sverdrup Environmental
H. L. "Bud" Jones - TNRCC
David Tolbert - LHAAP
Yolane Hartsfield - USACE, Tulsa District
Chris Villarreal - EPA, Region 6
Diane Potect - TNRCC
Amine Bou Onk - Radian
Glen Turney - OHM
Lynn Muckelrath, LHAAP
Jeff Armstrong--AEC
Ann Montgomery

2. The following is a list of topics discussed (in order of discussion):

**Opening Remarks, Review and Transmittal of Meeting Minutes:** On behalf of LHAAP, Ira Nathan welcomed all attendees to the Technical Review Committee/Monthly Managers' Meeting held at the LHAAP administration trailer on LHAAP, Karnack, Texas. Mr. Nathan extended a special welcome to Mr. Jeff Armstong. Mr. Nathan introduced Ms. Jonna Polk, outgoing Tulsa District project manager and wished it noted in these minutes that Ms. Polk will be missed by Longhorn Army Ammunition Plant staff and team. The February 1997 meeting minutes were reviewed and accepted with revisions. (Revised minutes attached.)

**LTTD POP Test Report:** The contractor reported that the plant successfully passed the POP Testing 13-15 February 1997. Plant began 24 hour operation schedule 10 March 1997 treating to comply with EPA's 10cy/hr limit. Plant operating well below EPA emissions' limit. Emissions are averaging between 2 - 5.5 lb/day (EPA emission limit 6 lb/hr or 144 lb/day). Final report from Radian International due in April 1997.

Radian is adding grist mill-like fingers and screening to reduce soil clod size on inflow into soil thermal desorber units. Bud Jones, TNRCC, agreed to provide David Tolbert, LHAAP, information about a similar process in Longview where the use of a grinder vice screening process to enable Mr. Tolbert to compare costs.

**Resistivity Study:** Sverdrup reported that the resistivity survey was completed on Site 16 as part of the Accelerated RI/FS with Treatability Study. Preliminary data looks useful. Final data should be ready late this week or early next week and will be used to assist in locating planned

extraction wells.



TNRCC requested revised schedule to reflect changes due to accelerated work activities. TNRCC noted that they have not concurred on schedule. TNRCC agreed to work to expedite review of work plans and will fax comments and/or conference call comments/resolution through COE. TNRCC noted that they would

**Sumps:** Contractor reported all sumps have been removed and demolished. Pits have been backfilled. Final walk-through with EAO anticipated. Have begun preparation of Closure Report which will be submitted by 31 March 1997. Hazardous waste contaminated soils from 2 sumps and 1 trough sediments were being sent off-site this date for proper disposal.

**Executive Summary Review:** The executive summary handout was reviewed and questions regarding projects' status were answered. Group 1 schedule for RI and ROD submittal are included herewith. (It was noted that the Public Meeting, scheduled for this summer, would require a transcriptionist.) Landfill Caps: query as to whether if we use treated soils from BG3 as backfill into the excavation trenches, what impact to LF16 cap design. COE agreed to have cap designer look at design to see if soil volumes can be minimized without jeopardizing cap integrity. OHM to provide COE volume of concrete debris delivered to LF16. Team interested if : 1) redesign possible; 2)total savings expected; and, 3) whether savings would off-set redesign.

OHM personnel reported that they need cost analysis to update schedule based upon soil availability. 1 April they will be clearing and grubbing LF 12/16 and by 15 April they should be placing soil cap. By 28 March soil to LF 12 from GWTP will be completed (currently estimate 8000 cy total to go to LF 12).

Landfill 12 and 16 caps are scheduled for completion October 1998. Landfill 12 cap expected completion date December 1997.

**Monthly Meeting Schedule and Location:** The next monthly meeting will be held on 8 April 1997 by teleconference starting at 0930.

**Meeting adjourned.**

**Monthly Managers' Meeting**
**Longhorn Army Ammunition Plant**
**11 February 1997**
**Longhorn Army Ammunition Plant, Karnack, Texas**

018581

Amended

1. The following is a list of participants:

James McPherson - LHAAP
Oscar Linebaugh - USACE, EAO
Vic Heister - USACE, Tulsa District
Dudley Beene - USACE, EAO
Cyril Onewokae - HQ, IOC, AMSIO-EQE
Bill Corrigan - Radian
Cliff Murray - USACE, Tulsa District
Ira Nathan - LHAAP
Earney Funderburg - OHM
Wilma Subra - Uncertain Audubon
Ruth Culver - Uncertain Audubon
H. L. "Bud" Jones - TNRCC
David Tolbert - LHAAP
Yolane Hartsfield - USACE, Tulsa District
Chris Villarreal - EPA, Region 6
Diane Poteet - TNRCC
Amine Bou Onk - Radian
Glen Turney - OHM
Frank Meleton - USACE, EAO
Jeff Armstrong (by telephone) --AEC

2. The following is a list of topics discussed (in order of discussion):

**Opening Remarks, Review and Transmittal of Meeting Minutes:** On behalf of LHAAP, James McPherson welcomed all attendees to the Monthly Managers' Meeting held at the LHAAP administration trailer on LHAAP, Karnack, Texas. Mr. McPherson introduced Ms. Yolane Hartsfield, Tulsa District COE, as the new project manager. The January 1997 meeting minutes were reviewed and accepted with revisions (Revised January 1997 meeting minutes attached).

**Future Land Use:** The Army has declared that LHAAP totally excessed to the Army's need and requirements with the intent to divest its interest to the property. The determination as to future land use (i.e. industrial, residential, etc.) is in process. Mr. McPherson outlined the normal process the Army uses to divest its interest in such properties and provided a general overview of the time involved to complete the process. Currently plans are to remediate to industrial use standards, with the Army acknowledging there may be some areas that the Army will retain interest to and ownership thereto. LHAAP has begun process to excess property and will keep regulators fully informed as to progress. COE prepared map is being completed.

**Landfill 16 Water Treatment:** The disposal plan for produced water was presented. Produced water will be conveyed to the GWTP at BG3, treated and discharged. TNRCC is to provide effluent concentration standards for explosives. Current high flow in Harrison Bayou is optimal for discharge of treated effluent. The addition of a carbon unit to the process was discussed. The carbon unit would be used to remove trace concentrations of high explosives and optimize water color.

**Proposed Change in Disposal Method for Landfill Tree Stumps:** A change in the disposal

plan for tree stumps at the landfills was presented. Originally the SOW called for chipping the stumps into mulch. The contractor proposes piling the stumps and burning same. This approach will be effective and efficient and save the government ± $16,800. Mr. Onewokae requested written documentation of the change. Mr. Nathan to provide.

**Sumps Update:** The contractor stated that they had demolished 62 of the 80 sumps and were down to the larger sumps. Smaller sumps had been removed whole, moved to the landfill, and demolished on site. The larger sumps will be demolished in-place and then the debris will be moved to the landfill. When sumps were removed, associated trough "leg-outs" were also removed. Discussion of the schedule to remove the remaining troughs was conducted. The consensus reached, with concurrence of the TNRCC, was that these minutes serve as sufficient revision to the work plan (OHM to revise their work plan and distribute) such that the 5 remaining troughs and associated soil will become a part of the Phase III, Group 4, investigation. OHM will place concrete in the trough structures, where to prevent potential releases of fluids from the exposed ends of troughs. A memo will be prepared addressing this change and submitted to the TNRCC (Ms. Hartsfield to prepare).

Mr. McPherson asked for clarification on backfilling the sumps' pits. It was decided to use clean fill or non-contaminated excavated soils (i.e. that soil which meets the Risk Reduction #2 standards). One or 2 sumps' pits will need clean fill according to the contractor. OHM to furnish LHAAP analyses for these 2 sump sites for decision on contaminated soil. No liners will be used in the backfilled pits.

**LTTD POP Test Overview:** The contractor verified that the plant was ready to go ahead with the POP Testing scheduled for 12 February 1997. Testing to include 3 sets of soil samples from highly contaminated sites, 3 sets from less contaminated sites.

**Executive Summary Review:** The executive summary handout was reviewed and questions regarding projects' status were answered.

**Monthly Meeting Schedule and Location:** The next monthly meeting will be held on 11 March 1997 at LHAAP at 0930.

**Meeting adjourned.**

# LONGHORN ARMY AMMUNITION PLANT
# IRP STATUS SUMMARY

## As Of 4 March 1997

| PROJECT NAME | PROJECT PHASE | PROJECT STATUS | NEXT MAJOR MILESTONE(S) |
|---|---|---|---|
| **Group #1**<br><br>(Sites 1, 11, XX, and 27) | Remedial Investigation/ Feasibility Study | Work continues to complete risk assessment and incorporate comments into RI report. | Draft final RI with Risk Assessment is scheduled for submittal 01 May 1997. Funding for this project in FY97 has been received to complete the RI and the ROD for closure of the sites with "no further action".<br>-ROD is now scheduled to be submitted 30 September, 1997. |
| **Group # 2**<br><br>(Sites 12, 17, 18, 24, 29, and 32) | Remedial Investigation/ Feasibility Study | Scoping of Phase III RI/FS was begun 13 March 1997. Contract negotiated 27 March 1997. | Expected contract award April 1997. |
| **Group # 4**<br><br>Wastewater Sumps 50 and 60 | Remedial Investigation/ Feasibility Study | Scope of work amended to include Sites 50 and 60. Contract negotiated 31 March 1997. | Expected contract award April 1997. |
| **Group # 5**<br><br>(Sites 52, and 63) | Site Investigation | - Draft Final Site Investigation Report submitted for regulatory review on 3 October.<br>- TNRCC and EPA comments received. | Submittal of Final Site Investigation Report. |
| **Burning Grounds #3**<br><br>(Group # 2, Sites 18 and 24) | Interim Remedial Action | -AMP and QAPP finalized in January 97.<br>- Groundwater Treatment Plant successfully ran with contaminated water in January 97.<br>- Awaiting effluent standards from TNRCC for explosives and mercury. | - Proof of Performance test for Low Temperature Thermal Desorber units for soil treatment completed February 1997. Currently awaiting Report from Contractor. |
| **Landfill Caps**<br><br>(Group # 2, Sites 12 and 16) | Interim Remedial Action | - Work Plan finalized with revisions in Nov 96.<br>- Work on Landfill 12 Cap underway, completion date scheduled for 12/97. Completion of Landfill 16 Cap scheduled for 10/98. | - Preliminary construction began in August 1996. Capping of both landfills scheduled to be complete in October 1998. |

# LONGHORN ARMY AMMUNITION PLANT
# IRP STATUS SUMMARY

## As Of 4 March 1997

| PROJECT NAME | PROJECT PHASE | PROJECT STATUS | NEXT MAJOR MILESTONE(S) |
|---|---|---|---|
| **Landfill Site 16**<br><br>Accelerated RI | RI/FS | - Quarterly sampling was conducted in Harrison Bayou on 5 February. | - Quarterly sampling has been funded for FY97, and will continue in FY97. Contract for Accelerated RI awaiting award. |
| **DERA SUMPS** | Removal Action | - Sump contents have been removed and disposed per TNRCC approval.<br>- Sump removal complete. | - Sump removal final report scheduled to be submitted in March/April 97. |

| SCHEDULED MEETINGS AND VISITS TO LHAAP | | |
|---|---|---|
| **Date / Time** | **Purpose of Meeting / Visit** | **Location** |
| 8 April/ 0930 | Managers' Meeting | Teleconference |
| 13 May/ 0930 | Manager's Meeting/Risk Assessment Planning Meeting | Dallas |

018585

**LHAAP, Group 2, Site 16, Accelerated RI/FS with Treatability Study, as of 01 April 1997**

| Task # | Task Name | Duration | Sched Start | Sched Finish | Actual Start | Actual Finish |
|---|---|---|---|---|---|---|
| 1 | Contract | 56d | 12/16/96 | 02/05/97 | 12/16/97 | |
| 2 | Workplan Prep | 28d | 02/05/97 | 03/02/97 | | |
| 3 | Resistivity Survey Plan Letter | 21d | 01/22/97 | 02/10/97 | | |
| 4 | Mobilize/Fieldwork | 7d | 02/10/97 | 02/16/97 | | |
| 5 | COE Review Workplan | 7d | 03/02/97 | 03/08/97 | | |
| 6 | Comment Resolution | 7d | 03/08/97 | 03/15/97 | | |
| 7 | Draft WP Combined Review | 30d | 03/15/97 | 04/10/97 | | |
| 8 | Resolve Comments | 7d | 04/10/97 | 04/16/97 | | |
| 9 | Revise Workplan | 7d | 04/17/97 | 04/23/97 | | |
| 10 | Final Regulatory Review/Approval | 7d | 04/23/97 | 04/29/97 | | |
| 11 | Mobilize | 7d | 04/23/97 | 04/29/97 | | |
| 12 | Fieldwork | 45d | 04/29/97 | 06/08/97 | | |
| 13 | Risk Assessment Planning Mtg | 3d | 05/13/97 | 05/13/97 | | |
| 14 | EW Start-up | 7d | 06/08/97 | 06/14/97 | | |
| 15 | EW Data Collection | 7d | 11/21/97 | 11/27/97 | | |
| 16 | Sampling & Analysis | 45d | 06/08/97 | 07/18/97 | | |
| 17 | Data Validation | 28d | 07/18/97 | 08/12/97 | | |
| 18 | Data Summary/Validation Report | 28d | 11/27/97 | 12/22/97 | | |
| 19 | Combined Review | 30d | 12/22/97 | 01/18/98 | | |
| 20 | Data Review Meeting | 1d | 01/18/98 | 01/18/98 | | |
| 21 | Modeling/Risk Assessment Scoping Meeting | 0d | 01/19/98 | 01/19/98 | | |
| 22 | Modeling Report | 150d | 01/18/98 | 05/31/98 | | |
| 23 | COE Review | 14d | 05/31/98 | 06/13/98 | | |
| 24 | Comment Resolution | 7d | 06/13/98 | 06/19/98 | | |
| 25 | Combined Review | 30d | 06/19/98 | 07/16/98 | | |
| 26 | Comment Resolution | 14d | 07/16/98 | 07/28/98 | | |

018586

**LHAAP, Group 2, Site 16, Accelerated RI/FS with Treatability Study, as of 01 April 1997**

| | | | | | | |
|---|---|---|---|---|---|---|
| 27 | Draft Risk Assessment Rpt. | 180d | 01/16/98 | 06/27/98 | | |
| 28 | COE Review | 14d | 06/27/98 | 07/09/98 | | |
| 29 | Comment Resolution | 7d | 07/09/98 | 07/16/98 | | |
| 30 | Army Review | 30d | 07/16/98 | 08/11/98 | | |
| 31 | Comment Resolution | 10d | 08/11/98 | 08/20/98 | | |
| 32 | Revise Risk Assess. Report | 7d | 08/20/98 | 08/26/98 | | |
| 33 | Regulatory Review of Risk Assessment | 30d | 08/26/98 | 09/22/98 | | |
| 34 | Comment Resolution | 14d | 09/22/98 | 10/04/98 | | |
| 35 | Prepare RI/FS Report | 90d | 10/05/98 | 12/23/98 | | |
| 36 | Army Review | 10d | 12/24/98 | 01/01/99 | | |
| 37 | Comment Resolution | 7d | 01/01/99 | 01/08/99 | | |
| 38 | Draft RI/FS | 7d | 01/08/99 | 01/14/99 | | |
| 39 | Regulatory Review | 30d | 01/14/99 | 02/09/99 | | |
| 40 | Comment Resolution | 30d | 02/09/99 | 03/09/99 | | |
| 41 | Revise RI/FS Report | 30d | 03/09/99 | 04/08/99 | | |
| 42 | Proposed Plan | 55d | 04/08/99 | 05/30/99 | | |

## LHAAP, GROUP 1, RI/ROD; as of 26 March 1997

| Task # | Task Name | Duration | Sched Start | Sched Finish | Actual Start | Actual Finish |
|---|---|---|---|---|---|---|
| 1 | Review Draft RI | 30d | 05-01-97 | 05-30-97 | | |
| 2 | Prepare Proposed Plan | 30d | 05-01-97 | 05-30-97 | | |
| 3 | Finalize RI | 30d | 05-01-97 | 05-30-97 | | |
| 4 | Issue Final RI | 1d | 06-01-97 | | | |
| 5 | Review Proposed Plan | 30d | 06-01-97 | 06-30-97 | | |
| 6 | Revise Proposed Plan | 7d | 07-01-97 | 07-08-97 | | |
| 7 | Issue Proposed Plan to Public | 30d | 07-09-97 | 08-07-97 | | |
| 8 | Public Meeting | | 07-28-97 | 07-31-97 | | |
| 9 | Prepare ROD and Responsiveness Summary | 15d | 08-08-97 | 08-21-97 | | |
| 10 | Review ROD | 30d | 08-22-97 | 09-20-97 | | |
| 11 | Revise ROD | 7d | 09-21-97 | 09-27-97 | | |
| 12 | Issue ROD for Signatures | | 09-28-97 | | | |

# Texas Natural Resource Conservation Commission

INTEROFFICE MEMORANDUM

018588

TO : Diane Poteet
Investigation Unit
Pollution Cleanup Division

DATE: March 17, 1997

Thru 3-17-97 Pat Radloff, Team Leader
Industrial Permits Team

FROM : Stephen Ligon
3/17/97 Industrial Permits Team

SUBJECT : Longhorn Army Ammuniti

| Fax Transmittal Memo | # of Pages 1 |
|---|---|
| To: POTEET | From: LIGON |
| Co.: | Co.: |
| Dept.: | Phone # 4527 |
| Fax # 24469 | Fax # |

DMFX14

You requested assistance (FAX dated 02/05/97) in establishing effluent guidelines for the discharge of treated groundwater from the above-referenced facility. A list of potential pollutants was provided. Effluent limitations for mercury were sent to you in an earlier memo dated February 19, 1997. Water quality criteria had to be developed by Dr. B.J. Lee, Toxicity Evaluation Team - Water Planning and Assessment Division, for the remaining pollutants. The following effluent limitations were calculated utilizing those criteria:

| | Units are (µg/l) | | |
|---|---|---|---|
| POLLUTANT | Daily Avg | Dly Max | MAL |
| Nitrobenzene (CAS 98-95-3) | 100 | 213 | 10 |
| Antimony (CAS 7440-36-0) | 34 | 72 | 60 |
| 2,3-Dinitrotoluene (CAS 121-14-2) | 2.6 | 5.6 | ** |
| 2,3-Dinitrotoluene (CAS 602-01-7) | 19 | 39 | ** |
| 2-Nitrotoluene (CAS 88-72-2) | 623 | 1313 | ** |
| 3-Nitrotoluene (CAS 99-08-1) | 424 | 898 | ** |
| 4-Nitrotoluene (CAS 99-99-0) | 215 | 455 | ** |
| 1,3-Dinitrobenzene (CAS 99-65-0) | 21 | 43 | ** |
| 1,3,5-Trinitrobenzene (CAS 99-35-4) | 10.4 | 22 | ** |
| 2,4,6-Trinitrotoluene (CAS 118-96-7) | 55 | 117 | ** |
| RDX (CAS 121-82-4) | 18.5 | 39 | ** |
| HMX (CAS 2691-41-0) (Octohydro-1,3,57-tetranitro-1,3,57-tetraazocine) | 849 | 1796 | ** |
| Tetryl (CAS 479-45-8) | * | * | ** |
| 4-Amino-2,6-Dinitrotoluene (CAS 19406-51-0) | 74 | 157 | ** |
| 2-Amino-4,6-dinitrotoluene (CAS 35572-78-2) | 11.3 | 24 | ** |

* Not classified as a human carcinogen. No toxic criteria available.

** MAL's are not readily available. TNRCC - Houston laboratory is assisting. I will forward this information as soon as it becomes available.

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

018589

April 4, 1997

**VIA OVERNIGHT MAIL AND FACSIMILE**

James A. McPherson, Commander's Representative
Longhorn/Louisiana Army Ammunition Plant
Attn: SIOLH-CR
P.O. Box 658
Doyline, LA 71023

Re: Longhorn Army Ammunition Plant
Draft Work Plan for the Site 16 Phase III
Remedial Investigation/Feasibility Study and
Groundwater Treatability Study

Dear Mr. McPherson:

The Environmental Protection Agency (EPA) has completed its review of the above referenced document. Please find enclosed EPA's comments on this document. If you have any questions or comments regarding this matter, please call me at (214) 665-6758.

Sincerely,

Chris G. Villarreal

Chris G. Villarreal
Project Manager

Enclosure

cc: Steve Brunton, Sverdrup (via email)
Yolane Hartsfield, COE Tulsa District (via facsimile & regular mail)
Diane Poteet, TNRCC (MC-143) (via facsimile & regular mail)
Warren Sayes, COE Fort Worth District (via facsimile & regular mail)

# EPA'S COMMENTS ON THE DRAFT WORK PLAN (PART I) SITE 16 PHASE III REMEDIAL INVESTIGATION/FEASIBILITY STUDY AND GROUNDWATER TREATABILITY STUDY MARCH 1997

018590

## GENERAL COMMENTS:

The RI/FS needs to provide the decision-maker with an assessment of the extent and nature of the contamination at the site, an assessment of current and potential risks posed by the site to human health and the environment, a description of alternatives, and comparison of alternatives based on the nine criteria. In addition, the RI/FS identifies the performance levels each alternative is expected to attain to ensure protection of human health and the environment. The RI/FS must contain sufficient information to support the selection of a preferred alternative.

A RI/FS work plan expands the tasks of the Statement of Work (SOW) by detailing the work to be done in conducting the RI/FS. Major components of the SOW were not addressed in the draft RI/FS work plan. Namely, the Baseline Risk Assessment (SOW Task #10) and the Feasibility Study (SOW Task #7). The potential need for treatability studies, and a discussion of deliverables and schedule (SOW Section 4.0 Deliverables) should also be provided. A general discussion of a baseline risk assessment, treatability investigations, development and screening of alternatives, and detailed analysis of alternatives is provided below.

