LONGHORN ARMY AMMUNITION PLANT

KARNACK, TEXAS

ADMINISTRATIVE RECORD

VOLUME 4 of 5

1993

Bate Stamp Numbers
006667 - 007322

Prepared for:

Department of the Army
Longhorn Army Ammunition Plant
Marshall, Texas 75671-1059

1995

VOLUME 4 of 5

1993

P. Title: Final Workplan - Remedial Investigation (RI) Site Health & Safety Plan
Group(s): 1 (Partial)
Site(s): LHAAP-1 Inert Burning Grounds
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Company: Roy F. Weston, Inc.
Author(s): Roy F. Weston, Inc.
Recipient: U.S. Army Corps of Engineers, Tulsa District
Date: September, 1993
Bate Stamp: 006667 - 006882

Q. Title: Final Workplan - Remedial Investigation (RI) Chemical Data Acquisition Plan Addendum For LHAAP-1
Group(s): 1 (Partial)
Site(s): LHAAP-1 Inert Burning Ground
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Company: Roy F.Weston, Inc.
Author(s): Roy F. Weston, Inc.
Recipient: U.S. Army Corps of Engineers, Tulsa District
Date: September, 1993
Bate Stamp: 006883 - 007207

R. Title: Final Workplan - Remedial Investigation / Feasibility Study (RI / FS) Final Work Plan Addendum
Group(s): Early Interim Action At Burning Ground No. 3
Site(s): LHAAP-18 & LHAAP-24 Burning Ground / Washout Pond & Evaporation Pond
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Company: Roy F. Weston, Inc.
Author(s): Roy F. Weston, Inc.
Recipient: U.S. Army, Longhorn Army Ammunition Plant
Date: September, 1993
Bate Stamp: 007208 - 007246

S. Title: Letter - Subject: Approval Of Final Work Plan For Additional Investigation At Unlined Evaporation Pond / Burning Ground No. 3
Group(s): Early Interim Action At Burning Ground No. 3
Site(s): LHAAP-18 & LHAAP-24 Burning Ground / Washout Pond & Unlined Evaporation Pond
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Agency: Department Of The Army, Longhorn Army Ammunition Plant
Author(s): Lisa Marie Price, Environmental Protection Agency
Recipient: Lynn Muckelrath, Longhorn Army Ammunition Plant

VOLUME 4 of 5 (Continued)

1993

Date: September 9, 1993
Bate Stamp: 007247

T. Title: Letter - Subject: Approval Of Final Work Plan For Additional Investigation At Unlined Evaporation Pond / Burning Ground No. 3
Group(s): Early Interim Action At Burning Ground No. 3
Site(s): LHAAP-18 & LHAAP-24 Burning Ground / Washout Pond & Unlined Evaporation Pond
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Agency: Texas Water Commission
Author(s): Michael A. Moore, Superfund Investigation Section
Recipient: Lynn Muckelrath, Longhorn Army Ammunition Plant
Date: September 13, 1993
Bate Stamp: 007248 - 007250

U. Title: Meeting Agenda - LHAAP Technical Review Committee Meeting, March 10, 1994
Attach(s): Attendance List
Summary Of Events During Phase I Sumps Investigation
Group(s): All
Site(s): General
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Agency: U.S. Army
Author(s): U.S. Army Corps of Engineers, Tulsa District
Recipient: Meeting Participants
Date: September 14, 1993
Bate Stamp: 007251 - 007253

V. Title: Letter - Subject: Final Work Plan For Additional Investigation At Unlined Evaporation Pond / Burning Ground No. 3
Group(s): Early Interim Action At Burning Ground No. 3
Site(s): LHAAP-18 & LHAAP-24 Burning Ground / Washout Pond & Unlined Evaporation Pond
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Agency: Department Of The Army, Longhorn Army Ammunition Plant
Author(s): Lawrence J. Sowa, Lieutenant Colonel, U.S. Army
Recipient: Lisa Marie Price, Environmental Protection Agency
Date: October 6, 1993
Bate Stamp: 007254 - 007275

W. Title: Public Notice - Finding Of No Significant Impact - Environmental Assessment For The Proposed Treatment Area For Burning Ground No. 3 Longhorn Army Ammunition

VOLUME 4 of 5 (Continued)

1993

Plant
Group(s): Early Interim Action At Burning Ground No. 3
Site(s): LHAAP-18 & LHAAP-24 Burning Ground / Washout Pond & Unlined Evaporation Pond
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Company: Thiokol Corporation
Author(s): William A. Sniffen, Environmental Engineer
Recipient: U.S. Public
Date: December, 1993
Bate Stamp: 007276 - 007287

X. Title: Letter - Subject: Meeting, LHAAP, for Technical Review Committee - December 8, 1993
Attach(s): Meeting Agenda
Group(s): All
Site(s): General
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Agency: Department Of The Army, Longhorn Army Ammunition Plant
Author(s): Lawrence J. Sowa, Lieutenant Colonel, U.S. Army
Recipient: Ms. Lisa M. Price, Environmental Protection Agency
Date: December 1, 1993
Bate Stamp: 007288 - 007289

Y. Title: Letter - Draft Revised Schedule Federal Facility Agreement
Group(s): All
Site(s): General
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Agency: Department Of The Army, Longhorn Army Ammunition Plant
Author(s): Lawrence J. Sowa, Lieutenant Colonel, U.S. Army
Recipient: Ms. Lisa M. Price, Environmental Protection Agency
Date: December 2, 1993
Bate Stamp: 007290 - 007313

Z. Title: Meeting Agenda - LHAAP Technical Review Committee Meeting, December 8, 1993
Attach(s): Attendance List
Overhead Slide - RI Phase I Accomplishment
Overhead Slide - Environmental Activities Since 16 Nov 93
Overhead Slide - Phase I RI at Area LHAAP-1A
Overhead Slide - Preliminary results from RMIS 35 (Sumps) RI

VOLUME 4 of 5 (Continued)

1993

Overhead Slide - Phase I IRA at Burning Ground #3 & UEP
Group(s): All
Site(s): General
Location: Longhorn Army Ammunition Plant, Marshall, Texas
Agency: U.S. Army
Author(s): U.S. Army Corps of Engineers, Tulsa District
Recipient: Meeting Participants
Date: December 8, 1993
Bate Stamp: 007314 - 007322

006667

LONGHORN ARMY AMMUNITION PLANT

REMEDIAL INVESTIGATION/FEASIBILITY STUDY
DRAFT SITE HEALTH AND SAFETY PLAN
FOR AREA LHAAP-1A

Prepared for:

U.S. ARMY ENGINEER DISTRICT
TULSA DISTRICT

CONTRACT NO. DACA56-93-D-0008
DELIVERY ORDER NO. 1

Submitted by:

Roy F. Weston, Inc.
5599 San Felipe, Suite 700
Houston, Texas 77056

NOTICE

The information in this document has been funded by the U.S. Army Corps of Engineers (USACE) under Contract No. DACA-56-93-D-0008 to Roy F. Weston, Inc. (WESTON®). This document has not been formally released by either WESTON or the USACE. This document should not be cited or quoted.

LONGHORN ARMY AMMUNITION PLANT
REMEDIAL INVESTIGATION
DRAFT SITE HEALTH AND SAFETY PLAN

TABLE OF CONTENTS

SECTION	TITLE	PAGE
1.0	INTRODUCTION	1-1
2.0	PROJECT LOCATION AND BACKGROUND	2-1
2.1	BACKGROUND	2-1
2.2	PROJECT LOCATION	2-1
2.3	SITE DESCRIPTION	2-2
3.0	PROJECT DESCRIPTION	3-1
4.0	PROJECT ORGANIZATION AND RESPONSIBILITIES	4-1
4.1	RESPONSIBILITY FOR HEALTH AND SAFETY	4-1
4.1.1	Site Safety Management Structure	4-2
4.1.2	Health and Safety Officer	4-3
4.1.3	Site Health and Safety Coordinator	4-3
4.2	SELECTION OF PERSONNEL FOR THE SCREENING SITE INSPECTION	4-6
4.2.1	Additional Training	4-6
4.2.2	Subcontractor Safety	4-6
4.3	MEDICAL SURVEILLANCE PROGRAM	4-8
4.3.1	Objective	4-8
4.3.2	Purpose	4-9
4.3.3	Health Monitoring and Maintenance	4-9
4.3.4	Emergency Medical Care and Treatment	4-10
4.4	TRAINING	4-12
4.4.1	Pre-Entry Training	4-12
5.0	HAZARD ASSESSMENT	5-1
6.0	SITE WORK ZONES AND COMMUNICATIONS	6-1
7.0	MONITORING PROCEDURES AND ACTION LEVELS	7-1
8.0	PERSONAL PROTECTIVE EQUIPMENT	8-1
9.0	DECONTAMINATION PROCEDURES	9-1
10.0	EMERGENCY RESPONSE PROCEDURE	10-1
11.0	PLAN APPROVAL	11-1

LONGHORN ARMY AMMUNITION PLANT
REMEDIAL INVESTIGATION
DRAFT SITE HEALTH AND SAFETY PLAN

LIST OF FIGURES

SECTION	TITLE	PAGE
2-1	Location Map	2-3
2-2	Map of Inert Burning Grounds	2-4
4-1	Site Safety Management Structure	4-3

APPENDICES

Appendix A - LHAAP-1A Site Specific Health and Safety Plan

Appendix B - WESTON Standard Incident Report and Follow-Up Form

1.0 INTRODUCTION

A Remedial Investigation/Feasibility Study (RI/FS) is under way at 13 Solid Waste Management Units (SWMUs) at Longhorn Army Ammunition Plant (LHAAP), Karnack, Texas under a Federal Facilities Agreement (FFA) between the U.S. Environmental Protection Agency (EPA), Texas Natural Resource Conservation Commission (TNRCC), and Department of the Army. The FFA requires an RI/FS under the Comprehensive Environmental Response, Compensation and Liability act (CERCLA) to characterize the nature and extent of contamination at the 13 areas and develop a remedy of remediation of each area. During the RI Work Plan development for the Inert Burning Grounds, SWMU No. LHAAP-1, an additional area to be investigated was identified northwest of this site. Roy F. Weston, Inc. (WESTON®) has been contracted by the U.S. Army Corps of Engineers (USACE), Tulsa District under Contract No. DACA56-93-D-0008, Delivery Order No. 1, to prepare an RI/FS Work Plan Addendum to describe the RI of this additional area, identified as LHAAP-1A.

This site Health and Site Safety Plan (HASP) establishes procedures to protect workers, visitors, and the community from potential health and safety hazards during the RI of area LHAAP-1A. Remedial investigation field activities are described in detail in the following documents: Longhorn Army Ammunition Plan RI/FS Work Plan Volume 1 - General (USACE, June 1992, Longhorn Army Ammunition Plan RI/FS Work Plan Volume 2 - Chemical Data Acquisition Plan (USACE, June 1992), Field Work Plan Addendum, Remedial Investigation, Longhorn Army Ammunition Plant (WESTON, September 1993), and Chemical Data Acquisition Plan Addendum, Remedial Investigation, Longhorn Army

Ammunition Plant (WESTON, September 1993). These aforementioned documents were used as references to prepare this HASP.

This document has been prepared in accordance with OSHA regulations set forth in 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response; with the Longhorn Army Ammunition Plant RI/FS Work Plan Volume 3 - Site Safety and Health Plan (USACE, June 1992).

2.0 PROJECT LOCATION AND BACKGROUND

2.1 BACKGROUND

The Longhorn Army Ammunition Plant (LHAAP) is a government-owned, contractor-operated industrial facility under the jurisdiction of the U.S. Army Armament, Munitions, and Chemical Command. LHAAP was established in October 1942 with the primary mission of producing 2,4,6-trinitrotoluene (2,4,6-TNT) flake. Flake production halted in 1945 and the primary mission changed to the current mission of load, assembly, and pack (LAP) of pyrotechnic and illuminating/signal munitions and solid propellant rocket motors. The long history of these types of industrial operations at LHAAP resulted in the disposal of hazardous wastes into pits, landfills, streams, and earthen impoundments where contamination is suspected or has been identified. The Longhorn Division of Thiokol Corporation is the current operating contractor.

2.2 PROJECT LOCATION

The Longhorn Army Ammunition Plant (LHAAP) is located in 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. A location map for the installation is shown on Figure 2-1.

LHAAP is located in a moist, subhumid to humid, mild climate. The average annual rainfall is 46 inches. Precipitation is fairly evenly distributed throughout the year, although summer and fall are frequently drought seasons, and December through May are often the wettest months. Precipitation almost always occurs as rain, with snow a rare occurrence.

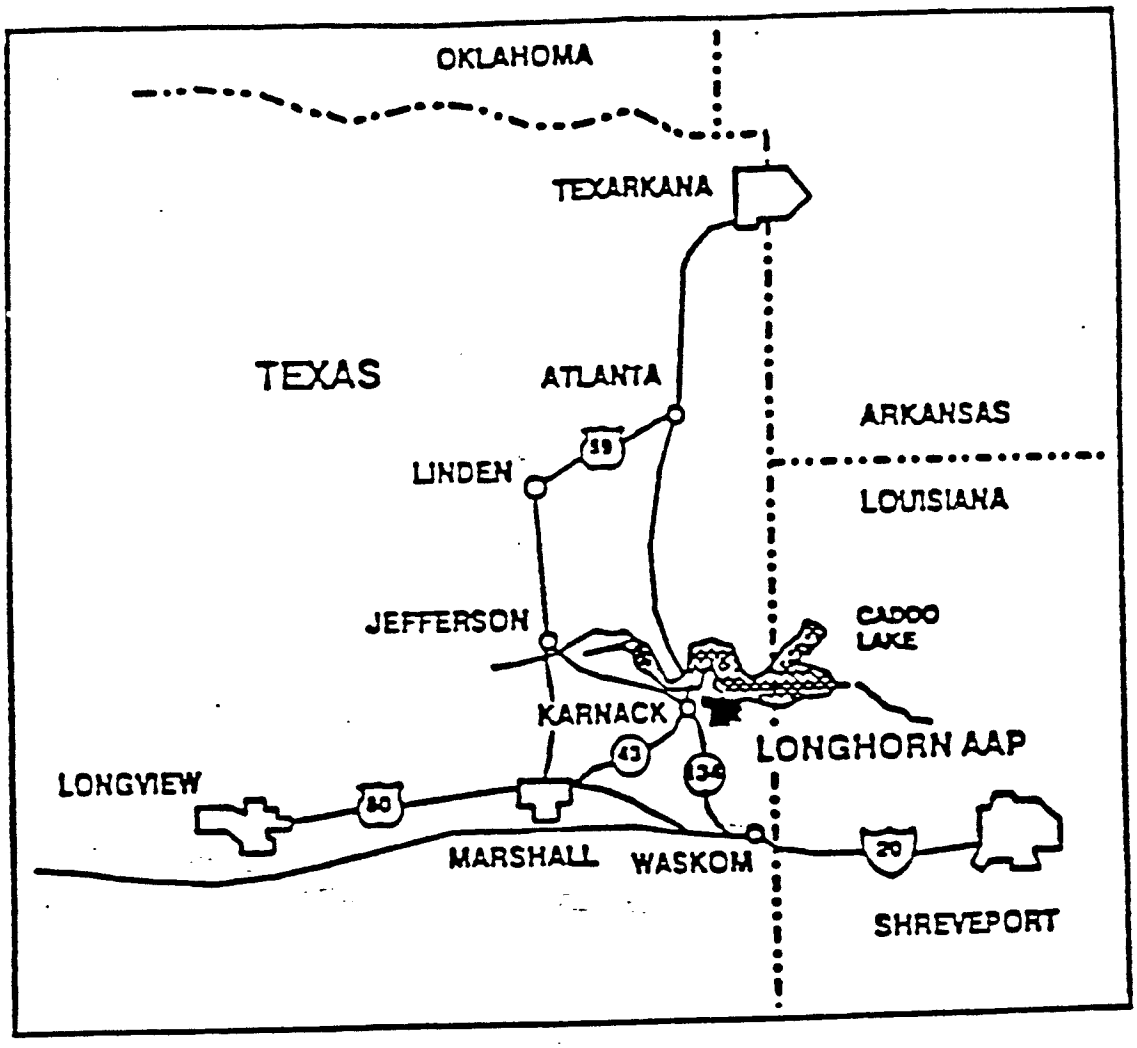
2.3 SITE DESCRIPTION

The site is situated in the extreme northwestern portion of LHAAP, as shown on Figure 2-2. The site is located directly adjacent to the northwest boundary of LHAAP-1. A detailed map of the southernmost portion of the Inert Burning Grounds and surrounding area is shown on Figure 2-3. It depicts detailed topography and surface drainage patterns, estimated groundwater flow direction, location of previous sampling points, and the suspected limit of the site. Also shown are roads, fences, and limited vegetation information with heavily timbered areas differentiated from lightly or nontimbered areas. The limits of this area of the site were established on the basis of field observations, detailed topographic information, and vegetation patterns. Current vegetation patterns serve as only a rough indicator of past disposal areas because there has been considerable regrowth of trees during the 25 or more years that have elapsed since the site was used for waste disposal. This additional area of the Inert Burning Grounds covers an area of approximately 4.8 acres.

FIGURE 2-1 GENERAL SITE LOCATION MAP

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

006674



SOURCE: EBASCO SERVICES, INC.

General soil and geologic maps and the boring data for nearby monitoring well 104 indicate the site is located within the outcrop of the Wilcox Group of sediments that typically consist of interbedded sands, silts, and clays. At this site, these sediments appear to be overlain by a few feet of residually-derived soils and/or fill materials. Depth to groundwater probably averages about five feet with some seasonal fluctuation. The groundwater hydraulic gradient is expected to be topographically controlled, with the general flow directions as indicated on Figure 2-3. The regional flow direction across the site is assumed to be toward the southeast.

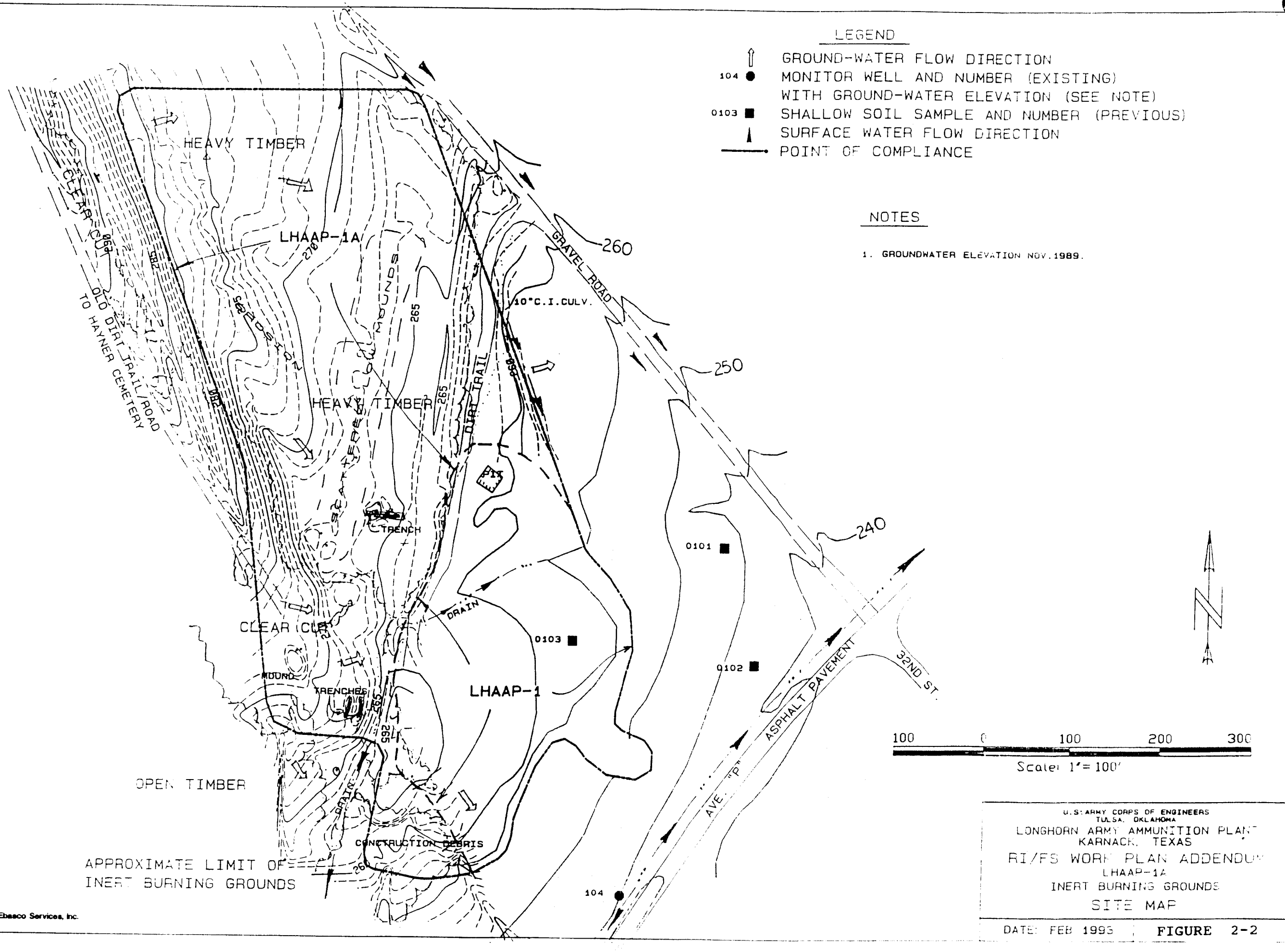
As shown on Figure 2-3, surface drainage from the site collects in ditches alongside Avenue P and 32nd Street, then passes through either the concrete culvert across 32nd Street at its intersection with Avenue P or the concrete culvert across Avenue P near well 104. The site's surface drainage eventually enters Goose Prairie Creek, which flows into Caddo Lake. The total flow distance from the site to Caddo Lake is approximately three miles.

LEGEND

- GROUND-WATER FLOW DIRECTION
- 104 ● MONITOR WELL AND NUMBER (EXISTING) WITH GROUND-WATER ELEVATION (SEE NOTE)
- 0103 ■ SHALLOW SOIL SAMPLE AND NUMBER (PREVIOUS)
- SURFACE WATER FLOW DIRECTION
- POINT OF COMPLIANCE

NOTES

1. GROUNDWATER ELEVATION NOV.1989.



Source: Ebasco Services, Inc.

U.S. ARMY CORPS OF ENGINEERS
TULSA, OKLAHOMA
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RI/FS WORK PLAN ADDENDUM
LHAAP-1A
INERT BURNING GROUNDS
SITE MAP

DATE: FEB 1993 **FIGURE 2-2**

3.0 PROJECT DESCRIPTION

The proposed field investigation for area LHAAP-1A includes the following:

Four	-	7-foot soil borings
Four	-	Groundwater grab samples from soil borings
Five	-	25-foot monitoring wells to be installed
Five	-	Monitoring wells to be sampled
Three	-	Surface water/sediment sample locations*

*Includes one background location.

Boring depths are estimated based on an anticipated depth to groundwater of five feet, with borings continuing at least two feet past the depth where groundwater is encountered. Actual depths may vary depending on the subsurface conditions encountered during investigations.

4.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The following sections briefly provide an overview of the WESTON Health and Safety Program, and describe the health and safety designations as well as general responsibilities which will be utilized for this investigation.

The WESTON Health and Safety Program is designed to oversee the medical surveillance programs, training programs, preparation and implementation of project safety plans; set standard operating procedures; and to ensure compliance of individuals working on hazardous waste sites with the OSHA regulations governing workplace health and safety.

4.1 RESPONSIBILITY FOR HEALTH AND SAFETY

George Crawford, WESTON's Corporate Health and Safety Director has the overall responsibility and authority to implement the Corporate Health and Safety Program. Division Managers have the responsibility to implement the Health and Safety Program in each division and regional office, and appoint qualified Division and Regional Safety Officers (DSO, RSO) to assist in administering the program. The Health and Safety Director reviews and approves the designation of DSOs/RSOs. Darryl Drenon is WESTON's Southcentral Health and Safety Manager/Regional Safety Officer (HSM/RSO).

All subcontractors are required to adhere to WESTON's Health & Safety Plan (HASP) unless a separate plan, which must be accepted by WESTON's Health & Safety Department, is submitted by the subcontractor. If the subcontractor chooses to follow

WESTON's plan, employees of the subcontractor must submit their signature verifying that they have read the plan and agree to follow it.

4.1.1 Site Safety Management Structure

WESTON's Health and Safety Policy assigns health and safety responsibility to all levels of management and project implementation.

Division, Regional, and Program Managers are charged with having effective health and safety programs. This responsibility is delegated to the DSO or RSO who assist with, review and approve HASPs, perform safety audits, ensure personnel are certified to work, investigate incidents and maintain liaison with Corporate Health and Safety. The DSO or RSO delegates the preparation of the HASP to a WESTON employee who is knowledgeable of the Southcentral Region's Health and Safety Program and who can competently serve as the site Health and Safety Officer (HSO).

Project Directors' and Project Managers' responsibilities include ensuring HASPs are prepared and implemented for each of their projects and the assignment of competent Site Health and Safety Coordinators (SHSC).

The SHSC, who must be certified by the Corporate Health and Safety Director, is responsible for ensuring that all personnel and activities are in conformance with the protocols defined in the Site HASP. The SHSC has authority over Health and Safety matters on-site and may stop work if Health and Safety procedures are compromised or are

not adequate. The SHSC maintains contact with appropriate Safety Officers or WESTON Corporate Health and Safety. The HSM/RSO will use an audit program to ensure that the defined health and safety protocols are being implemented in the field. The site health and safety management structure for the LHAAP1-A area is presented in Figure 4-1.

4.1.2 Health and Safety Manager/Regional Safety Officer

The safety program quality control will be maintained through review of project activity reports by the Health and Safety Manager/Regional Safety Officer (HSM/RSO). During these quality control checks, the HSM/RSO will monitor general safety and operating procedures, ensure that the personnel monitoring program is being carried out correctly, and verify that the results of safety tests are being interpreted accurately. The HSM/RSO will institute corrective action in any instance where it may be necessary. The HSO will assist the HSM/RSO as needed. The principal duties of the HSM/RSO include:

- Assistance in the initial site hazard analysis;
- Review and approval of the safety plan; and
- Quality control of the safety program throughout the duration of the project.

4.1.3 Site Health and Safety Coordinator

The SHSC, who must be certified by the Corporate Health and Safety Director, will administer the safety program at the site on a day-to-day basis. This duty involves supervision of the investigation study operation to insure that it is being conducted in a safe

manner. He or she is responsible for making sure that all safety regulations are adhered to by persons entering the work site. The SHSC will have the authority to stop activities at the site at any time there is a perceived imminent danger. Duties of the SHSC include:

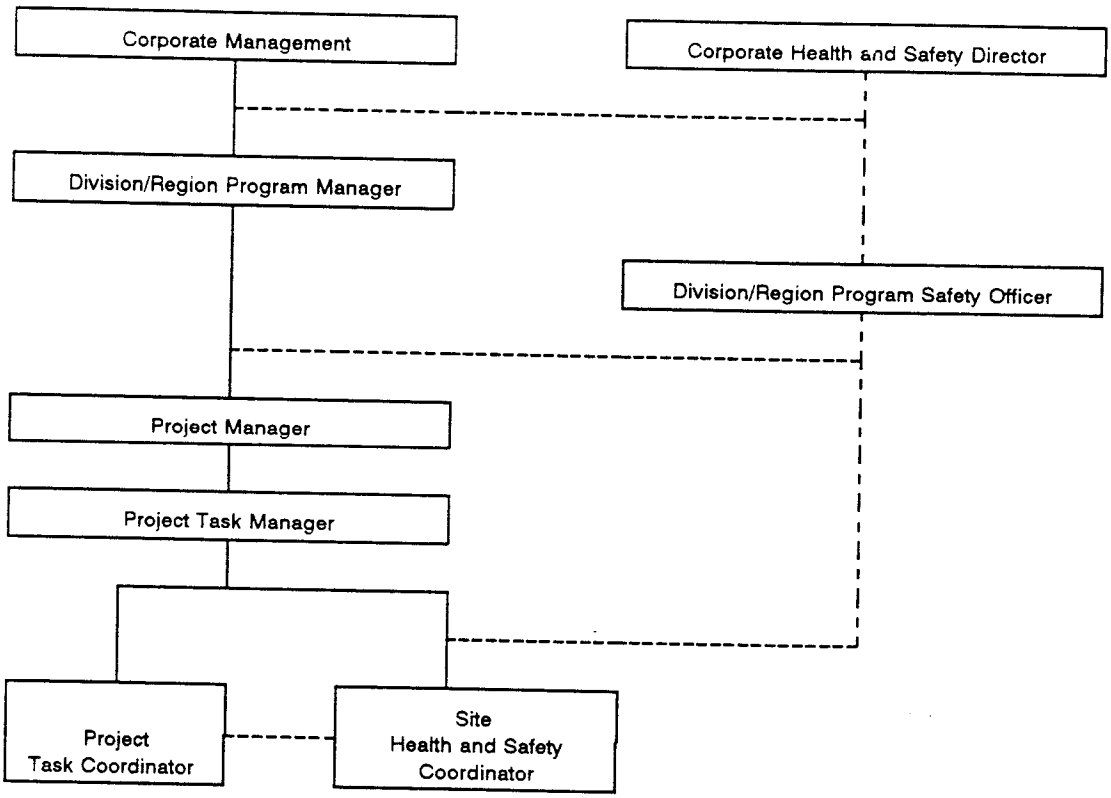
- Administer and enforce site safety plan;
- With the Task Coordinator and Health and Safety Officer, oversee the mobilization of equipment, conduct initial site survey, and monitor site preparation and decontamination procedures;
- Obtain and interpret instrument readings for the purpose of monitoring conditions on the site;
- Monitor and record personnel air monitoring data;
- Determine levels of protection needed on a daily basis;
- Conduct safety briefings; and
- Modify safety plan as needed.