## BASELINE RISK ASSESSMENT

A baseline risk assessment is conducted during the RI. The baseline risk assessment is used to determine whether, in the absence of remedial action, a particular site poses a substantial danger to public health and welfare and the environment. There are two separate inquires: human health and the environment. The human health evaluation addresses: all exposure pathways for each medium of concern; toxicity values for carcinogenic and noncarcinogenic effects; and the cancer and/or hazard index for each chemical of concern. The environmental evaluation addresses any critical habitats affected by site contamination and any species affected by the contamination.

The baseline risk assessment process is cumulative in nature: the components of the assessment build on one another. For assistance in planning the conduct of the baseline risk assessment, please refer to EPA's *Superfund Human Health Evaluation Manual, Superfund Exposure Assessment Manual,* and *Superfund Environmental Evaluation Manual,* and access the Integrated Risk Information System (IRIS) and Public Health Risk Evaluation Data Base.

Activities associated with the Baseline Risk Assessment include:

- Contaminant identification and documentation

- Exposure assessment and documentation
- Toxicity assessment and documentation
- Risk characterization
- Environmental evaluation



## TREATABILITY INVESTIGATIONS

Treatability studies are designed to provide information used in the detailed analysis of alternatives to the maximum extent practicable. The decision of whether to conduct these activities is made upon whether a treatment alternative is properly considered for the site, the nature and size of the site, the contaminants and media they are in, the potential for migration and possible site risks, available information in technical literature, and the uncertainties associated with selecting an appropriate site remedy. It is imperative that these activities be initiated during the scoping because they may take over six months to complete (i.e., biotreatability tests). The final decision on the type (literature survey, bench, or pilot) and extent of treatability testing depends on uncertainties of treatment and the amount of work that should be deferred to the remedial design (RD) process.

In addition to the progress meetings and reports, the required deliverables for treatability investigations may include:

- Identification of candidate technologies
- Literature survey and determination of whether testing is necessary
- Treatability testing work plan, or revisions to the original work plan
- Treatability study SAP, or revisions to the original
- A treatability study evaluation report summarizing the results, evaluating the test, and describing the following:
  - Remedial technology
  - Test objectives
  - Experimental procedures
  - Treatability conditions to be tested
  - Analytical methods
  - Data management and analysis
  - Health and safety
  - Residual waste management

Following the completion of treatability testing, data should be analyzed and interpreted in a technical report. Depending on the sequence of activities, this report may be a part of the RI/FS report or a separate deliverable. The report should also evaluate full-scale application of the technology, including a sensitivity analysis identifying the key parameters affecting full-scale operation.

## DEVELOPMENT AND SCREENING OF ALTERNATIVES

During the process of developing and screening alternatives, the following activities are conducted:

- Develop specific remedial action objectives acceptable to the EPA and the TNRCC using all RI generated data. This is very important as it sets the goals of the FS.
- Develop a range of general response actions
- Identify areas or volumes of the media to be treated, contained and/or subjected to institutional controls
- Identify, screen, and document technologies
- Assemble a number of alternatives depending on the site type and characteristics
- Screen the remedial action alternatives, if necessary, on the basis of effectiveness, implementability, and cost
- Prepare an alternatives array document.

The information developed during these two activities [developing and screening of alternatives] is used in assembling remedial technologies into alternatives for either the site as a whole or for a specific operable unit. At some sites, a number of potential remedial options may be developed early in the RI/FS process. In such cases, these options should be screened to narrow the list of options that will be evaluated in detail. The screening process is necessary for two reasons. First, it streamlines the feasibility study process. Second, it ensures that the most promising alternatives are being considered. During the screening process, ARARs should be given specific attention.

The information available at the time of screening should be used to identify and distinguish any differences among the various alternatives. If screening takes place, the technical memorandum should present the alternatives in such a manner that each alternative can be evaluated with respect to its effectiveness, implementability, and cost and document the rationale for screening out any alternatives. The retained alternatives are judged as the best or most promising while retaining a range of alternatives broad enough to satisfy requirements of CERCLA and the NCP. These alternatives should be subjected to further consideration and analysis. Alternatives that are screened out will not receive further consideration unless additional information indicates that further evaluation is warranted.

In the event that there are only a limited number of viable alternatives for a particular site, the alternative screening process should be either minimize or eliminated.

## DETAILED ANALYSIS OF ALTERNATIVES

Nine evaluation criteria have been developed to address statutory requirements, as well as the technical and policy considerations that have proven to be important for selecting from among

the remedial alternatives. These evaluation criteria serve as the basis for conducting the detailed analyses during the FS and for subsequently selecting an appropriate site remedy. The criteria are:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Short-term effectiveness
- Reduction of toxicity, mobility, or volume
- Implementability
- Cost
- State acceptance
- Community acceptance.

The detailed analysis process should include an evaluation of each alternative against the nine criteria. A memorandum summarizing the results of the comparative analysis should be submitted. In addition, a draft FS report should be submitted for review and approval. The report, as adopted or modified, provides a basis for remedy selection. It documents the development and analysis of remedial alternatives. The final FS report may be bound with the final RI report. Following completion of the RI/FS report and confirmation that there is sufficient information to support the selection of a preferred alternative, the process of remedy selection begins.

## SPECIFIC COMMENTS

1) Section 1.1 Purpose, page 1-1:

Text states, "Additionally, as part of the FS, a Water Treatability Study will be performed to provide information for the evaluation of groundwater extraction as an alternative in the FS."

Please provide additional information regarding the Water Treatability Study.

2) Table 3-2 & Table 3-3, pages 3-11 & 3-12:

Tables are missing in the copy provided for EPA's review.

3) Section 4.1, Installation of Extraction Wells, page 4-2:

Text states, "An intermediate extraction well will be installed to a depth of approximately 55 ft BGS adjacent to 16EW01 and 16EW02."

Figure 4-1 shows two intermediate extraction wells (16EW05 & 16EW06) adjacent to 16EW01 and 16EW02. Revised test to read "Intermediate extraction wells (16EW05 & 16EW06) will be installed to a depth of approximately 55 ft BGS adjacent to 16EW01 and 16EWE02."

4) Section 4.2 Installation of Monitoring Wells, page 4-3:

Text states, "Deep monitoring wells will be installed at a depth of approximately 100 ft BGS adjacent to monitoring wells 16WW16, 16WW17, and 16WW18."

Figure 4-1 does not show a proposed deep monitoring well near 16WW16 (shallow monitoring well). It does show the proposed deep monitoring wells (16WW20) near the existing wells 16WW14 (shallow monitoring well) and 16WW15 (deep monitoring well), proposed deep monitoring well 16WW19 near 16WW18 (deep monitoring well), and proposed deep monitoring well 16WW21 near 16WW17 (deep monitoring well).

Why are the proposed deep monitoring wells being installed near existing deep monitoring wells? [16WW19 near 16WW18, 16WW20 near 16WW15, & 16WW21 near 16WW17]

5) Section 4.4 Collection of Soil Samples, page 4-3:

Text states, "A total of sixteen soil samples will be collected from four soil borings during the installation of intermediate monitoring wells 16WW28, 16WW32, 16WW36, and 16WW38."

What was the rationale for selecting these locations?

6) Section 4.5 Collection of Groundwater Sample, page 4-5:

Text states, "A total of ten shallow soil samples will be collected from the proposed locations on Figure 4-1. Surface soil samples will be collected from a depth interval of 0- 1 ft."

The proposed shallow soil sample locations are not shown on Figure 4-1. In order to use these samples for the risk assessment, surface soil samples should be collected from a depth interval of 0 - 6".

7) Section 4.6 Collection of Grab Samples, page 4-5:

Text states, "Additionally samples from 16WW16, 16EW01, and 16WW36 will be analyzed for pesticides, PCBs, and dioxin/furans."

What was the rationale for selecting these locations?

8) Section 5.2.2.1 Shallow and Intermediate Monitoring Wells, Drilling and Installation:

In regards to the placement of well screens, text should be modified to indicate that the actual placement of the well screens will be based on field data. Specifically, the base of the well screens for the shallow and intermediate monitoring wells will correspond to the base of the shallow and intermediate saturated sand zones respectively.

9) Section 5.2.3 Deep Monitoring Wells:

In respect to the deep monitoring wells, has contamination been detected in the existing deep wells?

10) Section 5.2.5 Development, page 5-28:

Text states, "If a well bails or pumps 'dry' during development prior to removing the required volume [a minimum of 3 well volumes], the well will be considered developed."

It is vital for monitoring wells to be properly developed in order that samples can be collected that are truly representative of the quality of water that is moving through the formation. Additional well development methods should be used (e.g., backwashing, surge block) if the well bails or pumps "dry" during development. If backwashing, formation water should be used. If using a surge block, formation water should be used; in low-yield formation, outside water source can be used if analyzed to evaluate impact.

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

018596

April 7, 1997

**VIA HAND DELIVERY**

James A. McPherson, Commander's Representative
Longhorn/Louisiana Army Ammunition Plants
Att..: SIOLH-CR
P.O. Box 658
Doyline, LA 71023

Re: Longhorn Army Ammunition Plant
Early Interim Remedial Action at Burning Ground No. 3
Disposal of Treated Source Material

Dear Mr. McPherson:

This letter is in response to an inquiry made at the March 11, 1996 Technical Review Committee meeting. Specifically, a inquiry was made regarding whether or not source material from Burning Ground No. 3 could be land disposed back to the Burning Ground No. 3 after receiving treatment in the low temperature thermal desorber unit. The Environmental Protection Agency's (EPA) evaluation of this request and position are as follows:

- The May 1995 *Record of Decision for the Interim Remedial Action at Burning Ground No. 3* (ROD) states that "the source material was contaminated with spent halogenated solvents (F002) from nonspecific sources" and that "the source material is regulated under Resource Conservation and Recovery Act (RCRA) 40 CFR 261, Subpart D." Pursuant to 40 CFR §268.30 (c), "the F001-F005 solvent waste which are contaminated soil and debris resulting from a response action taken under section 104 or 106 of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA) . . . and the residues from treating these wastes are prohibited from land disposal." However, pursuant to 40 CFR §268.30(d)(1), the above requirement [40 CFR §268.30(c)] does not apply if the wastes meet the standards of Subpart D (Treatment Standards) of this part (See table 1 - enclosed). Pursuant to a conversation with Ms. Terry Sykes, RCRA Team Leader in the Legal Branch of EPA's Enforcement Division, treatment standards must be met for land disposal in a Subtitle C landfill.

- The ROD states that "Metals and other treatment residuals that are hazardous wastes will be managed in accordance with RCRA (40 CFR 261)." Pursuant to 40 CFR §268.7 (Waste analysis and record keeping), "if a generator's waste is listed in 40 CFR part 261, subpart D, the generator must test his waste, or test an extract using test method 1311

(the Toxicity Characteristic Leaching Procedure . . . ), or use knowledge of the waste, to determine if the waste is restricted from land disposal under this part." Additionally, "if a generator's waste exhibits one or more of the characteristics set out at 40 CFR part 261, subpart C, the generator must test his waste, or test an extract using test method 1311 (the Toxicity Characteristic Leaching Procedure . . . ), or use knowledge of the waste, to determine if the waste is restricted from land disposal under this part." Pursuant to 40 CFR §268.40 (a), "A waste identified in the table 'Treatment Standards for Hazardous Wastes' may be land disposed only if it meets the requirements found in the table."

The EPA has reviewed the results of the waste feed and treated soil samples taken from the Burning Ground No. 3 soil treatment plant between February 12, 1997 and March 8, 1997. Based upon these results, the treated soil is meeting the F002 land disposal treatment standards. However, pursuant to the land disposal restrictions, residuals generated from the treatment of debris contaminated with listed waste are still hazardous waste by virtue of the derived-from rule and would be subject to the hazardous waste management system. Therefore, because the source material from the Burning Ground No. 3 is contaminated with listed waste (F002), residuals generated from the treatment of the source material cannot be land disposed at the Burning Ground No. 3. If you have any questions, please contact me at (214) 665-6758.

Sincerely,

Chris G. Villarreal

Chris G. Villarreal
Project Manager

Enclosure

cc: Warren Sayes, COE Eastern Area Office (CESWF-AD-E)
Yolane Hartsfield, COE Tulsa District (CESWT-PP-ME)
Diane Poteet, TNRCC (MC-143)

# TABLE 1
# TREATMENT STANDARDS FOR HAZARDOUS WASTES[A]

| REGULATED HAZARDOUS CONSTITUENT | NONWASTEWATERS WASTE CODE F002 (mg/kg) [B] | MAXIMUM CONCENTRATION OF CONTAMINANTS FOR THE TOXICITY CHARACTERISTIC REGULATORY LEVEL (mg/L) |
|---|---|---|
| Acetone | 160 | ----- |
| Arsenic | ----- | 0.5 |
| Barium | ----- | 100 |
| Benzene | 10 | 0.5 |
| Cadmium | ----- | 1.0 |
| Chloroform | ----- | 6.0 |
| Chromium | ----- | 5.0 |
| 1, 2-Dichloroethane | ----- | 0.5 |
| 1, 1-Dichloroethene (1, 1-Dichloroethylene) | ----- | 0.7 |
| 2, 4-Dinitrotoluene | ----- | 0.13 |
| Ethylbenzene | 10 | ----- |
| Lead | ----- | 5.0 |
| Mercury | ----- | 0.2 |
| Methylene chloride | 30 | ----- |
| Selenium | ----- | 1.0 |
| Silver | ----- | 5.0 |
| Tetrachloroethylene | 6.0 | 0.7 |
| Toluene | 10 | ----- |
| 1, 1, 1-Trichloroethane | 6.0 | ----- |
| Trichloroethylene | 6.0 | 0.5 |
| Vinyl chloride | ----- | 0.2 |
| Xylenes-mixed isomers[C] | 30 | ----- |

[A] Values taken from 40 CFR §268.40 & 40 CFR §261.24

[B] All concentrations standards for nonwastewaters are based on analysis of grab samples.

[C] Sum of o-, m-, and p-xylene concentrations.

Meeting with Texas' Trustees
Longhorn Army Ammunition Plant
8 April 1997
Texas Natural Resource Conservation Commission, Austin, Texas

018599

1. The following is a list of participants:

Diane Hyatt, GLO/NRDA
Ira Nathan, LHAAP
David Tolbert, LHAAP
Karen Q. Myers, TPWD
Diane Poteet, TNRCC
Yolane Hartsfield, USACE
Michael Moore, TNRCC/SIS
Ginny King, TNRCC/NRTP
Richard Seiler, TNRCC
Don Pitts, TPWD
Chris Villarreal, EPA

2. The meeting was brought to order by Mr. David Tolbert and general introductions were made.

3. Mr. Tolbert distributed the Executive Summary dated 4 April 1997 to the assembled and using a map of Longhorn AAP discussed the status of the various sites, along with historical information to the Texas' Trustees. Trustees' questions were answered by Mr. Tolbert, Mr. Nathan, Ms. Hartsfield, Diane Poteet, Michael Moore, and Chris Villarreal.

4. Ms. King stated that the Trustees wanted to become more involved in the environmental work on-going at LHAAP. She stated that Longhorn AAP, Lonestar AAP, Air Force Plant #4, and Pantex were the four sites currently within the Trustees' purview. Ms. King stated that the Trustees' interest is in ultimate natural resource losses to the State of Texas and compensation to the State for such lost resources due to an historical spill, leak, or release of hazardous materials into the environment. The Trustees' evaluation is performed after the remedial action is accomplished. With the comprehensive remediation on-going at Longhorn AAP and the Plant's proactive approach, the Trustees' expressed that they do not anticipate any problems. Ms. King stated that she would be the Trustees' single point of contact for the Plant.

5. Trustees stated that they wanted to become members of the Longhorn AAP Team and would be furnishing to the Plant a draft Memorandum of Understanding/Agreement. Longhorn AAP personnel made no commitments of any kind.

6. There being no further discussion, the meeting was adjourned.

Yolane Hartsfield
Project Manager, Tulsa District USACE

018600

# TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

*Protecting Texas by Reducing and Preventing Pollution*

April 14, 1997

**CERTIFIED MAIL**
**Z 746 032 994**
**RETURN RECEIPT REQUESTED**

James A. McPherson, Commander's Representative
Longhorn/Louisiana Army Ammunition Plant
Attn: SIOLH-CR
P. O. Box 658
Doyline, LA 71023

Re: Longhorn Army Ammunition Plant
Group 2 - Landfill Site 16
Draft Work Plan (Part I) and Sampling and Analysis Plan (Part II)
Phase III Remedial Investigation/Feasibility Study and Groundwater Treatability Study

Dear Mr. McPherson:

The Texas Natural Resource Conservation Commission (TNRCC) staff has completed its review of the above referenced document, which was received on March 18, 1997. Our comments are enclosed. If you have any questions or comments regarding this matter, please call me at (512) 239-2502.

Sincerely,

Diane R. Poteet

Diane R. Poteet, Project Manager
RI/FS II Unit
Superfund Investigation Section (MC-143)
Pollution Cleanup Division

Enclosure

cc: Chris Villarreal, EPA Region 6 (6SF-AT)
Yolane Hartsfeld, COE Tulsa District (CESWT-PP-EA)
Warren Sayes, COE Eastern Area Office (CESWF-AD-E)

**Longhorn Army Ammunition Plant/Group 2 - Landfill Site 16**
**Comments on the Draft Work Plan (Part I) and Sampling and Analysis Plan (Part II)**
**Phase III Remedial Investigation/Feasibility Study and Groundwater Treatability Study**

Figure 4-1

1. This map is very difficult to read: too many details on one small portion of the map.

2. The symbol for the proposed piezometer nest location appears to be defined as a triangle within a circle, not a solid-colored "donut" shape as presented in the legend.

3. Well 16WW19 has a solid-colored triangle for its symbol when it should be an uncolored triangle for a deep well. There are no solid-colored triangles defined in the legend.

Table 3-1

1. What is meant by the column labeled "MCL"? Please either add a discussion in the text regarding this column or please remove this column.

2. Vinyl Chloride has an MCL of 0.002, but is not listed on the table.

3. When there is not an MCL listed, what number will be used?

4. Why are the soil, surface water and sediment regulatory limits listed in the column under "MCL"? This column could be called "Regulatory Limit".

5. Why use EPA's "Soil Screening Levels" when they may not be the most conservative number? The Texas Risk Reduction Rules (30 TAC 335 Subchapter S) are ARARs, and should be considered. Why are Preliminary Remediation Goals (PRGs) not calculated?

Section 4

1. Section 4.2, page 4-3. First paragraph. Monitoring well 16WW16 has no deep well listed next to it on Figure 4-1. Do you mean 16WW15 or 16WW14 will have a deep well next to it? Well 16WW18 has the wrong symbol next to it - see above.

2. Section 4.5, page 4-5. The proposed ten shallow soil samples are not on Figure 4-1. Please **do not** put their location on Figure 4-1. Instead, please place them on a separate figure and show more details (geology, soil type, topography, drainage, etc.).

3. Section 4.6, page 4-5. What is the rationale for analyzing for VOCs, explosives, metals, and anions once at the first, and then only sampling for VOCs and explosives the other two times? What is the sampling rationale for the project?

**(Site 16 Work Plan Comments Continued)**

4. Section 4.9, page 4-6. The piping system is considered a part of the tank system and must have secondary containment. Please see the section on tank systems found at 30 TAC §335.152 (a) (8), which refers to 40 CFR Part 264 Subpart J. Please provide plans for the extraction tank and piping system.

General

1. How is it known that the detection limits are low enough without identifying ARARs and deriving PRGs? Please provide in the work plan a table that shows for each constituent the test method, the laboratory's reporting limit, and the ARAR or PRG that will be used.

   We believe that it is more cost effective if the lab is specifically informed what method it should use to achieve the correct detection limit. For example, in Table 3.4-3 of Sverdrup's *Draft Final Sampling and Data Results Report for the Phase 2, Group 2 Sites Remedial Investigation, March 1996*, the detection limit for lead in a geoprobe groundwater sample (# 16PB04) was not low enough (>0.020 μg/L) to meet the health-based limit for drinking water (0.015 μg/L). If this sample was to be used for comparison purposes, it could not be used unless the sample was re-analyzed (within the holding time) or it would have to be re-collected and analyzed.

   The methods should be selected from the QAPP (or CDAP) based on what detection limits are needed to achieve the ARARs and/or PRGs, and then the lab should be instructed to use those methods. This would be the most cost effective way to proceed because it eliminates having to re-run analyses and/or re-collect samples and run new analyses if the initial analyses did not meet the ARARs/PRGs.

   More reasons why the Army needs to identify ARARs/PRGs: Even though a risk assessment will be performed, ARARs and PRGs need to be considered up front in the RI process. First, an ARAR value may supersede a concentration that is calculated based on risk. Second, the ecological and human health risk assessments occur later in the process, so that PRGs **for both** are needed to be determined up front to ensure that detection limits are low enough to provide data that will be useable in the risk assessment. This is particularly important for two reasons: 1) the concentration of concern for ecological risk may be different than the concentration for human health risk; and 2) if aquatic life criteria are to be based on ecological rather than human heath risk, lower detection limits may be required.

2. What is the treatability/feasibility study about? What parameters do you need to meet your goals? How will you get your parameters?

**(Site 16 Work Plan Comments Continued)**

3. Again, it is recommended that the Data Quality Objective process be used. See *Guidance for the Data Quality Objectives Process, USEPA QA/G-4, September 1994.*

4. The TNRCC regulations found at 30 TAC §335.563 (e) require that media cleanup levels be based on a future residential land use unless a person demonstrates, to the satisfaction of the Executive Director, that another land use scenario is appropriate. A discussion regarding criteria for justifying alternate land use is presented in *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (EPA/540/1-89/002) (RAGS)*, Chapter 6, Section 6.2.2. Supporting documentation, using the above-referenced TNRCC regulations and EPA guidance, regarding the anticipated future land use at the site must be submitted for consideration by the Superfund Investigation Section so that we can reach agreement on this issue. Until such time that an agreement is reached, the future land use is considered by default to be residential.