Figure 4-1

SITE HEALTH AND SAFETY MANAGEMENT STRUCTURE

LHAAP-1A

REMEDIAL INVESTIGATION



4.2 SELECTION OF PERSONNEL FOR THE REMEDIAL INVESTIGATION

All personnel involved in the remedial investigation are participating in the medical surveillance program, have attended a 40-hour health and safety training program, respirator fit tested, and have been informed of the potential hazards at the site:

Project Manager:	Michael E. Cavalier, P.E.
Task Manager:	Teri L. Schmidt, P.E.
Field Sampling Task Coordinator/ Alt. SHSC:	Shekhar Iyer
Data Eval./Report Preparation:	Andy Kallus
Field Team Leader/SHSC:	Steve Mitchell

4.2.1 Additional Training

The SHSC has received an additional eight (8) hours of health and safety instruction. The SHSC has also received additional training in the operation of air monitoring equipment and has been fit tested. In addition, the SHSC will be trained in the proper application of first aid, CPR and hazardous material shipping and bloodborne pathogens.

4.2.2 Subcontractor Safety

Subcontractors performing activities at Longhorn Army Ammunition Plan, Karnack, Texas, will be required to present an adequate health and safety program to WESTON's HSM/RSO

for acceptance and/or abide by WESTON's Health and Safety Plan in order to participate in this project. During the project, the subcontractor must adhere to their own site safety plan and/or to WESTON's H&S Plan. The SHSC is responsible for monitoring the contractor's safety procedures.

Drilling Subcontractor

The subcontractor for the drilling activities is:

A. W. Pool, Inc.
Rt. #1, 133 B
Clinton, OK 73601
(405) 323-3454

The personnel representative for this company is Mr. Winston Pool. A. W. Pool, Inc. will follow WESTON's HASP.

UXO Team

The UXO team will consist of a UXO Supervisor (Team Leader) and a UXO specialist (Team member). Both are graduates of the U.S. Naval Explosive Ordnance Disposal (EOD) School, with the UXO Supervisor having served more than 15 years in active duty military EOD assignments and the UXO specialist having served more than 10 years in

active duty military EOD assignments. The UXO Team Leader will be responsible for all UXO-explosive safety on the site.

Surveying Subcontractor

The subcontractor for the project's surveying activities is:

Landtech Consultants

2627 N. Loop West, Ste. 224

Houston, Texas 77008

The personnel representative for this company is Mr. Thomas A. Staudt. Landtech Consultants will follow WESTON's HASP.

4.3 MEDICAL SURVEILLANCE PROGRAM

4.3.1 Objective

The medical monitoring program has been established and maintained to safeguard the health of site personnel who are active in hazardous waste site work.

4.3.2 Purpose

The medical program provides the following essential services to protect the health of on-site field personnel:

- Health monitoring and maintenance,
- Emergency medical care and treatment, and
- Site specific health monitoring.

4.3.3 Health Monitoring and Maintenance

Health monitoring and maintenance consists of the following programs:

- Pre-exposure medical examination to establish the individual's state of health, baseline physiological data, and the ability to wear and adequately function while wearing personnel protective equipment;

- Arrangements to provide special medical examinations, care, and counseling in case of known or suspected exposures to toxic substances while involved with this project. Any special tests performed depend on the chemical substance to which the individual has been exposed;

- Annual medical examinations to continue to monitor the individual's health and detect any physiological changes which may be a result of work at hazardous waste sites;

- Each employee involved with hazardous projects and participating in the medical monitoring program is required to undergo an exit medical examination upon termination of employment at WESTON. Data gathered during this examination updates the individual's physiological status following his/her involvement with this project;

- Medical records of all project participants are maintained in complete and accurate form by the WESTON Health and Safety office for a minimum of 30 years. This program will effectively establish and maintain a medical portfolio on all project participants which will document the effects of hazardous substance exposure during the course of the site investigation operation; and

- Monthly records of field experience and field exposure are maintained in WESTON's Houston Office for each employee.

4.3.4 Emergency Medical Care and Treatment

Emergency medical care and treatment of Screening Site Inspection personnel, including possible exposure to toxic substances and injuries due to accidents or physical problems will be addressed by the following emergency care provisions:

1. Name, address, and telephone number of the nearest medical treatment facility will be conspicuously posted at the site. A map and directions to the facility, plus the travel time, will be readily available.

2. All administrative arrangements for accepting patients will be made in advance with the facility.

3. Arrangements will be made to quickly obtain ambulance, emergency, fire, and police services. Telephone numbers and procedures for obtaining these services will be conspicuously posted at the site.

4. Eye wash stations and first aid equipment will be readily available on site. A first aid station will be located at the support area on site.

5. Every supervisory WESTON person on the site will have current certification in application of first aid and cardiopulmonary resuscitation (CPR) and will have received Bloodborne Pathogens training.

6. Provisions will be made for rapid identification of the substance to which the worker has been exposed (if this has not previously been done). This information must be given to medical personnel.

7. Rest areas will be located in a non-contaminated area near the daily work areas and drilling sites. Water will be provided in the rest areas.

4.4 TRAINING

4.4.1 Pre-Entry Training

Prior to entering sites for sampling events, the employee must attend the WESTON corporate health and safety training program. The forty hour program covers the following topics:

- Introduction to incident response,
- Hazard recognition and evaluation,
- Personnel exposure guidelines/toxicology,
- Protective clothing,
- Respiratory protection,
- Air purifying respirators,
- Self-contained breathing apparatus (SCBA),
- Standard operating safety procedures,
    - Levels of protection
    - Site entry-survey and reconnaissance
    - Personnel and equipment decontamination
    - Response organization and evaluation
    - Simulated field exercises
- Air monitoring instruments,
- Communication devices and procedures,
- Sampling techniques and equipment,

- Hazardous materials shipping,
- Legal considerations,
- Regulations,
- Construction safety, and
- Radiation safety.

All personnel involved in the sampling efforts will be required to familiarize themselves with the site specific safety hazards by reading and signing the site specific safety plan.

5.0 HAZARD ASSESSMENT

A hazard assessment and task-by-task risk analysis is provided in Section II, Health and Safety Evaluation, of the Longhorn Army Ammunition Plant - Site Specific Health and Safety Plan, area LHAAP-1A included as Appendix A.

6.0 SITE WORK ZONES AND COMMUNICATIONS

For a discussion of site work zones and communications, see Section VI, Contingency Plans, of the Longhorn Army Ammunition Plant - Site Specific Health and Safety Plan, area LHAAP-1A provided in Appendix A.

7.0 MONITORING PROCEDURES AND ACTION LEVELS

For a discussion of monitoring procedures and action levels, see Section III, Personnel Protection Plan, of the Longhorn Army Ammunition Plant - Site Specific Health and Safety Plan, provided in Appendix A. Additional information on monitoring area procedures is discussed below.

Since LHAAP-1A is a suspected burial site for bulk TNT, during drilling the UXO team will test concentrations of TNT and RDX in soil in a mobile laboratory to ensure the safety of the field crew operating at the rig. Soil samples will be tested at least every 5 feet or when suspect material is encountered. Testing will continue until a clay layer at least 2 feet thick is encountered or the boring reaches a depth of 25 feet.

8.0 PERSONNEL PROTECTIVE EQUIPMENT

For a discussion of personnel protective equipment (PPE) to be used in the field investigation, see Section III, Personnel Protection Plan, of the Longhorn Army Ammunition Plant - Site Specific Health and Safety Plan, provided in Appendix A. It should be noted that this HASP makes provisions for the adjustment of protection levels. The type of equipment used and the overall level of protection should be reevaluated periodically as the amount of information about the site increases, and as workers are required to perform different tasks. The level of protection appropriate for the task and working conditions will be determine by the SHSC in consultation with the HSM/RSO. Protection levels may be upgraded and downgraded based on monitoring results or physical conditions (e.g. blowing dust) on site. Changes in protection levels will be made in accordance with the following criteria:

Reasons to Upgrade:

- Known or suspected presence of dermal hazards,
- Occurrence or likely occurrence of gas or vapor emission,
- Change in work task that will increase contact or potential contact with hazardous materials, and
- Request of the individual performing the task.

Reasons to Downgrade:

- New information indicating that the situation is less hazardous than originally thought,

- Change in site conditions that decreases the hazard, and

- Change in work task that will reduce contact with hazardous materials.

Any changes to the procedures set forth in this HASP will be documented by the SHSC in the site logbook. All changes must be approved by the HSM/RO.

9.0 DECONTAMINATION PROCEDURES

For a discussion of decontamination procedures, see Section V, Decontamination Plan, of the Longhorn Army Ammunition Plant - Site Specific Health and Safety Plan, provided in Appendix A.

10.0 EMERGENCY RESPONSE PROCEDURES

The Emergency Response Plan is detailed in Section VI, Contingency Plans, of the Longhorn Army Ammunition Plant - Site Specific Health and Safety Plan, provided in Appendix A.

The following additional procedures for incident investigation and reporting will also be implemented. All series mishaps requiring emergency response will be reported immediately by telephone to the HSM/RSO. A written report and/or memo will be forwarded to the HSM/RSO within 24 hours of the incident. The report form should be detailed and also contain recommendations to prevent recurrence. The WESTON Standard Incident Report and Follow-up Form (See Appendix B) will be used to assist in the investigation of serious incidents or accidents on site.

11.0 PLAN APPROVAL

By their signature, following, the undersigned certify that this Site Specific Health and Safety Plan will be utilized for the protection of the health and safety of workers during the field investigation of the Longhorn Army Ammunition Plant Site.

_____	_____
Health and Safety Officer	Date
_____	_____
Site Safety Coordinator	Date
_____	_____
Project Manager	Date
_____	_____
Contract Manager	Date
_____	_____
Health and Safety Manager/ Regional Safety Officer	Date

006699

APPENDIX A

LHAAP-1A
Site Specific Health and Safety Plan

SITE SPECIFIC HEALTH AND SAFETY PLAN (HASP) FORM

Prepared By: Robert L Deese
W. O. #: 03886-087-001-0020

Date 9/14/93

I. General Information

A. Project Identification

1. Division: SCR
2. Department/Office: Consulting (000536 & 00910), Houston, TX.
3. Site Name: Longhorn Army Ammunition Plnt. (LHAAP-1A)
4. Client: U.S. Army Corps of Engr. Dist. Tulsa
5. Work Location Address: Longhorn Army Ammunition Plnt., Karnack, TX

B. Site History

1. Describe briefly: LHAAP is a government - owned, contractor operated armament and munitions industrial facility.

C. Scope of Work

1. Describe briefly: Perform a Remedial Investigation (RI) at LHAAP-1A Inert Burning Grounds to determine presence, nature, and extent of hazardous waste contamination to determine the risk posed to public health and the environment, and evaluate a feasible remedial action alternative for each area.

Site Visit only, Site HASP not necessary, list personnel here and sign below:

_____, _____, _____, _____

D. Hazard Assessment and Regulatory Status

Indicate Yes (Y) or No (N) to:

1. Types of hazards anticipated.

(Y) Physio-chemical

Toxic Chemical - Levels

(N)	>TLV-TWA	(N)	>TLV-STEL
(N)	>IDLH	(Y)	Bio-Hazards
(N)	Radiation	(Y)	Physical
(Y)	Construction type	(Y)	Industrial type
(N)	Nuclear Industry type		

2. Approve /: _

( ) a.
( ) b.

Project Start Da
Reissued/Reappro

Amendment Date

F. Key Personne

1. WESTO

Organization/

WESTON/Hc

WESTON/Hc

WESTON/Hc

WESTON/Hc

WESTON/Hc

WESTON/Hc

2. Roles an

The PM
performe afely
ensuring saf
HSO ser

2. Site Regulatory Status:

CERCLA/SARA

(Y) U.S. EPA (Y) State
(Y) NPL Site

RCRA

(N) U.S. EPA (N) State

OSHA

(Y) 1910 (Y) 1926
(N) State

NRC

(N) 10 CFR 20

Other Federal Agency)

(N) DOE (N) USATH
(N) Air Force

Based on the Hazard Assessment and Regulat
Standard HASP(s) applicable to this project. Indi
HASP will be used and append the appropriate
with the Standard Plan.

3. Standard Plan to be used:

(N)	Stack Test	(N)	Air Emis
(N)	Asbestos	(N)	Industria
(N)	Life Systems	(Y)	Hazardo
(N)	Construction	(N)	NRC/DC
(N)	USATHAMA	(N)	Air Forc

E. Review and Approval Documentation

1. Reviewed by:

a. P.M. _____
b. P.D. _____
c. DSO/RSO _____
d. SHSC _____

of the PTC ensures the safe completion of all field activities in the absence the PTM.

WESTON Subcontractors (See Attachment A of this HASP)

ganization/Branch	Name/Title	Address	Telephone
.V. Pool, Inc./ lling	Winston Pool/ Vice-President	Rt. 1, Box 133B Clinton, OK 73601	(405)323-3454
ıdtech Consultants/ veying	Thomas A. Staudt/ Representative	2627 N. Loop West Ste. 224 Houston, Texas 77008	(713) 861-7068
___/Unexploded Ordnance (UXO) Team		To Be Determined	

Roles and Responsibilities

(1) A.W. Pool, Inc. will perform all activities associated with the installation of groundwater monitoring wells. (2) Landtech Consultants will perform all land and location surveying activities involving the identification of onsite sampling points. (3) The to be determined UXO team will ensure that concentrations of explosive constituents in soils are not high enough to ent an imminent safety hazard to onsite personnel.

Specific Health and Safety Personnel

The Site Health and Safety coordinator (SHSC) for activities to be conducted at this site is Steve Mitchell. The FTL who is also the SHSC has total responsibility for ensuring that the provisions of this Site Specific HASP are adequate and implemented in the field. Changing field conditions may require decisions to be made concerning adequate protection programs. Therefore, the personnel assigned as SHSCs are experienced and meet the additional training requirements specified by OSHA in 29 CFR 1910.120.

HSC Qualifications:

he SHSC designated for this site assessment will have OSHA 40-hour aining and current refresher training as applicable. The SHSC will have mpleted the WESTON SHSC training course. He will have current first d, CPR, bloodborne pathogens and dangerous goods shipping training. He ill have completed the appropriate amount of field work in the level of otection with WESTON medical monitoring program and have a current edical, and he will meet the approval of the HSM/RSO as SHSC.

ated alternatives include the field personnel listed on page 41 that eet training requirements for SHSC who are selected by the PTC and

approved by the HSM/RSO to be designated alternative SHSCs. An asterisk appears after the name of the personnel listed on page 41 who are eligible for this role.

II. Health and Safety Evaluation

A. Hazard Assessment

1. Background Review: Complete () Partial (Y) If partial, why?
The RI/FS Work Plan approved by the EPA and TNRCC details tasks necessary to perform a RI for thirteen (13) sites at the plant. Site LHAAP-1 is one such site that is the subject of an Ebasco Environmental Consultant field investigation and Site Characterization Summary Report (SCS). WESTON is tasked by the U.S. Army Corps of Engineers to perform investigations on-site LHAAP-1A which is a physical extension of site LHAAP-1. During previous investigations compounds detected at the LHAAP-1 site included metals and explosives. Therefore, the conclusion made is that the same chemical and physical hazards associated with site LHAAP-1 exist at area LHAAP-1A.

2. Activities Covered Under this Plan

(See Task by Task Risk Analysis pgs. 13 & 14)

No.	Task/Subtask	Description	Schedule
(1)	UXO Escort Services	Provide magnetometer support to assure areas are clear of magnetic anomalies.	11/1/93 - 4/30/94
(2)	Soil Borings	Borings will be performed using drilling rigs and hollow-stem auger drilling techniques.	11/1/93 - 4/30/94
(3)	Groundwater Grab Samples	Grab samples will be taken from soil boreholes.	11/1/93 - 4/30/94
(4)	Monitoring Well Installations	Monitoring wells will be installed using drill rig and sampled.	11/1/93 - 4/30/94
(5)	Surface Water and Sediment	Samples will be taken from drainage pathways flowing offsite.	11/1/93 - 4/30/94

3. Types of Hazards: (Place a Y/N in each ( ) to indicate presence/absence of hazard)

a. PhysioChemical[1][1]

(Y)	Flammable	(Y)	Explosive	(Y)	Corrosive
(N)	Reactive	(N)	O_2 Rich	(N)	O_2 Deficient

Chemically Toxic

(Y)	Inhal.	(Y)	Ingest.	(Y)	Cont.
(Y)	Absorb.	(N)	Carcin.	(N)	Mutagen
(N)	Terat.	(Y)	OSHA 1910.1000 Substance		

(N) OSHA Specific Hazard. Sub. Standard, Describe:

b. Biological[2][1]

(N) Etiol. Agent (Y) Other - Plant, insect, animal

c. Radiation Ionizing[3][1]

(N) Internal Exposure (N) External Exposure

Non-ionizing

(N)	UV	(N)	IR	(N)	RF
(N)	MicroW	(N)	LASER		

d. Physical Hazards: (Y) [4][1]

e. Construction Activities: (Y) [5][1]

B. Source/Location of Contaminants and Hazardous Substances

1. Directly Related to Tasks

(Y)	Air	(Y)	Soil
(N)	Other Surface	(Y)	S.. Water
(Y)	G. Water	(Y)	Other Sediment

2. Indirectly Related to Work - Nearby Process(s) which could affect team members:

(N) Client Facility (N) Nearby Non-client Facility.

Describe:

(Y) Client briefing arranged.

---

[1] The number in the [ ] refers to one of the following hazard evaluation forms. Complete hazard evaluation forms for each appropriate Hazard Class.

C. Chemical Hazards[1]

1. Identify and attach Material Safety Data Sheets for all reagent type chemicals, solutions or other materials identified as or which in normal use could produce hazardous substances used in performing tasks related to this project. ( ) N/A

2. Chemical Contaminants of Concern ( ) N/A. If present, provide following data.

Hazardous Substance/ Task	Physical Properties and Characteristics*	Exposure Limits PEL/TLV**	Route(s) of Exposure***/ Symptoms	Monitoring Instruments/IP+ % Response
Nitro-benzene	(*E) State Liquid pH NA FP 190°F LEL 1.8% (200°F) UEL NA Auto.Ig NA BP NA MP NA Incompatible with - Concentrated nitric acid, nitrogen tetroxide, caustic, phosphorous pentachloride, and zinc Sp.Gr 1.20 Vap.D NA Vap.P 1 mm H_2O Sol.0.2% Oth. (112°F)	NIOSH/OSHA 1 ppm (5mg/m^3) IDLH = 200 ppm	INH, ABS, ING, CON/ Anoxia; irritate eyes; derm; anemia; in animals; liver, kidney; skin damage.	Organic Vapor Analyzer (OVA) Response = 98% calibrated to methane IP = 9.92

[1] Chemical Hazard Continued

Material Safety Data Sheets (MSDS) are attached for all reagent type chemicals, solutions, or other materials which during normal use may produce hazardous substances while performing tasks related to this project. Sodium Hydroxide (NaOH), Hydrochloride Acid (HCl), Hexane, and Nitric Acid (HNO_3) may be used as sample preservative and/or decontamination reagents. MSDSs attached include:

- NaOH (Sample preservative),
- Hexane (Decontamination reagent),
- HNO_3 (Decontamination reagent),
- HCl (Sample preservative),
- Gasoline (Automotive), and
- Diesel Oil.

SODIUM HYDROXIDE

SHD

Common Synonyms	Solid flakes or pellets White	Odorless
Caustic soda Lye	Soluble and reacts with water.	

Avoid contact with solid and dust. Keep people away.
Wear rubber overclothing (including gloves).
Stop discharge if possible.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Not flammable.
May cause fire on contact with combustibles.
Flammable gas may be produced on contact with metals.
Wear rubber overclothing (including gloves).
Flood discharge area with water.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID

DUST
Irritating to eyes, nose and throat.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.
IF IN EYES, hold eyelids open and flush with plenty of water.

SOLID
Will burn skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water (two glasses).
DO NOT INDUCE VOMITING.

Water Pollution

Dangerous to aquatic life in high concentrations.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-corrosive
Restrict access
Disperse and flush

2. LABEL

2.1 Category: Corrosive
2.2 Class: 8

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: NaOH
3.3 IMO/UN Designations: 8.0/1823
3.4 DOT ID No.: 1823
3.5 CAS Registry No.: 1310-73-2

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Solid
4.2 Color: White
4.3 Odor: Odorless

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Chemical safety goggles; face shield; filter or dust-type respirator; rubber boots; rubber gloves.

5.2 Symptoms Following Exposure: Strong corrosive action on contacted tissues. INHALATION: dust may cause damage to upper respiratory tract and lung tissue, producing from mild nose irritation to pneumonitis. INGESTION: severe damage to mucous membranes; severe scar formation or perforation may occur. EYE CONTACT: produces severe damage.

5.3 Treatment of Exposure: INHALATION: remove from exposure; support respiration; call physician. INGESTION: give water or milk followed by dilute vinegar or fruit juice; do NOT induce vomiting. SKIN: wash immediately with large quantities of water under emergency safety shower while removing clothing; continue washing until medical help arrives; call physician. EYES: irrigate immediately with copious amounts of water for at least 15 min.; call physician.

5.4 Threshold Limit Value: 2 mg/m³

5.5 Short Term Inhalation Limits: Not pertinent

5.6 Toxicity by Ingestion: (10% solution) oral rabbit LD_{Lo} = 500 mg/kg

5.7 Late Toxicity: None

5.8 Vapor (Gas) Irritant Characteristics: Non-volatile

5.9 Liquid or Solid Irritant Characteristics: Severe skin irritant. Causes second- and third-degree burns on short contact and is very injurious to the eyes.

5.10 Odor Threshold: Not pertinent

5.11 IDLH Value: 200 mg/m³

6. FIRE HAZARDS

6.1 Flash Point: Not flammable
6.2 Flammable Limits in Air: Not flammable
6.3 Fire Extinguishing Agents: Not pertinent
6.4 Fire Extinguishing Agents Not to Be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: Not flammable
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not flammable
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: Dissolves with liberation of much heat; may steam and splatter
7.2 Reactivity with Common Materials: When wet, attacks metals such as aluminum, tin, lead, and zinc to produce flammable hydrogen gas.
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Flush with water, rinse with dilute acetic acid
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Groups: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity:
125 ppm/96 hr/mosquito fish/TL_m/fresh
180 ppm/23 hr/oysters/salt/salt water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): None
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Technical flakes; USP pellets
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

SS

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Corrosive material
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	3
Flammability (Red)	0
Reactivity (Yellow)	1

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Solid
12.2 Molecular Weight: 40.00
12.3 Boiling Point at 1 atm: Very high
12.4 Freezing Point: 604°F = 318°C = 591°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 2.13 at 20°C (solid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.17 Heat of Fusion: 80.9 cal/g
12.18 Limiting Value: Data not available
12.19 Reid Vapor Pressure: Data not available

NOTES

006707

n-HEXANE

HXA

Common Synonyms	Watery liquid	Colorless	Gasoline-like odor
Hexane			

Floats on water. Flammable, irritating vapor is produced.

Stop discharge if possible. Keep people away.
Shut off ignition sources and call fire department.
Stay upwind and use water spray to knock down vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to nose and throat.
If inhaled, will cause coughing or dizziness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea or vomiting.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
FOR EYES: hold eyelids open and flush with plenty of water.
If SWALLOWED and victim is CONSCIOUS, have victim drink water.
DO NOT INDUCE VOMITING.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
Foaming to shorelines.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Evacuate area
Disperse and flush

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Paraffin
3.2 Formula: $CH_3(CH_2)_4CH_3$
3.3 IMO/UN Designation: 3.1/1208
3.4 DOT ID No.: 1208
3.5 CAS Registry No.: 110-54-3

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Like gasoline

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Eye protection (like gasoline).
5.2 Symptoms Following Exposure: INHALATION causes irritation of respiratory tract, cough, mild depression, cardiac arrhythmias. ASPIRATION causes severe lung irritation, coughing, pulmonary edema; excitement followed by depression. INGESTION causes nausea, vomiting, sweating of abdomen, headache, depression.
5.3 Treatment of Exposure: Call a doctor. INHALATION: maintain respiration; give oxygen if needed. ASPIRATION: enforce bed rest; give oxygen if needed. INGESTION: do NOT induce vomiting. SKIN OR EYES: wipe off; wash skin with soap and water; wash eyes with copious amounts of water.
5.4 Threshold Limit Value: 50 ppm
5.5 Short Term Inhalation Limits: 500 ppm for 30 min.
5.6 Toxicity by Ingestion: Very slight
5.7 Late Toxicity: None
5.8 Vapor (Gas) Irritant Characteristics: Vapors are nonirritating to the eyes and throat.
5.9 Liquid or Solid Irritant Characteristics: No appreciable hazard. Practically harmless to the skin.
5.10 Odor Threshold: Data not available
5.11 IDLH Value: 5,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: —7°F C.C.
6.2 Flammable Limits in Air: 1.2%-7.7%
6.3 Fire Extinguishing Agents: Foam, dry chemical, carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Vapors may explode
6.7 Ignition Temperature: 437°F
6.8 Electrical Hazard: Class I, group D
6.9 Burning Rate: 7.3 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 31

8. WATER POLLUTION

8.1 Aquatic Toxicity: Data not available
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 0% (theor.), 7 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Research grade; technical grade
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U-V-W

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	0
Liquid or Solid Irritant	0
Poisons	1
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	1
Aesthetic Effect	1
Reactivity	
Other Chemicals	0
Water	0
Self Reaction	0

11.3 NFPA Hazard Classifications:

Category	Classification
Health Hazard (Blue)	1
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 86.17
12.3 Boiling Point at 1 atm: 156.7°F = 69.7°C = 341.9°K
12.4 Freezing Point: -219.3°F = -139.6°C = 133.6°K
12.5 Critical Temperature: 453.6°F = 234.5°C = 507.4°K
12.6 Critical Pressure: 436.6 psia = 29.7 atm = 3.01 MN/m²
12.7 Specific Gravity: 0.659 at 20°C (liquid)
12.8 Liquid Surface Tension: 18.4 dynes/cm = 0.0184 N/m at 20°C
12.9 Liquid-Water Interfacial Tension: 51.1 dynes/cm = 0.0511 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: 2.0
12.11 Ratio of Specific Heats of Vapor (Gas): 1.063
12.12 Latent Heat of Vaporization: 144 Btu/lb = 80.0 cal/g = 3.36 X 10⁵ J/kg
12.13 Heat of Combustion: —19,948 Btu/lb = —10,682 cal/g = —447.85 X 10⁵ J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 36.27 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 5.0 psia

NOTES

JUNE 1985

NITRIC ACID

006708 NAC

Common Synonyms	Watery liquid. Colorless to light brown. Choking odor.
	Spills and mixes with water. Harmful vapor is produced.

AVOID CONTACT WITH LIQUID AND VAPOR. Keep people away.
Wear chemical protective suit with self-contained breathing apparatus.
Stop discharge if possible.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Not flammable.
May cause fire on contact with combustibles.
Flammable gas may be formed on contact with metals.
Poisonous gases are produced when heated.
Wear chemical protective suit with self-contained breathing apparatus.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Will burn eyes, nose and throat.
If inhaled, will cause difficult breathing or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Will burn skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-corrosive
Restrict access
Evacuate area
Disperse and flush

2. LABEL

2.1 Category: Oxidizer; Corrosive
2.2 Class: 5 & 8

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Nitric acid
3.2 Formula: HNO_3-H_2O
3.3 SMDG/USI Designations: 8.0/2031
3.4 DOT ID No.: 2031
3.5 CAS Registry No.: 7697-37-2

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Acrid; sweet to acrid

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Air mask; rubber acid suit, hood, boots and gloves; chemical goggles; safety shower and eye bath.

5.2 Symptoms Following Exposure: Vapor irritates eyes and respiratory tract; lung injury may not become apparent for several hours following exposure. Liquid may cause severe burns to eyes and skin.

5.3 Treatment of Exposure: INHALATION: remove to fresh air, administer artificial respiration if required. INGESTION: drink large volumes of water; do NOT induce vomiting. SKIN OR EYES: flush with water for at least 15 min.

5.4 Threshold Limit Value: 2 ppm

5.5 Short Term Inhalation Limits: 15 ppm for 5 min.

5.6 Toxicity by Ingestion: Grade 3; LD_{50} = 50 to 500 mg/kg

5.7 Late Toxicity: None

5.8 Vapor (Gas) Irritant Characteristics: 50-69%: Vapor is moderately irritating such that personnel will not usually tolerate moderate or high vapor concentrations. 85%: Vapors cause severe irritation of eye and throat and can cause eye and lung injury. They cannot be tolerated even at low concentrations.

5.9 Liquid or Solid Irritant Characteristics: Severe skin irritant. Causes second and third-degree burns on short contact and is very injurious to the eyes.

5.10 Odor Threshold: Data not available

5.11 IDLH Value: 100 ppm

6. FIRE HAZARDS

6.1 Flash Point: Not flammable
6.2 Flammable Limits in Air: Not flammable
6.3 Fire Extinguishing Agents: Use water on adjacent fires.
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: May give off poisonous oxides of nitrogen and acid fumes when heated in fires.
6.6 Behavior in Fire: Decomposes and gives off poisonous oxides of nitrogen.
6.7 Ignition Temperature: Not flammable
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not pertinent
6.10 Adiabatic Flame Temperature: Data not available

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: May react up on mixing, but dissolution or formation of vapors unlikely.
7.2 Reactivity with Common Materials: Very corrosive to wood, paper, cloth and most metals. Toxic nitrous oxides of nitrogen are formed.
7.3 Stability During Transport: When heated may give off toxic red oxides of nitrogen.
7.4 Neutralizing Agents for Acids and Caustics: Flush with water
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Motor Fuels (Flammable to Products): Data not available
7.8 Reactivity Group: 2

8. WATER POLLUTION

8.1 Aquatic Toxicity:
72 ppm/96 hr/mosquito fish/TL_m/fresh water
330-1000 ppm/48 hr/oysters/LC_{50}/salt water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): None
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Various grades: 52-69%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-P

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Oxidizer

11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	0
Health	
Vapor Irritant	3
Liquid or Solid Irritant	4
Poisons	3
Water Pollution	
Human Toxicity	3
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	4
Water	0
Self Reaction	0

11.3 NFPA Hazard Classifications:

Category	Classification
Health Hazard (Blue)	3
Flammability (Red)	0
Reactivity (Yellow)	0

Key

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: Not pertinent
12.3 Boiling Point at 1 atm: 182.8°F = 83.8°C = 356.1°K
12.4 Freezing Point: -58°F = -49.8°C = 227.3°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.49 at 20°C (liquid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): (est.) 1.245
12.12 Latent Heat of Vaporization: 214 Btu/lb = 119 cal/g = 4.98 X 10^5 J/kg
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: -595 Btu/lb = -114 cal/g = -4.76 X 10^5 J/kg
12.16 Heat of Polymerization: Not pertinent
12.35 Heat of Fusion: Data not available
12.36 Limiting Value: Data not available
12.37 Reid Vapor Pressure: 1.0 psia

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

006709

HYDROCHLORIC ACID

HCL

Common Synonyms			
Muriatic Acid	Watery liquid	Colorless	Sharp, irritating odor

Sinks and mixes with water, irritating vapor is produced.

AVOID CONTACT WITH LIQUID AND VAPOR. Keep people away.
Wear chemical protective suit with self-contained breathing apparatus.
Stop discharge if possible.
Stay upwind and use water spray to knock down vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Not flammable.
Flammable gas may be produced on contact with metals.
Wear chemical protective suit with self-contained breathing apparatus.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause coughing or difficult breathing.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Will burn skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

Dangerous to aquatic life in high concentrations.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Initial warning-corrosive
Restrict access
Disperse and flush

2. LABEL

2.1 Category: Corrosive
2.2 Class: 8

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Non-oxidizing mineral acid
3.2 Formula: HCl-H_2O
3.3 IMO/UN Designation: 8.0/1789
3.4 DOT ID No.: 1789
3.5 CAS Registry No.: 7647-01-0

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (at ambient): Liquid
4.2 Color: Colorless to light yellow
4.3 Odor: Pungent; sharp, pungent, irritating

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Self-contained breathing equipment, air-line mask, or industrial canister-type gas mask; rubber or rubber-coated gloves, apron, coat, overalls, shoes.
5.2 Symptoms Following Exposure: Inhalation of fumes results in coughing and choking sensation, and irritation of nose and lungs. Liquid causes burns.
5.3 Treatment of Exposure: INHALATION: remove person to fresh air; keep him warm and quiet and get medical attention immediately; start artificial respiration if breathing stops. INGESTION: have person drink water or milk; do NOT induce vomiting. EYES: immediately flush with plenty of water for at least 15 min. and get medical attention; continue flushing for another 15 min. if physician does not arrive promptly. SKIN: immediately flush skin while removing contaminated clothing; get medical attention promptly; use soap and wash area for at least 15 min.
5.4 Threshold Limit Value: 5 ppm
5.5 Short Term Inhalation Limits: 5 ppm for 5 min.
5.6 Toxicity by Ingestion: Data not available
5.7 Late Toxicity: None
5.8 Vapor (Gas) Irritant Characteristics: Vapor is moderately irritating such that personnel will not usually tolerate moderate or high vapor concentrations.
5.9 Liquid or Solid Irritant Characteristics: Fairly severe skin irritant; may cause pain and second-degree burns after a few minutes' contact.
5.10 Odor Threshold: 1-5 ppm
5.11 IDLH Value: 100 ppm

6. FIRE HAZARDS

6.1 Flash Point: Not flammable
6.2 Flammable Limits in Air: Not flammable
6.3 Fire Extinguishing Agents: Not pertinent
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Toxic and irritating vapors are generated when heated.
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: Not flammable
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not flammable
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: Corrosive to most metals with evolution of hydrogen gas, which may form explosive mixtures with air.
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Flush with water; apply powdered limestone, soda ash, soda ash, or sodium bicarbonate.
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Water Reactivity (Reactions to Products): Data not available
7.8 Reactivity Groups: 1

8. WATER POLLUTION

8.1 Aquatic Toxicity: 282 ppm/96 hr/mosquito fish/TL$_m$/fresh water; 100-330 ppm/48 hr/shrimp/LC_{50}/salt water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): None
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Food processing or technical: 18° Be-67.9%, 20 Be-31.5%, 22° Be-35.2%; Reagent, ACS, and USP: 22° Be-37.1%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-P

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Corrosive material
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	0
Health	
Vapor irritant	3
Liquid or Solid irritant	3
Poisons	2
Water Pollution	
Human Toxicity	2
Aquatic Toxicity	2
Aesthetic Effect	2
Reactivity	
Other Chemicals	3
Water	0
Self Reaction	0

11.3 NFPA Hazard Classifications:

Category	Classification
Health Hazard (Blue)	3
Flammability (Red)	0
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: 36.46
12.3 Boiling Point at 1 atm: 123°F = 50.5°C = 323.5°K
12.4 Freezing Point: Not pertinent
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.19 at 20°C (Liquid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid-Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: 178 Btu/lb = 99.6 cal/g = 4.13 X 10^5 J/kg
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: —699 Btu/lb = —388 cal/g = —80 X 10^5 J/kg
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 13.0 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 0.0 psia

*Physical properties apply to 37 % solution.

NOTES

JUNE 1985

GAT GASOLINES: AUTOMOTIVE (<4.23g lead/gal)

12.17 SATURATED LIQUID DENSITY		12.18 LIQUID HEAT CAPACITY		12.19 LIQUID THERMAL CONDUCTIVITY		12.20 LIQUID VISCOSITY	
Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F	Temperature (degrees F)	British thermal unit-inch per hour-square foot-F (estimate)	Temperature (degrees F)	Centipoise
45	46.270	10	.459	40	.909	46	.521
50	46.130	15	.462	50	.900	48	.514
55	46.000	20	.464	60	.891	50	.507
60	45.850	25	.467	70	.883	52	.500
65	45.710	30	.470	80	.874	54	.494
70	45.560	35	.472	90	.865	56	.487
75	45.400	40	.475	100	.856	58	.481
80	45.240	45	.478	110	.847	60	.475
85	45.080	50	.480	120	.838	62	.469
90	44.910	55	.483	130	.829	64	.463
95	44.750	60	.486	140	.821	66	.457
100	44.570	65	.488	150	.812	68	.451
105	44.390	70	.491	160	.803	70	.446
110	44.210	75	.494	170	.794	72	.440
115	44.030	80	.496	180	.785	74	.435
		85	.499	190	.776	76	.430
		90	.502			78	.424
		95	.504			80	.419
		100	.507			82	.414
		105	.510			84	.410
						86	.405
						88	.400
						90	.396
						92	.391
						94	.387
						96	.382

12.21 SOLUBILITY IN WATER		12.22 SATURATED VAPOR PRESSURE		12.23 SATURATED VAPOR DENSITY		12.24 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	Pounds per 100 pounds of water	Temperature (degrees F)	Pounds per square inch	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F
	INSOLUBLE		DATA NOT AVAILABLE		NOT PERTINENT		DATA NOT AVAILABLE

OILS, FUEL: 2-D

OTD

Common Synonyms	Oily liquid	Yellow-brown	Lube or fuel oil odor
Diesel oil, medium	Floats on water.		

Stop discharge if possible
Call fire department
Avoid contact with liquid
Isolate and remove discharged material
Notify local health and pollution control agencies

Fire

Combustible.
Extinguish with dry chemical, foam, carbon dioxide
Water may be ineffective on fire
Cool exposed containers with water

Exposure

CALL FOR MEDICAL AID

LIQUID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes
Flush affected areas with plenty of water
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED, and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

Dangerous to aquatic life in high concentrations.
Fouling to shorelines.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Mechanical containment
Should be removed
Chemical and physical treatment

2. LABEL

2.1 Category: None
2.2 Class: Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Miscellaneous Hydrocarbon Mixtures
3.2 Formula: Not applicable
3.3 IMO/UN Designation: 3.1/1270
3.4 DOT ID No.: 1270
3.5 CAS Registry No.: Data not available

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Light brown
4.3 Odor: Characteristic

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Protective gloves; goggles or face shield.
5.2 Symptoms Following Exposure: INGESTION causes nausea, vomiting, and cramping; depression of central nervous system ranging from mild headache to anesthesia, coma, and death; pulmonary irritation secondary to exhalation of solvent; signs of kidney and liver damage may be delayed. ASPIRATION causes severe lung irritation with coughing, gagging, dyspnea, substernal distress, and rapidly developing pulmonary edema; later, signs of bronchopneumonia and pneumonitis; acute onset of central nervous system excitement followed by depression.
5.3 Treatment of Exposure: INGESTION: do NOT induce vomiting. ASPIRATION: enforce bed rest; administer oxygen; seek medical attention. EYES: wash with copious quantity of water. SKIN: remove solvent by wiping and wash with soap and water.
5.4 Threshold Limit Value: No single TLV applicable.
5.5 Short Term Inhalation Limits: Data not available
5.6 Toxicity by Ingestion: Grade 1; LD_{50} = 5-15 g/kg
5.7 Late Toxicity: Data not available
5.8 Vapor (Gas) Irritant Characteristics: Slight smarting of eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 Liquid or Solid Irritant Characteristics: Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of skin.
5.10 Odor Threshold: Data not available
5.11 IDLH Value: Data not available

6. FIRE HAZARDS

6.1 Flash Point: 125°F C.C.
6.2 Flammable Limits in Air: 1.3%-6.0%
6.3 Fire Extinguishing Agents: Dry chemical, foam, or carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Water may be ineffective
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: 490—545°F
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: 4 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 33

8. WATER POLLUTION

8.1 Aquatic Toxicity: 204 mg/l/24 hr/juvenile American shad/TL_m/salt water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): Data not available
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Diesel fuel 2-D (ASTM)
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester)

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Combustible liquid
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classification:

Category	Classification
Health Hazard (Blue)	0
Flammability (Red)	2
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: Not pertinent
12.3 Boiling Point at 1 atm: 540—640°F = 282—338°C = 555—611°K
12.4 Freezing Point: 0°F = 18°C = 256°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 0.87—0.90 at 20°C (liquid)
12.8 Liquid Surface Tension: Data not available
12.9 Liquid Water Interfacial Tension: Data not available
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: —19,440 Btu/lb = —10,800 cal/g = —452.17 X 10^6 J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: Data not available
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

NOTES

* E = Explosive, F = Flammable, C = Corrosive, R = Reactive, W = Water reactive, O = Oxide, Ra = Radioactive. State = Normal physical state at site/proj. temp.

** Use lowest of two, if no TLV/PEL, use Toxicity data in following order: Lowest Toxic Co humans (LTC-HMN), Lowest Lethal Conc. in humans (LLC-HMN), Lowest Toxic Dose in humans (LT Lowest Lethal Dose in humans (LLD-HMN), LC_{50} or LD_{50} in humans, the Lowest Toxic Concentration Lowest Toxic Dose in animals, the lowest LC_{50} or LD_{50} in animals.

*** I - Inhalation, G = Ingestion, S = Skin Absorption, C = Contact, D = Direct Penetration

\+ IP = Ionization Potential

D. Biological Hazards of Concern[2]

No. Hazard	(Y/N)	Task No.(s)*	Location/ Source (K/S)**	Route of Exposure (I,G,C,D)+	Team Member(s) Allergic?	Immuni-cation Req'd?
Poisonous Plants	(Y)	All	Suspected	Contact	No	No
Insects	(Y)	All	Suspected	Direct Penet.	No	No
Snakes	(Y)	All	Suspected	Direct Penet.	No	No
Animals	(Y)	All	Suspected	Direct Penet.	No	No
Sewage	(N)		None reported or suspected at the site.			
Etiologic Agents	(N)		None reported a suspected at the site			
	()					

* List all task numbers which would involve potential exposure to these hazard(s).

** K = Known, S = Suspect. +I = Inhalation, G = Ingestion, C = Contact, D = Direct Penetration (Bite, Inject., Open wound or sore)

E. Radiation Hazards of Concern (NA)

TYPE

1. Ionizing

	Location/ Source	Type Emitter	Task No.(s)	Exposure Limits	Protection Protocol Reference
RadioNuclide					

2. Non-ionizing

	Location/ Source	Type Emiter	Task No.(s)	Exposure Limits	Protection Protocol Reference
Ultra violet					
Infra Red					
Microwave					
Radio-Freq.					
LASER					

F. Physical Hazards of Concern (See Attachment B of this HASP)[4]

	Hazard (Y/N)	TASK NO(S).	Protection OP(s) Attached
1. Noise	(Y)	1,2 & 4	FLD01
2. Heat - ambient air	(Y)	All	FLD02,FLD05 & FLD07
- Hot Process - Steam	(N)		
- Hot Process - LT^3	(N)		
- Hot Process - Incin.	(N)		
3. Cold	(Y)	All	FLD02,FLD06 & FLD07
4. Rain	(Y)	All	FLD02 & FLD07
5. Snow	(N)		
6. Electric Storms	(Y)	All	FLD02
7. Confined Space Entry	(N)		
8. "Hot Work"	(N)		
9. Heavy Manual Lifting/Moving	(Y)	All	FLD10
10. Rough Terrain	(Y)	All	FLD11
11. Housekeeping	(Y)	All	FLD12
12. Structural Integrity	(N)		
13. Neighborhood	(N)		
14. Remote Area	(Y)	All	FLD14 & FLD15

F. Physical Hazards of Concern (continued)

	Hazard (Y/N)	TASK NO(S).	Protection OP(s) Attached
15. Compressed Gases	(Y)	3 & 4	FLD16
16. Diving	(N)		
17. Using Boats	(N)		
18. Working Over Water	(N)		
19. Traffic	(Y)	All	FLD20
20. Explosives	(Y)	All	FLD21
21. Heavy Equipment Operation	(Y)	1, 2, 3, & 4	FLD22A, 22B & 23
22. Lifting Equipment Operation			
- Cranes,	(N)		
- Manlifts	(N)		
23. Working at Elevation	(N)		
24. Using Ladders	(N)		
25. Using Scaffolding	(N)		
26. Excavating/Trenching	(N)		
27. Materials Handling	(Y)	All	FLD29
28. Haz. Mat. Use/Storage			
- fam.liq./gases	(Y)	2 & 4	FLD30
- oxidizers	(Y)	3, 4, & 5	FLD30
- corrosives	(Y)	3, 4, & 5	FLD30
29. Fire Prevent/Response plan required	(Y)		pgs. 32, 33
30. Fire Extinguishers required	(Y)	All	FLD32
31. Demolition	(N)		
32. Utilities - Underground	(Y)	1, 2, & 4	FLD34
- Overhead	(Y)	2 & 4	FLD34
33. Electrical - General	(Y)	2 & 4	FLD35
- High Voltage	(N)		
34. Welding/cutting/burning	(N)		
35. Hand tools	(Y)	All	FLD38
36. Power Hand Tools	(Y)	1, 2, & 4	FLD38
37. High Pressure Water	(Y)	2 & 4	FLD37
38. Other Drill Operations	(Y)	2 & 4	Drill Rig Safety Guide
39. Other Standard Hand and Emergency Signals	(Y)	All	FLD41
40. Other _____	(N)		

G. Construction Activities[5]

Construction activities involve the use of the heavy equipment for drilling, subsurface soil and groundwater sampling, and groundwater monitoring well installation.

Task by Task Risk Analysis

The preceding Tables identify the hazards known or suspected to be present in accomplishing the tasks involved in this project.

Section II A.2. of this HASP describes the background of this site/project and identifies the tasks involved.

Below briefly describes each task and the likelihood of exposure to the hazards identified and the protective protocols to be used. The task numbers in parenthesis and each associated task correspond with the Section II A.2. tasks and tasks descriptions.

Detailed descriptions of planned activities for the LHAAP-1A RI are included in the Longhorn Army Ammunition Plant (LHAAP) Remedial Investigative and Feasibility Study (RI/FS) Work Plan Addendum for area LHAAP-1A. Investigation and sampling procedures are described in the LHAAP RI Chemical Data Acquisition Plan (CDAP) Addendum for area LHAAP-1A. WESTON understands that an UXO escort will be used for all investigative activities performed onsite.

The task by task risk associated with the field activities is initially low because the major contaminants (1,3,5-TNB, aluminum, barium, cadmium, chromium, copper, lead, manganese, nickel, strontium, and zinc) found at the LHAAP-1 Inert Burning Grounds site were well below their Time-Weighted Average (TWA) exposure limits and Immediately Dangerous to Life or Health (IDLH) concentrations. Since LHAAP-1A is property directly adjacent to LHAAP-1, the conclusion is that these same contaminants potentially exist in similar concentrations. Therefore, the investigative activities discussed below will initially be performed in modified Level D. If site conditions exist that emit elevated levels that reach the action level requirements described in Section III.C. Personnel Protective Equipment (PPE) of this HASP, personnel will upgrade to Level C. If Level B is warranted, work activities will be reevaluated in order to reduce potential hazardous concentrations below action levels.

The tasks descriptions are as follow:

(1) An Unexploded Ordnances (UXO) Team will provide magnetometer support to clear all investigation areas of magnetic anomalies.

(2) Soil borings are planned for several locations of the LHAAP-1A area. These borings will be completed using drill rig and hollow-stem auger drilling techniques. Subsurface

soil samples will be collected using a pushed shelby-tube or driven split-spoon samplers.

(3) Groundwater grab samples will be taken from the boreholes after subsurface soil sampling is completed. Groundwater samples will be collected using either purge and sample pumps or manually operated bailers. All reusable equipment will be decontaminated in accordance with the procedures in the CDAP Addendum for area LHAAP-1A.

(4) Selected soil borings will be converted to groundwater monitoring wells. The wells will be constructed using PVC casing materials, silica sand packs, sodium-bentonite seals, and cement-bentonite grout. Care will be taken to minimize dust production during mixing of grout. When working with these materials, at least a half-face respirator will be worn to protect against airborne dust. The wells will be developed using a combination surging and pumping technique.

(5) Surface water and sediment samples will be taken from drainage pathways flowing offsite. Surface water samples will be collected using "grab" sample methods. Sediment samples will be collected using stainless steel scoops, hand augers, or specialized sediment samplers. Reusable equipment will be decontaminated in accordance with the procedures described in the CDAP Addendum for area LHAAP-1A. All soil borings, monitoring wells, and soil sampling locations will be surveyed for lateral locations and elevation during field activities. A WESTON representative will accompany the surveyors to monitor the breathing zone during surveying operations.

III. Personnel Protection Plan

A. Engineering Controls

1. Describe Engineering Controls used as part of Personnel Protection Plan:

Task(s) All

(1) UXO escort services. (2) Wetting down dusty areas during field operations. (3) Locating personnel upwind of potential hazardous conditions.

B. Administrative Controls

1. Describe Administrative controls used as part of Personnel Protection Plan:

Task(s) All

(1) Daily Site Specific Training Meeting. (2) Buddy system to ensure assistance is available during emergency situations. (3) Two way radio and telephone communication will be available for general and emergency communications.

C. Personnel Protective Equipment (PPE)

1. Action Levels for Changing Level of Protection.

Air Monitoring at LHAAP-1A will require the use of a flame ionization detector (FID).

FID Air Monitoring

Air monitoring with a FID Organic Vapor Analyzer (OVA), will be performed continuously during well sampling and other intrusive activities, and periodically during non-intrusive activities where organic vapors are suspected. Monitoring will be conducted in the breathing zone. Air monitoring data will be used to specify the level of respiratory protection to be used by site investigation personnel during field activities. The action level (AL) for the OVA is calculated as follows:

$$AL = \frac{TLV}{2} \times R$$

TLV = threshold limit value
R = OVA response factor expressed as a percent

The level of respiratory protection and personal protective equipment may be ungraded or downgraded by the SHSC based on data from OVA monitoring. For the purpose of calculating action levels for the OVA, nitrobenzene is the contaminant of concern. The aforementioned AL calculation is for Level D to Level C PPE upgrade.

The AL for the OVA, to determine Level C to Level B PPE upgrade is calculated as follows:

$$AL = \frac{IDLH}{2} \times R$$

IDLH = Immediately Dangerous to Life or Health.
R = OVA response factor expressed as a percent.

The following action levels will be used to specify the level of respiratory protection where nitrobenzene or volatile organics in general are suspected.

OVA reading above background (for a continuous period of 5 minutes or more)	Type of Respiratory Protection
0 - 1 unit	Level D
1 - 98 units	Level C
> 98 units	Level B

The action levels were established based on the TLV and IDLH for nitrobenzene. If OVA readings of 1 unit above background are encountered, work will upgrade to Level C. If OVA readings are between 1 and 98 units above background, work will proceed in Level C. If OVA readings are greater than 98 units, continued work will require upgrade to Level B. At this point work activities will be re-evaluated in order to reduce levels to below 1 unit. Levels of protection may be modified only by the SHSC concerning air monitoring and potential of exposure to hazardous compounds. Because of the low Permissible Exposure Limit (PEL) for nitrobenzene, National Dräeger, Inc. was contacted concerning the availability of a Dräeger tube as an additional air monitoring instrument. WESTON was informed that no Dräeger tube was available for nitrobenzene detection.

2. Description of Levels

Task(s)	Level D (2, 3, 4, & 5)	Level D Modified (1,2, & 4)
Head	(Y) Hardhat	(Y) Hardhat
Eye & Face	(Y) Safety Glasses/Goggles	(Y) Face shield (as needed)
Hearing	( )	(Y) Earplugs (as needed)
Arms & Legs Only	( )	
Whole body	(Y) Cotton Coveralls	(Y) Cotton Coveralls and Tyvek
apron	(Y) Tyvek (if needed)	
Hand - gloves		
- gloves	(Y) Chemical (outer)	(Y) Cotton (outer); Use chemical when soil sampling is performed.
- gloves	(Y) Surgical (inner)	(Y) Surgical (inner)
Foot - boots		
- boots	(Y) Steel toes	(Y) Steel toes
- boots	(Y) Boot covers	(Y) Boot covers

2. Description of Levels (continued)

	Task(s) Level C (2, 3, 4 & 5)	Task(s) Level C Modified (1, 2, & 4)
Head	(Y) Hardhat	(Y) Hardhat
Eye & Face	(Y) Safety Glasses/Goggles	(Y) Face Shield (as needed)
Hearing	( )	(Y) Earplugs (as needed)
Arms & Legs Only	( )	( )
Whole body apron	(Y) Saranex or Tyvek	(Y) Saranex or Tynek
Hand - gloves	(Y) Chemical (outer)	(Y) Chemical (outer)
- gloves	(Y) Surgical (inner)	(Y) Surgical (inner)
- gloves		
Foot - boots	(Y) Steel toes	(Y) Steel toes
- boots	(Y) Boot Covers	(Y) Boot Covers
- boot	( )	
Full Face	(Y) MSA Ultratwin	(Y) MSA Ultratwin
Cart./Canister Type C	(Y) GMC - H Cartidges	(Y) GMC - H Cartidges
SAR - Airline	( )	
SCBA	( )	
Comb. Airline/	( )	
SCBA	( )	
Cascade Syst.	( )	
Compressor	( )	
Fall Protection	( )	
Floatation	( )	
Foot - boots	( )	

IV. Site or Project Hazard Monitoring Program

A. Direct Reading Air Monitoring Instruments

1. Instrument Selection & Initial Check Road

	No.	Task No.(s)	Instrument checked upon receipt	Initials
CGI-	( )			
O_2	( )			
CGI/O_2-	( )			
CGI/O2/tox-PPM,H2S,H2S/CO	( )			
RAD-GM	( )			
-NaI	( )			
-ZnS	( )			
Other _____	( )			
PID -HNU 10.2	( )			
-HNU 11.7	( )			
-HNU 9.5,	( )			
-PHOTOVAC, TMA, OTHER	( )			
FID -FOX-128	(Y)	All		
-FOX 128GC	( )			
-Health, Aid, Other _____	( )			
RAM, Mini-RAM, Other _____	( )			
MONITOX-HCN	( )			
H_2S	( )			
COCL,	( )			
SO_2	( )			
Other _____	( )			
Bio-Aerosol Monitor	( )			
Detector Tubes	( )			
Pump - MSA, Draeger, Sensidyne	( )			
Tubes(No.)/type	( )			
Tubes(No.)/type	( )			

Reporting Format

__X__ 1. Field notebook. _____ 2. Field data sheets. _____ 3. Air monitoring log
_____ 4. Trip report. _____ 5. Other.

B. Direct Reading Air Monitoring Instruments Calibration Record (To be completed in the Field Logbook)

Instrument Mfg. Model, Eqp.ID.No.	Date	Time	Calib Material	Calib. Method Mfg.'s	Other	Initial Setting & Reading	Final Setting & Reading	Calibs. Initials

006722

C. Site Air Monitoring Program

Air Monitoring Instrument: FID-FOXBORO OVA

Air Monitoring Frequency — Tasks

___X___ 1. Periodically (Decon and staging areas) — All
_____ 2. Periodically
_____ 3. Continuous
_____ 4. Other:

Monitoring Locations — Tasks

___X___ 1. Upwind/downwind of site activities — All
_____ 2. Near residents, etc.
___X___ 3. Key site activity locations:
- ___X___ decon area
- ___X___ staging area
- _____ excavation area
- _____ field lab area
- _____ storage tanks
- _____ lagoons
- _____ drums

_____ 4. Fixed stations
___X___ 5. Other: Monitor in breathing zone during entry, sampling, and drilling activities on a continuous basis.

Air Monitoring Instrument:

Air Monitoring Frequency — Tasks

_____ 1. Periodically
_____ 2. Periodically
_____ 3. Continuous
_____ 4. Other:

Monitoring Locations — Tasks

_____ 1. Upwind/downwind of site activities
_____ 2. Near residents, etc.
_____ 3. Key site activity locations:
- _____ decon area
- _____ staging area
- _____ excavation area
- _____ field lab area
- _____ storage tanks
- _____ lagoon
- _____ drums

_____ 4. Fixed stations
_____ 5. Other:

D. Action Levels

___ 1.	Explosive atmosphere:	Task
	Action Level	Action
	<10% LEL	Continue investigation
	10%-20% LEL	Continue on-site monitoring with extreme caution as higher levels are encountered.
	>20% LEL	Explosion hazard. **Withdraw from area immediately.**
___ 2.	Oxygen:	Task
	Action Level	Action
	<19.5%	Monitor wearing SCBA. NOTE: Combustible gas readings may not be valid in atmospheres with <19.5% oxygen.
	19.5%-25%	Continue investigation with caution, as Oxygen levels >21% require extreme caution. Other than normal level may be due to presence of other substances.
	>25%	Fire hazard potential. Stop work and **consult a fire safety specialist.**
___ 3.	Radiation:	Task
	Action Level	Action
	3 x BKG - <1 mr/hr	Radiation above background levels (normally 0.01-0.02 mR/hr)[g] signifies possible source(s) radiation present.
		Continue investigation with caution. Perform thorough monitoring. **Consult with a health physicist.**
	>1 mrem/hr	Potential radiation hazard. Evacuate site. Continue investigation only upon the advice of a health physicist.
X 4.	Organic gases and vapors:	1 Unit above background
___ 5.	Inorganic gases and vapors:	
	Action Level	Action
	Depends on chemical	Consult standard reference manuals for air concentration/toxicity data. Action level depends on PEL/REL/TLV.

SODIUM HYDROXIDE

0067 24D

Common Synonyms	Solid flakes or pellets White Odorless
Caustic soda Lye	Sinks and mixes with water.

- Avoid contact with solid and dust. Keep people away.
- Wear rubber overclothing (including gloves).
- Stop discharge if possible.
- Isolate and remove discharged material.
- Notify local health and pollution control agencies.

Fire

Not flammable.
May cause fire on contact with combustibles.
Flammable gas may be produced on contact with metals.
Wear rubber overclothing (including gloves).
Flood discharge area with water.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID

DUST
Irritating to eyes, nose and throat.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.
IF IN EYES, hold eyelids open and flush with plenty of water.

SOLID
Will burn skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water (two glasses).
DO NOT INDUCE VOMITING.

Water Pollution

Dangerous to aquatic life in high concentrations.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-corrosive
Restrict access
Disperse and flush

2. LABEL

2.1 Category: Corrosive
2.2 Class: 8

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Not listed
3.2 Formula: NaOH
3.3 IMO/IMI Designation: 8.0/1823
3.4 DOT ID No.: 1823
3.5 CAS Registry No.: 1310-73-2

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Solid
4.2 Color: White
4.3 Odor: Odorless

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Chemical safety goggles; face shield; filter or dust-type respirator; rubber boots; rubber gloves.

5.2 Symptoms Following Exposure: Strong corrosive action on contacted tissues. INHALATION: dust may cause damage to upper respiratory tract and lung tissue, producing from mild nose irritation to pneumonia. INGESTION: severe damage to mucous membranes; severe scar formation or perforation may occur. EYE CONTACT: produces severe damage.

5.3 Treatment of Exposure: INHALATION: remove from exposure; support respiration; call physician. INGESTION: give water or milk followed by dilute vinegar or fruit juice; do NOT induce vomiting. SKIN: wash immediately with large quantities of water under emergency safety shower while removing clothing; continue washing until medical help arrives; call physician. EYES: irrigate immediately with copious amounts of water for at least 15 min.; call physician.

5.4 Threshold Limit Value: 2 mg/m³

5.5 Short Term Inhalation Limits: Not pertinent

5.6 Toxicity by Ingestion: (10% solution) oral rabbit LD_{Lo} = 500 mg/kg

5.7 Late Toxicity: None

5.8 Vapor (Gas) Irritant Characteristics: Non-volatile

5.9 Liquid or Solid Irritant Characteristics: Severe skin irritant. Causes second- and third-degree burns on short contact and is very injurious to the eyes.