DEPARTMENT OF THE ARMY
LONGHORN/LOUISIANA ARMY AMMUNITION PLANTS
P.O. BOX 658
DOYLINE, LOUISIANA 71023-0658

19496

REPLY TO ATTENTION OF

February 19, 1997

SIOLH-OR

SUBJECT: Closure of Sumps at Longhorn Army Ammunition Plant

Ms. Lila Beckley
Texas Natural Resource Conservation Commission
TNRCC MC-128
Post Office Box 13087
Austin, TX 78711-3087

Dear Ms. Beckley:

Waste water sumps at Longhorn Army Ammunition Plant have been removed and properly disposed. As part of the removal action, portions of drainage troughs were also removed and disposed.

Remaining concrete drainage troughs and other related components are to be investigated as part of the Phase III, Group 4 Remedial Investigation. This investigation will include soil and groundwater in the immediate area of the troughs and sumps. Trough contents (i.e. dried sediment) and surrounding soils will be investigated for indication of historical use related leaks or spills.

The point of contact is Ms. Yolane Hartsfield, 918-669-7530.

Sincerely,

JAMES A. McPHERSON
Commander's Representative

CF:
TNRCC (Diane Poteet)

Feb 21, 1997

United States Environmental Protection Agency

Technical Review Workgroup for Lead

December 1996

19497

# Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil

# Preface

This report includes a fact sheet, *Technical Review Workgroup for Lead (TRW) Recommendations for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil* along with an Appendix, *Equations and Rationale for Default Values Assigned to Parameters in the Slope Factor Approach and Exposure Model for Assessing Risk Associated with Adult Exposures to Lead in Soil*, which discusses in greater detail the equations and parameters used in the methodology.

# U.S. Environmental Protection Agency

## Technical Review Workgroup for Lead

CHAIRPERSONS

**Patricia Van Leeuwen**
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Chicago, IL

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Washington, DC

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Office of Solid Waste and
Emergency Response
Washington, DC

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of the
Technical Review Workgroup for Lead

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Office of Research and Development
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Office of Solid Waste and
Emergency Response
Washington, DC

# 1. INTRODUCTION

This report describes a methodology for assessing risks associated with non-residential adult exposures to lead in soil. The methodology focuses on estimating fetal blood lead concentration in women exposed to lead contaminated soils. This approach also provides tools that can be used for evaluating risks of elevated blood lead concentrations among exposed adults. The methodology is the product of extensive evaluations by the Technical Review Workgroup for Lead (TRW) which began considering methodologies to evaluate nonresidential adult exposure in 1994 (Balbus-Kornfeld, 1994; U.S. EPA, 1994a). In 1995, the TRW reviewed a methodology developed by EPA Region 8 for deriving risk-based remediation goals (RBRGs) for nonresidential soil at the California Gulch NPL site (U.S. EPA, 1995). A TRW committee on adult lead risk assessment was formed in January, 1996 to further develop the ideas and information gathered as part of these previous efforts into a generic methodology that could be adapted for use in site-specific assessments.

This report provides technical recommendations of the TRW for the assessment of adult lead risks using this methodology. An overriding objective in the development of this methodology was the immediate need for a scientifically defensible approach for assessing adult lead risks associated with nonresidential exposure scenarios. The TRW recognizes that other adult lead models may provide useful information. In particular, models providing more detailed representations of lead kinetics may be useful in supporting more detailed predictions about the time course of blood lead concentrations among individuals who receive brief acute exposures to lead or whose exposures otherwise change markedly with time. The methodology presented here uses a simplified representation of lead biokinetics to predict quasi-steady state blood lead concentrations among adults who have relatively steady patterns of site exposures (as described in this report). The TRW believes that this approach will prove useful for assessing most sites where places of employment are (or will be) situated on lead contaminated soils. This information is expected to promote consistency in assessments of adult lead risks. The methodology described in this report is an interim approach that is recommended for use pending further development and evaluation of integrated exposure biokinetic models for adults. The TRW is undertaking review of other models and will provide reviews on other approaches as appropriate. The Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children (U.S. EPA, 1994b,c) is the recommended approach for assessing residential lead risks.

The recommended approach for assessing nonresidential adult risks utilizes a methodology to relate soil lead intake to blood lead concentrations in women of child-bearing age. It is conceptually similar to a slope factor approach for deriving RBRGs that had been proposed by Bowers et al. (1994) and which was adapted for use at the California Gulch NPL site in Region 8 (U.S. EPA, 1995). This report describes the basic algorithms that are used in the methodology and provides a set of default parameter values that can be used in cases where high quality data are not available to support site-specific estimates. The rationale for each parameter default value is provided in the Appendix.

# 2. OVERVIEW OF THE APPROACH

The methodology described in this report relates soil lead concentrations to blood lead concentrations in the exposed population according to the algorithms described below. Note that the algorithms may consist of variables that include superscripts and/or subscripts. The convention adopted in this report is to use superscripts as exponents (i.e., a mathematical operation), whereas subscripts represent key words that provide additional information to distinguish between similar variables. The basis for the calculation of the blood lead concentration in women of child-bearing age is the algorithm given by Equation 1:

$$PbB_{adult,central} = PbB_{adult,0} + \frac{PbS \cdot BKSF \cdot IR_S \cdot AF_S \cdot EF_S}{AT} \qquad \text{(Equation 1)}$$

where:

$PbB_{adult, central}$ = Central estimate of blood lead concentrations (µg/dL) in adults (i.e., women of child-bearing age) that have site exposures to soil lead at concentration, PbS.

$PbB_{adult, 0}$ = Typical blood lead concentration (µg/dL) in adults (i.e., women of child-bearing age) in the absence of exposures to the site that is being assessed.

PbS = Soil lead concentration (µg/g) (appropriate average concentration for individual).

BKSF = Biokinetic slope factor relating (quasi-steady state) increase in typical adult blood lead concentration to average daily lead uptake (µg/dL blood lead increase per µg/day lead uptake).

$IR_S$ = Intake rate of soil, including both outdoor soil and indoor soil-derived dust (g/day).

$AF_S$ = Absolute gastrointestinal absorption fraction for ingested lead in soil and lead in dust derived from soil (dimensionless).

$EF_S$ = Exposure frequency for contact with assessed soils and/or dust derived in part from these soils (days of exposure during the averaging period); may be taken as days per year for continuing, long term exposure.

AT = Averaging time; the total period during which soil contact may occur; 365 days/year for continuing long term exposures.

The basis for the RBRG calculation is the relationship between the soil lead concentration and the blood lead concentration in the developing fetus of adult women that have site exposures. As a health-based goal, EPA has sought to limit the risk to young children of having elevated blood lead concentrations. Current Office of Solid Waste and Emergency Response (OSWER) guidance calls

for the establishment of cleanup goals to limit childhood risk of exceeding 10 µg/dL to 5% (U.S. EPA, 1994a). Equation 2 describes the estimated relationship between the blood lead concentration in adult women and the corresponding 95th percentile fetal blood lead concentration ($PbB_{fetal, 0.95}$), assuming that $PbB_{adult, central}$ reflects the geometric mean of a lognormal distribution of blood lead concentrations in women of child-bearing age. If a similar 95th percentile goal is applied to the protection of fetuses carried by women who experience nonresidential exposures, Equation 2 can be rearranged to reflect a risk-based goal for the central estimate of blood lead concentrations in adult women using Equation 3:

$$PbB_{fetal,0.95} = PbB_{adult,central} \cdot GSD_{i,adult}^{1.645} \cdot R_{fetal/maternal} \qquad \text{(Equation 2)}$$

$$PbB_{adult,central,goal} = \frac{PbB_{fetal,0.95,goal}}{GSD_{i,adult}^{1.645} \cdot R_{fetal/maternal}} \qquad \text{(Equation 3)}$$

where:

$PbB_{adult, central, goal}$ = Goal for central estimate of blood lead concentration (µg/dL) in adults (i.e., women of child-bearing age) that have site exposures. The goal is intended to ensure that $PbB_{fetal, 0.95, goal}$ does not exceed 10 µg/dL.

$PbB_{fetal, 0.95, goal}$ = Goal for the 95th percentile blood lead concentration (µg/dL) among fetuses born to women having exposures to the specified site soil concentration. This is interpreted to mean that there is a 95% likelihood that a fetus, in a woman who experiences such exposures, would have a blood lead concentration no greater than $PbB_{fetal, 0.95, goal}$ (i.e., the likelihood of a blood lead concentration greater than 10 µg/dL would be less than 5%,for the approach described in this report).

$GSD_{i, adult}$ = Estimated value of the individual geometric standard deviation (dimensionless); the GSD among adults (i.e., women of child-bearing age) that have exposures to similar on-site lead concentrations, but that have non-uniform response (intake, biokinetics) to site lead and non-uniform off-site lead exposures. The exponent, 1.645, is the value of the standard normal deviate used to calculate the 95th percentile from a lognormal distribution of blood lead concentration.

$R_{fetal/maternal}$ = Constant of proportionality between fetal blood lead concentration at birth and maternal blood lead concentration (dimensionless).

The soil lead concentration associated with a given exposure scenario and $PbB_{adult, central, goal}$ can be calculated by rearranging Equation 1 and substituting $PbB_{adult, central, goal}$ for $PbB_{adult, central}$:

$$RBRG = PbS = \frac{(PbB_{adult, central, goal} - PbB_{adult,0}) \cdot AT}{(BKSF \cdot IR_S \cdot AF_S \cdot EF_S)} \qquad \text{(Equation 4)}$$

It is this form of the algorithm that can be used to calculate a RBRG where the RBRG represents the soil lead concentration (PbS) that would be expected to result in a specified adult blood lead concentration ($PbB_{adult, central, goal}$) and corresponding 95th percentile fetal blood lead concentration ($PbB_{fetal, 0.95, goal}$).

Equations 1-4 are based on the following assumptions:

1. Blood lead concentrations for exposed adults can be estimated as the sum of an expected starting blood lead concentration in the absence of site exposure ($PbB_{adult, 0}$) and an expected site-related increase.

2. The site-related increase in blood lead concentrations can be estimated using a linear biokinetic slope factor (BKSF) which is multiplied by the estimated lead uptake.

3. Lead uptake can be related to soil lead levels using the estimated soil lead concentration (PbS), the overall rate of daily soil ingestion ($IR_S$), and the estimated fractional absorption of ingested lead ($AF_S$). The term "soil" is used throughout this document to refer to that portion of the soil to which adults are most likely to be exposed. In most cases, exposure is assumed to be predominantly to the top layers of the soil which gives rise to transportable soil-derived dust. Exposure to soil-derived dust occurs both in outdoor and indoor environments, the latter occurring where soil-derived dust has been transported indoors. Other types of dust, in addition to soil-derived dust, can contribute to adult lead exposure and may even predominate in the occupational setting; these include dust generated from manufacturing processes (e.g., grinding, milling, packaging of lead-containing material), road dust, pavement dust, and paint dust. This methodology, as represented in Equations 1 and 4, does not specifically account for site exposure to dusts that are not derived from soil. However, the methodology can be modified to include separate variables that represent exposure to lead in various types of dust. This approach is discussed in greater detail in the Appendix.

4. As noted above, exposure to lead in soil may occur by ingesting soil-derived dust in the outdoor and/or indoor environments. The default value recommended for $IR_S$ (0.05 g/day) is intended for occupational exposures that occur predominantly indoors. More intensive soil contact would be expected for predominantly outdoor activities such as construction, excavation, yard work, and gardening.

5. A lognormal model can be used to estimate the inter-individual variability in blood lead concentrations (i.e., the distribution of blood lead concentrations in a population of individuals who contact similar environmental lead levels).

6. Expected fetal blood lead concentrations are proportional to maternal blood lead concentrations.

The primary basis for using Equation 4 to calculate a RBRG is that fetuses and neonates are a highly sensitive population with respect to the adverse effects of lead on development and that 10 µg/dL is considered to be a blood lead level of concern from the standpoint of protecting the health of sensitive populations (U.S. EPA, 1986, 1990; NRC, 1993). Therefore, risk to the fetus can be estimated from the probability distribution of fetal blood lead concentrations (i.e., the probability of exceeding 10 µg/dL), as has been the approach taken for estimating risks to children (U.S. EPA, 1994a,c). Equation 4 can be used to estimate the soil lead concentration at which the probability of blood lead concentrations exceeding a given value (e.g., 10 µg/dL) in fetuses of women exposed to environmental lead is no greater than a specified value (e.g., 0.05).

The methodology can be modified to accommodate different assumptions or to estimate RBRGs for different risk categories. For example, a RBRG could be estimated for risks to adults (e.g., hypertension) by substituting an appropriate adult blood lead concentration benchmark. Similarly, other exposure scenarios can be incorporated into the assessment. Alternative methods for estimating soil lead risk by partitioning soil into outdoor soil and indoor dust components are discussed in the Appendix.

Recommended default values for each of the parameters in Equations 1 - 4 are presented in Table 1. These defaults should not be casually replaced with other values unless the alternatives are supported by high quality site-specific data to which appropriate statistical analyses have been applied and that have undergone thorough scientific review. Examples of the output from the methodology are presented in Figures 1 and 2, which show plots of the calculated $PbB_{fetal,\ 0.95}$ as a function of PbS when different combinations of default parameter values are used. The rationale for each default value listed in Table 1 is summarized in the Appendix.

Table 1. Summary of Default Parameter Values for the Risk Estimation Algorithm (Equations 1 - 4)

| Parameter | Unit | Value | Comment |
|---|---|---|---|
| $PbB_{fetal,\ 0.95,goal}$ | µg/dL | 10 | For estimating RBRGs based on risk to the developing fetus. |
| $GSD_{i,adult}$ | -- | 1.8<br>2.1 | Value of 1.8 is recommended for a homogeneous population while 2.1 is recommended for a more heterogeneous population. |
| $R_{fetal/maternal}$ | -- | 0.9 | Based on Goyer (1990) and Graziano et al. (1990). |
| $PbB_{adult,0}$ | µg/dL | 1.7-2.2 | Plausible range based on NHANES III phase 1 for Mexican American and non-Hispanic black, and white women of child bearing age (Brody et al. 1994). Point estimate should be selected based on site-specific demographics. |
| BKSF | µg/dL per µg/day | 0.4 | Based on analysis of Pocock et al. (1983) and Sherlock et al. (1984) data. |
| $IR_S$ | g/day | 0.05 | Predominantly occupational exposures to indoor soil-derived dust rather than outdoor soil; (0.05 g/day = 50 mg/day). |
| $EF_S$ | day/yr | 219 | Based on U.S. EPA (1993) guidance for average time spent at work by both full-time and part-time workers (see Appendix for recommendations on minimum exposure frequency and duration). |
| $AF_S$ | -- | 0.12 | Based on an absorption factor for soluble lead of 0.20 and a relative bioavailability of 0.6 (soil/soluble). |

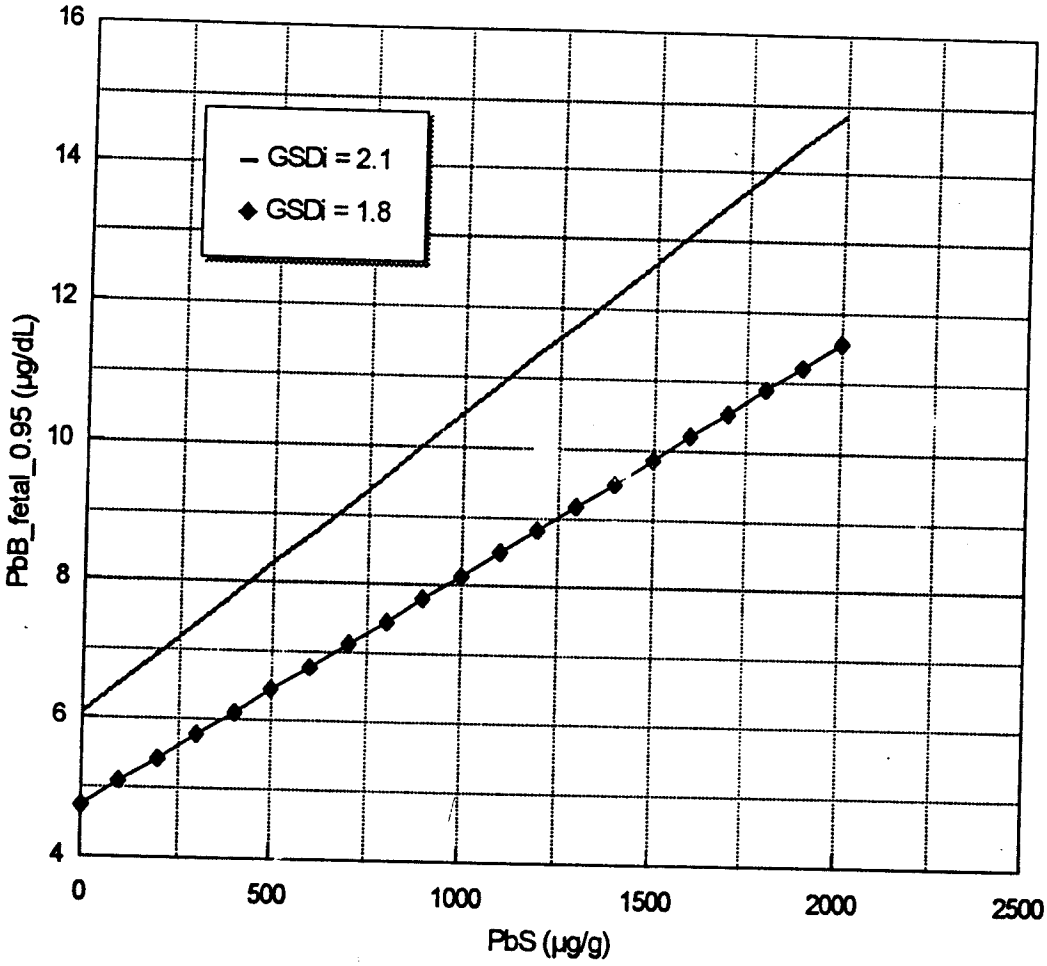


Figure 1. Example output of risk estimation algorithm (Equation 4) assuming a $PbB_{adult,\,0}$ of 2.0 µg/dL (mixed racial) and a $GSD_{i,\,adult}$ of either 1.8 (homogeneous population) or 2.1 (heterogeneous urban population).

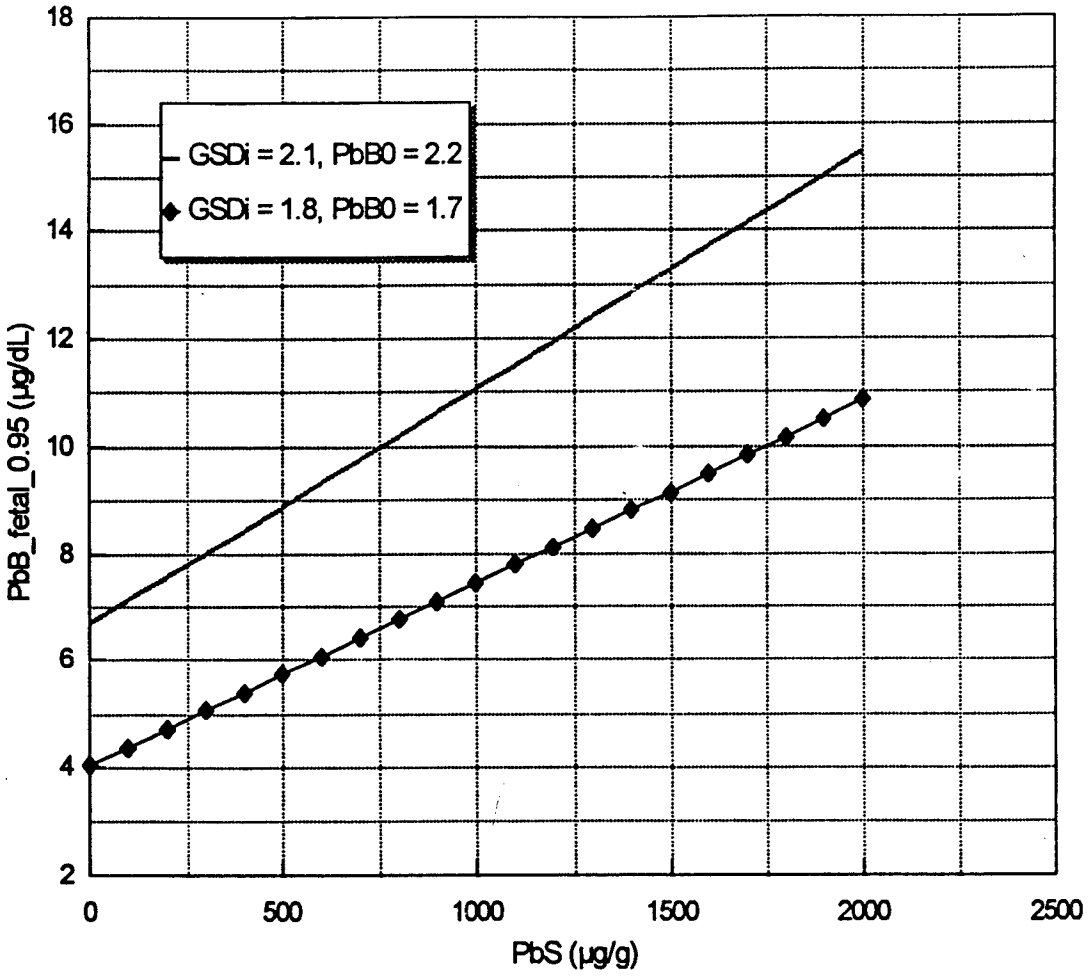


Figure 2. Example output of risk estimation algorithm (Equation 4) assuming plausible default minimum and maximum values of $PbB_{adult,0}$ (1.7 and 2.2 µg/dL) and $GSD_{i,adult}$ (1.8 and 2.1).

# 3. REFERENCES

Balbus-Kornfeld, J. 1994. Comments and Recommendations on the Draft Interim Guidance for Screening Levels of Lead in Soil for Non-Residential Sites. Letter from John Balbus-Kornfeld to Bruce Means. November 17, 1994.

Bowers, T.S., B.D. Beck and H.S. Karam. 1994. Assessing the relationship between environmental lead concentrations and adult blood lead levels. Risk Analysis. 14(2): 183-189.