5.10 Odor Threshold: Not pertinent

5.11 IDLH Value: 200 mg/m³

6. FIRE HAZARDS

6.1 Flash Point: Not flammable
6.2 Flammable Limits in Air: Not flammable
6.3 Fire Extinguishing Agents: Not pertinent
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: Not flammable
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not flammable
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: Dissolves with liberation of much heat; may steam and splatter
7.2 Reactivity with Common Materials: When wet, attacks metals such as aluminum, tin, lead, and zinc to produce flammable hydrogen gas.
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Flush with water, rinse with dilute acetic acid
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Groups: Data not available

8. WATER POLLUTION

8.1 Aquatic Toxicity:
125 ppm/96 hr/mosquito fish/TL$_m$/fresh
180 ppm/23 hr/oysters/lethal/salt water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): None
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Technical flakes; USP pellets
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

S3

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Corrosive material
11.2 NAS Hazard Rating for Bulk Water Transportation: Not listed
11.3 NFPA Hazard Classifications:

Category	Classification
Health Hazard (Blue)	3
Flammability (Red)	0
Reactivity (Yellow)	1

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Solid
12.2 Molecular Weight: 40.00
12.3 Boiling Point at 1 atm: Very high
12.4 Freezing Point: 604°F = 318°C = 591°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 2.13 at 20°C (solid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: Not pertinent
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.26 Heat of Fusion: 60.0 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: Data not available

NOTES

006725

SHD

SODIUM HYDROXIDE

12.17 SATURATED LIQUID DENSITY		12.18 LIQUID HEAT CAPACITY		12.19 LIQUID THERMAL CONDUCTIVITY		12.20 LIQUID VISCOSITY	
Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F	Temperature (degrees F)	British thermal unit-inch per hour-square foot-F	Temperature (degrees F)	Centipoise
	NOT PERTINENT		NOT PERTINENT		NOT PERTINENT		NOT PERTINENT

12.21 SOLUBILITY IN WATER		12.22 SATURATED VAPOR PRESSURE		12.23 SATURATED VAPOR DENSITY		12.24 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	Pounds per 100 pounds of water	Temperature (degrees F)	Pounds per square inch	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F
34	44.810		NOT PERTINENT		NOT PERTINENT		NOT PERTINENT
36	47.660						
38	50.500						
40	53.350						
42	56.190						
44	59.040						
46	61.880						
48	64.719						
50	67.570						
52	70.410						
54	73.259						
56	76.099						
58	78.950						
60	81.790						
62	84.639						
64	87.480						
66	90.320						
68	93.169						
70	96.009						
72	98.860						
74	101.700						
76	104.500						
78	107.400						
80	110.200						
82	113.099						
84	115.900						

006726

n-HEXANE

HXA

Common Synonyms			
Hexane	Watery liquid	Colorless	Gasoline-like odor

Floats on water. Flammable, irritating vapor is produced.

Stop discharge if possible. Keep people away.
Shut off ignition sources and call fire department.
Stay upwind and use water spray to knock down vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID

VAPOR
Irritating to nose and throat.
If inhaled, will cause coughing or dizziness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea or vomiting.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING

Water Pollution

Effect of low concentrations on aquatic life is unknown.
Fouling to shorelines.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Issue warning-high flammability
Evacuate area
Disperse and flush

2. LABEL

2.1 Category: Flammable liquid
2.2 Class: 3

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Paraffin
3.2 Formula: $CH_3(CH_2)_4CH_3$
3.3 IMO/UN Designation: 3.1/1208
3.4 DOT ID No.: 1208
3.5 CAS Registry No.: 110-54-3

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Like gasoline

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Eye protection (like gasoline).
5.2 Symptoms Following Exposure: INHALATION causes irritation of respiratory tract, cough, mild depression, cardiac arrhythmias. ASPIRATION causes severe lung irritation, coughing, pulmonary edema; excitement followed by depression. INGESTION causes nausea, vomiting, swelling of abdomen, headache, depression.
5.3 Treatment of Exposure: Call a doctor. INHALATION: maintain respiration; give oxygen if needed. ASPIRATION: enforce bed rest; give oxygen if needed. INGESTION: do NOT induce vomiting. SKIN OR EYES: wipe off; wash skin with soap and water; wash eyes with copious amounts of water.
5.4 Threshold Limit Value: 50 ppm
5.5 Short Term Inhalation Limit: 500 ppm for 30 min.
5.6 Toxicity by Ingestion: very slight
5.7 Late Toxicity: None
5.8 Vapor (Gas) Irritant Characteristics: Vapors are nonirritating to the eyes and throat.
5.9 Liquid or Solid Irritant Characteristics: No appreciable hazard. Practically harmless to the skin.
5.10 Odor Threshold: Data not available
5.11 IDLH Value: 5,000 ppm

6. FIRE HAZARDS

6.1 Flash Point: —7°F C.C.
6.2 Flammable Limits in Air: 1.2%-7.7%
6.3 Fire Extinguishing Agents: Foam, dry chemical, carbon dioxide
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Not pertinent
6.6 Behavior in Fire: Vapors may explode
6.7 Ignition Temperature: 437°F
6.8 Electrical Hazard: Class I, group D
6.9 Burning Rate: 7.3 mm/min.
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: No reaction
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Not pertinent
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 31

8. WATER POLLUTION

8.1 Aquatic Toxicity: Data not available
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): 0% (theor.), 7 days
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Research grade; technical grade
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
A-T-U-V-W

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Flammable liquid
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	3
Health	
Vapor Irritant	0
Liquid or Solid Irritant	0
Poisons	1
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	1
Aesthetic Effect	1
Reactivity	
Other Chemicals	0
Water	0
Self Reaction	0

11.3 NFPA Hazard Classifications:

Category	Classification
Health Hazard (Blue)	1
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 16°C and 1 atm: Liquid
12.2 Molecular Weight: 86.17
12.3 Boiling Point at 1 atm: 156.7°F = 69.7°C = 341.9°K
12.4 Freezing Point: -219.3°F = -139.6°C = 133.6°K
12.5 Critical Temperature: 453.8°F = 234.2°C = 507.4°K
12.6 Critical Pressure: 436.6 psa = 29.7 atm = 3.01 MN/m²
12.7 Specific Gravity: 0.659 at 20°C (liquid)
12.8 Liquid Surface Tension: 18.4 dynes/cm = 0.0184 N/m at 20°C
12.9 Liquid Water Interfacial Tension: 51.1 dynes/cm = 0.0511 N/m at 20°C
12.10 Vapor (Gas) Specific Gravity: 3.0
12.11 Ratio of Specific Heats of Vapor (Gas): 1.063
12.12 Latent Heat of Vaporization: 144 Btu/lb = 80.0 cal/g = 3.35 X 10⁴ J/kg
12.13 Heat of Combustion: —18,346 Btu/lb = —10,692 cal/g = —447.65 X 10⁴ J/kg
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: Not pertinent
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 36.27 cal/g
12.26 Limiting Value: Data not available
12.27 Reid Vapor Pressure: 5.0 psa

NOTES

006727

HXA	n-HEXANE

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
35	42.220
40	42.060
45	41.890
50	41.730
55	41.570
60	41.400
65	41.240
70	41.070
75	40.910
80	40.740
85	40.580
90	40.410
95	40.250
100	40.080
105	39.920
110	39.750
115	39.590
120	39.420
125	39.260
130	39.090
135	38.930
140	38.760
145	38.600

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.502
10	.508
20	.513
30	.519
40	.524
50	.530
60	.535
70	.541
80	.547
90	.552
100	.558
110	.563
120	.569
130	.574
140	.580
150	.585

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
—5	.933
0	.927
5	.921
10	.914
15	.908
20	.902
25	.895
30	.889
35	.883
40	.876
45	.870
50	.863
55	.857
60	.851
65	.844
70	.838
75	.832
80	.825
85	.819
90	.813
95	.806
100	.800
105	.794
110	.787
115	.781

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
35	.334
40	.330
45	.327
50	.324
55	.321
60	.318
65	.315
70	.312
75	.309
80	.306
85	.304
90	.301
95	.298
100	.296
105	.294
110	.291
115	.289
120	.287
125	.285
130	.282
135	.280
140	.278
145	.276

12.21 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
	INSOLUBLE

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
0	.312
10	.439
20	.607
30	.827
40	1.106
50	1.466
60	1.913
70	2.467
80	3.147
90	3.971
100	4.962
110	6.143
120	7.539
130	9.177
140	11.090
150	13.300
160	15.840
170	18.740
180	22.050
190	25.780
200	29.990
210	34.700

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
0	.00545
10	.00750
20	.01016
30	.01355
40	.01781
50	.02308
60	.02955
70	.03740
80	.04681
90	.05799
100	.07116
110	.08656
120	.10440
130	.12490
140	.14840
150	.17510
160	.20520
170	.23890
180	.27670
190	.31860
200	.36490
210	.41600

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.350
25	.365
50	.381
75	.396
100	.411
125	.426
150	.440
175	.455
200	.469
225	.484
250	.498
275	.512
300	.526
325	.539
350	.553
375	.566
400	.579
425	.592
450	.605
475	.618
500	.630
525	.642
550	.655
575	.667
600	.678

006728

NITRIC ACID

NAC

Common Synonyms

Watery liquid | Colorless to light brown | Choking odor

Strike and mixes with water. Harmful vapor is produced.

AVOID CONTACT WITH LIQUID AND VAPOR. Keep people away.
Wear chemical protective suit with self-contained breathing apparatus.
Stop discharge if possible.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Not flammable.
May cause fire on contact with combustibles.
Flammable gas may be formed on contact with metals.
Poisonous gases are produced when heated.
Wear chemical protective suit with self-contained breathing apparatus.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID

VAPOR
Will burn eyes, nose and throat.
If inhaled, will cause difficult breathing or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Will burn skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water (or milk).
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-corrosive
Restrict access
Evacuate area
Disperse and flush

2. LABEL

2.1 Category: Oxidizer; Corrosive
2.2 Class: 8 & 8

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Nitric acid
3.2 Formula: HNO_3-H_2O
3.3 IMO/UN Designation: 8.0/2031
3.4 DOT ID No.: 2031
3.5 CAS Registry No.: 7697-37-2

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (as shipped): Liquid
4.2 Color: Colorless
4.3 Odor: Acrid; sweet to acrid

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Air mask; rubber acid suit, hood, boots and gloves; chemical goggles; safety shower and eye bath.
5.2 Symptoms Following Exposure: Vapor irritates eyes and respiratory tract; lung injury may not become apparent for several hours following exposure. Liquid may cause severe burns to eyes and skin.
5.3 Treatment of Exposure: INHALATION: remove to fresh air, administer artificial respiration if required. INGESTION: drink large volumes of water; do NOT induce vomiting. SKIN OR EYES: flush with water for at least 15 min.
5.4 Threshold Limit Value: 2 ppm
5.5 Short Term Inhalation Limits: 15 ppm for 5 min.
5.6 Toxicity by Ingestion: Grade 3; LD_{50} = 50 to 500 mg/kg
5.7 Late Toxicity: None
5.8 Vapor (Gas) Irritant Characteristics: 86-88%: Vapor is moderately irritating such that personnel will not usually tolerate moderate or high vapor concentrations. 95%: Vapors cause severe irritation of eye and throat and can cause eye and lung injury. They cannot be tolerated even at low concentrations.
5.9 Liquid or Solid Irritant Characteristics: Severe skin irritant. Causes second and third-degree burns on short contact and is very injurious to the eyes.
5.10 Odor Threshold: Data not available
5.11 IDLH Value: 100 ppm

6. FIRE HAZARDS

6.1 Flash Point: Not flammable
6.2 Flammable Limits in Air: Not flammable
6.3 Fire Extinguishing Agents: Use water on adjacent fires.
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: May give off poisonous oxides of nitrogen and acid fumes when heated in fires.
6.6 Behavior in Fire: Decomposes and gives off poisonous oxides of nitrogen.
6.7 Ignition Temperature: Not flammable
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not pertinent
6.10 Adiabatic Flame Temperature: Data not available

(Continued)

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: May react up on mixing, but evaporation or formation of vapors unlikely.
7.2 Reactivity with Common Materials: Very corrosive to wood, paper, cloth and most metals. Toxic red gases of nitrogen are formed.
7.3 Stability During Transport: When heated may give off toxic red gases of nitrogen.
7.4 Neutralizing Agents for Acids and Caustics: Flush with water
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Products): Data not available
7.8 Reactivity Group: 3

8. WATER POLLUTION

8.1 Aquatic Toxicity:
72 ppm/96 hr/mosquito fish/TL_m/fresh water
330-1000 ppm/48 hr/oysters/LC_{50}/salt water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): None
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Various grades: 62-86%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-P

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Oxidizer
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	0
Health	
Vapor irritant	3
Liquid or Solid irritant	4
Poisons	3
Water Pollution	
Human Toxicity	3
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	4
Water	0
Self Reaction	0

11.3 NFPA Hazard Classifications:

Category	Classification
Health Hazard (Blue)	3
Flammability (Red)	0
Reactivity (Yellow)	0

Key

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 15°C and 1 atm: Liquid
12.2 Molecular Weight: Not pertinent
12.3 Boiling Point at 1 atm: 182.8°F = 83.8°C = 356.1°K
12.4 Freezing Point: −97°F = −44.6°C = 227.6°K
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.49 at 20°C (liquid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): (est.) 1.248
12.12 Latent Heat of Vaporization: 214 Btu/lb = 119 cal/g = 4.88 X 10^4 J/kg
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: −835 Btu/lb = −114 cal/g = −4.76 X 10^4 J/kg
12.16 Heat of Polymerization: Not pertinent
12.35 Heat of Fusion: Data not available
12.36 Limiting Value: Data not available
12.37 Reid Vapor Pressure: 1.0 psia

6. FIRE HAZARDS (Continued)

6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

006729

NAC

NITRIC ACID

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
35	95.139
40	94.830
45	94.520
50	94.209
55	93.910
60	93.599
65	93.290
70	92.990
75	92.679
80	92.370
85	92.070
90	91.759
95	91.450

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
51	470
52	471
53	472
54	472
55	473
56	473
57	474
58	474
59	475
60	475
61	476
62	477
63	477
64	478
65	478
66	479
67	479
68	480
69	480
70	481
71	482
72	482
73	483
74	483
75	484
76	484

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
	NOT PERTINENT

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
	NOT PERTINENT

12.21 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
	MISCIBLE

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
80	1.291
85	1.489
90	1.713
95	1.964
100	2.246
105	2.560
110	2.912
115	3.303
120	3.737
125	4.218
130	4.750
135	5.336
140	5.981
145	6.690
150	7.467
155	8.317
160	9.246
165	10.260
170	11.360
175	12.560
180	13.860

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
80	.01404
85	.01605
90	.01829
95	.02078
100	.02355
105	.02662
110	.03000
115	.03374
120	.03784
125	.04235
130	.04728
135	.05267
140	.05855
145	.06494
150	.07189
155	.07943
160	.08758
165	.09640
170	.10590
175	.11610
180	.12720

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
0	.206
10	.209
20	.213
30	.216
40	.219
50	.223
60	.226
70	.229
80	.232
90	.236
100	.239
110	.242
120	.246
130	.249
140	.252
150	.255
160	.259
170	.262
180	.265
190	.269
200	.272
210	.275
220	.278
230	.282
240	.285
250	.288

HYDROCHLORIC ACID 006730 HCL

Common Synonyms	Watery liquid	Colorless	Sharp, irritating odor
Muriatic Acid	Spills and mixes with water. Irritating vapor is produced.		

AVOID CONTACT WITH LIQUID AND VAPOR. Keep people away.
Wear chemical protective suit with self-contained breathing apparatus.
Stop discharge if possible.
Stay upwind and use water spray to knock down vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Not flammable.
Flammable gas may be produced on contact with metals.
Wear chemical protective suit with self-contained breathing apparatus.

Exposure

CALL FOR MEDICAL AID

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause coughing or difficult breathing.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Will burn skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

Dangerous to aquatic life in high concentrations.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)
Issue warning-corrosive
Restrict access
Disperse and flush

2. LABEL

2.1 Category: Corrosive
2.2 Class: 8

3. CHEMICAL DESIGNATIONS

3.1 CG Compatibility Class: Non-oxidizing mineral acid
3.2 Formula: HCl-H_2O
3.3 IMO/URI Designations: 8.0/1789
3.4 DOT ID No.: 1789
3.5 CAS Registry No.: 7647-01-0

4. OBSERVABLE CHARACTERISTICS

4.1 Physical State (at ambient): Liquid
4.2 Color: Colorless to light yellow
4.3 Odor: Pungent; sharp, pungent, irritating

5. HEALTH HAZARDS

5.1 Personal Protective Equipment: Self-contained breathing equipment, air-line mask, or industrial canister-type gas mask; rubber or rubber-coated gloves, apron, coat, overalls, shoes.
5.2 Symptoms Following Exposure: Inhalation of fumes results in coughing and choking sensation, and irritation of nose and lungs. Liquid causes burns.
5.3 Treatment of Exposure: INHALATION: remove person to fresh air; keep him warm and quiet and get medical attention immediately; start artificial respiration if breathing stops. INGESTION: have person drink water or milk; do NOT induce vomiting. EYES: immediately flush with plenty of water for at least 15 min. and get medical attention; continue flushing for another 15 min. if physician does not arrive promptly. SKIN: immediately flush skin while removing contaminated clothing; get medical attention promptly; use soap and wash area for at least 15 min.
5.4 Threshold Limit Value: 5 ppm
5.5 Short Term Inhalation Limits: 5 ppm for 5 min.
5.6 Toxicity by Ingestion: Data not available
5.7 Late Toxicity: None
5.8 Vapor (Gas) Irritant Characteristics: Vapor is moderately irritating such that personnel will not usually tolerate moderate or high vapor concentrations.
5.9 Liquid or Solid Irritant Characteristics: Fairly severe skin irritant; may cause pain and second-degree burns after a few minutes' contact.
5.10 Odor Threshold: 1-5 ppm
5.11 IDLH Value: 100 ppm

6. FIRE HAZARDS

6.1 Flash Point: Not flammable
6.2 Flammable Limits in Air: Not flammable
6.3 Fire Extinguishing Agents: Not pertinent
6.4 Fire Extinguishing Agents Not to be Used: Not pertinent
6.5 Special Hazards of Combustion Products: Toxic and irritating vapors are generated when heated.
6.6 Behavior in Fire: Not pertinent
6.7 Ignition Temperature: Not flammable
6.8 Electrical Hazard: Not pertinent
6.9 Burning Rate: Not flammable
6.10 Adiabatic Flame Temperature: Data not available
6.11 Stoichiometric Air to Fuel Ratio: Data not available
6.12 Flame Temperature: Data not available

7. CHEMICAL REACTIVITY

7.1 Reactivity With Water: No reaction
7.2 Reactivity with Common Materials: Corrosive to most metals with evolution of hydrogen gas, which may form explosive mixtures with air.
7.3 Stability During Transport: Stable
7.4 Neutralizing Agents for Acids and Caustics: Flush with water; apply powdered limestone, sodium lime, soda ash, or sodium bicarbonate.
7.5 Polymerization: Not pertinent
7.6 Inhibitor of Polymerization: Not pertinent
7.7 Molar Ratio (Reactant to Product): Data not available
7.8 Reactivity Group: 1

8. WATER POLLUTION

8.1 Aquatic Toxicity: 282 ppm/96 hr/mosquito fish/TL$_m$/fresh water; 100-330 ppm/48 hr/shrimp/LC$_{50}$/salt water
8.2 Waterfowl Toxicity: Data not available
8.3 Biological Oxygen Demand (BOD): None
8.4 Food Chain Concentration Potential: None

9. SHIPPING INFORMATION

9.1 Grades of Purity: Food processing or laboratory: 18° Be-27.9%, 20 Be-31.5%, 22° Be-36.2%; Reagent, ACS, and USP: 23° Be-37.1%
9.2 Storage Temperature: Ambient
9.3 Inert Atmosphere: No requirement
9.4 Venting: Open

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)
A-P

11. HAZARD CLASSIFICATIONS

11.1 Code of Federal Regulations: Corrosive material
11.2 NAS Hazard Rating for Bulk Water Transportation:

Category	Rating
Fire	0
Health	
Vapor irritant	3
Liquid or Solid irritant	3
Poisons	2
Water Pollution	
Human Toxicity	2
Aquatic Toxicity	2
Aesthetic Effect	2
Reactivity	
Other Chemicals	3
Water	0
Self Reaction	0

11.3 NFPA Hazard Classifications:

Category	Classification
Health Hazard (Blue)	3
Flammability (Red)	0
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 Physical State at 16°C and 1 atm: Liquid
12.2 Molecular Weight: 36.46
12.3 Boiling Point at 1 atm: 123°F = 50.5°C = 323.5°K
12.4 Freezing Point: Not pertinent
12.5 Critical Temperature: Not pertinent
12.6 Critical Pressure: Not pertinent
12.7 Specific Gravity: 1.19 at 20°C (Solid)
12.8 Liquid Surface Tension: Not pertinent
12.9 Liquid-Water Interfacial Tension: Not pertinent
12.10 Vapor (Gas) Specific Gravity: Not pertinent
12.11 Ratio of Specific Heats of Vapor (Gas): Not pertinent
12.12 Latent Heat of Vaporization: 178 Btu/lb = 99.5 cal/g = 4.13 X 10^5 J/kg
12.13 Heat of Combustion: Not pertinent
12.14 Heat of Decomposition: Not pertinent
12.15 Heat of Solution: —668 Btu/lb = —480 cal/g = —20 X 10^5 J/kg
12.16 Heat of Polymerization: Not pertinent
12.25 Heat of Fusion: 13.0 cal/g
12.26 Limiting Values: Data not available
12.27 Reid Vapor Pressure: 0.0 psia

*Physical properties apply to 37 % solution.

NOTES

HCL

006731

HYDROCHLORIC ACID

12.17 SATURATED LIQUID DENSITY		12.18 LIQUID HEAT CAPACITY		12.19 LIQUID THERMAL CONDUCTIVITY		12.20 LIQUID VISCOSITY	
Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F	Temperature (degrees F)	British thermal unit-inch per hour-square foot-F	Temperature (degrees F)	Centipoise
40	74.770	35	.417				
50	74.599	40	.429				
60	74.419	45	.441				
70	74.250	50	.453				
80	74.080	55	.465				
90	73.900	60	.477				
100	73.730	65	.489				
110	73.559	70	.501				
120	73.381	75	.513				
		80	.525				
		85	.537				
		90	.548				
		95	.560				
		100	.572				
		105	.584				
		110	.596				
		115	.608				
		120	.620				

NOT PERTINENT

NOT PERTINENT

12.21 SOLUBILITY IN WATER		12.22 SATURATED VAPOR PRESSURE		12.23 SATURATED VAPOR DENSITY		12.24 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	Pounds per 100 pounds of water	Temperature (degrees F)	Pounds per square inch	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	British thermal unit per pound-F
	MISCIBLE	52	1.844				
		54	1.970				
		56	2.104				
		58	2.246				
		60	2.396				
		62	2.555				
		64	2.723				
		66	2.901				
		68	3.088				
		70	3.287				
		72	3.496				
		74	3.717				
		76	3.951				
		78	4.197				
		80	4.456				
		82	4.730				
		84	5.018				
		86	5.321				
		88	5.640				
		90	5.975				
		92	6.328				
		94	6.699				
		96	7.089				
		98	7.499				
		100	7.929				
		102	8.380				

NOT PERTINENT

NOT PERTINENT

GAT	GASOLINES: AUTOMOTIVE (<4.23g lead/gal) 006732

12.17 SATURATED LIQUID DENSITY

Temperature (degrees F)	Pounds per cubic foot
45	46.270
50	46.130
55	46.000
60	45.850
65	45.710
70	45.560
75	45.400
80	45.240
85	45.080
90	44.910
95	44.750
100	44.570
105	44.390
110	44.210
115	44.030

12.18 LIQUID HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
10	.459
15	.462
20	.464
25	.467
30	.470
35	.472
40	.475
45	.478
50	.480
55	.483
60	.486
65	.488
70	.491
75	.494
80	.496
85	.499
90	.502
95	.504
100	.507
105	.510

12.19 LIQUID THERMAL CONDUCTIVITY

Temperature (degrees F)	British thermal unit-inch per hour-square foot-F (estimate)
40	.909
50	.900
60	.891
70	.883
80	.874
90	.865
100	.856
110	.847
120	.838
130	.829
140	.821
150	.812
160	.803
170	.794
180	.785
190	.776

12.20 LIQUID VISCOSITY

Temperature (degrees F)	Centipoise
46	.521
48	.514
50	.507
52	.500
54	.494
56	.487
58	.481
60	.475
62	.469
64	.463
66	.457
68	.451
70	.446
72	.440
74	.435
76	.430
78	.424
80	.419
82	.414
84	.410
86	.405
88	.400
90	.396
92	.391
94	.387
96	.382

12.21 SOLUBILITY IN WATER

Temperature (degrees F)	Pounds per 100 pounds of water
	INSOLUBLE

12.22 SATURATED VAPOR PRESSURE

Temperature (degrees F)	Pounds per square inch
	DATA NOT AVAILABLE

12.23 SATURATED VAPOR DENSITY

Temperature (degrees F)	Pounds per cubic foot
	NOT PERTINENT

12.24 IDEAL GAS HEAT CAPACITY

Temperature (degrees F)	British thermal unit per pound-F
	DATA NOT AVAILABLE

006733 GASOLINES: AUTOMOTIVE (<4.23g lead/gal)

GAT

Common Synonyms	Watery liquid	Colorless to pale brown or pink	Gasoline odor
Motor spirit Petrol	Floats on water. Flammable, irritating vapor is produced		

Stop discharge if possible. Keep people away.
Shut off ignition sources and call fire department.
Stay upwind and use water spray to knock down vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause dizziness, headache, difficult breathing or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea or vomiting.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Fouling to shoreline.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Issue warning-high flammability
Evacuate area
Disperse and flush

2. LABEL

2.1 **Category:** Flammable liquid
2.2 **Class:** 3

3. CHEMICAL DESIGNATIONS

3.1 **CG Compatibility Class:** Miscellaneous Hydrocarbon Mixtures
3.2 **Formula:** (Mixture of hydrocarbons)
3.3 **IMO/UN Designation:** 3.1/1203
3.4 **DOT ID No.:** 1203
3.5 **CAS Registry No.:** Data not available

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquid
4.2 **Color:** Colorless to brown
4.3 **Odor:** Gasoline

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Protective goggles, gloves.
5.2 **Symptoms Following Exposure:** Irritation of mucous membranes and stimulation followed by depression of central nervous system. Breathing of vapor may also cause dizziness, headache, and incoordination or, in more severe cases, anesthesia, coma, and respiratory arrest. If liquid enters lungs, it will cause severe irritation, coughing, gagging, pulmonary edema, and, later, signs of bronchopneumonia and pneumonitis. Swallowing may cause irregular heartbeat.
5.3 **Treatment of Exposure:** INHALATION: maintain respiration and administer oxygen; enforce bed rest if liquid is in lungs. INGESTION: do NOT induce vomiting; stomach should be lavaged (by doctor) if appreciable quantity is swallowed. EYES: wash with copious quantity of water. SKIN: wipe off and wash with soap and water.
5.4 **Threshold Limit Value:** 300 ppm
5.5 **Short Term Inhalation Limits:** 500 ppm for 30 min.
5.6 **Toxicity by Ingestion:** Grade 2; LD_{50} = 0.5 to 5 g/kg.
5.7 **Late Toxicity:** None
5.8 **Vapor (Gas) Irritant Characteristics:** Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 **Liquid or Solid Irritant Characteristics:** Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 **Odor Threshold:** 0.25 ppm
5.11 **IDLH Value:** Data not available

6. FIRE HAZARDS

6.1 **Flash Point:** —36°F C.C.
6.2 **Flammable Limits in Air:** 1.4%-7.4%
6.3 **Fire Extinguishing Agents:** Foam, carbon dioxide, dry chemical
6.4 **Fire Extinguishing Agents Not to be Used:** Water may be ineffective
6.5 **Special Hazards of Combustion Products:** None
6.6 **Behavior in Fire:** Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.
6.7 **Ignition Temperature:** 853°F
6.8 **Electrical Hazard:** Class I, Group D
6.9 **Burning Rate:** 4 mm/min
6.10 **Adiabatic Flame Temperature:** Data not available
6.11 **Stoichiometric Air to Fuel Ratio:** Data not available
6.12 **Flame Temperature:** Data not available

7. CHEMICAL REACTIVITY

7.1 **Reactivity With Water:** No reaction
7.2 **Reactivity with Common Materials:** No reaction
7.3 **Stability During Transport:** Stable
7.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent
7.5 **Polymerization:** Not pertinent
7.6 **Inhibitor of Polymerization:** Not pertinent
7.7 **Molar Ratio (Reactant to Product):** Data not available
7.8 **Reactivity Group:** 33

8. WATER POLLUTION

8.1 **Aquatic Toxicity:**
90 ppm/24 hr/juvenile American shad/TL_m/fresh water
91 mg/1/24 hr/juvenile American shad/TL_m/salt water
8.2 **Waterfowl Toxicity:** Data not available
8.3 **Biological Oxygen Demand (BOD):** 6%, 5 days
8.4 **Food Chain Concentration Potential:** None

9. SHIPPING INFORMATION

9.1 **Grades of Purity:** Various octane ratings; military specifications
9.2 **Storage Temperature:** Ambient
9.3 **Inert Atmosphere:** No requirement
9.4 **Venting:** Open (flame arrester) or pressure-vacuum

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U-V-W

11 HAZARD CLASSIFICATIONS

11.1 **Code of Federal Regulations:** Flammable liquid
11.2 **NAS Hazard Rating for Bulk Water Transportation:**

Category	Rating
Fire	3
Health	
Vapor Irritant	1
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	2
Aesthetic Effect	2
Reactivity	
Other Chemicals	0
Water	0
Self Reaction	0

11.3 **NFPA Hazard Classification:**

Category	Classification
Health Hazard (Blue)	1
Flammability (Red)	3
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Liquid
12.2 **Molecular Weight:** Not pertinent
12.3 **Boiling Point at 1 atm:** 140—390°F = 60—199°C = 333—472°K
12.4 **Freezing Point:** Not pertinent
12.5 **Critical Temperature:** Not pertinent
12.6 **Critical Pressure:** Not pertinent
12.7 **Specific Gravity:** 0.7321 at 20°C (liquid)
12.8 **Liquid Surface Tension:** 19-23 dynes/cm = 0.019—0.023 N/m at 20°C
12.9 **Liquid Water Interfacial Tension:** 49-51 dynes/cm = 0.049—0.051 N/m at 20°C
12.10 **Vapor (Gas) Specific Gravity:** 3.4
12.11 **Ratio of Specific Heats of Vapor (Gas):** (est.) 1.054
12.12 **Latent Heat of Vaporization:** 130—150 Btu/lb = 71—81 cal/g = 3.0 — 3.4 X 10^5 J/kg
12.13 **Heat of Combustion:** —18,720 Btu/lb = —10,400 cal/g = 435.1 X 10^5 J/kg
12.14 **Heat of Decomposition:** Not pertinent
12.15 **Heat of Solution:** Not pertinent
12.16 **Heat of Polymerization:** Not pertinent
12.25 **Heat of Fusion:** Data not available
12.26 **Limiting Value:** Data not available
12.27 **Reid Vapor Pressure:** 7.4 psia

NOTES

OILS, FUEL: 2-D

006734 | OTD

Common Synonyms	Oily liquid	Yellow-brown	Lube or fuel oil odor
Diesel oil, medium	Floats on water.		

Stop discharge if possible
Call fire department
Avoid contact with liquid
Isolate and remove discharged material
Notify local health and pollution control agencies

Fire

Combustible.
Extinguish with dry chemical, foam, carbon dioxide
Water may be ineffective on fire
Cool exposed containers with water

Exposure

CALL FOR MEDICAL AID

LIQUID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes
Flush affected areas with plenty of water
IF IN EYES, hold eyelids open and flush with plenty of water
IF SWALLOWED, and victim is CONSCIOUS, have victim drink water or milk
DO NOT INDUCE VOMITING

Water Pollution

Dangerous to aquatic life in high concentrations.
Fouling to shorelines.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook)

Mechanical containment
Should be removed
Chemical and physical treatment

2. LABEL

2.1 **Category:** None
2.2 **Class:** Not pertinent

3. CHEMICAL DESIGNATIONS

3.1 **CG Compatibility Class:** Miscellaneous Hydrocarbon Mixtures
3.2 **Formula:** Not applicable
3.3 **IMO/UN Designation:** 3.1/1270
3.4 **DOT ID No.:** 1270
3.5 **CAS Registry No.:** Data not available

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquid
4.2 **Color:** Light brown
4.3 **Odor:** Characteristic

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Protective gloves; goggles or face shield.
5.2 **Symptoms Following Exposure:** INGESTION causes nausea, vomiting, and cramping; depression of central nervous system ranging from mild headache to anesthesia, coma, and death; pulmonary irritation secondary to exhalation of solvent; signs of kidney and liver damage may be delayed. ASPIRATION causes severe lung irritation with coughing, gagging, dyspnea, substernal distress, and rapidly developing pulmonary edema; later, signs of bronchopneumonia and pneumonitis; acute onset of central nervous system excitement followed by depression.
5.3 **Treatment of Exposure:** INGESTION: do NOT induce vomiting. ASPIRATION: enforce bed rest; administer oxygen; seek medical attention. EYES: wash with copious quantity of water. SKIN: remove solvent by wiping and wash with soap and water.
5.4 **Threshold Limit Value:** No single TLV applicable.
5.5 **Short Term Inhalation Limits:** Data not available
5.6 **Toxicity by Ingestion:** Grade 1; LD_{50} = 5-15 g/kg
5.7 **Late Toxicity:** Data not available
5.8 **Vapor (Gas) Irritant Characteristics:** Slight smarting of eyes or respiratory system if present in high concentrations. The effect is temporary.
5.9 **Liquid or Solid Irritant Characteristics:** Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of skin.
5.10 **Odor Threshold:** Data not available
5.11 **IDLH Value:** Data not available

6. FIRE HAZARDS

6.1 **Flash Point:** 125°F C.C.
6.2 **Flammable Limits in Air:** 1.3%-6.0%
6.3 **Fire Extinguishing Agents:** Dry chemical, foam, or carbon dioxide
6.4 **Fire Extinguishing Agents Not to be Used:** Water may be ineffective
6.5 **Special Hazards of Combustion Products:** Not pertinent
6.6 **Behavior in Fire:** Not pertinent
6.7 **Ignition Temperature:** 490—545°F
6.8 **Electrical Hazard:** Not pertinent
6.9 **Burning Rate:** 4 mm/min.
6.10 **Adiabatic Flame Temperature:** Data not available
6.11 **Stoichiometric Air to Fuel Ratio:** Data not available
6.12 **Flame Temperature:** Data not available

7. CHEMICAL REACTIVITY

7.1 **Reactivity With Water:** No reaction
7.2 **Reactivity with Common Materials:** No reaction
7.3 **Stability During Transport:** Stable
7.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent
7.5 **Polymerization:** Not pertinent
7.6 **Inhibitor of Polymerization:** Not pertinent
7.7 **Molar Ratio (Reactant to Product):** Data not available
7.8 **Reactivity Group:** 33

8. WATER POLLUTION

8.1 **Aquatic Toxicity:** 204 mg/l/24 hr/juvenile American shad/TL_m/salt water
8.2 **Waterfowl Toxicity:** Data not available
8.3 **Biological Oxygen Demand (BOD):** Data not available
8.4 **Food Chain Concentration Potential:** None

9. SHIPPING INFORMATION

9.1 **Grades of Purity:** Diesel fuel 2-D (ASTM)
9.2 **Storage Temperature:** Ambient
9.3 **Inert Atmosphere:** No requirement
9.4 **Venting:** Open (flame arrester)

10. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook)

A-T-U

11. HAZARD CLASSIFICATIONS

11.1 **Code of Federal Regulations:** Combustible liquid
11.2 **NAS Hazard Rating for Bulk Water Transportation:** Not listed
11.3 **NFPA Hazard Classification:**

Category	Classification
Health Hazard (Blue)	0
Flammability (Red)	2
Reactivity (Yellow)	0

12. PHYSICAL AND CHEMICAL PROPERTIES

12.1 **Physical State at 15°C and 1 atm:** Liquid
12.2 **Molecular Weight:** Not pertinent
12.3 **Boiling Point at 1 atm:** 540—640°F = 282—338°C = 555—611°K
12.4 **Freezing Point:** 0°F = 18°C = 255°K
12.5 **Critical Temperature:** Not pertinent
12.6 **Critical Pressure:** Not pertinent
12.7 **Specific Gravity:** 0.87—0.90 at 20°C (liquid)
12.8 **Liquid Surface Tension:** Data not available
12.9 **Liquid Water Interfacial Tension:** Data not available
12.10 **Vapor (Gas) Specific Gravity:** Not pertinent
12.11 **Ratio of Specific Heats of Vapor (Gas):** Not pertinent
12.12 **Latent Heat of Vaporization:** Not pertinent
12.13 **Heat of Combustion:** —19,440 Btu/lb = —10,800 cal/g = —452.17 X 10^6 J/kg
12.14 **Heat of Decomposition:** Not pertinent
12.15 **Heat of Solution:** Not pertinent
12.16 **Heat of Polymerization:** Not pertinent
12.25 **Heat of Fusion:** Data not available
12.26 **Limiting Value:** Data not available
12.27 **Reid Vapor Pressure:** Data not available

NOTES

OTD

OILS, FUEL: 2-D

12.17 SATURATED LIQUID DENSITY	
Temperature (degrees F)	Pounds per cubic foot (estimate)
50	54.310
52	54.310
54	54.310
56	54.310
58	54.310
60	54.310
62	54.310
64	54.310
66	54.310
68	54.310
70	54.310
72	54.310
74	54.310
76	54.310
78	54.310
80	54.310
82	54.310
84	54.310

12.18 LIQUID HEAT CAPACITY	
Temperature (degrees F)	British thermal unit per pound-F
0	.414
5	.416
10	.419
15	.421
20	.424
25	.426
30	.428
35	.431
40	.433
45	.436
50	.438
55	.440
60	.443
65	.445
70	.448
75	.450
80	.452
85	.455
90	.457
95	.460
100	.462

12.19 LIQUID THERMAL CONDUCTIVITY	
Temperature (degrees F)	British thermal unit-inch per hour-square foot-F
35	.908
40	.908
45	.908
50	.908
55	.908
60	.908
65	.908
70	.908
75	.908
80	.908
85	.908
90	.908
95	.908
100	.908
105	.908
110	.908
115	.908
120	.908
125	.908

12.20 LIQUID VISCOSITY	
Temperature (degrees F)	Centipoise
0	3.773
10	3.397
20	3.071
30	2.788
40	2.541
50	2.324
60	2.134
70	1.965
80	1.815
90	1.681
100	1.561
110	1.454
120	1.358
130	1.270
140	1.191
150	1.120
160	1.054
170	.995
180	.940
190	.890
200	.844
210	.802

12.21 SOLUBILITY IN WATER	
Temperature (degrees F)	Pounds per 100 pounds of water
	INSOLUBLE

12.22 SATURATED VAPOR PRESSURE	
Temperature (degrees F)	Pounds per square inch
55	.456
60	.474
65	.492
70	.510
75	.529
80	.548
85	.567
90	.587
95	.607
100	.627
105	.647
110	.668
115	.689
120	.711
125	.732
130	.754

12.23 SATURATED VAPOR DENSITY	
Temperature (degrees F)	Pounds per cubic foot
	NOT PERTINENT

12.24 IDEAL GAS HEAT CAPACITY	
Temperature (degrees F)	British thermal unit per pound-F
	NOT PERTINENT

These Action Levels, if not defined by regulation, is some percent (usually 50%) of the applicable PEL/REL/TLV. That number must also be adjusted to account for instrument response factors.

Ambient Air Sampling- Decision Logic and action levels to institute Air Sampling.

_X_ No air sampling is required on this site.
____ An air sampling plan is incorporated in this HASP.

Check situations which will require or action levels which will apply to deciding to institute or increase scope of planned air sampling.

Meteorological conditions:

____ a. Dry weather for days.
____ b. Ambient temperature above F°.
____ c. Wind increasing potential of more contaminant dispersion in or migration out of controlled area.

Activities which will require instituting or increasing scope of air sampling:

____ a. major spills
____ b. new site activity resulting in potential presence of new chemical hazards.
____ c. site activity increases airborne contaminants possibilities.
____ d. Air sampling documentation required for:
____ downgrading from stipulated level of protection.
____ documenting no migration of contaminants off site through air.

Applicable Action Levels for Instituting Air Sampling: (Check as Appropriate)

____ a. Visible vapor/gas clouds or vapors levels, or
____ b. Visible dust or particulate levels measured with Direct Reading Instrument, two-three times background or above action level, sustained over 10-15 minute period.

1. Sampling Matrix/
air interface - Monitor matrix/air interface and breathing zone periodically with DRI, if Vapor levels > 2-3 times background, monitor continuously follow No. 4.
2. Container opening - Monitor opening and breathing zone periodically with DRI, if Vapor levels > 2-3 times background, monitor opening and breathing zone continuously, follow No. 4.

___ Mo

3. Excavation/Drilling/
Intrusive Work - Monitor at ground level and breathing zone periodical if Vapor levels > 2-3 times background, monitor opening and bre continuously, follow No. 4.

___

4. Breathing zone - Ensure level of protection specified in HASP is being u: HASP or Corporate Health and Safety relative to instituting person perimeter sampling.

Other:

F. 4

E. Sample Location

___ 1. Ambient background - Locations

Substances Sampled for

Task(s)

___ 2. Personal samples, onsite - Locations

___ ___

___ 3. Personal samples, offsite - Locations

Task(s)

___ 4. Fixed onsite samples - Locations

___ 5. Fixed offsite samples - Locations

Task(s)

___ 6. Mobile offsite samples - Locations

Sampling Media - Air Bag

Task(s)	Location	Duration	Frequency	Type	Anal.	Meth

G. sica

2. Hi-Volume Pumps

Sampling Media - Filter

Task(s)	Location	Duration	Frequency	Type	Anal.

3. Portable Gas Chromatograph Task(s) _____ Type _____

Portable GC Analytical Plan: _____

4. Passive Dosimeters

		TASK(s)	TYPE	LOCATION	FREQUENCY
Organic Vapor	( )				
Mercury Vapor	( )				
Paper Color Change	( )				
TLD	( )				
Film Badge	( )				
Liquid Media	( )				

5. Wipe Sampling

Wipe Sampling Plan: _____

006740

I. Work Location Instrument Readings (To be completed in Field Logbook)

Location: _____

% LEL ___, ___, ___, ___; % O_2 ___, ___, ___, ___; PID ppm ___, ___, ___, ___
FID ppm ___, ___, ___; Aerosol Monitor mg/M^3 ___, ___, ___
GM: Shield Probe/Thin Window - mR/hr ___, ___, ___; cpm ___, ___, ___
NaI ____, ____, ____, ____ uR/hr; ZnS ____, ____, ____, ____ cpm;
(Monitox) ppm: ( )___, ___, ___, ___; ( ) ___, ___, ___, ___;
( ) ___, ___, ___, ___, ___; ( ) ___, ___, ___, ___, ___
(Detector Tube) (s): ( ) ___, ___, ___, ___; ( )___, ___, ___, ___;
( ) ___, ___, ___, ___, ___; ( ) ___, ___, ___, ___, ___
Sound Levels ___dBA; ___dBA; ___dBA; ___dBA; ___dBA; ___dBA; ___dBA
Illumination ____; ____ Other ____ Other ____ Other ____ Other

Location: _____

% LEL ___, ___, ___, ___; % O_2 ___, ___, ___, ___; PID ppm ___, ___, ___, ___
FID ppm ___, ___, ___; Aerosol Monitor mg/M^3 ___, ___, ___
GM: Shield Probe/Thin Window - mR/hr ___, ___, ___; cpm ___, ___, ___
NaI ____, ____, ____, ____ uR/hr; ZnS ____, ____, ____, ____ cpm;
(Monitox) ppm: ( )___, ___, ___, ___; ( ) ___, ___, ___, ___;
( ) ___, ___, ___, ___, ___; ( ) ___, ___, ___, ___, ___
(Detector Tube) (s): ( ) ___, ___, ___, ___; ( )___, ___, ___, ___;
( ) ___, ___, ___, ___, ___; ( ) ___, ___, ___, ___, ___
Sound Levels ___dBA; ___dBA; ___dBA; ___dBA; ___dBA; ___dBA; ___dBA
Illumination ____; ____ Other ____ Other ____ Other ____ Other

Location: _____

% LEL ___, ___, ___, ___; % O_2 ___, ___, ___, ___; PID ppm ___, ___, ___, ___
FID ppm ___, ___, ___; Aerosol Monitor mg/M^3 ___, ___, ___
GM: Shield Probe/Thin Window - mR/hr ___, ___, ___; cpm ___, ___, ___
NaI ____, ____, ____, ____ uR/hr; ZnS ____, ____, ____, ____ cpm;
(Monitox) ppm: ( )___, ___, ___, ___; ( ) ___, ___, ___, ___;
( ) ___, ___, ___, ___, ___; ( ) ___, ___, ___, ___, ___
(Detector Tube) (s): ( ) ___, ___, ___, ___; ( )___, ___, ___, ___;
( ) ___, ___, ___, ___, ___; ( ) ___, ___, ___, ___, ___
Sound Levels ___dBA; ___dBA; ___dBA; ___dBA; ___dBA; ___dBA; ___dBA
Illumination ____; ____ Other ____ Other ____ Other ____ Other

V. Decontamination Plan

A. Personnel Decontamination

Section III C lists the tasks and specific levels of protection required for each. Consistent with the levels of protection required, step by step procedures for personnel decontamination for each Level of Protection are described below.

B. Levels of Protection Required for Personnel Decontamination are as follows:

1. Decontamination procedures for Level D protection will be set up in the following manner:

- Step 1 - segregated equipment drop,
- Step 2 - decontaminate boots,
  Two tubs, one of soapy wash water and one of rinse water, will be set up to wash and rinse boots. A brush will be used to clean boots.
- Step 3 - wash gloves,
  A bucket of soapy water and a bucket of clear water will be provided to wash outer gloves. Outer gloves will be reused if they can be adequately decontaminated, or bagged for later disposal if they cannot.
- Step 4 - remove tape,
- Step 5 - remove outer boots and gloves,
- Step 6 - remove coveralls, and
- Step 7 - remove inner gloves and bag for later disposal.

2. Decontamination for Level C protection will be set up in the following manner:

- Step 1 - segregated equipment drop,
- Step 2 - decontaminate boots,
  Two tubs, one of soapy wash water and one of rinse water, will be set up to wash and rinse boots. A brush will be used to clean boots.

- Step 3 - wash gloves,
  A bucket of soapy water and a bucket of clear water will be provided to wash outer gloves. Outer gloves will be reused if they can be adequately decontaminated, or bagged for later disposal if they cannot.

- Step 4 - remove tape,

- Step 5 - remove outer boots and gloves,

- Step 6 - remove coveralls, and

- Step 7 - remove inner gloves,

- Step 8 - remove respirator and decontaminate, and

- Step 9 - remove inner surgical gloves and discard for later disposal.

3. The decontamination procedures for Level B protection will be the same as Level C except that the respirator is removed in Step 8 and the mask is removed at the same place as the respirator. The tank is removed before removal of the coveralls in Step 6.

C. Equipment Decontamination

All sampling equipment will be decontaminated after use and before use if it has not been decontaminated previously. In addition, all equipment, sampling or otherwise (including knives and bailers) coming into direct contact with the samples will be decontaminated. The following decontamination procedure will be used for sampling equipment:

1. Wash in phosphorous-free soap/tap water solution to remove dirt and gross contamination.

2. Rinse with tap water.

3. Rinse with hexane to remove organic contaminants.

4. Rinse with deionized (DI) water.

5. Rinse with diluted nitric (10%) or hydrochloric acid to remove absorbed metal contaminants. Rinse thoroughly with DI water to remove residual contamination.

Pumps used for well sampling and development will be decontaminated between each well using a phosphorous-free soap and tap water solution by pumping the cleaning solution through the pump. The pump will then be submerged in a trash can (plastic or galvanized steel) containing potable water where the water will be circulated through the pump.

A decontamination pad will be constructed in an area designated by LHAAP and will serve as a decontamination facility for the equipment and vehicles working at this site. Decontamination water will either be contained with Visqueen or trapped in a sump at the end of the pad. Decontamination fluids will be transferred from the decon pad to drums for storage until further disposal. Decontamination tubs will be set up at the decon pad for personnel decontamination before exiting the zone.

The site vehicles will be decontaminated before exiting the exclusion zone. Decontamination of the vehicles will be performed at the above mentioned decon pad by steam cleaning.

D. Drilling Safety and Soils Sampling

Level D protection will be worn by all soil sampling personnel and members of the drilling crew during drilling activities unless air monitoring results warrant upgrading to Level C. Level D work clothes will be defined as long-sleeve coveralls or a Tyvek or Saranex suit. All cuttings will be drummed and stored on-site until further disposal.

E. Well Development and Groundwater Sampling

Level D protection will be worn by all members of the well development and sampling crew during groundwater sampling unless air monitoring results warrant upgrading to Level C. The ground immediately around the monitoring well being sampled will be covered with visqueen to prevent contact with potentially contaminated soils. After collection of the samples, the visqueen, bailer rope, and protective clothing will be drummed and stored on-site for later disposal.

F. Surface Water and Sediment Sampling

Level D protection will be worn by all members collecting surface water and sediment samples unless air monitoring results warrant upgrading to Level C.

G. Survey Safety

Level D protection will be worn by all members of the survey crew unless air monitoring warrants upgrade to Level C. The survey crew will be accompanied by a WESTON representative to monitor the breathing zone during surveying operations.

H. Waste Handling and Disposal

Water from well installation and development, well purging, well sampling, and decontamination will be placed in drums and stored on-site. Disposable protective equipment such as Tyvek and Saranex suits and gloves will be placed in, plastic bags within drums reserved for contaminated clothing, plastic, and other contaminated materials.

I. Fire/Explosion

The telephone number for contacting the local Fire/Emergency response agency is listed in the following section and will be posted in each WESTON vehicle at the site.

Fire and explosion hazards at the site are those associated with the unexploded ordnance that may exist onsite and the use of gasoline engines. Groundwater sample pump generators and steam cleaners utilize gasoline engines. The following precautions will be followed to prevent the occurrence of a fire or explosion:

1 - An UXO team utilizing a magnetometer will assure that all areas are clear of magnetic anomalies during all site investigative activities.

2 - No smoking will be permitted within the boundaries of the site.

3 - Fuel (gasoline or diesel) will be stored in approved containers only in an area away from potential sources of combustion.

If an explosion and/or a fire occurs, the field team should first alert (wave hands over head from side-to-side) surrounding personnel, evacuate the work site (pointed finger on extended arm) in an upwind direction to the support area, and then report the incident to the LHAAP Fire Department by the best communications possible.

Fire extinguishers (10 pound for Type A, B, and C fires) will be located in each WESTON vehicle and at the location where a gasoline engine is operated. The fire extinguishers will only be used to respond to small, non-threatening fires.

L. Spill/Release Response

Spills greater than 1 gallon will be classified as major spills and spills less than one gallon will be classified as minor spills. Any person recognizing a major spill of a hazardous substance, hazardous waste, or oil shall immediately:

(1) Contact the LHAAP Fire Department and give your name, the type of chemical spilled, the location of the spill, and the estimated quantity of the spill.

(2) Immediately notify the Supervisor in charge.

(3) Eliminate all sources of ignition (e.g., turn off drill rig).

(4) Immediately evacuate the area.

Any person recognizing a minor spill of a hazardous substance, hazardous waste, or oil shall immediately:

(1) Notify the Supervisor in charge.

(2) Eliminate all sources of ignition (e.g., turn off drilling).

(3) Evacuate the area if necessary.

Spills either will be resolved by using vermiculite absorbent and/or containment of the spill. The spent vermiculite will then be placed into plastic bags for disposal in the appropriate steel drums on-site.

Spills or accidental releases on the site could be either decontamination solvents and/or reagents (hexane, nitric acid, hydrochloric acid, sodium hydroxide), or fuels (gasoline and/or diesel). The spill volumes expected are small (<1 gallon) however, if the spill is of a corrosive or flammable liquid, contact with skin and/or eyes is a threat to worker safety.

VI Contingency Plans

A. Escape and Emergency Plans

Access to the potentially contaminated areas of the site during project activities will be limited by clearly visible markers such as traffic cones, caution tape, or other similar materials. All visitors will be required to sign the field log book, acknowledge the HASP provisions, and gain admittance only from the SHSC.

In case of emergency such as fire, explosion, or major chemical release, personnel will evacuate the LHAAP-1A area in an upwind direction to the support area or command post. The signals to evacuate an area is an audible alarm (one long blast from an air horn) and a pointed finger on an extended arm in the direction of the consolidation area. Personnel at the site will evacuate the site via the nearest accessible exit. If an escape route is blocked by a hazard, then personnel will use the next closest route to exit the site. Figure 1 is a map of the area with potential routes to exit the site highlighted.

B. Site Control Plan

Three safety zones will be established during most sites activities. Zone 1, the exclusion zone, will include at least the immediate ±10 ft. radial area around where work is in progress (drilling soil sampling, or groundwater sampling only). All groundwater sampling and other activities in the exclusion zone will require Level D protection unless measurements taken with an OVA warrant upgrading to Level C protection.

Zone 2 will be the contamination reduction zone (CRZ). Decontamination of equipment and personnel will occur in this zone. The decontamination area will be located at least 5 feet from the edge of the exclusion zone.

Zone 3 will be all other on and off-site areas associated with the LHAAP-1 site activities. A support zone will be established in this area containing the first aid kit, Infection Control Kit and a fire extinguisher. These areas are to be free of harmful levels of contamination (Figure 2).

C. On-Site Rest Stations and Emergency Medical Facilities

Water coolers will be provided in the support zone. Personnel will be required to remove gloves and wash their hands before obtaining water or other electrolyte replenishing liquids from the coolers. No eating or smoking will be allowed in the exclusion zone.

A first-aid station will be maintained in the support zone. The first-aid station will be furnished with a snake-bite kit, and first-aid kit containing basic first-aid supplies such as bandages, antiseptic, pain relievers, an eyewash kit and Infection Control Kit. Minor medical problems will be treated at the station. An ambulance will be called for major medical emergencies. A fire extinguisher will be kept inside all site vehicles and at the support zone to extinguish small fires.

D. On-Site Notification

In case of injuries or exposure to excessive levels of hazardous materials by WESTON or contractor personnel which requires more than First Aid response, contact the LHAAP Ambulance services. The on-site medical services may only supply care which will stabilize the injured/exposed person(s). The stabilization will be enough to allow for transportation to an off-site medical facility.

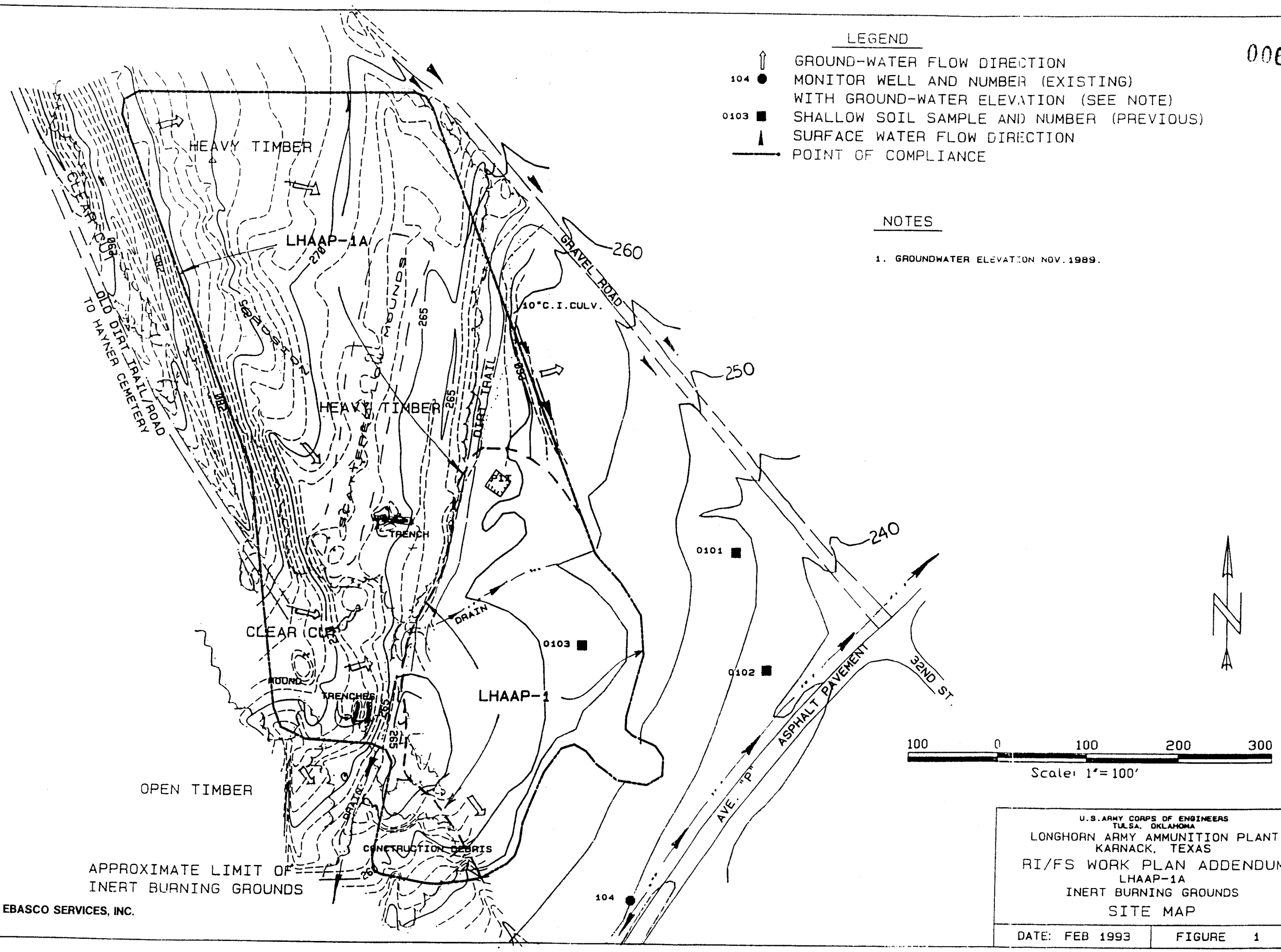
006747

LEGEND

- GROUND-WATER FLOW DIRECTION
- 104 ● MONITOR WELL AND NUMBER (EXISTING) WITH GROUND-WATER ELEVATION (SEE NOTE)
- 0103 ■ SHALLOW SOIL SAMPLE AND NUMBER (PREVIOUS)
- SURFACE WATER FLOW DIRECTION
- POINT OF COMPLIANCE

NOTES

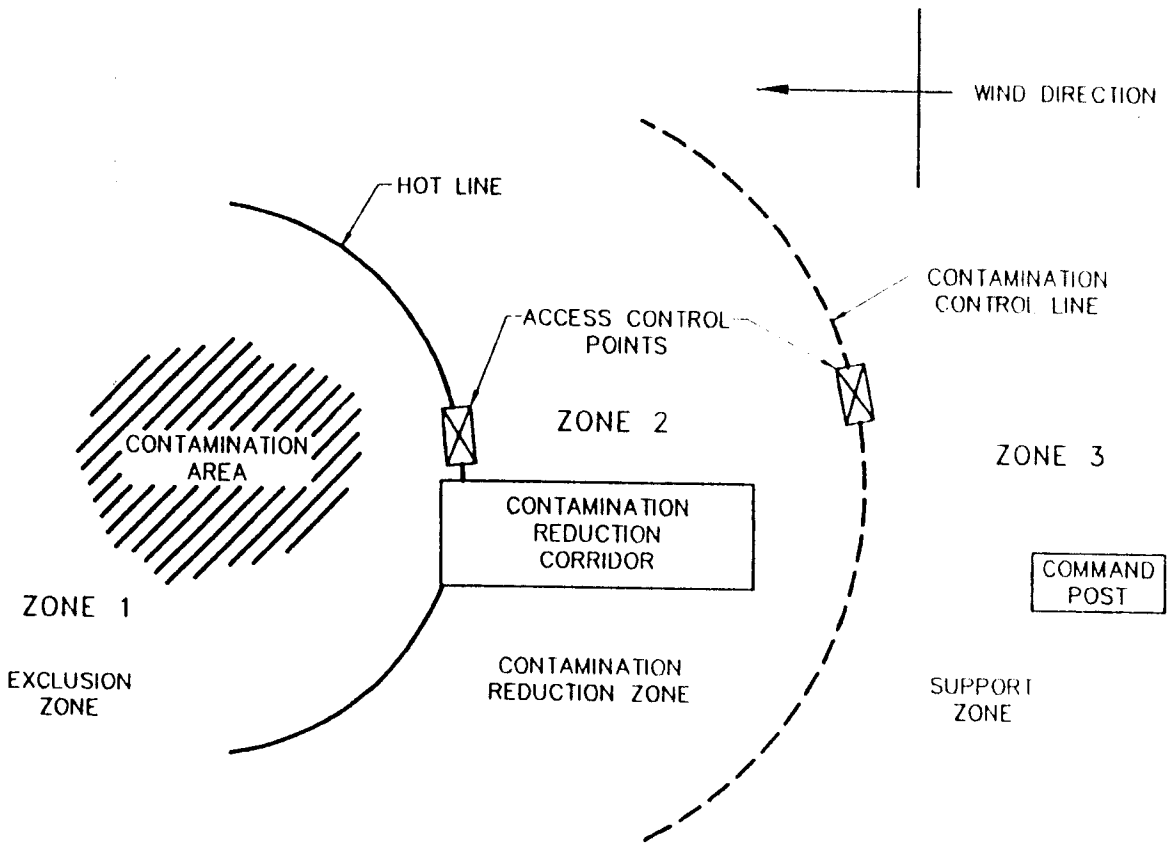
1. GROUNDWATER ELEVATION NOV. 1989.