Brody, D.J., J.L. Pirkle, R.A. Kramer, K.M. Flegal, T.D. Matte, E.W. Gunter and D.C. Paschal. 1994. Blood lead levels in the U.S. population. Phase 1 of the third National Health and Nutrition Examination Survey (NHANES III, 1988 to 1991). JAMA. 272(4): 277-283.

Goyer, R.A. 1990. Transplacental transport of lead. Environ. Health Perspect. 89: 101-105.

Graziano, J.H., D. Popovac, P. Factor-Litvak, P. Shrout, J. Kline, M.J. Murphy, Y. Zhao, A. Mehmeti, X. Ahmedi, B. Rajovic, Z. Zvicer, D. Nenezic, N. Lolacono and Z. Stein. 1990. Determinants of elevated blood lead during pregnancy in a population surrounding a lead smelter in Kosovo, Yugoslavia. Environ. Health Perspect. 89: 95-100.

NRC. 1993. Measuring Lead Exposure in Infants, Children and Other Sensitive Populations. National Academy Press. Washington, DC. ISBN 0-309-04927-X.

Pocock, S.J., A.G. Shaper, M. Walker, C.J. Wale, B. Clayton, T. Delves, R.F. Lacey, R.F. Packham and P. Powell. 1983. Effects of tap water lead, water hardness, alcohol, and cigarettes on blood lead concentrations. J. Epi. Comm. Health. 37: 1-7.

Sherlock, J.C., D. Ashby, H.T. Delves, G.I. Forbes, M.R. Moore, W.J. Patterson, S.J. Pocock, M.J. Quinn, W.N. Richards and T.S. Wilson. 1984. Reduction in exposure to lead from drinking water and its effect on blood lead concentrations. Human Toxicol. 3: 383-392.

U.S. EPA. 1986. Air Quality Criteria for Lead Volumes I - IV. Environmental Criteria and Assessment Office, Office of Research and Development, RTP, NC. EPA 600/8-83-028 a-d.

U.S. EPA. 1990. Supplement to the 1986 EPA Air Quality Criteria Document for Lead - Volume 1 Addendum. Office of Research and Development, Office of Health and Environmental Assessment, Washington, DC. EPA-600/8-89/049A.

U.S. EPA. 1993. Superfund's Standard Default Exposure Factors for the Central Tendency and RME-Draft. Working Draft, November 1993.

U.S. EPA. 1994a. Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities. OSWER Directive No. 9355.4-12. Office of Emergency and Remedial Response, Washington, D.C. EPA/540/F-94/043, PB94-963282.

U.S. EPA. 1994b. Technical Support Document: Parameters and Equations Used in the Integrated Exposure Uptake Biokinetic Model for Lead in Children (v. 0.99d). Office of Emergency and Remedial Response, Washington, D.C. EPA/540/R-94/040, PB94-963505.

U.S. EPA. 1994c. Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children. Office of Emergency and Remedial Response, Washington, D.C. EPA/540/R-93/081, PB93-963510.

U.S. EPA. 1995. A TRW Report: Review of a Methodology for Establishing Risk-Based Soil Remediation Goals for the Commercial Areas of the California Gulch Site. Technical Review Workgroup for Lead, October, 1995.

# APPENDIX

## Equations and Rationale for Default Values Assigned to Parameters in the Slope Factor Approach and Exposure Model for Assessing Risk Associated with Adult Exposures to Lead in Soil

# Equations and Rationale for Default Values Assigned to Parameters in the Slope Factor Approach and Exposure Model for Assessing Risk Associated with Adult Exposures to Lead in Soil

## 1. Equations for the Adult Lead Model

The format of the equations used in the adult lead methodology follows the approach used in the IEUBK Model for Lead in Children (IEUBK Model). Note that the equations may consist of variables that include superscripts and/or subscripts. The convention adopted in this report is to use superscripts as exponents (i.e., a mathematical operation), whereas subscripts represent key words that provide additional information to distinguish between similar variables. The term "soil" refers to that portion of the soil to which adults are most likely to be exposed. In most cases, exposure is assumed to be predominantly to the top layers of the soil which gives rise to transportable soil-derived dust. Exposure to soil-derived dust occurs both in outdoor and indoor environments, the latter occurring where soil-derived dust has been transported indoors. Other types of dust, in addition to soil-derived dust, can contribute to adult lead exposure and may even predominate in some occupational settings; these include dust generated from manufacturing processes (e.g., grinding, milling, packaging of lead-containing material), road dust, pavement dust, and paint dust.

**Exposure to lead from soil (direct and through indoor soil-derived dust) and lead intake:**

$$INTAKE = \frac{PbS \cdot IR_S \cdot EF_S}{AT} \qquad \text{(Equation A-1)}$$

INTAKE = Daily average intake (ingestion) of lead from soil taken over averaging time AT (µg/day).

PbS = Soil lead concentration (µg/g) (appropriate average concentration for individual).

$IR_s$ = Intake rate of soil, including outdoor soil and indoor soil-derived dust (g/day).

$EF_s$ = Exposure frequency for contact with assessed soils and/or dust derived in part from these soils (days of exposure during the averaging period); may be taken as days per year for continuing, long term exposures.

AT = Averaging time; the total period during which soil contact may occur; 365 days/year for continuing long term exposures.

**Lead uptake:**

$$UPTAKE = AF_S \cdot INTAKE \qquad \text{(Equation A-2)}$$

UPTAKE = Daily average uptake of lead from the gastrointestinal tract into the systemic circulation (µg/day).

$AF_S$ = Absolute gastrointestinal absorption fraction for ingested lead in soil and lead in dust derived from soil (dimensionless).

**Central estimate of adult blood lead concentration:**

$$PbB_{adult,central} = PbB_{adult,0} + BKSF \cdot UPTAKE \qquad \text{(Equation A-3)}$$

$PbB_{adult,central}$ = Central estimate of blood lead concentrations (µg/dL) in adults (i.e., women of child-bearing age) that have site exposures to soil lead at concentration, PbS.

$PbB_{adult,0}$ = Typical blood lead concentration (µg/dL) in adults (i.e., women of child-bearing age) in the absence of exposures to the site that is being assessed.

BKSF = Biokinetic slope factor relating (quasi-steady state) increase in typical adult blood lead concentration to average daily lead uptake (µg/dL blood lead increase per µg/day lead uptake).

**Distributional model for adult blood lead:**

In this methodology, variability in blood lead concentrations among a population is mathematically described by a lognormal distribution defined by two parameters, the geometric mean (GM) and the geometric standard deviation (GSD):

$$PbB_{adult} \sim Lognormal(GM, GSD)$$

$PbB_{adult}$ = Adult blood lead concentration (which is a variable quantity having the specified probability distribution).

GM = Geometric mean blood lead concentration (µg/dL) for adults having site exposure. The central estimate of adult blood lead, $PbB_{adult,central}$, constructed in Equation A-3 is treated as a plausible estimate of the geometric mean.

GSD = Geometric standard deviation for blood lead concentrations among adults having exposures to similar on-site lead concentrations, but having non-uniform response (intake, biokinetics) to site lead and non-uniform off-site lead exposures. The individual blood lead concentration geometric standard deviation, $GSD_i$, is substituted for GSD. As described below (Section 2 of the Appendix), $GSD_i$ is assumed to

address sources of variability in blood lead concentrations among the exposed population.

Parameter estimates for the geometric mean (GM) and geometric standard deviation (GSD) of the lognormal distribution are described below. Note that blood lead concentrations for site exposures can be quantified at any percentile of the population using these parameters. For example, the 95th percentile blood lead concentration can be calculated by Equation A-4:

$$PbB_{adult,0.95} = PbB_{adult,central} \cdot GSD_i^{1.645} \qquad \text{(Equation A-4)}$$

$PbB_{adult,\,0.95}$ = 95th percentile blood lead concentration (µg/dL) among individuals having exposures to the specified site soil lead concentrations. This is interpreted to mean that there is a 95% likelihood that an adult exposed to the specified soil lead concentrations would have a blood lead concentration less than or equal to $PbB_{adult,0.95}$.

**Distributional model for fetal blood lead:**

$$PbB_{fetal} = R_{fetal/maternal} \cdot PbB_{adult} \qquad \text{(Equation A-5)}$$

$PbB_{fetal}$ = Fetal blood lead concentration (µg/dL) (which, like $PbB_{adult}$, is a variable quantity having the specified probability distribution).

$R_{fetal/maternal}$ = Constant of proportionality between fetal and maternal blood lead concentrations.

$PbB_{adult}$ = Adult blood lead concentration (µg/dL), estimated with parameters appropriate to women of child bearing age.

Note that this relationship implies a deterministic (non-random) relationship between maternal and fetal blood lead concentrations. This assumption omits a source of variability (varying individual-specific ratios of fetal to maternal blood lead) that would tend to increase the variance of fetal blood lead concentrations. The assumption of proportionality implies that fetal blood lead concentrations also are lognormally distributed:

$$PbB_{fetal} \sim Lognormal(GM, GSD)$$

GM = Geometric mean blood lead concentration (µg/dL) for fetuses, equal to $R_{fetal/maternal}$ multiplied by $PbB_{adult,central}$.

GSD = Geometric standard deviation of blood lead concentration among adults, $GSD_i$ (Section 2 of the Appendix).

Similarly, percentiles of the fetal blood lead distribution can be estimated (for fetuses carried by women exposed to the specified concentration of lead at the assessed site). For example:

$$PbB_{fetal,0.95} = R_{fetal/maternal} \cdot PbB_{adult,central} \cdot GSD_{i,adult}^{1.645} \quad \text{(Equation A-6)}$$

$PbB_{fetal,0.95}$ = 95th percentile blood lead concentration (µg/dL) among fetuses born to women having exposures to the specified site soil lead concentrations. This is interpreted to mean that there is a 95% likelihood that a fetus born, in a woman who experiences such exposures, would have a blood lead concentration no greater than $PbB_{fetal,0.95}$.

Note that when the expressions for $PbB_{adult,central}$, INTAKE, and UPTAKE (Equations A-1, A-2 and A-3) are substituted into Equation A-6, we obtain the complete expression for $PbB_{fetal,0.95}$ that is presented in the fact sheet (Overview of the Approach, Equations 1 and 2):

$$PbB_{fetal,0.95} = R_{fetal/maternal} \cdot GSD_i^{1.645} \cdot \left[ \frac{(PbS \cdot BKSF \cdot IR_S \cdot AF_S \cdot EF_S)}{AT} + PbB_{adult,0} \right] \quad \text{(Equation A-7)}$$

Equation A-7 represents variability in blood lead concentration arising from two main factors: 1) exposure variables, including inter-individual variability in activity-weighted ingestion rates, and 2) inter-individual variability in physiology, including factors affecting lead biokinetics.

## 2. Individual Blood Lead Geometric Standard Deviation ($GSD_i$)

The $GSD_i$ is a measure of the inter-individual variability in blood lead concentrations in a population whose members are exposed to the same nonresidential environmental lead levels. Ideally, the value(s) for $GSD_i$ used in the methodology should be estimated in the population of concern at the site. This requires data on blood lead concentration and exposure in a representative sample of sufficient size to yield statistically meaningful estimates of GSD in subsamples stratified by nonresidential exposure level. In the absence of high quality data for the site, $GSD_i$ may be extrapolated from estimates for other surrogate populations. In making such extrapolations, factors that might contribute to higher or lower variability in the surrogate population than among similarly exposed individuals in the population of concern, should be evaluated. These factors include variability in exposure (level and pathways), and biokinetics (see Section 6 of Appendix), socioeconomic and ethnic characteristics, degree of urbanization and geographical location. Such extrapolations, therefore, are site-specific and are a potentially important source of uncertainty in the methodology.

GSD values measured in populations ($GSD_p$) reflect the combined effect of 1) variability in environmental concentration levels; and 2) activity-weighted exposures and lead biokinetics. Thus, estimates of $GSD_p$ can be considered a surrogate for estimating the $GSD_i$. Site data on blood lead concentrations collected from populations of varying homogeneity may be useful for establishing a plausible range of values of $GSD_i$, provided that the data are of adequate quality and can be stratified by nonresidential exposure level. The lowest values of $GSD_p$ are expected among homogeneous populations (e.g., individuals with similar socioeconomic and ethnic characteristics living within a relatively small geographic area) exposed to a single, dominant source of lead (e.g., lead mining or smelter sites). For example, a $GSD_p$ of 1.8 was recently calculated among adult women living in Leadville, CO (U.S. EPA, 1995). This relatively low GSD is consistent with an analysis of blood lead concentration data in mining communities in the United States and Canada, which suggest that $GSD_p$ ranges from 1.6 - 1.8 at active mining sites where blood lead concentrations are less than 15 µg/dL (U.S. EPA, 1992). By contrast, higher values of $GSD_p$ might be expected from a national survey. Although lead exposures among the general population are likely to be more greatly impacted by diet than soil (e.g., compared with populations exposed at a waste site), the national population is very heterogeneous, in that it includes individuals with different socioeconomic and ethnic characteristics living in distinct geographic areas.

The TRW has conducted a preliminary analysis of blood lead concentration data collected in NHANES III Phase 1 from 1988 to 1991 and found that the $GSD_p$ for women ages 17 to 45 years may range from 1.9 - 2.1 (Table A-1). Because of the complex survey design used in NHANES III (e.g., large oversampling of young children, older persons, black persons, and Mexican-Americans), this analysis used sampling weights included in the NHANES III Phase 1 data file to produce population estimates for blood lead concentration. The weighting factor "WTPEXMH1" was used to reflect the non-random sampling of individuals in both the mobile examination units (MEC) and the home examinations. The analysis did not account for the design effects associated with the selection of strata and primary sampling units (PSUs), which may result in an underestimation of sampling variance. Since this bias is not likely to greatly impact the $GSD_p$ (Brody, personal communication), the amount of underestimation of the $GSD_p$ by the values given in Table A-1 is likely to be small. Geometric mean blood lead concentrations listed in Table A-1 are within 0.2 µg/dL of these reported in Brody et al. (1994).

The TRW estimates that 1.8 - 2.1 is a plausible range for $GSD_i$, based on an evaluation of available blood lead concentration data for different types of populations. In cases where site-specific data are not available, a value within this range should be selected based on an assessment as to whether the population at the site would be expected to be more or less heterogeneous than the U.S. population with respect to racial, ethnic, cultural and socioeconomic factors that may affect exposure.

Table A-1. NHANES III Phase 1 Summary Statistics for Blood Lead Concentration Among U.S. Women by Age and Ethnic/Racial Characteristics[a].

| Age Group | Non-Hispanic White | | | Non-Hispanic Black | | | Mexican American | | |
|---|---|---|---|---|---|---|---|---|---|
| (years) | No. | GM | GSD | No. | GM | GSD | No. | GM | GSD |
| 20 - 49 | 728 | 1.9 | 1.90 | 622 | 2.3 | 2.01 | 729 | 2.1 | 2.10 |
| 50 - 69 | 476 | 3.2 | 1.88 | 256 | 4.2 | 1.80 | 255 | 3.3 | 2.12 |
| > 69 | 562 | 3.5 | 1.82 | 135 | 4.1 | 1.86 | 75 | 2.9 | 2.03 |
| 20 + | 1,766 | 2.4 | 2.01 | 1,013 | 2.7 | 2.07 | 1,059 | 2.3 | 2.14 |
| **17 - 45** | **742** | **1.7** | **1.89** | **658** | **2.1** | **1.98** | **763** | **2.0** | **2.10** |

[a]Analysis of data weighted by MEC and home weighting factor (WTPEXMH1), excluding samples missing data on blood lead concentration or age. GM PbB (μg/dL) = $\exp(\mu_{ln})$; GSD PbB = $\exp(\sigma_{ln})$.

## 3. Fetal/Maternal Blood Lead Concentration Ratio ($R_{fetal/maternal}$)

The TRW recommends a default value of 0.9 based on studies that have explored the relationship between umbilical cord and maternal blood lead concentrations (Goyer, 1990; Graziano et al., 1990). The Goyer (1990) estimate of an average fetal/maternal blood lead concentration ratio of 0.9 is supported by a large body of data that has been summarized in Agency documents (U.S. EPA, 1986, 1990). Graziano et al. (1990) compared maternal and umbilical cord blood lead concentrations at delivery in 888 mother-infant pairs who were between 28 and 44 weeks of gestation. The relationship was linear with a slope of 0.93 μg/dL cord blood per μg/dL maternal blood; the correlation coefficient was 0.92. The slope of 0.93 from the Graziano et al. (1990) study supports 0.9 as a point estimate for $R_{fetal/maternal}$.

Although average fetal/maternal blood lead concentration ratios, as reflected in cord blood, tend to show consistent trends (Goyer, 1990; Graziano et al., 1990), the trends may not reflect significant inter-individual variability in maternal and possibly fetal blood lead concentrations due to physiological changes associated with pregnancy. For example, mobilization of bone lead stores during pregnancy may be more substantial in some women, and iron and calcium deficiency associated with poor nutritional status, as well as pregnancy, may enhance gastrointestinal absorption of lead (U.S. EPA, 1990; Franklin et al., 1995). Conversely, maternal blood lead concentration may decrease during the later stages of pregnancy because of the dilution effect associated with a 30% rise in plasma volume, as well as an increased rate of transfer of lead to the placenta or to fetal tissues (Alexander and Delves, 1981). These changes may give rise to fetal/maternal blood lead concentration ratios that are different from 0.9.

## 4. Baseline Blood Lead Concentration ($PbB_{adult,0}$)

The baseline blood lead concentration ($PbB_{adult,0}$) is intended to represent the best estimate of a reasonable central value of blood lead concentration in women of child-bearing age who are not exposed to lead-contaminated nonresidential soil or dust at the site. In this analysis, geometric mean blood lead concentrations are used for this purpose. Ideally, the value(s) for $PbB_{adult,0}$ used in the

methodology should be estimated in the population of concern at the site. This requires data on blood lead concentrations in a representative sample of adult women who are not exposed to nonresidential soil or soil-derived dust at the site, but who may experience exposures to other environmental sources of lead that are similar in magnitude to exposures experienced by the population of concern. This would include exposure to lead in food and drinking water as well as residential soil and dust (dust derived from soil and all other non-site related sources). The sample must be of sufficient size to yield statistically meaningful estimates of $PbB_{adult,0}$.

In the absence of high quality data for the site, $PbB_{adult,0}$ may be extrapolated from estimates for other surrogate populations that would be expected to have a similar $PbB_{adult,0}$ distribution as that of the population of concern. In making such extrapolations, factors that might contribute to differences between the geometric mean $PbB_{adult,0}$ in the surrogate population and population of concern should be evaluated. These factors include differences in the residential exposure (level and pathways), socioeconomic, ethnic and racial demographics, housing stock, degree of urbanization, and geographical location. Such extrapolations, therefore, are site-specific.

In cases where site-specific extrapolations from surrogate populations are not feasible, the TRW recommends 1.7 - 2.2 μg/dL as a plausible range, based on the results of Phase 1 of the NHANES III as reported by Brody et al. (1994). Table A-2 summarizes the analysis of blood lead concentrations from a sample of 2,083 women ages 20 - 49, and stratified into the three ethnic and racial categories.

Table A-2. NHANES III Phase 1 Summary Statistics for Blood Lead Concentration Among Different Populations of U.S. Women Ages 20 - 49 (Brody et al., 1994).

| Population | No. | GM (95% CI) |
|---|---|---|
| Mexican American women | 732 | 2.0 (1.7 - 2.5) |
| non-Hispanic black women | 623 | 2.2 (2.0 - 2.5) |
| non-Hispanic white women | 728 | 1.7 (1.6 - 1.9) |
| Total | 2,083 | |

The TRW recommends that the estimates from Table A-2 be used in combination with data on the ethnic and racial demographics of the population of concern to select the most appropriate point estimate from within the plausible range of 1.7 - 2.2 μg/dL. For example, if the population at the site was predominantly Mexican American, 2.0 μg/dL might be selected as the point estimate. The plausible range is based on surveys of large samples of the national population and may not encompass central tendencies estimated from smaller regional or site-specific surveys, either because of bias associated with the smaller sample or because of real differences between the surveyed population and the national population. This needs to be evaluated in deciding whether or not to use data from small surveys that yield point estimates for $PbB_{adult,0}$ that fall outside of the plausible range.

## 5. Biokinetic Slope Factor (BKSF)

The BKSF parameter relates the blood lead concentration (μg Pb/dL) to lead uptake (μg Pb/day). The TRW recommends a default value of 0.4 μg Pb/dL blood per μg Pb absorbed/day for the BKSF parameter based on data reported by Pocock et al. (1983) on the relationship between tap water lead concentrations and blood lead concentrations for a sample of adult males, and on estimates of the bioavailability of lead in tap water (see Section 6 of the Appendix).

Pocock et al. (1983) analyzed data on lead concentrations in first draw tap water and blood lead concentrations in a population of 910 adult males. A linear model imposed on the data yielded a slope of 0.06 (μg/dL per μg/L first draw water) for water lead concentrations equal to or less than 100 μg/L (a lower slope was applied to the data for higher water concentrations). Pocock et al. (1983) also obtained data on lead concentrations in flushed water (and "random daytime") samples, in addition to first draw samples. Given the following assumptions, it is possible to derive a slope factor for ingested water lead (INGSF) from the Pocock et al. (1983) data:

- The lead concentration of flushed water was 25% of the concentration of first draw water ($C_{f/1st} = 0.25$) (U.S. EPA, 1995).
- Daily water intake consisted of 30% first draw and 70% flushed ($F_{1st} = 0.3$, $F_f = 0.7$) (U.S. EPA, 1992).
- Daily water ingestion (including tap water and beverages made with tap water) was 1.4 L/day ($IR_W = 1.4$) (U.S. EPA, 1989).