SOURCE: EBASCO SERVICES, INC.

U.S. ARMY CORPS OF ENGINEERS
TULSA, OKLAHOMA
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RI/FS WORK PLAN ADDENDUM
LHAAP-1A
INERT BURNING GROUNDS
SITE MAP

DATE: FEB 1993	FIGURE 1



006748

* ACTUAL WORK ZONES DEPENDENT ON EXISTING SITE CONDITIONS

FIGURE 2

WESTON MANAGERS DESIGNERS/CONSULTANTS

E. Emergency Medical Treatment Procedures

Any person who becomes ill or injured in the exclusion zone must be decontaminated to the maximum extent possible. If the injury or illness is minor, full decontamination should be completed and first aid administered prior to transport. If the patient's condition is serious, at least partial decontamination should be completed (i.e., complete disrobing of the victim and redressing clean coveralls or wrapping in a blanket). First aid should be administered while awaiting an ambulance or paramedics. All injuries and illnesses must immediately be reported to the WESTON Project Manager and Regional Safety Officer at (713) 621-1620.

Following the emergency calls to the WESTON representative, the following personnel listed below shall be notified:

Tulsa District

Bob Vandegriff, Safety Office	(918) 581-6742
Greg Snider, Industrial Hygienist	(918) 581-6101
Scott Henderson, Project Manager	(918) 581-6106

Fort Worth District

Rene Moradell, Safety Office	(817) 334-2195
Madeline, Morgan, Industrial Hygienist	(817) 334-2185
Deborah Fitzgerald, Project Manager	(817) 334-3221

Huntsville

David Douthat, Explosives MCX	(205) 955-5785 (Explosive incidents only)

The following agencies will be contacted as necessary:

Organization	Telephone
WESTON Medical Emergency Contract (EMP)	(800) 229-3674
Longhorn AAP Fire Department (Thiokol)	(903) 679-2315
Longhorn AAP Ambulance (Thiokol)	(903) 679-2315
Longhorn AAP Security (Thiokol)	(903) 679-2327
LHAAP Environmental Coordinator Lynn Muckelrath	(903) 679-2980
Ambulance Service (903) 938-6711	911
Marshall Fire Department (903) 938-6711	911
Marshall Police (903) 935-7831	911
Texas Water Commission	(903) 595-5466

RCRA/Superfund (M-F 8:30 am - 7:30 pm EST)	(800) 424-9346
Title III Community Right to Know (Answer question about Regulatory issues)	(800) 535-0202
National Response Center	(800) 424-8801
Center for Disease Control (CDC) (Atlanta, Georgia)	(404) 639-3311
Poison Control Center	(800) 822-9761
CDC - Emergency Response (Chemical spills)	(404) 639-0615
National Institute for Occupational Safety and Health (NIOSH), Cincinnati, Ohio	(800) 356-4674

F. Evacuation Routes Procedures

(1) Medical emergencies will be taken to:

Marshall Memorial Hospital
811 South Washington
Marshall, Texas
(903) 935-8745 (Emergency Number)

From Longhorn, Hwy. 43 southwest to Hwy. 59, south on Hwy. 59 to Hwy 80, west on Hwy. 80 to Grand, south on Grand 1 mile to Marshall Memorial Hospital. The directions to the hospital and location are shown on Figure 3.

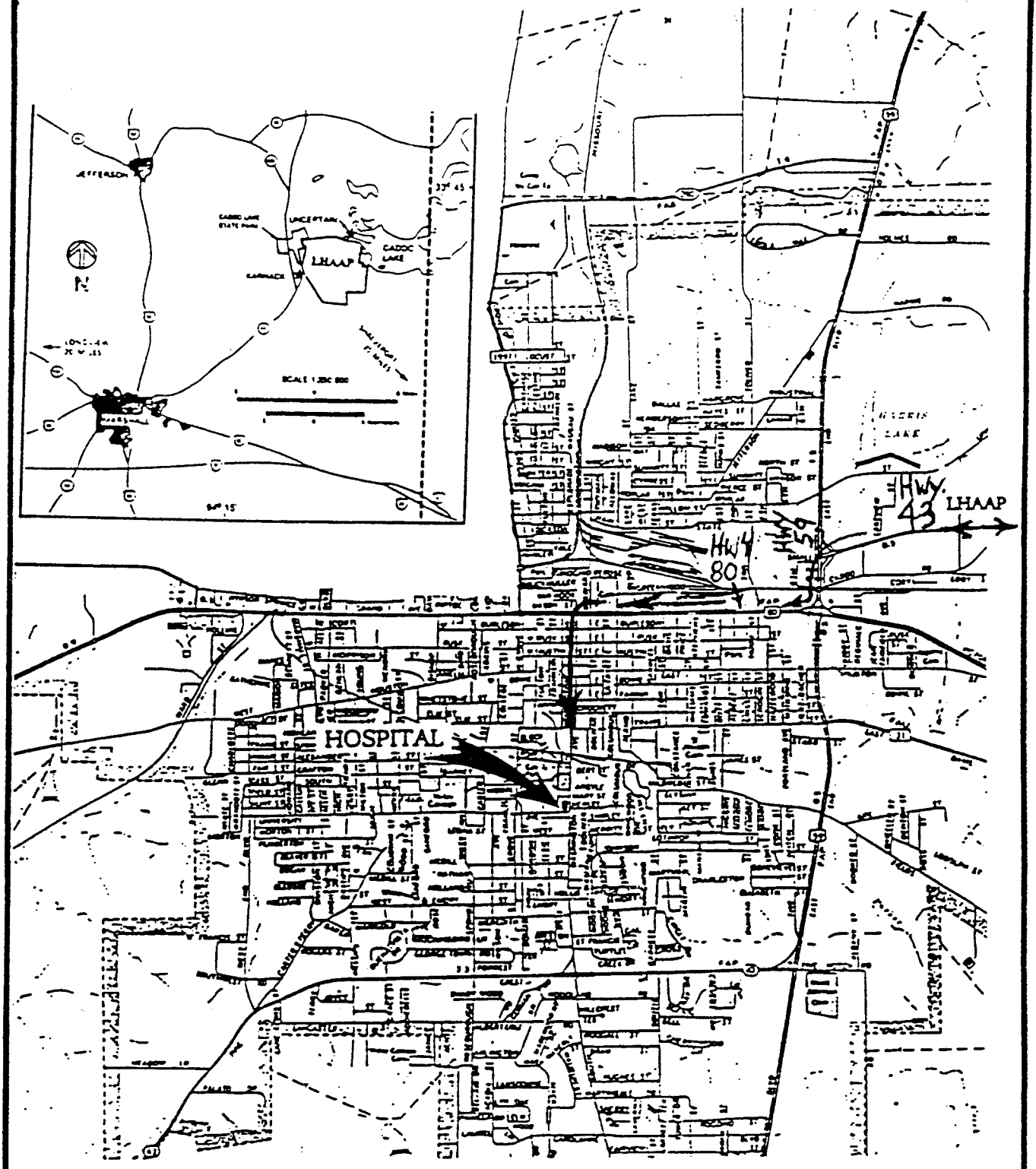
(2) Type of Medical Emergency Services at Marshall Memorial Hospital:

( ) Physical Trauma only
(X) Physical Trauma & Chemical Exposure
( ) Chemical Exposure only
(X) Available 24 Hours

Route to Hospital: (See attached map, Figure 3);

Travel Time from Site (minutes): (Will be field determined)
Distance to Hospital (miles): (Will be field determined)
Name/No. of 24 hour ambulance service: (See aforementioned contact list for Thiokol's LHAAP Ambulance sservice).

006751



SOURCE: EBASCO SERVICES, INC.

MARSHALL MEMORIAL
HOSPITAL LOCATION MAP

FIGURE 3

VII. Site Personnel and Certification Status

A. WESTON

Name	Title	Task(s)	Medical Current a.	Fit Test Current Qual b.	Fit Test Current Quant b.	Training Current c.	Certification Level or Description
Steve Mitchell	Assoc. Geologist	All	(Y)	(Y)	(Y)	(Y)	D-S/B-T
Dennis Hayes	Asst. Geologist II	All	(Y)	(Y)	(Y)	(Y)	B-T
Shekhar Iyer*	Senior Project Ldr.		(Y)	(Y)	(Y)	(Y)	C-S
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
Site Health and Safety Coordinator (SHSC)							
Steve Mitchell	Assoc. Geologist		(Y)	(Y)	(Y)	(Y)	D-S/B-T

(a) Training - All personnel, including visitors, entering the exclusion or contamination reduction zones must have certification of completion of training in accordance with OSHA 29 CFR 1910 29, CFR 1910 29, CFR 1226/1910 or 29 CFR 1910.120.

(b) Respirator Fit Testing - All persons, including visitors, entering any area requiring the use of potential use of any negative pressure respirator must have had as a minimum, a qualitative fit test, administered in accordance with OSHA 29 CFR 1910.134 or ANSI within the last 12 months. If site conditions require the use of a full face negative pressure, air purifying respirator for protection from Asbestos or lead, employees must have had

a Quantitative fit test, administered according to OSHA 29 CFR 1910.1002 or 1025 within the last 6 months.

(c) Medical Monitoring requirements - All personnel, including visitors, entering the exclusion or contamination reduction zones must be certified as medically fit to work, and to wear a respirator, if appropriate, in accordance with 29 CFR 1910, 29 CFR 1926/1910 or 29 CFR 1910.120.

The Site Health and Safety Coordinator is responsible for verifying all certifications and fit tests.

B. Subcontractor's Health and Safety Program Evaluation (See Attachment A)

Name and address of subcontractor:

Activities to be conducted by subcontractor:

EVALUATION CRITERIA

Item	Acceptable	Unacceptable	Comments
Medical Program meets OSHA/WESTON Criteria	( )	( )	
Personal Protective Equipment Available:	( )	( )	
a. meets OSHA criteria,	( )	( )	
b. is as specified in WLHASP	( )	( )	
On-site Monitoring Equipment Available, Calibrated and Operated Properly	( )	( )	
Safe Working Procedures Clearly Specified	( )	( )	
Training Meets OSHA/WESTON Criteria	( )	( )	
Emergency Procedures	( )	( )	
Decontamination Procedures	( )	( )	
General Health & Safety Program Evaluation	( )	( )	

Additional Comments:

Evaluation conducted by: ; Date:

B. 1. Subcontractor's Health and Safety Program Evaluation (See Attachment A)

Name and address of subcontractor:

Activities to be conducted by subcontractor:

EVALUATION CRITERIA

Item	Acceptable	Unacceptable	Comments
Medical Program meets OSHA/WESTON Criteria	( )	( )	
Personal Protective Equipment Available:	( )	( )	
a. meets OSHA criteria,	( )	( )	
b. is as specified in WLHASP	( )	( )	
On-site Monitoring Equipment Available, Calibrated and Operated Properly	( )	( )	
Safe Working Procedures Clearly Specified	( )	( )	
Training Meets OSHA/WESTON Criteria	( )	( )	
Emergency Procedures	( )	( )	
Decontamination Procedures	( )	( )	
General Health & Safety Program Evaluation	( )	( )	

Additional Comments:

Evaluation conducted by: ; Date:

B. 2. Subcontractor's Health and Safety Program Evaluation (See Attachment A)

Name and address of subcontractor:

Activities to be conducted by subcontractor:

EVALUATION CRITERIA

Item	Acceptable	Unacceptable	Comments
Medical Program meets OSHA/WESTON Criteria	( )	( )	
Personal Protective Equipment Available:	( )	( )	
a. meets OSHA criteria,	( )	( )	
b. is as specified in WESTON LHASP	( )	( )	
On-site Monitoring Equipment Available, Calibrated and Operated Properly	( )	( )	
Safe Working Procedures Clearly Specified	( )	( )	
Training Meets OSHA/WESTON Criteria	( )	( )	
Emergency Procedures	( )	( )	
Decontamination Procedures	( )	( )	
General Health & Safety Program Evaluation	( )	( )	

Additional Comments:

Evaluation conducted by: ; Date:

C. Subcontractor

Name	Title	Task(s)	Medical Current a.	Fit Test Current Qual b.	Fit Test Current Quant b.	Training Current c.	Certification Level or Description
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	
			( )	( )	( )	( )	

VIII. Health and Safety Plan Approval/Sign Off Format

A. Site Name: _____
Work Order No.: _____
Work Location Address:

_____

I have read, understood, and agreed with the information set forth in this Health and Safety Plan (and attachments) and discussed in the Personnel Health and Safety briefing.

Site Safety Co-ordinator: _____

Signature: _____ Date: _____

Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date

longhorn:38868701:hasp.917(eoi)

Name Signature Date

VIX. Training and Briefing Topics

A. The following items will be covered at the site specific training meeting, daily or periodically.

Site Specific Training Meeting	Daily	Periodically	
X			Site characterization and analysis, Sec. 3.0; 29 CFR 1910.120 i.
X	X		Physical hazards, Table 3.2.
X	X		Chemical hazards, Table 3.1.
X			Animal bites, stings and poisonous plants.
			Etiologic (Infectious) Agents.
X			Site control, Sec. 8.0; 29 CFR 1910.120 d.
X			Engineering controls and work practices, Sec. 8.5; 29 CFR 1910.120 g. Heavy Machinery.
			Forklift
			Backhoe
X	X		Equipment
X	X		Tools
			Ladder 29 CFR 1910.27 d.
X			Overhead and Underground Utilities
			Scaffolds
			Structural Integrity
			Unguarded Openings-wall, Floor, Ceilings (?).
			Pressurized Air Cylinders
X	X		Personnel Protective Equipment, Sec. 5.0; 29 CFR 1910.120 g; 20 CFR 1910.134
X			Respiratory Protection Sec. 5.8; 29 CFR 1910.120g; Z88.2-1980.

Site Specific Training Meeting	Daily	Periodically	
_____	_____	_____	Level A
__X__	_____	_____	Level B
__X__	_____	_____	Level C
__X__	__X__	_____	Level D
__X__	__X__	____X____	Monitoring, Sec. 7.0; 29 CFR 1910.120 h.
__X__	__X__	____X____	Decontamination, Sec. 9.0; 29 CFR 1910.120 k.
__X__	_____	____X____	Emergency Response, Sec. 10.0; 29 CFR 1910.120 l.
_____	_____	_____	Elements of an Emergency Response, Sec. 100; 29 CFR 1910.120 l.
__X__	_____	____X____	Procedures for Handling Site Emergency Incidents; Sec. 10.0; 29 CFR 1910.120 l.
__X__	_____	_____	Off Site Emergency Response, 29 CFR 1910.120 l.
__X__	__X__	_____	Handling Drums and Containers, 29 CFR 1910.120 j.
_____	_____	_____	Opening Drums and Containers
_____	_____	_____	Electrical Material Handling Equipment.
_____	_____	_____	Radioactive Waste.
_____	_____	_____	Shock Sensitive Waste.
_____	_____	_____	Laboratory Waste Packs.
_____	_____	_____	Sampling Drums and Containers.
__X__	_____	____X____	Shipping and Transport, 49 CFR 172.101.
_____	_____	_____	Tank and Vault Procedures.
_____	_____	_____	Illumination, 29 CFR 1910.120 m.
__X__	__X__	_____	Sanitation, 29 CFR 1910.120 n.

B. Key Personnel/Identification of Health and Safety Personnel
(See Section VI. Contingency Plans of this HASP).

1.0 Key Personnel

The following personnel and organizations are key to the activities at this site.

EPA Representatives

Organization/Branch	Name/Title	Address	Telephone

Roles and Responsibilities: _____

Other EPA Contractors & Subcontractors

Organization/Branch	Name/Title	Address	Telephone

Roles and Responsibilities: _____

Other Regulatory Agency Representatives

Organization/Branch	Name/Title	Address	Telephone

Roles and Responsibilities: _____

APPENDIX B

WESTON'S
STANDARD INCIDENT REPORT AND FOLLOW-UP FORM

OSHA No. 101

Case or File No. _____

WESTON MANAGERS DESIGNERS/CONSULTANTS

INCIDENT REPORT FORM

006762

Date: _____

SUPPLEMENTARY RECORD OF OCCUPATIONAL INJURIES AND ILLNESSES

EMPLOYER (WESTON or Subcontractor)

1. Name _____

2. Mail Address _____
City State ZIP

3. Location, if different from mail address _____

INJURED OR ILL EMPLOYEE

4. Name _____ S.S. No. _____
(First name) (Middle name) (Last name)

5. Home Address _____
No. and Street City or Town State Zip

6. Age _____ 7. Sex: Male ___ Female ___ Employee No. _____

8. Occupation _____ (Enter regular job title, not job title at time of injury or exposure)

9. Department (Name & No.) _____

THE ACCIDENT OR EXPOSURE TO OCCUPATIONAL ILLNESS

10. Place of accident or exposure _____

_____

(Give address or describe place injury occurred as accurately as possible)

11. Was place of accident or exposure on employee's premises? _____ (Yes or No)

12. What was employee doing when injured? _____

_____

_____

(Specify any tools/equipment/materials involved and what was being done)

13. How did the accident occur? _____

_____

_____

(Describe fully the events which resulted in the injury or illness)

14. List names of witnesses: _____

15. Was the injury due to an automobile accident? _____ (Yes or No) If so, attach automobile accident report.

OCCUPATIONAL INJURY OR OCCUPATIONAL ILLNESS

16. Describe the injury or illnesses _____

_____

_____

(Describe in detail and indicate the part of the body affected)

17. Name the object or substance which directly injured the employee _____

_____

18. Date of injury or initial diagnosis of occupational illness _____ Time of injury _____

Date of return to work _____ 19. Date/Time reported to Corporate Health & Safety _____

20. Did the employee die? _____ (Yes or No)

NOTE: Complete Questions 1 through 29 and Send Via Fax (215)430-3167 within 48 Hours. Forward completed report to Corporate Health and Safety within 5 days.

Incident Report Form

Case or File No. _____ Employee Name: _____

PROJECT/PROGRAM IDENTIFICATION

21. Work Order No. _____ or Program ID _____
22. Project Manager _____ Div/Reg OPs Manager _____
23. Div/Reg Operations Safety Officer _____
24. Site/Project Health and Safety Coordinator _____

OTHER

25. List protective equipment and clothing used by employee _____
26. Did limitations of protective equipment/clothing contribute to injury/illness? If so, explain: _____
27. Name and Address of treating physician (also attach medical consultants comments) _____
    - Indicate length of stay _____
28. If hospitalized, name and address of hospital _____
    - Indicate length of stay _____

CORRECTIVE ACTION

29. Explain corrective actions taken/to be taken which will prevent similar occurrances (attach additional pages if required): _____

DOCUMENTATION OF REVIEW

30. Employee Involved

(Name)	(Signature)	(Date)

31. Safety Management (Site Health and Safety Coordinator, and/or Regional or Divisional Operations Safety Officer)

(Name)	(Signature)	(Date)

32. Review by immediate supervisor and a minimum of one of the following:
    - Project Manager, Project Director, Department/Office Manager, Division/Regional Operations Manager, or Division/Region Manager

(Name)	(Signature)	(Date)

006764

Incident Report Form

Case or File No. _____ Employee Name: _____

(FOR CORPORATE HEALTH AND SAFETY USE ONLY)

33. Initial Review by _____ _____

Name Date

- Review and Comments:

_____

_____

_____

_____

33. Are additional corrective actions required? (Yes or No) List:

_____

_____

_____

_____

_____

(Date Due _____)

35. Date corrective actions accomplished: _____

36. Corporate Health and Safety Director

_____ _____ _____

(Name) (Signature) (Date)

INCIDENT ANALYSIS · First Aid Only _____. OSHA Recordable _____.

DATE	EMP #	DEPT #	OCCUPATION	DESCRIPTION	FATAL	1	2	3	4	5	6	A	B	C	D	E	F	FATAL	9	10	11	12	13

RFW 11-01-020/A-07/91

006765

WESTON

Please fax this form to Roy F. Weston, Inc. - Health & Safety (215)430-3167
ATTN: Anthony Taylor

RETURN TO WORK

IRF CASE NO. _____ EMPLOYEE NO. _____ SS# _____/_____/_____

EMPLOYEE NAME _____ DATE OF INJURY/ILLNESS: _____

PHYSICIAN'S NAME/ADDRESS _____

_____

TELEPHONE NO. ( ) _____

PHYSICIAN'S STATEMENT (Physician, please type or print clearly and fill out or attach equivalent form)

Type of Injury: _____

Diagnosis: _____

_____

Occupationally Related? _____

Treatment: _____

_____

==========

Is further treatment required? _____

Type of Care: _____

_____

Next Appointment: _____

==========

Can employee return to work immediately? _____

If No, when may employee return to work? _____

If Yes, are there any restrictions? _____

_____

How many days? _____

PHYSICIAN'S SIGNATURE: _____ DATE: _____
AUTHORIZATION TO RELEASE INFORMATION
I hereby authorize my attending physician and/or hospitals to release any information or copies thereof acquired in the course of my examination or treatment for the injury identified above to my employer or his representative.
EMPLOYEE'S SIGNATURE: _____ DATE: _____

RFW 11-01-020/B-07/91

ATTACHMENT A

WESTON SUBCONTRACTORS

A.W. POOL, INC.

ROUTE ONE, BOX 133B CLINTON, OKLAHOMA 73601

A.W. POOL, President
RES. 405/323-0642
•
WINSTON POOL, Operations
RES. 405/323-5272
•
CLINTON, OKLAHOMA
405/323-3454
Fax: 405/323-1414

006767

July 12, 1993

Mr. Ken Clayman
Roy F. Weston, Inc.
5599 San Felipe Dr., Suite 700
Houston, TX 77056

Re: Medical monitoring and safety training program

Dear Mr. Clayman:

A.W. Pool, Inc. certifies that its employees are involved in a medical monitoring program and receive CFR training and experience in accordance with OSHA regulation 1910.120.

The medical monitoring portion of the program is performed by Dr. James Rhymer. This includes a yearly physical including blood tests for the presence of PCB, benzene, lead, and illegal drugs. The safety portion is administered by Winston Pool, A.W. Pool, Inc.'s health and safety officer. Samples of site safety training and experience for key personnel are included along with this packet. The safety training includes a 40 hour course at the beginning of employment, an 8 hour refresher course each year, and a yearly respirator fit test.

If you have any questions about A.W. Pool, Inc.'s health and safety program, please call.

Respectively,

Winston Pool
Vice-President

WLP:slm

Enclosures

A. W. Pool, Inc.

Respirator Training & Fit Test

This Is To Certify That Greg Pool

Has Been Fitted and Trained in the use,

Limitations and Maintenance of

3M Brand 7200 and 7800 Respirator(s)

In Compliance with OSHA/MSHA Regulations.

5/10/93
Date

Company Safety Representative

894900

CERTIFICATE OF TRAINING
OSHA - SARA

HSI SIMON HYDRO-SEARCH

certifies that

Greg Pool

Has Met The 8 Hour Refresher Training Requirement Under OSHA Standard, 29 CFR 1910.120 Hazardous Waste Operations And Emergency Response

ACKNOWLEDGEMENT
Simon Hydro-Search

July 9, 1993
DATE
Certificate No. 316

006769

A. W. Pool, Inc.

This Certificate is awarded to

KEITH POOL

in recognition of participation in the

40 Hour SARA/RCRA Safety Training Course
In accordance with OSHA Standard 40 CFR 1910.120.

This 16th day of May, 19 86
Clinton, Oklahoma

Company Safety Representative

006770

CERTIFICATE OF TRAINING
OSHA - SARA

SIMON HYDRO-SEARCH

certifies that

Keith Pool

Has Met The 8 Hour Refresher Training Requirement Under OSHA Standard, 29 CFR 1910.120 Hazardous Waste Operations And Emergency Response

Laura J Baldon

ACKNOWLEDGEMENT

Simon Hydro-Search

July 9, 1993

DATE

Certificate No. 317

006771

A. W. Pool, Inc.

Respirator Training & Fit Test

This Is To Certify That Keith Pool

Has Been Fitted and Trained in the use,

Limitations and Maintenance of

3M Brand 7200 and 7800 Respirator(s)

In Compliance with OSHA/MSHA Regulations.

5/10/93
Date

Company Safety Representative

006772

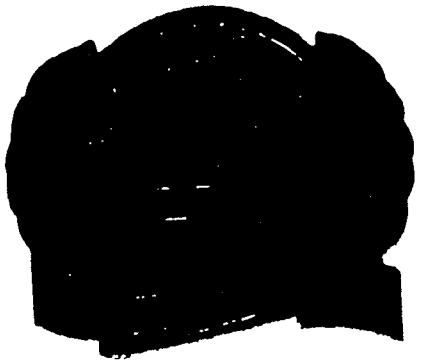
A. W. Pool, Inc.

This Certificate is awarded to

DAVID PEREZ

in recognition of participation in the

40 Hour SARA/RCRA Safety Training Course
In accordance with OSHA Standard 40 CFR 1910.120.



This 3rd day of June, 19 86
Clinton, Oklahoma

Company Safety Representative

006773

A. W. Pool, Inc.

This Certificate is awarded to

David Perez

in recognition of participation in the

8 Hour SARA/RCRA Annual Refresher Training Course
In accordance with OSHA Standard 40 CFR 1910.120.

This 10th day of May, 1993
Clinton, Oklahoma

Company Safety Representative

006774

A. W. Pool, Inc.

Respirator Training & Fit Test

This Is To Certify That David Perez

Has Been Fitted and Trained in the use,

Limitations and Maintenance of

3M brand 7200 and 7800 Respirator(s)

In Compliance with OSHA/MSHA Regulations.

5/10/93
Date

Company Safety Representative

006775

ATTACHMENT B

WESTON FIELD OPERATION PROCEDURES

2.4.1 Noise Protection - FLD01

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD01 - Noise Protection

Related SPOPSFLDS:

FLD03	Hot Processes
FLD08	Confined Spaces
FLD16	Compressed Gas Systems
FLD21	Explosives
FLD22	Heavy Equipment Operation
FLD33	Demolition
FLD38	Hand and Power Tools

Related Programs:

PPE Program Section

2.4.1.1 Hazard

Noise is defined as unwanted sound. Noise can cause sudden traumatic temporary hearing loss, long term more slowly occurring sensory-neural hearing loss which is irreversible, disruption of communication and masking of warning devices and alarms. Increased stress levels and effects on the cardiovascular and nervous systems have been documented. These latter two effects may occur at levels below that which cause damage to hearing and in situations where conditions are constant and daily.

2.4.1.2 Recognition and Risk Assessment

The need for noise monitoring equipment, noise dosimeters or hearing protection devices must be addressed in the planning stages of a project HASP.

Some of the source of noise at hazardous materials, demolition, construction and industrial sites which can cause hearing damage are: compressor motors, drill rig engines, hammer blows (such as from a split spoon), compressor motors, compressed air, compressed water, and heavy equipment. This list is not all inclusive. Any sound level surveys indicating noise levels of 85 dBA or above, or, in the absence of sound level measuring instrumentation, any noise/sound preventing normal vocal discussion between two individuals at arms length distance will dictate the need for hearing protection.

Where feasible, noise exposure will be controlled by engineering controls. Where high noise levels are encountered and where engineering controls cannot be accomplished, hearing

protection devices will be used for worker protection from noise induced hearing l
Hearing protection will be afforded by either disposable ear plugs or ear mu
Administrative time control is not an acceptable method for preventing noise exposure since
extreme noise for a short duration can cause severe, permanent hearing loss.

OSHA regulations generally apply to 8-hour exposures and consider 85 dBA as an action level for a Hearing Conservation Program. WESTON's Hearing Conservation Program includes physical examination and audiometric testing during annual medical monitoring.

The selection, use, maintenance, and control of hearing protection is further defined in the WESTON Personnel Protective Equipment Program.

2.4.1.3 Prevention and Hearing Conservation Program

Noise Evaluation

The noise exposure assessment is performed only by qualified personnel with special noise measuring equipment which is calibrated before and after each use. This program attempts to meet or exceed all government regulations pertaining to occupational noise exposure. Feasible engineering controls are sought as the primary means of noise attenuation. Weston personnel and Weston subcontractors are to wear hearing protection devices when required and where signs are posted requiring their use.

The Survey

If the HASP or the SHSC indicate that the site, or activity, requires an instrumentation survey then
initially the area will be screened with a sound level meter. If deemed necessary a more in depth evaluation utilizing a noise dosimeter may be performed.

Employee noise exposure is expressed as an eight-hour time-weighted average (full shift exposure) in decibels (dB) on the "A-scale" (dBA). This number is to be compared to the Occupational Safety and Health Administration's Permissible Exposure Limit (PEL) which is an 8-hour time-weighted average (TWA) of 90 dBA, and the OSHA Action Level (AL) which is 85 dBA.

The PEL is a limit which should not be exceeded, and the AL is a noise level threshold which when exceeded obligates the employer to establish a Hearing Conservation Program (HCP).

In order to understand the logarithmic decibel scale, consider that an increase of 5 decibels is just perceptible to most people, and an increase of 10 decibels is judged by most people to be doubling of "loudness".

The HCP includes baseline and annual hearing tests, and hearing conservation training. Whenever there is a reasonable possibility of employee noise exposure over 85 decibels, the affected employees are enrolled in the HCP.

All Weston personnel and WESTON subcontractors shall comply with the appropriate requirements stipulated in OSHA, Part 1926.52 "Occupational Noise Exposure," 1926.101 "Hearing Protection", 1910.95 "Occupational Noise Exposure and/or applicable state or local requirements when noise exposure exceeds the levels shown in Table 1.

If impact noise is present, the peak noise levels and the frequency of the impacts should be determined. The American Conference of Governmental Industrial Hygienists (ACGIH) recommends certain limits to impact noise which depend on the noise intensity and frequency of the impacts. The Table 2 shows the criteria being used.

Results of the Survey

The results of the survey and any recommendations and actions required will be sent in writing to the employee. Hearing protection devices are strongly recommended in any noisy environment, but are mandatory in the following situations:

1) The eight hour average may equal or exceed 90 decibels.

2) Any employee exposed to greater than or equal to 85 decibels and who have experienced a standard threshold shift (STS) in their hearing.

3) Any noise equal to greater than 115 decibels impact, continuous or intermittent. Note that in this case there may be areas where hearing protection devices are mandatory, but employees are not in the HCP.

4) Anywhere a "HEARING PROTECTION REQUIRED..." sign is posted. These signs are to be posted in all mandatory situations listed in (1) through (3) above, but are often posted in other noisy areas.

Audiometric Testing

Audiometric testing is performed to annually evaluate the hearing of all individuals who are exposed to 8 hour TWA exposures of 85 dBA or greater, or to impact noise. By evaluating the hearing of these individuals, the overall effectiveness of the Occupational Noise and Hearing Conservation Program can be systematically monitored.

Training

Initial and annual training shall be given to each employee included in the Hearing Conservation Program. The training will address the following:

- The effects of noise on hearing.

- The purpose of hearing protection, advantages, disadvantages, attenuation of various types, and the selection, fitting, use, and care of protectors.
- The purpose of audiometric tests and explanation of test procedures.

Hearing Protection

Hearing protection is available to each employee. Ear muffs and ear plugs are available. Hearing protector attenuation is intended to reduce employee exposures below 85 dBA for employees with standard threshold shifts and below 90 dBA for all other employees.

Not all hearing protection devices have the same noise reduction rating (NRR). Verification of NRR values must be made by referring the manufacturers specifications. Table 3 provides the NRR for selected hearing protection devices.

Recordkeeping

A record of all employee exposure measurements is retained for a minimum of two years and audiometric test records are retained for the duration of the employee's employment plus thirty years.

TABLE 1 NOISE EXPOSURE LIMITS NOISE PROTECTION SPOPSFLD01	
Duration in Hours	Sound Level dBA Slow Response
8	90
6	92
4	95
3	97
2	100
1 1/2	102
1	105
1/2	110
1/4 or less	115
In all cases, for operations exceeding the noise levels identified above, feasible administrative or engineering controls should be utilized. If such control fail to reduce sound levels within the levels of the table above, hearing protection is required. Additionally, when exposure exceeds those listed this table, a hearing conservation program should be administered.	

TABLE 2 NUMBER OF IMPACTS PER DAY NOISE PROTECTION SPOPFLD01	
Limit	Decibels
10,000	≥120
1,000	≥130
100	140

TABLE 3 HEARING PROTECTION DEVICE LIST NOISE PROTECTION SPOPSFLD01	
Hearing Protection Device	*Noise Reduction Rating (NRR)
Ear foam ear plugs	29 decibels
MSA molded ear plugs	22 decibels
Ear molded ear plugs	27 decibels
MSA Mark IV earmuff	25 decibels
3M earmuff	24 decibels
Ear 1,000 earmuff	24 decibels

* The higher the NRR, the greater the noise reduction.
* NRR's are subject to manufacture changes, verify the NRR of each protective device prior to use.

2.4.2 Inclement Weather - FLD02

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD02 - Inclement Weather

Related SPOPSFLDS:

FLD05	Heat Stress Prevention and Monitoring
FLD06	Cold Stress
FLD25	Working at Elevations
FLD26	Ladders
FLD27	Scaffolds

2.4.2.1 Hazard

Hot weather (ambient temperatures over 70°F), cold weather (ambient temperature levels below 40°F), rain, snow, ice and lightning are examples of inclement weather that may be hazardous or add risk to WESTON work activities. Heat stress and cold stress are covered under separate Standard Procedures.

Extremes of heat, cold and humidity, as well as rain, snow and ice, can adversely affect monitoring instrument response and reliability, respiratory protection performance, a chemical protective clothing materials.

Heat

Additional examples and protection from heat stress are addressed in WESTON Safety Procedure FLD05. Hot dry weather increases risk of soil drying, erosion and dust dispersion which may present or increase risk of exposure and environmental impact from toxic hazards. Hot weather will increase pressure on closed containers and the rate of volatilization, thereby potentially increasing the risk of exposure to toxic, flammable, or explosive atmospheres.

Rain, Wet Weather, and High Humidity

Rain and wet conditions increase slipping and tripping hazards, braking distances of vehicles, and the potential for slippage or handling difficulties on other devices such as augers, drills, etc. Rain fills holes, obscures trip and fall hazards, and increases risk of electrical shock when working with electrical equipment. Rain changes soil conditions in trenching and excavating activities with the potential to form quicksand, weaken walls, and increase the

risk of cave-in. Vehicles become stuck in mud and tools and personnel can slip on wet surfaces.

Rain and wet conditions additionally decrease visibility (especially when wearing respiratory protection) and limit the effectiveness of certain direct-reading instruments e.g., PIDs.

Cold, Snow, and Ice

In addition to cold stress, which is covered in WESTON Safety Procedure FLD06, cold weather affects vehicle operation by causing window frosting and increased difficulty in starting and braking. Ice and snow can accumulate on windows and obscures vision.

Cold, wet weather can cause icing of roadways, driveways, parking areas, general work places, ladders, stairs, and platforms. Ice is not always as obvious to see as is snow or rain and requires special attention especially as relates to driving speed and walking.

Snow and ice increases the risk of slipping when walking, climbing steps and ladders, working at elevation and of accidents when driving vehicles or operating heavy equipment. Heavy snow and ice storms may cause electric lines to sag or break, and use of electric equipment in snow increases the risk of electric shock. Snow can hide pot holes and mud, which can result in vehicles getting stuck or persons falling when stepping into hidden holes. Snow also may cover water, drums or containers, and sharp metal or sticks that can cause falls or punctures.

Personnel performing activities which require working over ice should be aware of minimal ice thickness safety guidelines as follows:

4 inch minimum: Activities such as walking or skating.
6 inch minimum: Activities such as snowmobiling or the use of equipment with the same weight and cross-sectional area as a snowmobile.

Personnel should always be aware that these measurements are under ideal conditions and that ice conditions on rivers, ponds or lakes with active currents, snow cover, and other environmental factors impact the safety of working on ice. Clear ice typically is the strongest while ice which appears cloudy or honeycombed is not as structurally sound. Measurements made by drilling or cutting through the ice should be made every few feet to verify safe conditions. Under no circumstances should WESTON personnel operate motor vehicles such as cars or trucks on ice.

Provisions for rescue, e.g., ladders or long poles and effective communications must be available.

Lightning

Lightning represents a hazard of electrical shock that is increased when working in flat c spaces, elevated work places, or working near tall structures or equipment such as sta radio towers, and drill rigs. Lightning has caused chemical storage tank and grass or fo fires. Static charges associated with nearby electrical storms can increase risk of fire or explosion when working around flammable materials and can cause adverse reaction to monitoring instruments.

2.4.2.2 Recognition and Risk Assessment

There are few OSHA regulations which apply to the conditions covered in this procedure however, under specific standards (e.g., Construction Industry, Subpart P, Excavations) and the OSH Act "General Duty Clause," inclement weather hazards must be addressed in safety programs.

Heat, rain, cold, snow, ice, and lightning are natural phenomena that complicate work activities, and add or increase risk. The potential for physical hazards must be considered for tasks which expose personnel to inclement weather. Risk assessment can be accomplished during the planning stages of a project by developing a task risk analysis for the most likely inclement weather conditions which may be encountered, i.e., rain and lightning in late spring, summer, and early fall, or lightning prone areas; cold, snow, and ice in winter. The true determination of risk must be made on-site by the Site Health and Safety Coordinator (SHSC) who must be alert to these hazards, does not take them simply as a matter of fact, and has time to notice them.

Much of the responsibility for protection from inclement weather hazards falls upon SHSC. The SHSC must recognize the inclement weather hazards affecting site for which they are responsible, and complete the pre-site activity risk assessment when inclement weather occurs. The SHSC must recognize which weather conditions affect instruments and PPE function, and constantly remind site workers of the effects and need for more careful attention to equipment check-outs. All personnel should monitor function and integrity of personal protective equipment and be alert to changing weather conditions. The SHSC must make decisions on the proper safety procedures to use if work must continue or to stop work if the risk is too great. **Corporate Health and Safety must be notified of all instances of the need to stop work for safety reasons including inclement weather.**

2.4.2.3 Prevention and Protection Programs

Procedures to follow regarding inclement weather include the following:

Monitoring equipment and PPE must be maintained in proper working order and used according to manufacturers' instructions.

Walkways, stairs, ladders, elevated workplaces, and scaffold platforms must be kept free of mud, ice, and snow.

Vehicles used in rain or cold weather must have windshield wipers and defrosters with windows kept clear of obstruction.

Employees must be protected from airborne contaminants using engineering controls such as wetting dry soil to prevent particle dispersion and providing local ventilation to reduce volatile air contaminants to safe levels, or if engineering controls are infeasible, using prescribed PPE.

Required conformance with traffic laws, including maintaining speed within limits safe for weather conditions, and wearing seat belts at all times.

Using a walking stick or probe to test footing ahead of persons walking where there is standing water, snow, or ice to protect the walker against stepping into pot holes or onto puncture hazards, buried containers, or other potential structurally unsound surfaces.

Prior to using vehicles or equipment in off-road work, walking the work area or intended travel way when puddles or snow may obscure pot holes, puncture hazards or buried containers, or other potential structurally unsound surfaces.

Arrange to have winches, come-alongs or other mechanical assistance available when vehicles are used in areas where there is increased risk of getting stuck. Cable or rope and mechanical equipment used for pulling stuck vehicles must be designed for the purpose, of sufficient capacity for the load, and be inspected regularly and before use to ensure safety. **Manually pushing stuck vehicles is to be avoided.**

Monitoring wind shifts and velocity where change may result in dispersion of airborne contaminants into work area.

Prior to working in areas or beginning projects during times when there is an increased likelihood of lightning or that increase the potential for lightning striking personnel, steps must be taken to predict the occurrence of lightning strikes, including:

a) Checking with client management to determine if there is any pattern or noted conditions that predict lightning or if there are structures that are prone to lightning strikes. Arrange for client notification when there is increased potential for lightning activities. Ensure that clients include WESTON workers in lightning contingency plans.

b) Monitoring weather reports.

c) Noting weather changes and conditions that produce lightning.

d) Stopping work in open areas, around drill rigs or other structures that may attract lightning, on or in water and in elevated work places when lightning strikes are sighted or thunder is heard near a work site.

e) Ensuring all personnel are provided with safe areas of refuge. Keep personnel f standing in open areas, under lone trees or drill rigs.

2.4.5 Heat Stress Prevention and Monitoring - FLD05

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD05 - Heat Stress Prevention and Monitoring

Related SPOPSFLDS:

FLD02	Inclement Weather
FLD03	Hot Processes - Steam
FLD08	Confined Space Entry
FLD36	Welding, Cutting and Burning
FLD37	Pressure Washing

2.4.5.1 Hazard

Heat stress may occur at any time work is being performed at elevated temperatures. Wearing chemical protective clothing in most cases results in a decrease of natural body heat loss and increases the risk of heat stress.

If the body's physiological processes fail to maintain a normal body temperature because of excessive heat, a number of physical reactions can occur, with symptoms ranging from mild (such as fatigue, irritability, anxiety, and decreased concentration or dexterity) to fatal. Because heat stress is one of the most common and potentially serious illnesses at hazardous waste sites, regular monitoring and other preventative measures are vital to ensure safe working conditions.

2.4.5.2 Recognition and Risk Assessment

In the planning stages of a project the potential for heat stress disorders must be considered as physical hazards in the site specific Health and Safety Plan (HASP). Risk assessment can be accomplished in the development stages of a project by listing in the HASP the most likely heat stress disorders which may occur. The true determination of risk must often be made on-site by the Site Health and Safety Coordinator (SHSC). It is important that the SHSC be alert to these hazards, does not take them simply as a matter of fact, and has time to notice them. In addition, all site personnel must be aware of these symptoms in both themselves and their co-workers.

Four common heat stress disorders and their associated prevention and treatment methods are identified below.

Heat Stroke

Heat stroke is an acute and dangerous reaction to heat stress caused by a failure of the

body's heat regulating mechanisms, i.e., the individual's temperature control system (sweating) stops working correctly. Body temperature rises so high that brain damage and death will result if the person is not cooled quickly.

Symptoms - Red, hot, dry skin, although a person may have been sweating earlier; nausea; dizziness; confusion; extremely high body temperature; rapid respiratory and pulse rate; unconsciousness or coma.

Treatment - Remove the victim from the source of heat and cool the victim quickly. If the body temperature is not brought down fast, permanent brain damage or death will result. Soak the victim in cool, but not cold water; sponge the body with cool water or pour water on the body to reduce the temperature to a safe level (less than 102°F). Monitor the victim's vital signs and obtain immediate medical help. Do not give coffee, tea, or alcoholic beverages.

Heat Exhaustion

Heat exhaustion is a state of very definite weakness or exhaustion caused by the loss of fluids from the body. The condition is much less dangerous than heat stroke, but it nonetheless must be treated.

Symptoms - Pale, clammy, moist skin; profuse perspiration and extreme weakness. Body temperature is normal, pulse is weak and rapid, and breathing is shallow. The person may have a headache, may vomit, and may be dizzy.

Treatment - Remove the person to a cool, air conditioned or temperature controlled area, loosen clothing, place in a head-low (shock prevention) position, and provide rest. Consult a physician, especially in severe cases. Have patient drink 1 to 2 cups of water immediately, and every 20 minutes thereafter until symptoms subside.

Heat Cramps

Heat cramps are caused by inadequate electrolyte intake. The individual may be receiving adequate water, however, if not combined with an adequate supply of electrolytes the blood can thin to the point where it seeps into the active muscle tissue causing cramping.

Symptoms - Acute painful spasms of voluntary muscles, most notably the abdomen and extremities.

Treatment - Remove victim to a cool area and loosen clothing. Have the patient drink 1 to 2 cups of lightly salted water or diluted commercial electrolyte solution immediately, and then every 20 minutes thereafter until symptoms subside. Electrolyte supplements can enhance recovery (i.e., Gatorade, Quench, etc.) however, it is best to double the amount of water required by package directions and/or add water to the liquid form.

Heat Rash

Heat rash is caused by continuous exposure to heat and humid air, and is aggravated by chafing clothes. The condition decreases ability to tolerate heat and can be extremely uncomfortable.

Symptoms - Mild red rash, especially in areas of the body that come into contact with protective gear.

Treatment - Decrease amount of time in protective gear and provide body powder to help absorb moisture and decrease chafing.

2.4.5.3 Prevention and Protection Programs

General Prevention Programs

Site workers must learn to recognize and treat the various forms of heat stress. The best approach is preventative heat stress management such as in the following:

Have workers drink 16 ounces of water before beginning work, at established breaks and in the morning or after lunch. The body's normal thirst mechanism is not sensitive enough to ensure body fluid replacement therefore, pre and post work loading is necessary. Un heavy work and hot conditions the body may lose up to 2 gallons of body fluids per d In order to prevent heat stress conditions, the individual must ensure replacement of this moisture.

Provide disposable 4-ounce cups, and water that is maintained at 50 - 60°F. Urge workers to drink 1 to 2 of these cups of water every 20 minutes for a total of 1 to 2 gallons per day. Provide a cool, shaded area for rest breaks. Discourage the intake of coffee during working hours. Monitor for signs of heat stress.

Ensure all workers maintain a good diet during these periods. In most cases a balanced diet and lightly salting foods should be the only requirement to maintain the body's electrolyte balance.

If utilizing commercial electrolyte mixes double the amount of water called for in the directions. Indications are that "full strength" preparations taken under high heat stress conditions may actually decrease the body's electrolytes.

Provide various fruits for workers as snacks. Bananas are especially good at maintaining the body's potassium level.

Acclimate workers to site work conditions by slowly increasing workloads, i.e., do not begin

site work activities with extremely demanding activities.

Provide cooling devices to aid natural body heat regulation. These devices, however, add weight and their use should be balanced against worker efficiency. An example of a cooling aid is long cotton underwear, which acts as a wick to absorb moisture and protect the skin from direct contact with heat-absorbing protective clothing.

In extremely hot weather, conduct field activities in the early morning and evening.

Ensure that adequate shelter is available to protect personnel against heat and direct sunlight which can decrease physical efficiency and increase the probability of heat stress. If possible, set up the command post in the shade.

In hot weather, rotate shifts of workers wearing impervious clothing.

Good hygienic standards must be maintained by frequent changes of clothing and showering. Clothing should be permitted to dry during rest periods. Persons who notice skin problems should immediately consult medical personnel.

Heat Stress Monitoring and Work Cycle Management

For strenuous field activities that are part of on-going site work activities in hot weather, the following guidelines should be used to monitor the body's physiological response to heat, and to manage the work cycle, even if workers are not wearing impervious clothing. These procedures should be instituted when the temperature exceeds 70°F and the tasks/risk analysis indicates an increased risk of heat stress problems. Consult the HASP and/or Corporate Health and Safety if questions arise as to the need for specific heat stress monitoring. In all cases the SHSC and site personnel must be aware of the signs and symptoms of heat stress, provide adequate rest breaks and proper aid as necessary.

Measure Heart Rate - Heart rate should be measured by the radial pulse for 30 seconds as early as possible in the resting period. The heart rate at the beginning of the rest period should not exceed 110 beats/minute. If the heart rate is higher, the next work period should be shortened by 33%, while the length of the rest period stays the same. If the pulse rate still exceeds 110 beats/minute at the beginning of the next rest period, the following work cycle should be further shortened by 33%. The procedure is continued until the rate is maintained below 110 beats/minute.

Measure Body Temperature - When ambient temperatures are over 90° F, body temperatures should be measured with a clinical thermometer as early as possible in the resting period. If the oral temperature exceeds 99.6°F (or 1 degree change from baseline) at the beginning of the rest period, the following work cycle should be shortened by 33%. The procedure is continued until the body temperature is maintained below 99.6°F (or 1 degree change from baseline). Under no circumstances should a worker be allowed to work if their oral temperature exceeds 100.6 degrees F.

Measure Body Water Loss

Body water loss greater than 1.5% of the total body weight is indicative of a heat stress condition. Body weight is measured before personal protective equipment (PPE) is donned and after the PPE is removed following a work cycle. Body water loss can be measured with an ordinary bathroom scale it, however, must be sensitive to one-half pound increments. A worker is required to drink additional fluids and rest if their body water loss is greater than 1.5%.

Note: For the purposes of this operating practice a break is defined as a 15 minute period and/or until an individual's vital signs are within prescribed guidelines.

Physiological Monitoring Schedule

A physiological monitoring schedule is determined by following the steps below.

1) Measure the air temperature with a standard thermometer.

2) Estimate the fraction of sunshine by judging what percent the sun is out. Refer to Table 1.

3) Calculate the adjusted temperature based on the following formula

Adjusted Temperature = actual temperature + 13 X (Fraction of the per sunshine factor).

4) Using Table 2 determine the frequency of physiological monitoring schedule for fit and acclimated workers.

The length of work period is governed by frequency of physiological monitoring (Table 2) The length of the rest period is governed by physiological parameters (heart rate and ora temperature).

For example, Site personnel anticipate wearing level C during site activities. The ai temperature is 80 F and there are no clouds in the sky. The adjusted temperature i calculated in the following manner.

Adjusted Temperature = Actual Temperature + 13 X (Fraction of the percent sunshin factor).
Adjusted Temperature = 80 F + 13 (.50)
Adjusted Temperature = 86.5 F

Using Table 2, the pulse rate, oral temperature and body water loss monitoring would be conducted after each 60 minutes of work. The adjusted temperature may need to be redetermined if the percent sunshine and ambient temperature changes drastically during site work.

If an individual's heart rate exceeds 110 beats/minute at the beginning of the rest period, that individual will remain on rest-time until his/her heart rate drops to baseline and their next work period is decreased by 33%.

TABLE 1
PERCENT SUNSHINE FACTORS
HEAT STRESS PREVENTION AND MONITORING
SPOPSFLD05

Percent Sunshine (%)	Cloud Cover	Sunshine fraction
100	No cloud cover	1.0
50	50% cloud cover	0.5
0	Full cloud cover	0.0

TABLE 2
PHYSIOLOGICAL MONITORING SCHEDULE
HEAT STRESS PREVENTION AND MONITORING
SPOPSFLD05

Adjusted Temperature	Level D (Permeable clothing)	Level C, B or A (Nonpermeable clothing)
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°F (30.8°-32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5°-87.5°F (28.1°-32.2°C)	After each 90 minutes of work	After each 60 minutes of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5°-77.5°F (22.5°-25.3°C)	After each 150 minutes of work	After each 120 minutes of work

2.4.6 Cold Stress - FLD06

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD06 - Cold Stress

Related SPOPSFLDS:

FLD02	Inclement Weather
FLD07	Wet Feet
FLD15	Remote Areas
FLD17	Diving
FLD18	Using Boats
FLD19	Working Over Water
FLD25	Working at Elevations

2.4.6.1 Hazard

Persons working outdoors in low temperatures (normally < 40 F), and especially at or below freezing, are subject to cold stress. Exposure to extreme cold for a short time can cause severe injury to the surface of the body, or result in profound generalized cooling, which, unchecked could ultimately cause death. Areas of the body that have high surface area-to-volume ratios such as fingers, toes, and ears, are the most susceptible.

Chemical protective clothing generally does not afford protection against cold stress. In many instances, it increases susceptibility. Chemical hazard site workers must learn to dress carefully to provide chemical protection and thermal insulation while not dressing so warmly that exercise or strenuous activity will result in cold stress.

Body heat is conserved through the constriction of surface blood vessels. This constriction reduces circulation at the skin layers and keeps blood nearer the body core.

Loss of body heat can occur through:

1. Respiration: In extreme cold, cover the mouth and nose with wool or fur to "pre-warm" the air you breath.

2. Evaporation: Wear layered clothing, remove outer layers prior to sweating to avoid soaking clothing. Replace layers prior to becoming chilled. Wear clothing that will "breath" or allow water vapor to escape to reduce cooling effect of evaporation.

3. Conduction: Sitting on snow, touching cold equipment and being rained on are examples of how heat can be lost by conduction. Extreme amounts of heat are lost rapidly when a person becomes wet. Deaths from hypothermia have occurred in

immersion in water at temperatures of 40 degrees F or lower. Perspiration or rai
should never be allowed to saturate clothing, such soaking will seriously reduce th
insulative properties of the clothing in addition to increasing heat loss. ost clothing
losses approximately 90 percent of their insulative properties when w

4. Radiation: The greatest amounts of body heat are lost from uncov surfaces of the body, especially the head, neck and hands. Covering these are s. therefore, extremely important.

5. Convection: The body continually heats a thin layer of air next to e skin. As long as this warm air is retained next to the body it will remain warm. If this warm air is removed by air currents (wind) then the body will be cooled attempting to rewarm the surface air. The primary function of clothing is to retain this warm surface layer of air while allowing water vapor to pass through. Ensure that clothing remains secure around the body especially the neck and waist. Wind Chill or Equivalent Chill Temperature Indices describe the chilling effect of moving air in combination with low temperature.

Two major factors which influence the potential of cold injury are: ambient temperature and wind velocity. Wind chill is used to describe the chilling effect of moving air in combination with low temperature. Additionally, water conducts heat 240 times faster than air; thus, the body cools suddenly when protective equipment is removed if the clothing underneath is perspiration soaked.

Tables 1 and 2 should be consulted to adjust working schedules for wind chill conditions. These tables are meant as guides only; ambient temperatures and wind conditions should be monitored frequently and work schedules adjusted as required. Workers' physical symptoms or condition will also be an indicator to modify work schedule.

2.4.6.2 Recognition and Risk Assessment

In the planning stages of a project and safety plan, the potential for cold stress disorders must be considered as physical hazards in the site specific Health and Safety Plan (HASP). Risk assessment can be accomplished in the development stages of a project by listing in the HASP the most likely cold stress disorders which may occur. The true determination of risk must often be made on-site by the Site Health and Safety Coordinator (SHSC). It is important that the SHSC is alert to these hazards, does not take them simply as a matter of fact, and has time to notice them. Two common cold stress disorders and treatment methods are identified below.

Frostbite

Local injury resulting from cold is included in the generic term frostbite. By definition, frostbite is the freezing of tissue, however, typically several stages are recognized based upon

the degree of injury. Frostbite most commonly affects the toes, fingers and face and occurs when an extremity loses heat faster than it can be replaced by the circulating blood. Frostbite may also result from direct exposure to extreme cold or high wind as happens with the nose, ears, and hands. Damp feet may freeze because of the conduction of heat away from the skin's surface.

Frostbite of the extremities can occur in three forms:

- Frost nip or incipient frostbite is characterized by sudden blanching or whitening of skin.
- Superficial frostbite is characterized by skin with a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.
- Deep frostbite is characterized by tissues that are cold, pale or darkened, and solid.

Treatment for frostbite:

- Move the victim indoors and/or away from additional exposure to cold, wet and wind.
- Superficially frostbitten areas are best warmed by placing them next to warm skin. The basic tenant to rewarming frostbitten areas is to not raise the temperature much above that of the body. The abdomen and the armpit are body areas which can be used to rewarm frostbitten areas. Water at 99 to 104 degrees F can be used. Avoid fires, hot water, external heaters.
- Give a warm drink - water or juices, not coffee, tea or alcohol. The victim must not smoke.
- If using water to rewarm the affected areas keep the frozen parts in warm water until all paleness has turned to pink or burgundy red but no longer. Remember, the tissue will be very painful as it thaws.
- After rewarming, elevate the injured area and protect it from injury.
- Do not allow blisters to be broken.
- Use sterile, soft, dry material to cover the injured areas.
- Keep victim warm and obtain medical care as necessary.
- Do not rub the frostbitten part (this may cause gangrene).
- Do not use ice, snow, gasoline or anything cold on the frostbitten area.

- Do not use heat lamps or hot water bottles to rewarm the part.
- Do not place the part near a hot stove.

Hypothermia

Systemic hypothermia occurs when body heat loss exceed body heat gain and the body core temperature falls below the normal 99 degrees. While many hypothermia cases are caused by extremely cold temperatures one must remember that most cases develop in air temperatures between 30 and 50 degrees F especially when compounded with water immersion, or soaking, and windy conditions.

Symptoms of hypothermia can include one or more of the following listings. Remember that the victim of hypothermia may not know, or refuse to admit, that he or she is undergoing signs of hypothermia. All personnel must be observant for these signs for themselves and for other team members.

- Uncontrolled fits of shivering.
- Vague, slow, slurred speech.
- Irrational actions.
- Memory lapses.
- Incoherence.
- Fumbling hands, frequent stumbling, lurching gait.
- Apathy, listlessness, and sleepiness, inability to get up after a rest.
- Unconsciousness, glassy stare, slow pulse and slow respiration.
- Death.