Based on the above assumptions, a INGSF of 0.09 μg/dL per μg intake/day is estimated as follows:

$$INGSF = \frac{0.06}{IR_W \cdot (F_{1st} + (C_{f/1st} \cdot F_f))} \qquad \text{(Equation A-8)}$$

$$INGSF = \frac{0.06}{1.4 \cdot (0.3 + (0.25 \cdot 0.7))}$$

$$INGSF = 0.09$$

This suggests that the product of the BKSF, reflecting the slope for absorbed rather than ingested lead, and the absorption factor for lead in drinking water ($AF_w$) should be approximately 0.09 if it is to match the estimate of INGSF based on the Pocock et al. (1983) study:

$$INGSF = BKSF \cdot AF_w \qquad \text{(Equation A-9)}$$

Values of $AF_w$ within the range 0.20 - 0.25 would correspond to a range for BKSF of 0.36 - 0.45, or approximately 0.4 µg/dL per µg/day (rounded to one significant figure). A range of 0.20 - 0.25 for $AF_w$ is supported by data from numerous lead bioavailability studies (see Section 6 of the Appendix for a more detailed discussion of these studies).

The above estimate of 0.4 µg/dL per µg/day for the BKSF can be compared with the approach described by Bowers et al. (1994), who used the same data set along with different assumptions and arrived at essentially the same estimate of the BKSF, 0.375 or approximately 0.4 µg/dL per µg/day. Bowers et al. (1994) assumed a daily tap water intake of 2 L/day and 8% absorption of lead ingested in tap water; and did not make adjustments for a mixture of first draw and flushed water intake in the Pocock et al. (1983) study.

Several uncertainties should be considered in applying the default value of 0.4 µg/dL per µg/day to any specific population. Since it is based on the Pocock et al. (1983) data, it represents an extrapolation from adult men to women of child bearing age. Physiological changes associated with pregnancy may affect the value of the BKSF (see Section 6 of the Appendix); therefore, some uncertainty is associated with applying the default value to populations of pregnant women.

An additional uncertainty concerns the assumption of linearity of the relationship between lead intake and blood lead concentration. The Pocock et al. (1983) study provides data on a large sample population of adult men whose members were exposed to relatively low drinking water lead levels; 898 subjects (97%) were exposed to first draw water lead concentrations less than 100 µg/L and 473 (52%) to 6 µg/L or less. A smaller study of adult women exposed to higher concentrations was reported by Sherlock et al. (1982, 1984); out of 114 subjects, 32 (28%) had flush drinking water lead concentrations less than 100 µg/L and only 13 (11%) less than 10 µg/L. Sherlock et al. (1982, 1984) used a cube root regression model, rather than a linear model, to describe the relationship between drinking water and blood lead concentration. Given the much larger sample size in the Pocock et al. (1983) study, particularly towards the low end of the distribution for water lead concentration, greater confidence can be placed in the estimated slope of the linear regression model from the Pocock et al. (1983) study than in the cube root regression model of Sherlock et al. (1982, 1984). Nevertheless, it is useful to compare the output of the two models because they were applied to the different sexes and because they differ so fundamentally in the treatment of the blood lead - water lead slope; the slope is constant in the linear model and decreases in the cube root model as water lead concentration increases. Figure A-1 compares the output of the two models and shows the output of a linear regression of the unweighted output of the Sherlock et al. (1984) model. Three observations can be made from this comparison that are relevant to the BKSF:

1. Both the Pocock et al. (1983) and Sherlock et al. (1984) models predict higher blood lead concentrations than would be expected in the average U.S. population today as suggested from NHANES III. This is indicative of higher lead intakes in the study populations which may have contributed to the apparent nonlinearities observed (e.g. above 100 µg/L in Pocock et al.(1983) and at lower concentrations in Sherlock et al. (1984).

2. The cube root regression model of Sherlock et al. (1984) predicts lower blood lead

concentrations than the linear model of Pocock et al. (1983). This may reflect greater lead intakes from sources other than drinking water in the Pocock et al. (1983) population (see Section 6 of the Appendix for further discussion).

3. The linear approximation of the Sherlock et al. (1984) and the linear model from Pocock et al. (1983) have similar slopes; 0.08 and 0.06 µg/dL per µg/L, respectively. Thus, although the Sherlock et al. (1984) study casts some degree of uncertainty on the assumption of linearity of the blood lead - drinking water lead relationship both at low (<10 µg/L) and high (> 100 µg/L) tap water lead concentrations, a linear model with a constant slope of 0.06 µg/dL per µg/L appears to approximate the output of the nonlinear model of Sherlock et al. (1984) reasonably well for water lead concentrations less than100 µg/L.

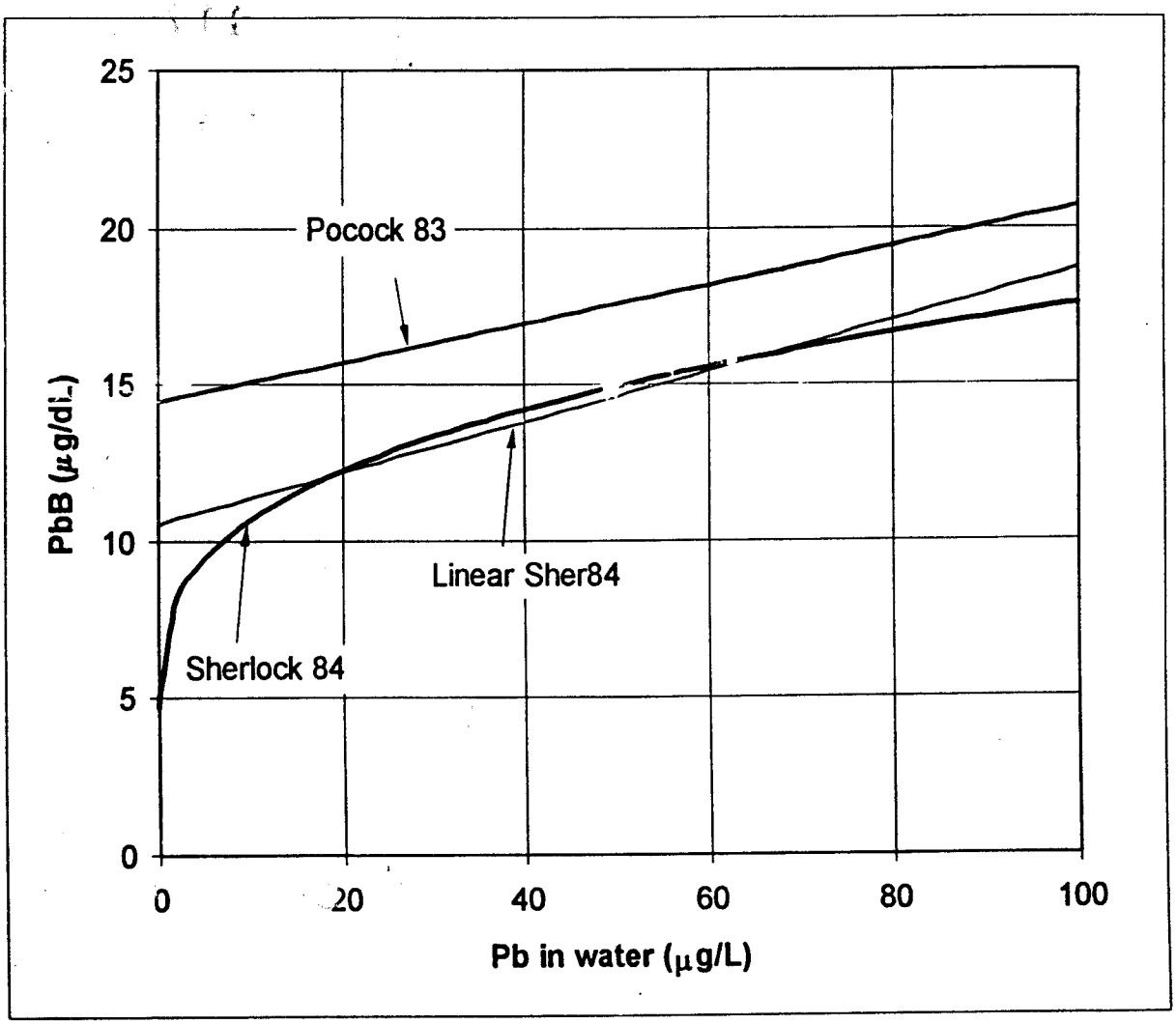


Figure A-1. Comparison of linear model of Pocock et al. (1983) with cube root model of Sherlock et al. (1984) and a linear model imposed on the unweighted output of the Sherlock model over the water lead range 0 - 100 µg/L (linear Sher84). The slope of the linear Sher84 model is 0.08 µg/dL per µg/L. The slope of the Pocock et al. (1983) model is 0.06 µg/dL per µg/L.

Experimental data on the pharmacokinetics of lead in adult humans support the default value of 0.4 (μg/dL per μg/day absorbed lead) for BKSF estimated from Pocock et al. (1983). Several distinct kinetic pools of lead are evident from observations of the rate of change of blood lead isotope with time after a period of daily dosing in which lead is abruptly terminated (Rabinowitz et al., 1976). A rapid exchange pool, denoted pool 1, includes the blood and a portion of the extracellular fluid, and is the physiological pool from which urinary and hepatobiliary excretion of blood lead occurs. Several estimates of the size of pool 1 ($V_1$) and the residence times for lead in pool 1 ($T_1$) have been derived from experiments in which human subjects were administered tracer doses of stable isotopes of lead from which pool 1 clearances ($C_1$) have been estimated; these estimates are summarized in Table A-3.

Table A-3. Summary of Experimental Studies with Humans to Assess Clearance Rates of Lead from Blood and Extracellular Fluid.

| Subject | $V_1$[a] (dL) | $T_1$[b] (day) | $T_{½}$[c] (day) | $C_1$[d] (dl /day) | Reference |
|---|---|---|---|---|---|
| A | 77 | 34 | 24 | 2.3 | Rabinowitz et al., 1974 |
| B | 115 | 50 | 35 | 2.3 | |
| A | 74 | 34 | 24 | 2.2 | Rabinowitz et al., 1976 |
| B | 100 | 40 | 28 | 2.5 | |
| C | 101 | 37 | 26 | 2.7 | |
| D | 99 | 40 | 28 | 2.5 | |
| E | 113 | 27 | 19 | 4.2 | |
| ACC | 70[e] | 29 | 20 | 2.4 | Chamberlain et al., 1978 |
| DN | 94[e] | 39 | 27 | 2.4 | |
| PL | 85[e] | 40 | 28 | 2.1 | |
| ACW | 94[e] | 48 | 33 | 2.0 | |
| MJH | 97[e] | 41 | 28 | 2.4 | |
| ANB | 95[e] | 40 | 28 | 2.4 | |
| Mean ± SD | 93 ± 14 | 38 ± 6 | 27 ± 4 | 2.5 ± 0.5 | |

[a] The reported volume of pool 1, which refers to blood and rapidly exchangeable extracellular fluid compartment.
[b] The reported residence time for lead in pool 1.
[c] The half life of lead in pool 1; $T_{½} = (T_1) \times \ln(2)$.
[d] Clearance of lead from pool 1; $C_1 = V_1/T_1$.
[e] Estimated assuming $V_1 = V_{blood} \times 1.7$ (Rabinowitz et al., 1976).

The above experiments support a value for $C_1$ of 2.5 dL/day. At steady state, the clearance is equivalent to the rate of uptake of lead into pool 1 per unit of blood lead concentration (µg/day per µg/dL). Theoretically, this should correspond to a slope factor of 0.40 µg/dL per µg/day absorbed lead (i.e., the reciprocal of the clearance estimate). Thus, the default value for the BKSF parameter of 0.4 µg/dL per µg/day absorbed lead derived from the population survey data of Pocock et al. (1983) is consistent with the clearance estimates from experimental studies.

## 6. Soil Lead Absorption Factor ($AF_S$)

The $AF_S$ parameter is the fraction of lead in soil ingested daily that is absorbed from the gastrointestinal tract. The TRW recommends a default value of 0.12 based on the assumption that the absorption factor for soluble lead ($AF_{soluble}$) is 0.2 and that the relative bioavailability of lead in soil compared to soluble lead ($RBF_{soil/soluble}$) is 0.6:

$$AF_S = AF_{soluble} \cdot RBF_{soil/soluble} \qquad \text{(Equation A-10)}$$

$$AF_S = 0.2 \cdot 0.6 = 0.12$$

The default value of 0.2 for $AF_{soluble}$ in adults represents a weight of evidence determination based on experimental estimates of the bioavailability of ingested lead in adult humans with consideration of three major sources of variability that are likely to be present in populations, but are not always represented in experimental studies; these are variability in food intake, lead intake, and lead form and particle size.

**Effect of food on lead bioavailability.** The bioavailability of ingested soluble lead in adults has been found to vary from less than 10% when ingested with a meal to 60 - 80% when ingested after a fast (Blake, 1976; Blake et al., 1983; Blake and Mann, 1983; Graziano et al., 1995; Heard and Chamberlain, 1982; James et al., 1985; Rabinowitz et al., 1976, 1980). The general consensus is that constituents of food in the gastrointestinal tract decrease absorption of ingested lead, although the exact mechanisms by which this occurs are not entirely understood. Lead intake within a population would be expected to occur at various times with respect to meals. Therefore, the central tendency for lead absorption would be expected to reflect, in part, meal patterns within the population and to have a value between the experimentally determined estimate for fasted and fed subjects.

An estimate of a "meal-weighted" $AF_{soluble}$ can be obtained from the data reported by James et al. (1985) and certain simplifying assumptions. James et al. (1985) assessed the effects of food on lead bioavailability by measuring the fraction retained in the whole body of adult subjects 7 days after they ingested a dose of radioactive lead either after a fast or at various times before or after a meal. The total lead dose was approximately 50 µg (fasted) - 100 µg (with food). Lead retention was 61 ± 8.2 (SD)% when lead was ingested on the 12th hour of a 19-hour fast and decreased to 4% - 16% when lead was ingested between 0 and 3 hours after a meal; retention was further reduced (3.5 ± 2.9%) when lead was ingested with a meal (breakfast) (the bioavailability may have been more than these retention estimates since some absorbed lead would have been excreted during the 7 day

interval between dosing and measurement of whole-body lead). Since ingested material may be retained in the human stomach or at least 1 hour (Hunt and Spurrel, 1951; Davenport, 1971), lead bioavailability also may be reduced when lead is ingested 1 hour before a meal. The average "meal-weighted" bioavailability can be estimated based on the average number of waking hours during the day, the number of meals eaten, the bioavailability of lead ingested within 1 hour before a meal, the bioavailability of lead ingested within 0 to 3 hours after a meal, and the bioavailability of lead at other times during the day. For example, if it is assumed that people eat three meals each day and, based on the James et al. (1985) study, the bioavailability of lead ingested within 1 hour before a meal or 0 to 3 hours after a meal is approximately 0.1, and the bioavailability of lead ingested at all other times in a 16 hour day is 0.6, then the average "meal-weighted" bioavailability during a 16 hour day is approximately 0.2:

$$\frac{(0.1 \cdot 12\ hrs) + (0.6 \cdot 4\ hrs)}{16\ hrs} = 0.23$$

This example suggests that the use of 0.2 as a default value for $AF_{soluble}$ is plausible for populations in which soil lead intake occurs throughout the day, interspersed with meals. This may not apply to all members of a population. For example, the average bioavailability would be higher if less than three meals were consumed each day (e.g., using a similar calculation it can be shown that the average bioavailability for one meal each day would be 0.5). Average bioavailability also may be greater than 0.2 if lead intake was to occur predominantly in the early morning, before the first meal of the day.

Although lead bioavailability may be lower in individuals whose soil lead ingestion coincides with meals, the TRW cautions against the use of a value less than 0.2 for several reasons. Iron and calcium deficiency associated with poor nutritional status may enhance absorption (U.S. EPA, 1990). In addition, numerous factors may affect the absorption, distribution, excretion, and mobilization of lead during pregnancy: increased plasma volume (i.e., hemodilution); decreased hematocrit; previous exposure history of the mother (i.e., bone lead sequestration); changes in nutritional status; significant loss of body weight or depletion of fat stores; hormonal modulation; age; race; administration of drugs; and illness (Silbergeld, 1991). There is likely to be significant inter-individual variability in these factors, and studies of women at different stages of pregnancy have not shown clear trends in effects on blood lead concentration (Gershanik et al., 1974; Alexander and Delves, 1981; Baghurst et al., 1987; Silbergeld, 1991). While there is evidence to support 0.2 as a reasonable estimate of $AF_{soluble}$ for women of child-bearing age, there is still some basis for concern regarding potentially elevated absorption during pregnancy. However, a potential increase in lead absorption during pregnancy would be expected to occur dynamically with changes in bone mobilization, blood volume and glomerular filtration rate. Thus, the TRW cautions against adjusting the value for $AF_{soluble}$ (or BKSF) based on assumptions regarding the effects of pregnancy on blood lead concentration.

**Nonlinearity in blood lead concentration.** Another reason for caution in adopting values for $AF_{soluble}$ less than 0.2 derives from uncertainty about the relationship between blood lead concentration, lead intake, and lead absorption. Several studies have shown that the relationship between environmental lead levels (e.g., drinking water lead concentration) and blood lead concentration is nonlinear and suggest the possibility that fractional absorption of ingested lead is

dose-dependent, and decreases as lead intake (and blood lead concentration) increases. Pocock et al. (1983) reported a nonlinear relationship between blood lead concentration and water lead that could be approximated by two linear equations: a slope of 0.06 µg/dL per µg/L was estimated for water lead concentrations equal to or less than 100 µg/L and a slope of 0.01 was estimated for water lead concentrations above 100 µg/L. Sherlock et al. (1982, 1984) used a cube root regression model to relate blood and water lead concentrations; however, over the range of water lead concentrations of 100 µg/L or less, the slope of 0.06 µg/dL per µg/L water lead from Pocock et al. (1983) approximates the relationship observed in the Sherlock et al. (1982, 1984) study (Figure A-1). The linear relationship between water lead and blood lead in the Pocock et al. (1983) study extends from a blood lead concentration range of 14 to 20 µg/dL. Based on these data, the value of $AF_{soluble}$ of 0.2 may be considered a reasonable default estimate if applied to exposure scenarios in which the estimates of blood lead concentration do not exceed 20 µg/dL. At blood lead concentrations greater than this, absorption of soluble lead may be less than the default value.

An appropriate value of $AF_{soluble}$ also can be supported by estimating the range of daily lead intake that is likely to result in a linear relationship between intake and blood lead concentration. Data represented in Figure A-1 suggest that if water lead concentrations are less than 100 µg/L, the blood lead - water lead relationship is approximately linear. If assumptions regarding the magnitude of first draw and flushed water intakes and lead concentrations are applied (see Equations A-8 and A-9 and discussion of BKSF), a first draw water lead concentration of 100 µg/L in the Pocock et al. (1983) study represents a water lead intake of approximately 70 µg/day:

$$100 \cdot 1.4 \cdot (0.3 + (0.25 \cdot 0.7)) \approx 70$$

We do not know with certainty the total lead intake in the Pocock et al. (1983) population, although we can be certain that it exceeded the above estimated intake from drinking water since intake from diet and other sources, including occupational, would have occurred; this is consistent with the higher blood lead concentrations that were observed in the male population. Sherlock et al. (1982) estimated that, in their study population of adult women, the dietary contribution to total lead intake was equal to that from drinking water when the water lead concentration was 100 µg/L, and that the contribution of lead from sources other than diet and water was very small. If the same assumption is applied to the Pocock et al. (1983) study, it is likely that total lead intake in the male population was at least 140 µg/day (70 µg/day from drinking water and 70 µg/day from diet; the Pocock et al., 1983 study included 40 households from the Sherlock et al., 1982 study site), and may have been higher because of occupational exposure in the male population. A crude estimate of the relative magnitudes of the non-water lead intakes in the two studies can be obtained by comparing the predicted water lead concentration required to achieve the same blood lead concentration in the two populations. For example, a water lead concentration of 100 µg/L corresponded to a predicted blood lead concentration of approximately 18 µg/dL in the female population (Sherlock et al., 1984); the same blood lead concentration corresponded to a water lead concentration of 50 µg/L in the male population (Pocock et al., 1983). Therefore, the non-water lead intakes in the male population may have been twice that in the female population. If it is assumed that drinking water and diet contributed equally to lead intake in both studies, then a drinking water lead concentration of 100 µg/L in the Pocock et al. (1983) study translates to a total lead intake of approximately 300 µg/day:

$$I_{total} = I_{water} + I_{diet} + I_{other} \quad \text{(Equation A-11)}$$

$$I_{total} = 70 + 70 + 140 \approx 300\ \mu g/day$$

Thus, the departure from linearity observed in the Pocock et al. (1983) study may have occurred at lead intakes at or above 300 µg/day. In the various experimental assessments of lead bioavailability, subjects ingested lead in amounts that varied among the studies but were all within the range 100 - 300 µg (Blake, 1976; Blake et al., 1983; Blake and Mann, 1983; Graziano et al., 1995; Heard and Chamberlain, 1982; James et al., 1985; Rabinowitz et al., 1976, 1980), which is within the approximate linear range, if the extrapolation from the Pocock et al. (1983) and Sherlock et al. (1982) studies is reasonable. Based on these considerations, the value of $AF_{soluble}$ of 0.2 is considered to be a reasonable default value if applied to exposure scenarios in which lead intakes are less than 300 µg/day. At intakes greater than this, absorption of soluble lead may be less than the default value; however, it can be similarly argued that, based on the Sherlock et al. (1984) regression model, the default $AF_{soluble}$ may underestimate absorption by some degree at low exposures.

**Effect of lead form and particle size on lead bioavailability.** The default value of 0.2 for $AF_{soluble}$ applies to soluble forms of lead in drinking water and food and would be expected to overestimate absorption of less soluble forms of lead in soil. Experimental studies have shown that the bioavailability of lead in soil tends to be less than that of soluble lead. Weis et al. (1994) assessed the relative bioavailability of lead in soil compared to water soluble lead (acetate) in immature swine and estimated that the relative bioavailability of lead in soil from Leadville, CO was 0.6 to 0.8. Ruby et al. (1996) reported estimates of the relative bioavailability of lead in a variety of soils from mining sites and smelters as assessed in the Sprague-Dawley rat; the estimates ranged from 0.09 to 0.4. Maddaloni et al. (1996) reported preliminary data from a study in which 6 fasted human subjects were administered a single dose of lead-contaminated soil. The dose was 250 µg lead normalized to a 70 kg body weight; the concentration of lead in the soil was 2850 µg/g and the amount of soil administered to each subject was generally a little less than 100 mg. The average estimate of lead absorption in the six subjects was 26%. If the absorption factor for soluble lead in fasted adults is assumed to be 0.6 (James et al., 1985), then the Maddaloni et al. (1996) estimate suggests a relative bioavailability of 0.5 (i.e., 0.3/0.6) for lead in soil.

Based on the above evidence, the TRW considers 0.6 to be a plausible default point estimate for the relative bioavailability of lead in soil compared to soluble lead ($RBF_{soil/soluble}$) when site-specific data are not available. Such data are highly desirable as variation in relative bioavailability is expected for different species of lead and different particle sizes (Barltrop and Meek, 1975, 1979), both of which may vary from site to site. For example, the bioavailability of metallic lead has been shown to decrease with increasing particle size (Barltrop and Meek, 1979), therefore, the default value for $RBF_{soil/soluble}$ may overestimate absorption of lead if applied to soils contaminated with large lead particles such as firing range debris or mine tailings. Here again, the TRW cautions against the use of a lower value for the $RBF_{soil/soluble}$, unless it can be supported by experimental assessments of relative bioavailability.

The default value of 0.6 for $RBF_{soil/soluble}$, coupled with the default value of 0.2 for $AF_{soluble}$, yields a default value of 0.12 for $AF_S$ (0.6 · 0.2). The TRW considers 0.12 to be a plausible point estimate for the absorbed fraction of ingested soil lead for use in assessments in which site-specific data on lead bioavailability are not available. The default value of 0.12 takes into account uncertainties regarding the possible nonlinearity in the relationship between lead intake and absorption and should be adequately protective in scenarios in which predicted blood lead concentrations are less than 20 µg/dL. The use of the default value for populations that have substantially higher blood lead concentrations may result in an overestimate of lead uptake, and conversely, lead uptake may be underestimated at lower exposures.

## 7. Daily Soil Ingestion Rate ($IR_S$)

The TRW recommends a default value of 0.05 g/day as a plausible point estimate of the central tendency for daily soil intake from all occupational sources, including soil in indoor dust, resulting from non-contact intensive activities. This would include exposures that are predominantly indoors. More intensive soil contact would be expected for predominantly outdoor activities such as construction, excavation, yard work, and gardening (Hawley, 1985). Site-specific data on soil contact intensity, including potential seasonal variations, should be considered in evaluating whether or not the default value is applicable to the population of concern and, if not, activity-weighted estimates of $IR_S$ that more accurately reflect the site can be developed.

In adopting the single $IR_S$ parameter to describe all sources of ingested soil, the methodology remains consistent with recommendations of the Superfund program and their implementation for risk assessment; specifically, the 0.05 g/day value used for adult soil ingestion addresses all occupational soil intake by the individual, whether directly from soil or indirectly through contact with dust (U.S. EPA, 1993). This value specifically applies to the assessment of soil lead risk, and not risks associated with non-soil sources of lead in dust. In making soil ingestion exposure estimates under the Risk Assessment Guidelines for Superfund (RAGS) framework, no specific assumptions are needed about the fraction of soil intake that occurs through dust.

An alternative approach was needed in the IEUBK Model because childhood lead exposures are often strongly influenced by indoor sources of lead in dust (e.g., indoor paint) (U.S. EPA, 1994b). In a situation where indoor sources of dust contamination are important, an exposure estimate that addresses only soil exposures (including the soil component of dust) would be incomplete. The IEUBK Model assigns separate values to outdoor soil and total indoor dust ingestion and partitions the indoor dust into soil-derived and non-soil-derived sources. At a minimum, paired soil and indoor dust samples should be collected to adequately characterize exposure to lead where indoor sources of dust lead may be significant.

**Alternate method for calculating soil and dust ingestion as separate exposure pathways.** In this alternate approach, separate estimates are made of lead intake from the direct ingestion of outdoor soil and from the ingestion of indoor dust (which may contain lead from soil and as well as from indoor sources such as deteriorated lead based paint). Exposure to lead from soil (outdoor contact) can be calculated using Equation A-12, while exposure to lead from indoor dust can be

calculated using Equation A-13.

$$INTAKE_{S,outdoors} = \frac{PbS \cdot IR_{S,outdoors} \cdot EF_{Site}}{AT} \qquad \text{(Equation A-12)}$$

$$INTAKE_{D,indoors} = \frac{PbD \cdot IR_{D,indoors} \cdot EF_{Site}}{AT} \qquad \text{(Equation A-13)}$$

| | | |
|---|---|---|
| $INTAKE_{S,\ outdoors}$ | = | Daily average intake (ingestion) of lead from soil ingested outdoors (µg/day). |
| $INTAKE_{D,\ indoors}$ | = | Daily average intake (ingestion) of lead from dust ingested indoors (µg/day). |
| PbS | = | Soil lead concentration (µg/g) (average concentration in assessed individual exposure area). |
| PbD | = | Indoor dust lead concentration (µg/g). |
| $IR_{S,\ outdoors}$ | = | Intake rate (ingestion) of outdoor soil (g/day). |
| $IR_{D,\ indoors}$ | = | Intake rate (ingestion) of indoor dust (g/day). |
| $EF_{Site}$ | = | Exposure frequency at site (days of exposure during the averaging period); may be taken as days per year for continuing, long term exposures. |
| AT | = | Averaging time, the total period during which the assessed exposures (from all sources) occur (days). May be taken as 365 days per year for continuing, long term exposures. |

Note that, in Equations A-12 and A-13, exposure frequency refers to the number of days that an individual is present at the site and does not partition between periods of indoor and outdoor exposures. The intake rate is a long term average value appropriate for that media and is influenced by both the duration of outdoor (or indoor) exposures and the intensity of those exposures.

**Calculation of $IR_{S,\ outdoors}$ and $IR_{D,\ indoors}$ from total intake of soil and dust ($IR_{S+D}$).** Intermediary calculations may be needed to generate estimates of the parameters in the intake equations. An estimate of the total intake of soil and dust materials ($IR_{S+D}$) serves as a starting point. Note that $IR_{S+D}$ differs from $IR_S$, which was discussed above, because $IR_{S+D}$ includes not only the total mass of soil ingested (both directly and as a component of indoor dust), but also the ingested mass of non-soil derived dust components including various materials of indoor origin. Since a

substantial fraction of the mass of indoor dust comes from sources other than outdoor soils, an estimate of $IR_{S+D}$ will be higher than the corresponding estimate of $IR_S$. Secondly, an estimate of the fraction the total soil and dust intake that is ingested directly as soil is needed ($Weighting_{soil}$). This estimate needs to take into account the intensity and duration of the outdoor soil intake and the indoor dust intake. Equations A-14 and A-15 can be used to derive media-specific ingestion rates from $IR_{S+D}$ and $Weighting_{soil}$.

$$IR_{S,outdoors} = Weighting_{soil} \cdot IR_{S+D} \qquad \text{(Equation A-14)}$$

$$IR_{D,indoors} = (1 - Weighting_{soil}) \cdot IR_{S+D} \qquad \text{(Equation A-15)}$$

$Weighting_{soil}$ = Fraction of total soil and dust intake that is directly ingested as soil (dimensionless).

$IR_{S+D}$ = Total daily average intake of outdoor soil and indoor dust (all dust components) (g/day).

Data are needed to generate separate estimates of the concentrations of lead in outdoor soil and in indoor dust. A site assessment using this alternate methodology would generally be based on direct measurement data for both soil and dust at the facilities of concern. For comparison with exposure estimates based on total soil ingestion (the primary approach presented in this paper), Equation A-16 may be utilized to estimate the ratio of dust lead concentration to soil lead concentration.

$$PbD = PbS \cdot K_{SD} \qquad \text{(Equation A-16)}$$

$K_{SD}$ = Ratio of indoor dust lead concentration to soil lead concentration (dimensionless).

Assuming that the same absorption fraction is applicable to both soil and dust, Equation A-17 may be used to estimate the uptake of lead from these two sources.

$$UPTAKE = AF_{S,D} \cdot (INTAKE_{S,outdoors} + INTAKE_{D,indoors}) \qquad \text{(Equation A-17)}$$

UPTAKE = Daily average uptake of lead from the gastrotintestinal tract into the systemic circulation; soil and dust sources (µg/day).

$AF_{S,D}$ = Absolute gastrointestinal absorption fraction for ingested lead in soil and dust (dimensionless).

**Comparison of lead intake estimated from principal and alternate approaches.** It is helpful to compare exposure estimates derived using our principal approach based on total soil intake

(including soil present in ingested dust) with the results of the disaggregated pathway analysis for soil and dust. We will consider the case in which there are not important indoor sources of lead in dust. We can then compare the total lead intake estimates from the two approaches.

Under the model based on total soil ingestion (which we re-label as $IR_{S,total}$ for clarity):

$$INTAKE = \frac{PbS \cdot IR_{S,total} \cdot EF_{Site}}{AT} \qquad \text{(Equation A-18)}$$

By contrast, using the disaggregated soil and dust model, Equations A-14, A-15, A-16, and A-18 may be combined to give Equation A-19:

$$INTAKE = \frac{PbS \cdot IR_{S+D} \cdot (Weighting_{soil} + K_{SD} \cdot (1 - Weighting_{soil})) \cdot EF_{Site}}{AT} \qquad \text{(Equation A-19)}$$

When applied to the same exposure assessment problem, the two approaches should give equivalent estimates of lead intake. The estimates will be equivalent when:

$$IR_{S+D} \cdot (Weighting_{soil} + K_{SD} \cdot (1 - Weighting_{soil})) = IR_{S,total}$$

## 8. Exposure Frequency ($EF_S$)

The TRW recommends a default value of 219 days/year. This is the same as the central tendency occupational exposure frequency recommended by U.S. EPA (1993) Superfund guidance, which is based on 1991 data from the Bureau of Labor Statistics. This estimate corresponds to the average time spent at work by both full-time and part-time workers engaged in non-contact intensive activities (U.S. EPA, 1993). Site-specific data on exposure frequency should be considered in evaluating whether or not the default value is applicable to the population of concern. In evaluating site-specific data, it should be kept in mind that exposure frequency and daily soil ingestion rate ($IR_S$) may be interdependent variables, particularly in contact-intensive scenarios; therefore, the assignment of a site-specific value to $EF_S$ should prompt an evaluation of the applicability of the default value for $IR_S$ to the population of concern (see Section 7 of the Appendix for further discussion).

Nonresidential exposure scenarios in which exposure frequency would be substantially less than 219 days/year are frequently encountered. Examples include trespassing and recreational use of a site. Important methodology constraints on exposure frequency and duration must be considered in assigning values to $EF_S$ that would represent infrequent contact with the site; these constraints relate to the steady state assumptions that underlie the BKSF. The BKSF derived from the Pocock

et al. (1983) data applies to exposures that result in a quasi-steady state for blood lead concentration; that is, an intake over a sufficient duration for the blood lead concentration to become nearly constant over time. Based on estimates of the first order elimination half-time for lead in blood of approximately 30 days for adults (Rabinowitz, et al., 1974, 1976; Chamberlain et al., 1978), a constant lead intake rate over a duration of 90 days would be expected to achieve a blood lead concentration that is sufficiently close the quasi-steady state. This is the minimum exposure duration to which this methodology should be applied.

Infrequent exposures (i.e., less than 1 day per week) over a minimum duration of 90 days would be expected to produce oscillations in blood lead concentrations associated with the absorption and subsequent clearance of lead from the blood between each exposure event. Based on the above assumptions about the elimination half-time lead in blood, the TRW recommends that this methodology should not be applied to scenarios in which $EF_S$ is less than 1 day/week.

## 9. Applying Monte Carlo Analysis to the Adult Lead Methodology

Recent EPA guidance (Browner, 1995) recommends that risk assessments include a clear and transparent discussion of variability and uncertainty. The lead risk assessment methodology presented here develops explicit estimates of the variability of blood lead levels among adults who are exposed to specified concentrations of environmental lead. This analysis relies on data from a large number of studies (baseline blood lead levels, variability of blood lead levels, contact rates with environmental media, lead bioavailability, and lead biokinetics) to support a predictive probabilistic (lognormal) model for adult and fetal blood lead concentrations. Important issues regarding the uncertainty in parameter inputs and the mathematical form of the model are discussed in the sections of this Appendix. The TRW recognizes that there is considerable scientific interest in the different analytical approaches that may be applied to aid in the analysis of variability and uncertainty in risk assessments. In particular, under appropriate circumstances, Monte Carlo methods may provide a useful approach for developing quantitative estimates of the variability, uncertainty (or both) in risk predictions.

The TRW chose not to pursue application of Monte Carlo or other stochastic simulation methods in this effort addressing adult lead risk assessment. Several factors went into this decision. First, the TRW understood the needs of EPA Regions for a risk model that could be developed relatively rapidly and which Regional lead risk assessors could apply easily with limited need for additional study or training. These considerations made it advantageous to focus on models that are conceptually similar to the IEUBK model for children in terms of applying a parametric lognormal modeling approach to address distributions for blood lead levels. Secondly, the TRW recognized that there would be substantial scientific issues associated with developing widely applicable stochastic simulation models for adult lead risk assessment. These difficulties primarily relate to the absence of reliable distributional data for a variety of important variables in the assessment. As one example, very limited data are available on soil ingestion rates in adults and a distributional choice for this key parameter would depend heavily on individual judgement with little Agency precedent for support. Additionally, in a stochastic assessment, a greater complexity would arise due to likely correlations among the variables in the adult lead risk assessment. Stochastic analyses need to explicitly account for important correlations among variables if the simulations are to provide realistic distributions of

risk. As an example, dependence is likely to exist between the starting (non-site related) blood lead concentrations for individuals and their site-related increases in blood lead. This dependence may result from individual patterns of behavior and from biological factors associated with lead pharmacokinetics. However, data on this dependence are sparse or absent, and the necessary statistical estimates of the correlation strength would depend heavily on personal judgement.

The TRW does encourage further efforts to better define the distributional data on which stochastic simulations of lead risks might rest. Further attention to these data can provide useful insights for lead risk assessment. The TRW also recognizes that Regions may be presented with lead risk assessments based on Monte Carlo modeling. In order to facilitate review of Monte Carlo analyses, some EPA Regions have found it important to establish requirements for the orderly development and review of these assessments. Borrowing on this approach, the TRW recommends that:

- A plan for the use of Monte Carlo analysis in a lead risk assessment should be submitted to responsible Regional personnel and accepted by them before the Monte Carlo analysis is undertaken.

- In general, it is expected that site-specific exposure related parameters that are supported with site-specific information will provide the basis for proposed Monte Carlo simulations.

- Scientific review is needed to determine that the risk assessment conformed to the plan and to evaluate the reliability of the results.

These recommendations are designed to ensure that assessments can provide meaningful results that can be understood and evaluated. If analyses are submitted in a format that is difficult to understand, the utility of the analysis will be diminished. We recommend that Regional staff seek advice from the TRW as a resource in this process.

## 10. References

Alexander, F.W. and H.T. Delves. 1981. Blood lead levels during pregnancy. Int. Arch. Occup. Environ. Health. 48: 35-39.

Baghurst, P.A., A.J. McMichael, G.V. Vimpani, E.F. Robertson, P.D. Clark, and N.R. Wigg. 1987. Determinants of blood lead concentrations of pregnant women living in Port Pirie and surrounding areas. Medical J. of Australia. 146: 69-73.

Balbus-Kornfeld, J. 1994. Comments and Recommendations on the Draft Interim Guidance for Screening Levels of Lead in Soil for Non-Residential Sites. Letter from John Balbus-Kornfeld to Bruce Means. November 17, 1994.

Barltrop, D. and F. Meek. 1975. Absorption of different lead compounds. Postgrad. Med. J. 51: 805-809.

Barltrop, D. and F. Meek. 1979. Effect of particle size on lead absorption from the gut. Arch. Environ. Health. 34: 280-285.

Blake, K.C.H. 1976. Absorption of $^{203}Pb$ from gastrointestinal tract of man. Environ. Res. 11: 1-4.

Blake, K.C.H. and M. Mann. 1983. Effect of calcium and phosphorus on the gastrointestinal absorption of $^{203}Pb$ in man. Environ. Res. 30: 188-194.

Blake, K.C.H., G.O. Barbezat and M. Mann. 1983. Effect of dietary constituents on the gastrointestinal absorption of $^{203}Pb$ in man. Environ. Res. 30: 182-187.

Bowers, T.S., B.D. Beck and H.S. Karam. 1994. Assessing the relationship between environmental lead concentrations and adult blood lead levels. Risk Analysis. 14(2): 183-189.

Brody, D.J. Personal communication on October 24, 1996 and October 29, 1996.

Brody, D.J., J.L. Pirkle, R.A. Kramer, K.M. Flegal, T.D. Matte, E.W. Gunter and D.C. Paschal. 1994. Blood lead levels in the U.S. population. Phase 1 of the third National Health and Nutrition Examination Survey (NHANES III, 1988 to 1991). JAMA. 272(4): 277-283.

Browner, C.M. 1995. Policy for Risk Characterization at the U.S. EPA. Memorandum from U.S. EPA Administrator dated March 21, 1995.

Chamberlain, A.C., M.J. Heard, P. Little, D. Newton, A.C. Wells and R.D. Wiffen. 1978. Investigations into lead from motor vehicles. Harwell, United Kingdom: United Kingdom Atomic Energy Authority, Report No. AERE-R9198.

Davenport, H.W. 1971. Gastric digestion and emptying; absorption. In: Physiology of the Digestive Tract, 3rd ed. Year Book Medical Publishers Inc., Chicago. pp. 165-168.

Franklin, C.A., M.J. Inskip, C.L. Baccanale, E.J. O'Flaherty, W.I. Manton, D.L. Schanzer, J. Blenkinsop and C.M. Edwards. 1995. Transplacental transfer of lead in non-human primates (*Macaca fascicularis*): use of serially administered stable isotope tracers of lead to elicit contribution of maternal bone lead to blood lead and the fetus. Poster presented at the 1995 meeting of the Society of Toxicology, Baltimore, MD. The Toxicologist. 15: 194.

Gershanik, J.J., G.G. Brooks, and J.A. Little. 1974. Blood lead values in pregnant women and their offspring. Amer. J. Obstet. Gynecol. 4: 508-511.

Goyer, R.A. 1990. Transplacental transport of lead. Environ. Health Perspect. 89: 101-105.

Graziano, J.H., D. Popovac, P. Factor-Litvak, P. Shrout, J. Kline, M.J. Murphy, Y. Zhao, A. Mehmeti, X. Ahmedi, B. Rajovic, Z. Zvicer, D. [illegible]nezic, N. Lolacono and Z. Stein. 1990. Determinants of elevated blood lead during pregnancy in a population surrounding a lead smelter in Kosovo, Yugoslavia. Environ. Health Perspect. 89: 95-100.

Graziano, J.H., W.I. Manton, C.B Blum and N.J. LoIacono. 1995. Bioavailability of lead in wine, by stable isotope dilution. Poster presented at the 1995 meeting of the Society of Toxicology, Baltimore, MD. The Toxicologist. 15: 135 (abst).

Hawley, J.D. 1985. Assessment of health risk from exposure to contaminated soil. Risk Analysis. 5: 289-302.

Heard, M.J. and A.C. Chamberlain. 1982. Effect of minerals and food on uptake of lead from the gastrointestinal tract in humans. Human Toxicol. 1: 411-415.

Hunt, J.N. and W.R. Spurrell. 1951. The pattern of emptying of the human stomach. J. Physiol. 113: 157-168.

James, H.M., M.E. Milburn and J.A. Blair. 1985. Effects of meals and meal times on uptake of lead from the gastrointestinal tract of humans. Human Toxicol. 4: 401-407.

Maddaloni, M., W. Manton, C. Blum, N. LoIacono and J. Graziano. 1996. Bioavailability of soil-borne lead in adults, by stable isotope dilution. The Toxicologist. 30: 15 (abst.)

NRC. 1993. Measuring Lead Exposure in Infants, Children and Other Sensitive Populations. National Academy Press. Washington, DC. ISBN 0-309-04927-X.

Pocock, S.J., A.G. Shaper, M. Walker, C.J. Wale, B. Clayton, T. Delves, R.F. Lacey, R.F. Packham and P. Powell. 1983. Effects of tap water lead, water hardness, alcohol, and cigarettes on blood lead concentrations. J. Epidemiol. Commun. Health. 37: 1-7.

Rabinowitz, M.B., G.W. Wetherill and J.D. Koppel. 1974. Studies of human lead metabolism by use

of stable isotope tracers. Environ. Health Perspect. 7: 145-153.

Rabinowitz, M.B., G.W. Wetherill and J.D. Koppel. 1976. Kinetic analysis of lead metabolism in health humans. J. Clin. Invest. 58: 260-270.

Rabinowitz, M.B., J.D. Koppel and G.W. Wetherill. 1980. Effect of food intake on fasting gastrointestinal lead absorption in humans. Am. J. Clin. Nutr. 33: 1784-1788.

Ruby, M.V., A . Davis, R. Schoof, S. Eberle and C. M. Sellstone. 1996. Estimation of lead and arsenic bioavailability using a physiologically based extraction test. Environ. Sci. Technol. 30: 422-430.

Sherlock, J., G. Smart, G.I. Forbes, M.R. Moore, W.J. Patterson, W.N. Richards and T.S. Wilson. 1982. Assessment of lead intakes and dose-response for a population in Ayr exposed to a plumbosolvent water supply. Human Toxicol. 1: 115-122.

Sherlock, J.C., D. Ashby, H.T. Delves, G.I. Forbes, M.R. Moore, W.J. Patterson, S.J. Pocock, M.J. Quinn, W.N. Richards and T.S. Wilson. 1984. Reduction in exposure to lead from drinking water and its effect on blood lead concentrations. Human Toxicol. 3: 383-392.

Silbergeld, E.K. 1991. Lead in bone: Implications for toxicology during pregnancy and lactation. Environ. Health Perspect. 91: 63-70.

U.S. EPA. 1986. Air Quality Criteria for Lead Volumes I - IV. Environmental Criteria and Assessment Office, Office of Research and Development, RTP, NC. EPA 600/8-83-028 a-d.

U.S. EPA. 1989. Exposure Factors Handbook. Office of Health and Environmental Assessment, Washington, DC. EPA/600/8-89/043.

U.S. EPA. 1990. Supplement to the 1986 EPA Air Quality Criteria Document for Lead - Volume 1 Addendum. Office of Research and Development, Office of Health and Environmental Assessment, Washington, DC. EPA-600/8-89/049A.

U.S. EPA. 1992. A TRW Report: Review of the EPA Uptake Biokinetic Model for Lead at the Butte NPL Site. Technical Review Workgroup for Lead, October, 1992.

U.S. EPA. 1993. Superfund's Standard Default Exposure Factors for the Central Tendency and RME-Draft. Working Draft, November 1993.

U.S. EPA. 1994a. Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities. OSWER Directive No. 9355.4-12. Office of Emergency and Remedial Response, Washington, D.C. EPA/540/F-94/043, PB94-963282.

U.S. EPA. 1994b. Technical Support Docuement: Parameters and Equations Used in the Inegrated Exposure Uptake Biokinetic Model for Lead in Children (v. 0.99d). Office of Emergency and Remedial Response, Washington, D.C. EPA/540/R-94/040, PB94-963505.

U.S. EPA. 1994c. Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children. Office of Emergency and Remedial Response, Washington, D.C. EPA/540/R-93/081, PB93-963510.

U.S. EPA. 1995. A TRW Report: Review of a Methodology for Establishing Risk-Based Soil Remediation Goals for the Commercial Areas of the California Gulch Site. Technical Review Workgroup for Lead, October, 1995.

Weis, C.P., G.M. Henningsen, R.L. Poppenga, B.J. Thacker, A. Curtis, R. Jolly and T. Harpstead. 1994. Use of an immature swine model to sensitively differentiate lead absorption from soluble and mineralogical matrices. Presented at the Society for Environmental Geochemistry and Health, Salt Lake City, UT, July 18-19, 1994.

Draft Region 6 Superfund Guidance

Adult Lead Cleanup Level

**Basic Equations:**

$$Cs = \frac{(PbB_{GM}target - PbBo)}{BKSF \times (IRs \times EFs \times AFs + Ksd \times IRd \times EFd \times AFd)}$$

$$PbB_{GM}target = PbB_{95th}maternal/GSDi^{1.645}$$

$$PbB_{95th}maternal = PbB_{95th}fetal/R$$

**Input Parameters to the Model:**

1. 95th Percentile PbB in fetus ($PbB_{95th}fetal$)

   The EPA and CDC recommend that no more than 5% likelihood that a child would exceed 10 µg/dL. For an industrial/commercial setting, the exposed population could include pregnant women. The recommended $PbB_{95th}fetal$ is 10 µg/dL.

2. Mean ratio of fetal to maternal PbB (R)

   The relationship between fetal and maternal blood lead is estimated to be 0.9 (Goyer 1990). The recommended "R value" is 0.9.

3. Individual geometric standard deviation (GSDi)

   A "typical" GSDi is 1.8.

4. Baseline blood lead value (PbBo)

   The demographic composition of the site should be considered. The geometric mean PbB values reported for women aged 20 - 49 years for African Americans was 2.2 µg/dL, for Hispanics was 2.0 µg/dL, and for whites was 1.7 µg/dL.

5. Biokinetic slope factor (BKSF)

   The recommended BKSF is 0.4 µg/dL per µg/day.

6. Soil ingestion rate (IRs)

   The recommended IRs is 0.025 g/day. This assumes that one-half the "default" soil/dust ingestion rate of 0.05 g/day is from soil.

7. Dust ingestion rate (IRd)

The recommended IRd is 0.025 g/day. This assumes that one-half the "default" soil/dust ingestion rate of 0.05 g/day is from dust.

8. Ratio of concentration in dust to that in soil (Ksd)

The Ksd can range from 0.2 to 1.0 with a "typical" value of 0.7.

9. Soil exposure frequency (EFs)

The "default" exposure frequency for an industrial setting is 250 days/year. This exposure frequency is based upon 5 work days per week for 50 weeks/year. The recommended EFs is 250 days/year.

10. Dust exposure frequency (EFd)

The "default" exposure frequency for an industrial setting is 250 days/year. This exposure frequency is based upon 5 work days per week for 50 weeks/year. The recommended EFd is 250 days/year.

11. Absolute absorption fraction of lead in soil (AFs)

The absorption fractions for adults range from 0.06 to 0.2. The recommended AFs for most sites is 0.1. The source of lead contamination should be considered in selecting the AFs value.

12. Absolute absorption fraction of lead in dust (AFd)

The absorption fractions for adults range from 0.06 to 0.2. The recommended AFs for most sites is 0.1. The source of lead contamination should be considered in selecting the AFs value.

| Model Parameter | Plausible Range | "Typical" Value |
|---|---|---|
| 95th Percentile PbB in fetus (µg/dL) | 5 - 15 | 10 |
| R (Mean ratio of fetal to materal PbB) | 0.8 - 1.0 | 0.9 |
| Individual geometric standard deviation (GSDi) | 1.6 - 2.0 | 1.8 |
| Baseline blood lead value (PbBo) (µg/dL) | 1.6 - 2.2 | 1.9 |
| Biokinetic slope factor (BKSF) (µg/dL per µg/day) | 0.3 - 0.5 | 0.4 |
| Soil ingestion rate (IRs) (mg/day) | 10 - 25 | 25 |
| Dust ingestion rate (IRd) (mg/day) | 10 - 25 | 25 |
| Ratio of concentration in dust to that in soil (Ksd) | 0.2 - 1.0 | 0.7 |
| Soil ingestion frequency (EFs) (days/year) | 100 - 350 | 250 |
| Dust ingestion frequency (EFd) (days/year) | 100 - 350 | 250 |
| Absolute absortion fraction of lead in soil (AFs) | 0.06 - 0.2 | 0.1 |
| Absolute absortion fraction of lead in dust (AFd) | 0.06 - 0.2 | 0.1 |
| Resulting soil concentration (mg/kg) | | 2,000 |

# Screening Level for Lead Program v1.00

## 1.0 Starting the Program

To start the "Screening Level for Lead Program" (PRG), enter **PRG** at the DOS prompt of the subdirectory containing the executable file (PRG.EXE).

## 2.0 Data Entry

Figure 1 illustrates an example Data Entry Screen for PRG.

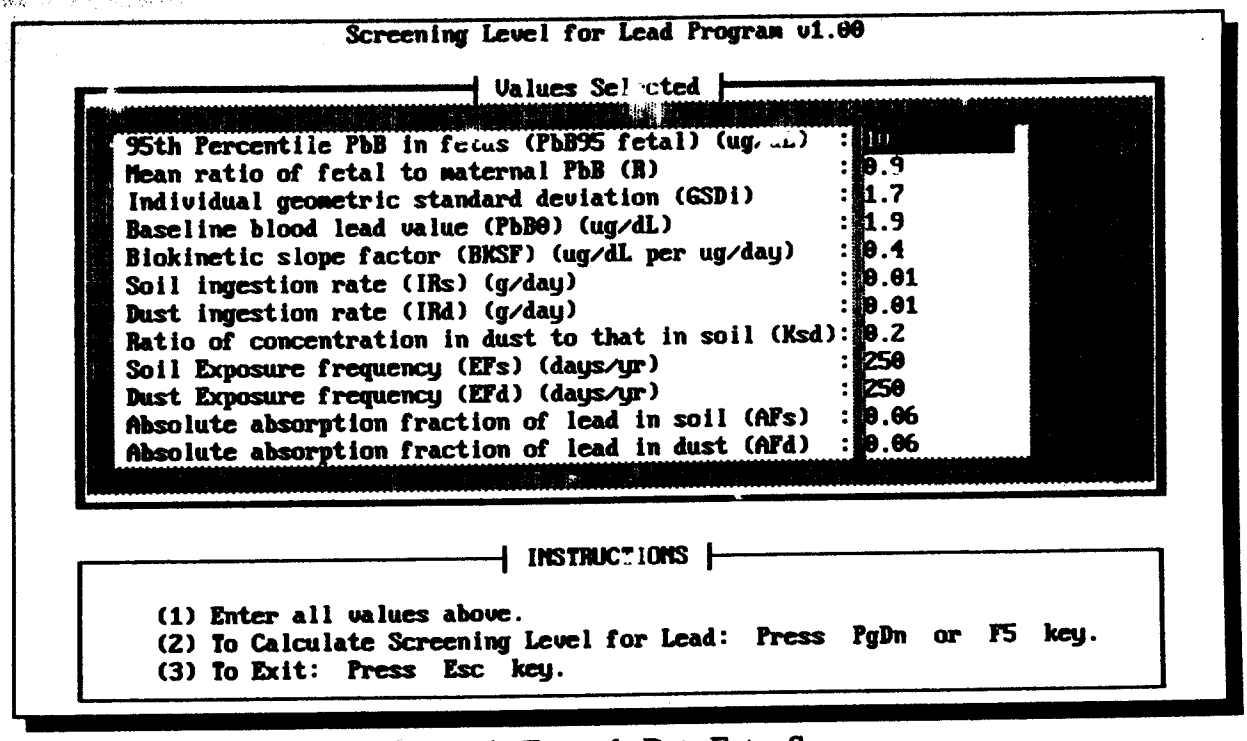


**Figure 1.** Example Data Entry Screen

When started initially, all data entry fields are zero. Some fields (such as $GSD_i$, BKSF, and R) can not be left as zero because division by zero is prohibited. Also, this program does not allow entry of negative numbers in any field. After all values are entered, press either the PgDn key or the F5 key to calculate the Screening Level for Lead (in ug/g).

## 3.0 Results

Figure 2 illustrates an example Results Screen.

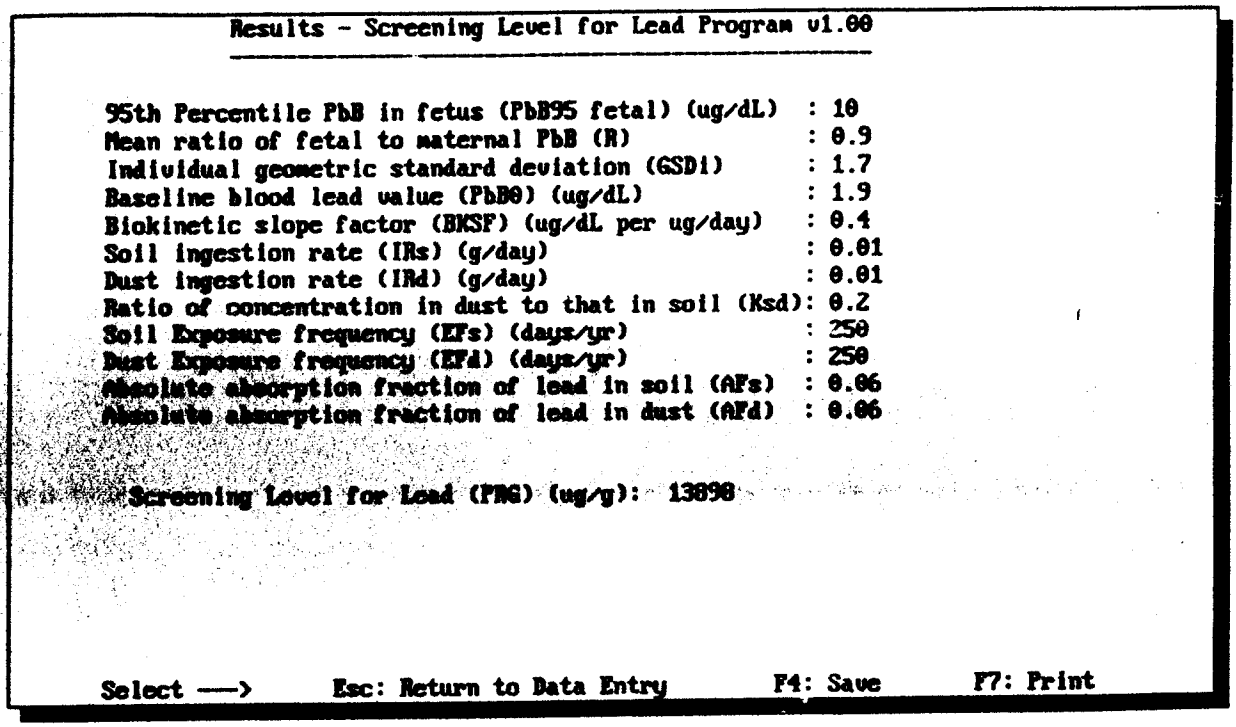


Figure 2. Example Results Screen

The Results Screen can be printed or saved to a file. All data entry values are retained when returning to the Data Entry Screen.

## 4.0 Equation Used for Calculation

The following equation is used to calculate The Screening Level for Lead:

$$\text{Screening Level for Lead (PRG) (ug/g)} = \frac{(PbB_{95}\ \text{fetal} / (R \bullet (GSD_i)^{1.645})) - PbB0}{BKSF \bullet ((IR_s \bullet AF_s \bullet EF_s / 365) + (K_{sd} \bullet IR_d \bullet AF_d \bullet EF_d / 365))}$$

## Adult Lead Cleanup Level

**Basic Equations:**

$$Cs = \frac{(PbB_{GM}target - PbBo)}{BKSF \times (IRs \times AFs + Ksd \times IRd \times AFd)}$$

$$PbB_{GM}target = PbB_{95th}maternal/GSDi^{1.645}$$

$$PbB_{95th}maternal = PbB_{95th}fetal/R$$

DRAFT

**Input Parameters to the Model:**

1. 95th Percentile PbB in fetus (PbG95 fetal)

   The EPA and CDC recommend that no more than 5% likelihood that a child would exceed 10 µg/dL. The exposed population at the RSR site could include pregnant women. The recommended PbG95 fetal for the RSR site is 10 µg/dL.

2. Mean ratio of fetal to maternal PbB (R)

   The relationship between fetal and maternal blood lead is estimated to be 0.9 (Goyer 1990). The recommended R value for the RSR site is 0.9

3. Individual geometric standard deviation (GSDi)

   The recommended GSDi for the RSR site is 1.8. This GSDi is based on the geometric standard deviation which as estimated from measured blood lead data from children in west Dallas.

4. Baseline blood lead value (PbBo)

   The demographic composition of west Dallas is primarily a mixture of African Americans and Hispanics. The geometric mean PbB values reported for women aged 20 - 49 years for African Americans was 2.2 µg/dL and Hispanics was 2.0 µg/dL. The recommended PbBo for the RSR site is 2.1 µg/dL.

5. Biokinetic slope factor (BKSF)

   The recommended BKSF for the RSR site is 0.4 µg/dL per µg/day.

6. Soil ingestion rate (IRs)

   The recommended IRs for the RSR site is 0.025 g/day. This assumes that one-half the "default" soil/dust ingestion rate of 0.05 g/day is from soil.

7. Dust ingestion rate (IRd)

The recommended IRd for the RSR site is 0.025 g/day. This assumes that one-half the "default" soil/dust ingestion rate of 0.05 g/day is from dust.

8. Ratio of concentration in dust to that in soil (Ksd)

The empirical data for dust and soil in the west Dallas households suggest a dust/soil ratio of 0.21. The recommended Ksd for the RSR site is 0.21.

9. Soil exposure frequency (EFs)

The "default" exposure frequency for an industrial setting is 250 days/year. This exposure frequency is based upon 5 work days per week for 50 weeks/year. The recommended EFs for the RSR site is 250 days/year.

10. Dust exposure frequency (EFd)

The "default" exposure frequency for an industrial setting is 250 days/year. This exposure frequency is based upon 5 work days per week for 50 weeks/year. The recommended EFd for the RSR site is 250 days/year.

11. Absolute absorption fraction of lead in soil (AFs)

The lead contamination on the RSR site is the result of an abandon secondary lead smelter. Lead from smelters tend to be more available than lead from other sources (i.e., waste rock, slap). The absorption fractions for adults range from 0.08 to 0.1. The recommended AFs for the RSR site is 0.1 due to the source of lead contamination.

12. Absolute absorption fraction of lead in dust (AFd)

The lead contamination on the RSR site is the result of an abandon secondary lead smelter. Lead from smelters tend to be more available than lead from other sources (i.e., waste rock, slap). The absorption fractions for adults range from 0.08 to 0.1. The recommended AFd for the RSR site is 0.1 due to the source of lead contamination.

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# Assessing the Relationship Between Environmental Lead Concentrations and Adult Blood Lead Levels

**Teresa S. Bowers,[1,3] Barbara D. Beck,[1] and Hala S. Karam[2]**

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This paper presents a model for predicting blood lead levels in adults who are exposed to elevated environmental levels of lead. The model assumes a baseline blood lead level based on average blood lead levels for adults described in two recent U.S. studies. The baseline blood lead level in adults arises primarily from exposure to lead in diet. Media-specific ingestion and absorption parameters are assessed for the adult population, and a biokinetic slope factor that relates uptake of lead into the body to blood lead levels is estimated. These parameters are applied to predict blood lead levels for adults exposed to a hypothetical site with elevated lead levels in soil, dust and air. Blood lead levels ranging from approximately 3–57 μg/dl are predicted, depending on the exposure scenarios and assumptions.

**KEY WORDS:** Blood lead; adult; exposure; model.

## 1. INTRODUCTION

In recent years, there has been significant interest in the potential human health risks resulting from exposures to lead in soil and dust. This concern is most often focused on young children because, given the same concentration of lead in soil and dust, children's exposures will be higher than those of adults. This is because of children's high hand-to-mouth behavior, and the amount of time they spend playing outside, coming into contact with and ingesting more lead-contaminated dirt. In addition, children absorb more lead ingested from soil and dust than adults absorb, and children are more sensitive to the toxic effects of lead.

However, adults may be exposed to high levels of lead in soil and dust in situations where there are no exposures to children. These situations include adults working on a daily basis in occupations that involve lead exposures, or adults involved in construction or remediation activities at lead-contaminated sites. In these situations adults may be at risk for elevated blood lead levels due to soil and dust exposures. For such situations it would be useful to have an adult lead exposure model to assess risk. It should also be noted that the United States Occupational Safety and Health Administration (OSHA) regulates lead in air in the working environment, but not lead in soil or dust,[1] further emphasizing the potential use of an adult lead exposure model.

An adult lead exposure model should relate lead concentrations in various media (air, water, soil, and dust) to blood lead levels. Several such models exist for assessing childhood exposures to lead, including the LEAD Model.[2] However, models designed to predict blood lead levels in children cannot be easily used for adults because of significant differences between children and adults in the pharmacokinetic parameters that control the distribution of lead in the body.

Models relating adult blood lead levels to some types of environmental exposures have been developed by O'Flaherty,[3] Carrington and Bolger,[4] and Chamberlain and Heard.[5] O'Flaherty predicted adult blood lead levels from exposure to air, water, and diet using a so-

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phisticated, multicompartment pharmacokinetic model. An individual's exposure history was developed from historic environmental lead levels and both steady and nonsteady state exposures can be modeled. Use of the model requires access to the computer program, and soil and dust exposures for adults are not considered. Carrington and Bolger predicted adult blood lead levels using a Monte Carlo analysis of estimates of the range of lead intake and lead concentrations in air, soil, dust, water, food, ceramics, and wine. They used an empirically derived conversion factor based on observations of blood lead values and dietary intake to relate lead intake to blood lead. The focus of their work was to predict the effects of lead in wine on blood lead levels of the adult population. Chamberlain and Heard modeled the overall lead balance for an individual based on several studies using lead tracers to track inhaled and ingested quantities of lead. They calculated total lead uptake from media-specific intake and clearance information, and related uptake to blood lead by comparing measured blood lead levels to uptakes estimated from their lead balance model. None of the models described provide a direct means of relating soil or dust lead concentrations to blood lead levels for adults with occupational exposures.

Here we propose a method to calculate adult blood lead levels that is based on statistical information concerning baseline exposures to lead arising largely from dietary lead and an assessment of current exposure to lead in soil, dust, water, and air. The estimated baseline exposure is applicable to adults with no large pre-existing burden of lead, or no previous excessive occupational exposures to lead. The value chosen to represent baseline exposures is summed with a calculation of current site-specific exposures based on standard relationships between lead concentrations, lead intake and uptake, and the relationship between lead uptake and blood lead in adults. Equations relating environmental sources of lead to blood lead levels rely on estimates for adults for several parameters, including the biokinetic slope factor (BSF) that relates blood lead levels to daily absorbed lead amounts, ingestion rates for soil and dust, water, an inhalation rate for air, and media-specific absorption fractions. The value for each of these parameters differs for adults and children.

In order to interpret the output of this model, it is necessary to describe the effects of lead on adults. The response of adults to lead is both quantitatively and qualitatively different from that of children.[6] For example, central nervous system effects, such as mood disturbance and psychomotor impairment, occur at lower blood lead levels in children than in adults, with effects from prenatal exposure occurring at somewhat lower levels than effects of postnatal exposure, (see, *e.g.*, results of prospective analyses in Boston, Refs. 7–9). Peripheral nervous system toxicity, such as wrist drop, is characteristic of high level lead poisoning in adults, but not in children. Thus one cannot simply extrapolate from results in children to evaluate risks of lead exposure in adults. We therefore describe health endpoints in adults to be considered in interpreting the output of a lead risk assessment.

Of particular relevance to assessing the impact of low level exposure to lead in adults are recent epidemiological studies demonstrating an association between blood lead levels and increases in systolic and diastolic blood pressure, as reviewed recently by Schwartz[10] and Weeden.[11] In general, there is a small, but significant, impact of lead on adult blood pressure (both systolic and diastolic). Schwartz observed that the impact of a 5 μg/dl difference in adult blood lead on diastolic blood pressure in males ranged from about 0.3–2 mmHg with an average of about 1 mmHg. Lead is one of multiple risk factors that affect blood pressure. For example, in a study by Rabinowitz *et al.*[12] on the effects of lead on hypertension in pregnancy, the correlation between blood lead and systolic blood pressure accounted for less than 1% of the variability in systolic pressure.

Although EPA has identified the impact of lead on blood pressure in adult men as one of the critical effects of low blood lead levels, EPA notes that a threshold for blood pressure effects in men has not been defined.[6] The strength and magnitude of the lead/hypertension association, as well as the relationship between increased blood pressure and risk of stroke or heart attack, should be considered in defining permissible blood lead levels for adults. Rather than propose a specific level, we present our analyses in terms of target blood lead levels defined by OSHA for adult workers and by the Centers for Disease Control (CDC) for young children.

OSHA states that the blood lead level of workers (male and female) intending to have children should remain below 30 μg/dl. OSHA allows 40 μg/dl as a "permissible" blood lead level in lead-exposed workers, below which no further medical monitoring or workplace intervention is required.

The Centers for Disease Control (CDC) has selected 10 μg/dl as the "level of concern" for young children. CDC concludes that when a "significant percentage" (undefined) of children in a community have blood lead levels between 10 and 14 μg/dl, some form of community intervention, such as educational programs, should be considered. While the CDC criteria for children were not developed for adults, they may be useful as a screening technique for adults. That is, if the predicted blood

lead distribution would be considered acceptable for children, it would also be acceptable for adults.

In this paper, we provide estimates of blood lead levels for a group of adults with current occupational exposure at a hypothetical site that includes soil contamination and indoor dust contamination in a warehouse. Calculated percentages of workers with blood lead levels exceeding 10 μg/dl (the CDC screening criterion for children), 30 μg/dl (the OSHA nonmandatory criterion for adults intending to have children), and 40 μg/dl (OSHA permissible standards) are presented.

## 2. BASELINE ADULT BLOOD LEAD LEVELS

An estimate of baseline blood lead levels for adults without previous excessive occupational exposures can be obtained from the results of two recent epidemiological studies in Butte, Montana[13] and Midvale, Utah.[14] (Results from the soon-to-be released NHANES III study will provide a more comprehensive assessment of adult blood lead levels and could be used as input into the model.) These studies reported measured blood lead levels for 48 and 43 adults, respectively, with geometric mean blood lead levels of 3.1 μg/dl and 2.2 μg/dl, respectively. The measured range of blood lead levels in adults was from 0.5–12.0 μg/dl at Butte, and from nondetectable to 8.0 μg/dl at Midvale. These ranges can be described by geometric standard deviations (GSD) of 1.94 and 1.77, respectively. Because these levels are relatively low, we assume the adults in the studies had no significant previous occupational exposures to lead. The highest blood lead level of 12 μg/dl is much lower than the permissible adult levels under OSHA standards of 40 μg/dl. Adult blood lead calculations presented below use the higher geometric mean blood lead value from Butte, 3.1 μg/dl, as an average or baseline adult blood lead level in 1991 representative of adult exposures to average lead concentrations arising largely from lead in diet. It should be noted that use of a community-based baseline blood lead for the risk assessment model is, in fact, conservative, and likely to overestimate the actual value. The overestimate occurs because the proposed baseline for these individuals already incorporates some exposures from soil, dust, air, and water.

## 3. EXPOSURE MODELS

Multiple pathway exposure assessments depend on: (1) an evaluation of the concentration of the chemical of concern in each environmental medium; (2) a quantification of the variables affecting each potential exposure route, such as inhalation, ingestion, or dermal contact; and (3) an understanding of how daily exposure from each pathway is combined to represent a total exposure to the chemical from all sources and pathways. McKone and Daniels[15] have proposed a detailed multiple pathway exposure model that depends on each of these components, and that can be used for a variety of chemicals of concern. This model, and others like it, form the basis for the type of model presented here.

In the case of lead, total exposure is reflected in an individual's blood lead level, a variable that can be measured. A multiple pathway exposure model is used here to calculate adult blood lead levels that arise from environmental lead sources. The basic equation of the model is similar to that used in the U.S. EPA LEAD Model for children, but makes use of a biokinetic slope factor to relate total uptake of lead in adults to blood lead, rather than the multiple compartment distribution model for children used by the LEAD Model. (In theory, other modeling approaches such as structural equation modeling[14] could be developed for specific sites.) The following equation is used:

$$\mathrm{PbB} = \mathrm{PbB}_{\mathrm{baseline}} + (\mathrm{BSF})(\mathrm{Uptake}_{\mathrm{air}} + \mathrm{Uptake}_{\mathrm{water}} + \mathrm{Uptake}_{\mathrm{soil/dust}}) \quad (1)$$

where PbB stands for blood lead, $\mathrm{PbB}_{\mathrm{baseline}}$ refers to a baseline blood lead level which largely depends on dietary intake of lead, and BSF is the biokinetic slope factor that relates blood lead levels in μg/dl to daily absorbed amounts of lead in μg/day. The other source-specific uptakes (in μg/day) are defined by

$$\mathrm{Uptake}_{\mathrm{air}} = (A_a)(V_a)(C_a) \quad (2)$$

$$\mathrm{Uptake}_{\mathrm{water}} = (A_w)(I_w)(C_w) \quad (3)$$

$$\mathrm{Uptake}_{\mathrm{soil/dust}} = (A_{s/d})(I_{s/d})[(t_0)(C_s) + (t_i)(C_d)] \quad (4)$$

where $A_a$, $A_w$, and $A_{s/d}$ represent the absorption fractions for lead taken into the body from air, water, and soil/dust, respectively, $V_a$ is the ventilation rate in $m^3$/day, $I_w$ is the ingestion rate of water in l/day, $I_{s/d}$ is the ingestion rate of soil and dust in g/day, and $C_a$, $C_w$, $C_s$, and $C_d$ are the concentrations of lead in air (μg/$m^3$), water (μg/l or ppb), and soil and dust (μg/g or ppm). The parameters $t_0$ and $t_i$ refer to time-activity patterns that represent the relative proportions of soil and dust ingested, and sum to 1.

Concentration parameters are site-specific, while ingestion rates, absorption, and time-activity patterns may be similar for many sites. The calculated blood lead level is a geometric mean value representing an individual with average (or median) intake patterns. The expected

range of blood lead levels for a group of workers or a community of individuals can be determined by applying an appropriate geometric standard deviation to the calculated blood lead value.

## 4. ASSESSMENT OF ADULT EXPOSURE PARAMETERS FOR ESTIMATION OF BLOOD LEAD LEVELS

In order to use the equations described in the section above, values for each of the parameters must be defined for adults. The following sections give the values used in this study. A summary of these values is given in Table I. The values given here may best be described as default values, and may be altered depending on specific site conditions.

### 4.1. Soil and Dust

Average soil and dust ingestion rates for adults have been estimated to be 0.02 g/day, approximately one fifth the average value for children.[2] Ingestion rates may exceed this value for especially dusty occupational settings. Absorption of lead from soil and dust is assumed to be 8% for adults, assuming the absorption from soil and dust is similar to absorption from food and water. A value of 8% may be an overestimate for soil and dust, based on the comparison of uptake of lead in soil and dust (30% as a maximum) vs. uptake of lead in food in children (approximately 50%[2]) It is likely that a lower absorption of lead from soil and dust than from food and water also occurs in adults. In addition, lower values for absorption from soil and dust may be appropriate for some communities (*e.g.*, mining sites[16,17]).

**Table I.** Adult Parameters for Current Exposure Blood Lead Calculations

| Symbol | Description | Value |
|---|---|---|
| $A_{sd}$ | Soil/dust absorption | 0.08 |
| $A_w$ | Water absorption | 0.08 |
| $A_a$ | Lung deposition and absorption | 0.32 |
| $I_{sd}$ | Soil/dust ingestion | 0.02 g/day |
| $I_w$ | Water ingestion | 2.0 l/day |
| $V_a$ | Ventilation rate during waking hours | 20.0 m³/day |
| BSF | Biokinetic slope factor | 0.375 μg/dl per μg/day |

### 4.2. Water

Adult water intake averages 2 l/day.[18] Absorption of lead from water for adults is estimated at 2–10% with meals and 40–60% between meals.[19] A recent article by O'Flaherty[3] suggests a value of 8% based on the literature and shows that this absorption works well in predicting adult blood lead levels from exposure to water and food.

### 4.3. Air

A detailed assessment of ventilation rates has recently been presented by Layton.[20] Layton suggests that the lifetime average inhalation rate for men is 14 m³/day (0.58 m³/hr) and for women is 10 m³/day (0.42 m³/hr). Information presented in Layton allows calculation of average daytime ventilation rates for adults aged 18–65. These values, averaged over all activities except sleep, are 20 m³/day (0.83 m³/hr) for men and 16 m³/day (0.67 m³/hr) for women. Calculations presented here use a ventilation rate of 20 m³/day, applied only to waking hours.

Absorption of lead into the blood stream from air taken into the lungs depends on the deposition rate of air lead in the lungs, and the absorption fraction of lead that is deposited. U.S. EPA[21] estimates that the range of air lead deposition is 28–70%, depending on particle size, ventilation rate, and type of work conditions. The absorbed fraction ranges widely, but an average value can be taken as 50%. This suggests that the amount of air lead in the lungs that is deposited and absorbed into the blood stream may range from 14–35%. This value is estimated at 32% for the following calculations. Site-specific information may suggest alternate values.

### 4.4. BSF

Biokinetic slope factors have not been directly measured for adults, but an estimate can be obtained from the work of Pocock *et al.*[22] who measured blood lead levels in over 7000 middle-aged men in 24 British towns. Tap water lead analyses were made at the residences of 941 of these men. This study found a relationship between blood lead levels and lead concentrations in residential tap water, and alcohol and tobacco consumption. Other sources of lead exposure, such as occupation, were not evaluated. Pocock and coworkers derived a slope of blood lead to water lead concentration of 0.06 μg/dl blood lead per μg/l water concentration. An equation

describing the contribution of water lead to blood lead can be derived from Eqs. (1) and (3) where

$$PbB_{water} = (BSF)(A_w)(I_w)(C_w) \quad (5)$$

Rearrangement of this expression yields

$$PbB_{water}/C_w = 0.06 = (BSF)(A_w)(I_w) \quad (6)$$

Substituting $A_w = 0.08$ and $I_w = 2$ l/day and solving for BSF yields a value for BSF of 0.375 μg/dl blood lead per μg/day lead uptake. A BSF value for children can be derived from the output of EPA's LEAD Model by dividing predicted blood lead levels by total uptake. The average value derived in this manner is about 0.3 μg/dl per μg/day, and compares favorably with the adult value used in this study.

## 5. ASSESSING POTENTIAL ADULT BLOOD LEAD LEVELS: A HYPOTHETICAL SITE

Calculations are presented here for a hypothetical site consisting of an industrial manufacturing warehouse with substantial interior dust lead contamination, elevated air lead concentrations, and surrounding acreage containing waste dumps of lead-containing material that has contaminated the soil. Table II summarizes hypothetical geometric mean concentration levels for soil, dust, and air that are used for the following calculations. The background level of lead in soil and dust used in the following calculations is approximately the natural level of lead in soil in many parts of the United States. The background level of lead in air is taken from the LEAD Model default value for the average concentration of lead in air.

Two exposure scenarios are considered: the outdoor worker, who spends all of his working time outdoors on the site, and the warehouse worker, who spends all of his working time inside the warehouse. A geometric mean blood lead level is calculated from the following relationship:

$$PbB = 3.1 + (BSF)[(I_{s/d})(A_{s/d})(t_s)(C_{s/d} - C_{bgs/d}) + (V_a)(A_a)(t_{s2})(C_a - C_{bga})] \quad (7)$$

where $t_s$ and $t_{s2}$ represent time-activity patterns corresponding to the fraction of waking hours spent on site (for assessment of onsite percent of soil and dust ingestion), and the fraction of total hours spent on site (for assessment of onsite percent of ventilated air), respectively. (Soil and dust ingestion occurs only during working hours, assumed to be 16 hr/day, while air inhalation occurs 24 hr/day.) We assume that the workers spend 8 hr/day, 5 days/weeks, 50 weeks/year onsite. Values of $t_s$ and $t_{s2}$ are therefore 0.34 and 0.23, respectively. Background concentrations of lead in soil/dust and air are subtracted from the site concentrations because time spent onsite replaces exposure that would otherwise be to background lead levels. No elevated exposures to lead in water are considered for this hypothetical site.

Solving Eq. (7) with the values of the parameters given in Tables I and II yields a geometric mean blood lead for the outdoor worker of 3.4 μg/dl and for the warehouse worker of 6.8 μg/dl.

We describe the hypothetical industrial manufacturing warehouse as a dusty place with significant particulate matter in the air due to the nature of the work. We therefore assume that the working adult in such an environment may ingest more soil and dust than they might otherwise in, for example, a residential environment. An alternate calculation of the warehouse worker blood lead level can be made by assuming that during the time the adult is in the warehouse his soil and dust ingestion rate increases to 0.1 g/day, or 5 times the value used in the previous calculation. This higher assumed ingestion rate results in a geometric mean blood lead level for the warehouse worker of 19.8 μg/dl.

A range of blood lead levels consistent with these exposure conditions can be estimated by applying an appropriate blood lead GSD value to the calculated geometric mean blood lead. Observed GSDs for adults at Butte and Midvale were 1.94 and 1.77, respectively. EPA's Draft Lead Guidance Manual suggests that the range of blood lead levels for a population with a narrow range of exposure conditions, such as a group of children all living in one house, may be described by a GSD of approximately 1.35. More accurate estimates of the blood lead GSD in adults will be available from the NHANES III study. For a potential maximum adult blood lead for workers exposed to this site, we assess the 95th percentile blood lead level using GSD values of both 1.4 and 1.9.

**Table II.** Lead Concentration Levels for the Hypothetical Site

| Symbol | Description | Value (geometric mean) |
|---|---|---|
| $C_s$ | Soil concentration | 1450 ppm |
| $C_d$ | Dust concentration in warehouse | 16,000 ppm |
| $C_a$ | Air concentration in warehouse | 1.0 μg/m³ |
| $C_{bgs}$ | Background concentration of soil and dust | 100 ppm |
| $C_{bga}$ | Background concentration of air | 0.20 μg/m³ |

Table III. Summary of Predicted Blood Lead Levels

| Scenario | Outdoor worker | | Warehouse worker low ingestion rate | | Warehouse worker high ingestion rate | |
|---|---|---|---|---|---|---|
| Geometric mean (μg/dl) | 3.4 | | 6.8 | | 19.8 | |
| GSD | 1.4 | 1.9 | 1.4 | 1.9 | 1.4 | 1.9 |
| 95th percentile (μg/dl) | 5.9 | 9.8 | 11.8 | 19.5 | 34.4 | 56.9 |
| % > 10 μg/dl | 0.07 | 4.6 | 12.6 | 27.4 | 97.7 | 85.6 |
| % > 30 μg/dl | < 0.01 | 0.03 | < 0.01 | 1.0 | 10.8 | 25.9 |
| % > 40 μg/dl | < 0.01 | 0.01 | < 0.01 | 0.29 | 1.8 | 13.7 |

The resulting values are 5.9–9.8 μg/dl for the outdoor worker, 11.8–19.5 μg/dl for the warehouse worker with the low soil/dust ingestion value, and 34.4–56.9 μg/dl for the warehouse worker with the high soil/dust ingestion value. A summary of calculated geometric mean blood lead levels together with the 95th percentile and percentages of workers predicted to have blood lead levels exceeding 10, 30, and 40 μg/dl for these scenarios is presented in Table III. It is clear that the maximum blood lead values are very dependent on the choice of GSD. Higher GSD values will increase the percent of workers with high blood lead levels and lower GSD values will decrease the percent. In addition, blood lead levels greater than about 20–25 μg/dl are likely to be overestimates due to nonlinearities in the relationship between lead exposure and blood lead (see, e.g., Fig. 2 of Pocock *et al.*, Ref. 22). Nevertheless, these calculations give some qualitative indication of the range of blood lead levels that might be expected from adult exposure to this hypothetical site.

## 6. SUMMARY

We have presented here a preliminary model to assess adult blood lead levels arising from site-specific exposures to elevated lead levels in air, water, soil, and dust. An example for a hypothetical site with substantial dust lead contamination in an industrial manufacturing warehouse shows that the blood lead levels may range from an average expected value of 6.8 μg/dl to a potential 95th percentile value as high as 57 μg/dl for warehouse workers. The outdoor worker may have an average expected blood lead value of 3.4 μg/dl with a 95th percentile estimate between 6 and 10 μg/dl. The example shown here includes a calculated increment to blood lead due to exposure to elevated air, soil, and dust lead levels. Although no example is provided for water, the method is formulated to include any medium, and adult exposures to elevated water lead concentrations can be similarly assessed.

We believe this model will be useful in identifying the most important sources of lead exposure in adults and in assessing the potential impacts of anticipated future lead exposures. Information developed from this model may be applied to risk management activities aimed at adult lead exposures. It should be emphasized that we have presented a model with default parameters. These parameters should be modified based on site-specific information. Paired environmental and blood lead data would be useful in assessing these model parameters for adults. In such a situation, the influence of prior lead exposures would be particularly important to evaluate.

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## REFERENCES

1. OSHA, Occupational Safety and Health Standards (29 CFR, Part 1910.1025, July 1, 1991).
2. U.S. EPA, Guidance Manual for Site-Specific Use of the U.S. Environmental Protection Agency LEAD Model (Draft, December, 1991).
3. E. J. O'Flaherty, "Physiologically Based Models for Bone-Seeking Elements IV: Kinetics of Lead Disposition in Humans," *Tox. and Appl. Pharm.* **118**, 16–29 (1993).
4. C. D. Carrington and P. M. Bolger, "Monte Carlo Analysis of Exposure to Lead in the United States (SOT meeting abstract, 1992).
5. A. C. Chamberlain and M. J. Heard, "Lead Tracers and Lead Balances," In: D. R. Lynam, L. G. Piantanida, J. F. Cole, (eds.), *Environmental Lead. Proceedings of the Second International Symposium on Environmental Lead Research* (December 1978,

Cincinnati, Ohio, New York, Academic Press, 1981), pp. 175–198.
6. U.S. EPA, "Review of the National Ambient Air Quality Standards for Lead: Assessment of Scientific and Technical Information OAQPS Staff Paper" (Office of Air Quality Planning and Standards, EPA-450/2-89-022, 1990).
7. D. A. Bellinger, A. Leviton, C. Waterhaux, H. L. Needleman, and M. Rabinowitz, "Longitudinal Analyses of Prenatal and Postnatal Lead Exposure and Early Cognitive Development," *N. Engl. J. Med.* **316**, 1037–1043 (1987).
8. D. Bellinger, J. Sloman, A. Leviton, M. Rabinowitz, H. L. Needleman, and C. Waterhaux, "Low-Level Lead Exposure and Children's Cognitive Function in Preschool Years," *Pediatrics* **87**, 219–227 (1991).
9. A. Leviton, D. Bellinger, E. N. Allred, M. Rabinowitz, H. Needleman, and S. Schoenbaum, "Pre- and Postnatal Low-Level Lead Exposure and Children's Dysfunction in School," *Environ.* **60**, 30–43 (1993).
10. J. Schwartz, "Lead, Blood Pressure, and Cardiovascular Disease," In: H. L. Needleman (ed.), *Human Lead Exposure* (CRC Press, Boca Raton, Florida, 1992), pp. 223–232.
11. R. P. Weeden, "Lead, the Kidney, and Hypertension," In: H. L. Needleman (ed.), *Human Lead Exposure* (CRC Press, Boca Raton, Florida, 1992), pp. 169–190.
12. M. Rabinowitz, D. Bellinger, A. Leviton, H. Needleman, and S. Schoenbaum, "Pregnancy Hypertension Blood Pressure During Labor and Blood Lead Levels," *Hypertens.* 9:447–452 (1987).
13. Butte-Silver Bow DOH and UCDEH, "The Butte-Silver Bow Environmental Health Lead Study," (Butte-Silver Bow Department of Health, Butte, Montana, and University of Cincinnati, Department of Environmental Health, Cincinnati, Ohio, 1991).
14. R. L. Bornschein, S. Clark, and W. Pan, "Midvale Community Lead Study" (Final report, University of Cincinnati, Department of Environmental Health, Cincinnati, Ohio, 1990).
15. T. E. McKone and J. I. Daniels, "Estimating Human Exposure Through Multiple Pathways from Air, Water, and Soil," *Reg. Tox. and Pharm.* **13**, 36–61 (1991).
16. M. J. Steele, B. D. Beck, B. L. Murphy, and H. S. Strauss, "Assessing the Contribution from Lead in Mining Wastes to Blood Lead," *Reg. Tox. and Pharm.* **11**, 158–190 (1990).
17. C. P. Hemphill, M. V. Ruby, B. D. Beck, A. Davis, and P. D. Bergstrom, "The Bioavailability of Lead in Mining Wastes: Physical/Chemical Considerations," *Chemical Speciation and Bioavailability* **3**, 135–148 (1991).
18. U.S. EPA, "Risk Assessment Guidance for Superfund" (Office of Emergency and Remedial Response, December 1989).
19. H. M. James, M. E. Hilburn, and J. A. Blair, "Effects of Meal and Meal Times on Uptake of Lead from the Gastrointestinal Tract in Humans," *Human Toxicol.* **4**, 401–407 (1985).
20. D. W. Layton, "Metabolically Consistent Breathing Rates for Use in Dose Assessments," *Health Physics* (1992).
21. U.S. EPA, "Air Quality Criteria for Lead," (Environmental Criteria and Assessment Office, June 1986).
22. S. J. Pocock, A. G. Shaper, M. Walker, C. J. Wale, B. Clayton, T. Delves, R. F. Lacey, R. F. Packham, and P. Powell, "Effects of Tap Water Lead, Water Hardness, Alcohol, and Cigarettes on Blood Lead Concentrations," *Jour. Epidem. Comm. Health* **37**, 1–7 (1983).