Below the critical body core temperature of 95 degrees F the victim cannot produce enough body heat by himself to recover. At this point emergency measures must be taken to reverse the drop in core temperature. The victim can slip into hypothermia in a matter of minutes and can die in less than 2 hours after the first signs of hypothermia are detected. Treatment and medical assistance are critical.

Treatment for hypothermia:

- Prevent further heat loss by moving the person to a warmer location out of the wind, wet and cold.
- Remove cold wet clothing. If necessary, based upon the victims condition, external sources of heat (e.g., warm blankets, warm water baths, or body contact) will be necessary to rewarm the victim.
- If the victim is conscious, provide warm liquids, candy or sweetened foods. Carbohydrates are the food most quickly transformed into heat and energy. No alcohol or caffeine.
- Keep the victim awake, monitor ABCs, perform first aid as appropriate and obtain medical assistance soon as possible.

2.4.6.3 Prevention and Protection Programs

Site workers must learn to recognize and treat the various forms of cold stress. The best approach is preventative cold stress management such as in the following:

- Wear loose, layered clothing, masks, woolen scarves and hats in extreme cold weather.
- Keep clothes dry by wearing water and wind resistant clothing and footwear.
- Eat well-balanced meals, ensure adequate intake of liquids and avoid alcoholic beverages. Dehydration will increase risk of cold stress.
- Have warm shelter available and implement work-rest schedules.
- Monitor yourself and others for changes in physical and mental conditions.
- If wearing face protector remove periodically to check for frostbite.
- Never touch cold metal with bare hands.

The following guidelines should be used when working in air temperatures below 40°F.

- When cold surfaces below -7°C (19.4°F) are within reach, a warning should be given to each worker by the SHSC to prevent inadvertent contact by bare skin.
- If the air temperature is -17.5°C (0°F) or less, the hands should be protected by mittens. Machine controls and tools for use in cold conditions should be designed

so that they can be handled without removing the mittens.

Provisions for additional total body protection are required if work is performed in an environment at or below 4°C (39.2°F). The workers should wear cold protective clothing appropriate for the level of cold and physical activity:

- If the air velocity at the job site is increased by wind, draft, or artificial ventilating equipment, the cooling effect of the wind should be reduced by shielding the work area or by wearing an easily removable windbreak garment.

- If only light work is involved and if the clothing on the worker may become wet on the job site, the outer layer of the clothing in use may be of a type impermeable to water. With more severe work under such conditions, the outer layer should be water repellent, and the outerwear should be changed as it becomes wetted. The outer garments should include provisions for easy ventilation to prevent wetting of inner layers by sweat. If work is done at normal temperatures or in a hot environment before entering the cold area, the employee should make sure that clothing is not wet as a consequence of sweating. If clothing is wet, the employee should change into dry clothes before entering the cold. The workers should change socks and any removable felt insoles at regular daily intervals or use vapor barrier boots. The optimal frequency of change should be determined empirically and will vary individually and according to the type of shoe worn and how much the individual's feet sweat.

- If the available clothing does not give adequate protection to prevent hypothermia or frostbite, work should be modified or suspended until adequate clothing is made available or until weather conditions improve.

- Workers handling evaporative liquid (gasoline, alcohol, or cleaning fluids) at air temperatures below 4°C (39.2°F) should take special precautions to avoid soaking of clothing or gloves with the liquids because of the added danger of cold injury due to evaporative cooling.

Work/Warming Regimen

If work is performed continuously in the cold at an equivalent chill temperature (ECT) or below -7°C (19.4°F), heated warming shelters, tents, cabins, rest rooms, etc., should be made available nearby. The workers should be encouraged to use these shelters at regular intervals, the frequency depending on the severity of the environmental exposure. The onset of heavy shivering, frostnip, the feeling of excessive fatigue, drowsiness, irritability, or euphoria are indications for immediate return to the shelter. When entering the heated shelter, the outer layer of clothing should be removed and the remainder of the clothing loosened to permit sweat evaporation or a change of dry work clothing provided. A change of dry work clothing should be provided as necessary to prevent workers from returning to

work with wet clothing. Dehydration, or the loss of body fluids, occurs insidiously in the cold environment and may increase the susceptibility of the worker to cold injury due to a significant change in blood flow to the extremities. Warm sweet drinks and soups should be provided at the work site to provide caloric intake and fluid volume. The intake of coffee should be limited because of the diuretic and circulatory effects.

For work practices at or below -12°C (10.4°F) ECT, the following should apply:

- The worker should be under constant protective observation (buddy system or supervision).

- The work rate should not be so high as to cause heavy sweating that will result in wet clothing; if heavy work must be done, rest periods must be taken in heated shelters and opportunity for changing into dry clothing should be provided.

- New employees should not be required to work full-time in the cold during the first days of employment until they become accustomed to the working conditions and required protective clothing.

- The weight and bulkiness of clothing should be included in estimating the required work performance and weights to be lifted by the worker.

- The work should be arranged in such a way that sitting still or standing still for long periods is minimized. The worker should be protected from drafts to the greatest extent possible.

- The workers should be instructed in safety and health procedures. The training program should include, as a minimum, instruction in:

  - Proper rewarming procedures and appropriate first aid treatment.

  - Proper clothing practices.

  - Proper eating and drinking habits.

  - Recognition of signs and symptoms of impending hypothermia or excessive cooling of the body even when shivering does not occur.

  - Safe work practices.

108801

Table 1

Cooling Power of Wind on Exposed Flesh Expressed as Equivalent Temperature*

Estimated Wind Speed (mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (°F)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	**LITTLE DANGER** In <1 hour with dry skin. Maximum danger of false sense of security.				**INCREASING DANGER** Danger from freezing of exposed flesh within 1 minute.			**GREAT DANGER** Flesh may freeze within 30 seconds.				
Trenchfoot and immersion foot may occur at any point on this chart.												

*Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA.

Table 2

Cold Work/Warmup Schedule for 4-Hour Shifts,

Equivalent Chill Temperature	Maximum Work Period	No. of Breaks
≥-24°F	Normal	1
-25° to -30°F	75 minutes	2
-31° to -35°F	55 minutes	3
-36° to -40°F	40 minutes	4
-41° to -45°F	30 minutes	5
≤-46°F	Stop work	Stop work

208900

2.4.7 Wet Feet - FLD07

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD07 - Wet Feet

Related SPOPSFLDS:

FLD05 Heat Stress Prevention and Monitoring
FLD06 Cold Stress

2.4.7.1 Hazard

Under both hot and cold stress conditions, feet that become wet and are allowed to remain wet can lead to serious problems. Trench foot, paddy foot and immersion foot are terms associated with foot ailments resulting from feet being wet for long periods of time and are similar in effect. Initial symptoms include edema (swelling), tingling, itching and severe pain. These may be followed by more severe symptoms including blistering, death of skin tissue, and ulceration.

2.4.7.2 Recognition and Risk Assessment

In the planning stages of a project and safety plan, the potential for wet feet must be considered as a physical hazard. Risk assessment can be accomplished in part in the development stages of a project by listing in the Health and Safety Plan (HASP), the most likely task where wet feet may occur. These tasks could include extended work in chemical protective clothing and wading during biological assessments. The true determination of risk must often be made on-site by the Site Health and Safety Coordinator (SHSC). It is important that the SHSC and site personnel are alert to these hazards, do not take them simply as a matter of fact, and have time to notice them.

2.4.7.3 Prevention and Protection Program

Prevention methods are required when work is performed in wet conditions or when conditions result in sweating allowing the feet to become and remain wet. Proper hygiene is critical, workers must dry their feet and change socks regularly to avoid injuries associated with wet feet. Use of foot talc or powder can additionally assist in prevention of this injury.

2.4.10 Manual Lifting and Handling of Heavy Objects - FLD10

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD10 - Manual Lifting and Handling of Heavy Objects

2.4.10.1 Hazard

Improper lifting can result in cuts, pinches, crushing and serious back, abdomen, arm and leg muscle, and joint injury.

Even "light" objects, lifted improperly, can contribute to injury causing cuts and muscle injuries.

Cuts, Pinching, and Crushing

Splinters, slivers, and sharp edges on objects to be lifted can result in cuts. Heavy objects can pinch or crush fingers, toes, arms, and legs between the object and nearby objects, i.e., walls, tables, counters, railings, and obstructions. Insects or other biological hazards on or under objects to be lifted can result in bites or scratches. Contamination of objects can lead to chemical or radioactive materials exposure.

Muscle and Joint Injuries

Muscle and joint injuries occur when objects to be lifted are too heavy or awkward, in restricted access areas, or are lifted improperly.

Lifting tasks, which are awkward and repetitive, involving even light objects can lead to nerve and joint damage.

2.4.10.2 Recognition and Hazard Assessment

The need for manual lifting must be identified as a physical hazard when project tasks specifically require manual handling or use of heavy equipment, and the following safe lifting techniques, must be instituted:

- Plan any lifting task, noting:
  - Contact hazards - Check each object before lifting for presence of splinters, slivers, sharp edges or parts, cracks and loose joints, signs of biological hazards, and chemical or radioactive material contamination.
  - Weight of object - Unless involved in weight training, recommended safe lifting weights for an average man or woman are 50 and 35 pounds respectively.

- Size and shape of object - Large and oddly shaped objects are more difficult to lift, even within safe weight limits, due to imbalanced center of gravity.
- Area in which lifting is to be done - Check for pinch points such as other objects close by and that there is room for safe lifting.
- Conditions under which lifting is to be accomplished - Check for wet or slippery surfaces. Also consider level of protection to be used and that Level B or A protection may add up to 40 lb to be lifted as well as restricting range of motion and adding to area restriction by increasing bulk.
- Route to be traveled if lifting involves carrying - Check walking and working surfaces for slip and trip hazards, note ramps, changes on level of elevation, and ladders or stairways that need to be negotiated.

2.4.10.3 **Prevention and Protection Programs**

- Identify the potential for contact hazards on objects to be lifted before lifting. Check each object before lifting, remove any noted hazards as feasible, wear gloves (at a minimum cotton), leather or kevlar, chemical resistant, etc., depending on the nature of the hazard. Also wear safety boots, coveralls and chemical protection as appropriate.
- Avoid contact with cracks or loose joints or cover if hands or body can come into contact to reduce hazards of pinching.
- Workers must know their lifting limitations, plan lifting, keep themselves reasonably in shape and get help if uncertain that they can lift safely, and, Managers must plan and allow for safe lifting. Safe lifting takes time.
- Lifting an object from the floor
  - Determine that object is within safe weight limit.
  - Check for contact hazards.
  - Check floor for slip hazards.
  - Check that there is ample space between the object to be lifted and

other objects to avoid pinching or crushing.

- Check that there is ample room to squat, lift, turn or maneuver without twisting the back or other muscles or joints.
- Walk the intended route of travel to identify, and remove slip and fall hazards, if possible.
- Identify changes in elevation, steps, ramps, stairs and ladders which must be negotiated.

- To lift objects which are square or rectangular in shape or form:
  - Place one foot slightly in front of the other.
  - Squat as close to the object as possible.
  - Grasp one of the top corners away from the body and the opposite bottom corner closest to the body.
  - Tilt the object slightly away from the body, tilt forward at the hips, keep the back straight and tuck in the chin.
  - Test to be sure the object is loose from floor and will lift with snagging.
  - Straighten the legs, keeping the back bone straight, pull the object into the body and stand up slowly and evenly without jerking or twisting.
  - If turning or change of direction is required, turn with feet without twisting the torso and step in the direction to travel
- To set an object down, reverse the sequence, being sure not to trap the bottom hand between the object & the surface on which the object is set.

This system, at first feels and seems awkward. Workers must be trained and have the opportunity to use the system with lighter objects before performing heavy lifting. **For other shaped objects, the only modification needed should be hand hold position.** When two or more persons are lifting, have a plan and a set of signals so lifting occurs simultaneously.

Do not carry objects in a manner which obstruct vision in line of travel and of feet and footing.

Carry objects so one hand is free for travel on stairs or there is unobstructed view of footing

and two hands are free for travel on ladders.

2.4.10.4 Manual Handling of Heavy Objects

Hazard

Manual maneuvering or handling of heavy objects without actually lifting is often required on hazardous materials, RCRA facilities, and construction sites. This often involves moving drums or other containers. Manual handling of heavy objects, even when not actually lifting, can pose all of the hazards of lifting including, cuts, pinches, bruises, crushing, muscle and joint strain, and hazardous material and biological hazard contact.

Recognition and Risk Assessment

The need for manual handling of heavy objects must be addressed in the planning stages of a project HASP. Drums and other containers which must be maneuvered, for access to information or sampling locations, that are inaccessible to mechanical handling equipment, require manual handling and special precautions. When handling of heavy objects does not actually involve lifting, workers can handle heavier objects, even those weighing several hundred pounds, safely if proper techniques are used. In many instances, the procedures involve balancing and taking advantage of the shape of the object.

Prevention and Protection Programs

Prior to performing manual handling, it must be determined that it can be done safely and that mechanical assistance is infeasible.

Mechanical equipment or assistance such as dollies, carts, come-alongs or rollers are to be used whenever possible. Mechanical assistance must be of proper size, have wheels sized for the terrain, and be designed to prevent pinching or undue stress on wrists. Objects to be moved must be secured to prevent falling and properly balanced to prevent tipping.

The minimum protection for manual handling is heavy cotton or leather gloves, safety boots, and coveralls. Metatarsal guards, chemical protective clothing, and metal mesh or kevlar gloves must be used as risk of heavy items falling, hazardous materials contact and sharp edges, splinters or slivers increases.

Workers must be aware of their handling capacities and work within their capacities.

Objects to be manually handled must be checked prior to beginning movement for contact hazards and ensure handling will not trap hands, arms, legs, or feet between the object and other objects, walls, or railings.

Properly trained personnel may roll round or cylindrical objects if rolling will not damage the structural integrity. Rolling must be controlled by chutes, tag-lines, or other means limiting acceleration. Workers must not be positioned down hill from rolled objects. Use of the legs for pushing and tag-line control of rolled objects must be stressed.

Only properly trained, personnel may move cylindrical objects which must remain upright by hand. Cylindrical objects, such as drums that must remain upright, are maneuvered manually by slightly tilting the object using the legs for control and balancing the object on the bottom edge. The handler then walks beside the object, with the object tilted toward the body, positioning the hands on the top edge away from the body and moving so they do not cross, thus, maintaining the balance and a steady controlled forward motion. Motion must be controlled so that stopping walking and moving the hands will stop forward motion.

Prior to moving cylindrical objects in this way, the route of travel must be walked to identify any changes of elevation, pot holes, or other obstructions that could cause the object to snag, tip, or get out of control.

Flat, square, or rectangular objects are most easily handled using make-shift rollers or skids to break the friction with the resting surface and pushing, using the legs.

2.4.11 Rough Terrain - FLD11

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD11 - Rough Terrain

Related SPOPSFLDs:

FLD02 Inclement Weather
FLD15 Remote Areas

2.4.11.1 Hazard

Physical hazards associated with rough terrain include vehicle accidents, falling, slipping and tripping. Driving vehicles on uneven surfaces creates a possibility of the vehicle rolling, getting stuck in mud or ditches, or of an accident due to flat tires or striking obstacles, and vehicles. Falling is a potential hazard when working near mountain cliffs or steep inclines. Steep surfaces covered with heavy vegetation and under growth create a tripping hazard. Heavy or downed vegetation can hide holes or breaks in the terrain which increase risk of falls or vehicle accidents. Contact with animals, poisonous plants or insects may be increased due to vegetation or uneven terrain.

2.4.11.2 Recognition and Risk Assessment

Rough terrain complicates work activities and adds or increases risk. In the planning stages of a project, rough terrain must be considered as a physical hazard. Risk assessment is usually accomplished from site history information (i.e. site topography) and onsite by the Site Health and Safety Coordinator (SHSC).

2.4.11.3 Hazard Prevention and Protection Programs

Hazard prevention can be achieved by ensuring all maintenance is performed on vehicles before going to the field. In order to minimize accidents, a site surveillance on foot might be required to choose clear driving paths. The site crew should be alert and observe terrain while walking to minimize slips and falls. Boots that are ankle high or higher provide additional support and stability and should be worn. Seatbelts should be worn at all times. Fall protection is required when there is a potential for falls.

Personnel should maintain a high level of physical conditioning due to increased body stress/exertion. Personnel should be aware of potential hazards and ensure proper/adequate first aid supplies and knowledge of the nearest medical assistance.

2.4.12 Housekeeping - FLD12

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD12 - Housekeeping

Related SPOPSFLDS:

FLD29 Material Handling
FLD33 Demolition
FLD39 Illumination

2.4.12.1 Hazard

Hazards associated with poor housekeeping include; slips, trips, falls, punctures, cuts, and fires.

2.4.12.2 Recognition and Risk Assessment

Good housekeeping is an important element of accident prevention. Good housekeeping should be planned at the beginning of the job and carefully supervised and followed to the final clean-up.

In the planning stages of a project and safety plan, housekeeping requirements must addressed. Risk assessment can be accomplished in the development stages of a pro by listing in the HASP, good housekeeping requirements and the hazards associated wi poor housekeeping (i.e., slips, trips and falls). The true determination of risk must often be made on-site by the Site Health and Safety Coordinator (SHSC). It is important that the SHSC be alert to poor housekeeping practices and assist in maintaining order when large quantities of equipment or materials are stored onsite.

2.4.12.3 Prevention and Protection Programs

Poor housekeeping can be prevented by establishing 3 steps:

1) Plan ahead. A materials storage area which has been planned is more orderly than one which has developed haphazardly.

2) Assign responsibilities. If the size of the job and working force merit, a person should be specifically detailed to clean-up. Ideally, each individual should pick up after themselves and keep the site neat.

3) Implement the program. Housekeeping must be part of the daily routine, with clean-up being a continuous procedure.

Poor housekeeping accidents can be prevented by adhering to the following:

Lunch areas should be kept clear of empty bottles, containers, and papers. Trash disposal cans should be provided. An effective means of preventing litter is the provision of suitable receptacles for hazardous waste as well as nonhazardous wastes.

Accumulation of flammable and combustible liquids on floors, walls, etc., is prohibited. All spills of flammable and combustible liquids must be cleaned up immediately. Combustible waste, such as soiled rags, paper, etc, are to be stored in a safe place such as a covered metal container and disposed of regularly.

WESTON Project Managers and WESTON Subcontractors should provide sufficient personnel and equipment to insure compliance with all housekeeping requirements.

Work will not be allowed in those areas that do not comply with the requirements of this section.

The SHSC and WESTON Subcontractors will inspect the work area daily for adequate housekeeping and record unsatisfactory findings on the daily inspection report.

If applicable, the decontamination line will be keep neat and free of debris.

Adequate lighting should be provided in or around all work areas, passageways, stairs, ladders, and other areas used by personnel.

All stairways, passageways, gangways, and accessways shall be kept free of materials, supplies, and obstructions at all times.

Loose or light material should not be stored or left on roofs or floors that are not closed in, unless it is safely secured.

Tools, materials, extension cords, hoses, or debris are to be used, disposed of or stored so as not to cause a tripping or other hazard.

Tools, materials, and equipment subject to displacement or falling should be adequately secured.

Empty bags having contained lime, cement, and other dust-producing material should be removed periodically as specified by the designated authority.

Protruding nails in scrap boards, planks, and timbers should be removed, hammered in bent over flush with the wood unless placed in containers or trucks for removal.

Walkways, runways, and sidewalks should be kept clear of excavated material or other obstructions and no sidewalls should be undermined unless shored to carry a minimum live load of one hundred and twenty-five (125) pounds per square foot.

Containers should be provided for storing or carrying rivets, bolts and drift pins, and secured against accidental displacement when aloft.

When rivet heads are knocked off, or backed out, they should be kept from falling.

Form and scrap lumber and debris should be cleared from work areas, passageways, and stairs in and around building storage yards and other structures.

All storage and construction sites should be kept free from the accumulation of combustible materials. All materials should be maintained in neat stockpiles for ease of access. Keep aisles and walkways clear of loose materials and tools.

Weeds and grass should be kept down. A standard procedure should be established for cleanup of the area as specified by the SHSC.

Rubbish, brush, long grass, or other combustible material must be kept from areas wh flammable and combustible liquids are stored, handled, or processed.

2.4.14 Site Security - FLD14

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD14 - Site Security

Related SPOPSFLDS:

FLD15 Remote Areas
FLD39 Illumination

2.4.14.1 Hazard

When WESTON's responsibilities include site control, one area which is included is security, i.e., maintaining control of access to the site. Contingency plans are required to deal with unauthorized entry. Inquisitive and/or hostile persons may interfere with the monitoring/sampling effort, jeopardizing the safety of themselves as well as the safety of the field team.

2.4.14.2 Recognition and Risk Assessment

In the planning stages of a project and safety plan, the potential for security problems must be considered as physical hazards in the site specific Health and Safety Plan (HASP). Risk assessment can be accomplished in the development stages of a project by listing in the HASP, the most likely security problems which may be encountered. The true determination of risk must often be made onsite by the Site Health and Safety Coordinator (SHSC). It is important that the SHSC be alert to these hazards, does not take them simply as a matter of fact, and has time to notice them.

Entry to a site by unauthorized persons presents risks to the person(s) entering and to WESTON personnel who may have to interact with the individual(s). In many cases the unauthorized entry is accidental or unintentional, however, contingency plans must also include procedures for instances when unauthorized entry is deliberate or for purposes which could pose a threat to site personnel.

During the assessment of risk for each site, security problems must be identified. The contingency plan should identify ways to prevent and respond.

Security problems may arise from the site neighborhood due to:

- Socio-economic factors
- Client/neighbor
- Client/labor relations
- Poor lighting

- Remoteness and size of site
- Value of equipment and materials, etc
- Sampling equipment tampering

2.4.14.3 Prevention and Protection Program

Prevention programs are an integral portion of a Security Contingency Plan. An effective preventative measure is to inform all interested parties of the site activities. An attempt should be made to notify state and local police, the fire department, and any local/state governmental officials of the projects purpose and scope. This will allow those authorities to answer questions posed to them by local residents and the media by preparing statements on the projects purpose or by informing the public where to call for further information. This will alleviate the problem of work stoppage due to field personnel answering questions.

One must ensure that the client understands and approves of any information released. In most cases the liaison should be between the client and outside persons.

The Security Contingency Plan must:

- Identify the person responsible for implementing the Contingency Plan.
- State as the first priority the safety of WESTON personnel.
- Be designed to minimize the chance of confrontation and to obtain security assistance as quickly as possible.
- Assign the enforcement of security functions to properly trained and authorized bonded agencies.
- Establish a communication procedure for obtaining assistance.
- Be communicated to site personnel.

Security Problem Prevention measures include:

- Community relations programs,
- Visible security precautions (i.e., fences, "keep out" signs)
- Carefully defined rules/requirements for authorizing site access,
- Clearly delineated access points and barriers around work areas,
- Vigilance by all site personnel,
- Adequate lighting,
- Working in pairs or teams in sensitive areas,
- Locking and storing equipment securely,
- Using discretion in discussions and conversations when off-site,
- Working to avoid confrontation.

In short, security prevention involves not advertising or inviting intrusion. The telephone number and instructions for obtaining security assistance must be clearly posted on-site.

Personnel onsite must always have access to communications. These communications may be to additional onsite personnel, in certain situations communications by team members to outside response agencies may be necessary.

2.4.15 Remote Areas - FLD15

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD15 - Remote Areas

Related SPOPSFLDS:

FLD05	Heat Stress Prevention and Monitoring
FLD06	Cold Stress
FLD10	Manual Lifting of Heavy Objects
FLD11	Rough Terrain
FLD13	Structural Integrity
FLD34	Utilities

2.4.15.1 Hazards

Hazards associated with remote areas include the following:

Exposure to irritant and toxic plants such as poison ivy and sticker bushes may cause allergic reactions to personnel;

Surfaces covered with heavy vegetation and under growth create a tripping hazard or falling hazard due to holes or depressions that are not apparent.

Back strain due to carrying instruments or equipment.

Native wildlife such as rodents, ticks, and snakes present the possibility of insect bites and associated diseases such as Lyme disease.

Driving vehicles on uneven or unsafe surfaces can result in accidents such as overturned vehicles or flat tires.

Structurally unsound buildings pose overhead hazards.

Limited access to medical assistance.

Heat stress/cold stress exposure.

2.4.15.2 Recognition and Risk Assessment

Remote areas complicate work activities and add or increase risks. In the planning stages of a project, physical hazards associated with remote areas must be considered. Risk

2.4.16 Pressure Systems - Compressed Gas Systems - FLD16

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD16 - Pressure Systems - Compressed Gas Systems

Related SPOPSFLDS:

FLD10 Manual Lifting of Heavy Objects
FLD21 Explosives

2.4.16.1 Hazards

The specific hazards that gas pressure systems present to employees, property, and the public must be considered in the design, installation, and use of these systems. Such hazards include mechanical injury, toxicity, fire, explosion, and suffocation. This operating procedure outlines policies and required procedures for mitigating hazards that occur with installation, operation and maintenance of pressure systems.

2.4.16.2 Recognition and Risk Assessment

A compressed gas is a gas that is stored and used at pressures greater than nominal atmospheric pressure (15 psia at sea level). Compressed gases are supplied in cylinders or through piping systems.

All pressure systems, including compressed gas systems, should be designed, fabricated, installed, tested, inspected and operated in compliance with national codes and national consensus standards. Pressure system piping design, installation and testing should meet the requirements of the Pressure Piping Code, American National Standards Institute (ANSI) B31 series and the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, Sections I through XI. More information can be obtained from the Handbook of Compressed gases, Matheson Gas Data Book and the National Fire codes and Standards.

Only personnel who are trained and familiar with pressure systems, including compressed gas pressure systems should design, fabricate, install, operate, inspect, test and/or maintain pressure systems.

2.4.16.3 Prevention and Protection Program

Safe Handling Procedures for Transporting Compressed Gas Cylinders

Before moving, be certain all cylinder valves are closed, the regulator removed, and the protective cap installed.

When possible, use a hand truck for moving single cylinders. Do not drag or slide containers.

Take care not to drop cylinders or permit them to strike each other or other surfaces violently.

Never use protective cap as a lifting point for moving a cylinder from one vertical position to another.

When transporting by truck, make sure cylinders are well secured to prevent bumping. Do not transport in a closed vehicle.

Safe Handling Rules - Pipes, Tubes, and Hoses

Use metal pipe and tubing with a maximum allowable working pressure (MAWP) rated at or above system MAWP.
Secure pipes and tubes to a firm foundation.

Use flexible tubing or hose only when metal piping and tubing cannot be used.

Keep hose lengths as short as possible.

Chain hose ends (not fittings) together or substantially anchor the ends to prevent whipping if the hose or hose fitting fails.

If a run of hose or other flexible material must be used, it must be secured to ground or to other fixed surfaces to minimize whipping in the event of a break. Special fittings are available for this purpose.

Avoid sharp hose bends; follow hose manufacturer's recommendations.

PVC and other brittle materials should not be used in a pressurized gas system.

Safe Handling Rules - Gauges

The bourdon tube in a pressure gauge is a typical point of failure. The tube can fail when a gauge is new or after an indeterminate number of cycles. When the tube fails, the sudden burst of high pressure can blow the gauge face, hands, or cover into the faces of operators and passers-by.

The safety -type gauge should be selected when available and the requisitions for such gauges should specify a) safety types; b) full-size blowout backs; 3) integral sides and front design to protect the operator in event of failure; and d) either plastic or double-laminated safety glass gauge face cover.

Nonsafety-type gauges shall be replaced or have a gauge guard installed. The guard shi have appropriate standoffs and shall be made of at least 3/8 inch-thick polycarbonate or 5/ inch acrylic plastic. It shall be undamaged and free of gripper marks, tool chatter marks, or any other stress risers.

Safe Handling Rules - Installing a Regulator

Be certain to obtain the proper regulator for the specific gas cylinder being used.

Visually inspect the cylinder valve and regulator to make certain they are free of foreign material.

A pressure manifold from a gas cylinder to a closed pressure system must contain a vent valve, a fill valve, and a relief device unless these features are integral parts of the pressure system.

A regulator is required if the operating pressure of the system is less than the pressure of a filled bottle.

A gauge is required unless the system is provided with a gauge indicating system pressure.

Whenever possible, a proper two-stage regulator should be used for efficiency and safety. Specialty gas and regulator supplier catalogs are good references for regulator selection

Incompatible gases should not be connected to a common purge manifold.

Never use a regulator for oxygen service unless it is clearly specified and marked for oxygen use.

Turn the delivery pressure adjusting "tee" counterclockwise until it turns freely.

Install the regulator on the cylinder valve. Open the cylinder valve slowly until cylinder pressure registers on the regulator.

With the flow control valve at the outlet of the regulator closed, turn the delivery pressure adjusting "tee" clockwise until the desired pressure is read.

To remove the regulator, be certain that the cylinder valve is tightly closed.

Safe Handling for Opening a Gas Cylinder

Open compressed gas cylinders slightly at first, then all the way.

Stand to one site and look away from the regulator and gauge face when opening the

cylinder valve. Valve outlets should be pointed away from yourself and others.

On cylinders equipped with hand valves use only your hands to open the cylinder valve; never use a hammer to wrench. If the cylinder will not open with hand pressure, have it returned to the supplier.

Safe Handling Procedures for Storing Cylinders of Compressed Ga:

Valve protection caps should be in place when compressed gas cylinders are transported, moved or stored.

Cylinder valves should be closed when work is finished and when cylinders are empty or are moved.

Compressed gas cylinders should be secured (chained or strapped) in an upright position at all times, except if necessary for short periods of time when cylinders are actually being hoisted or carried.

Cylinders should be kept at a safe distance or shielded from welding or cutting operation. Cylinders should be placed where they cannot become part of an electrical circuit.

Cylinders should not be taken into confined spaces, except for SCBAs or airline supplied air respirator (SAR) emergency egress cylinders.

Protect cylinders against the possibility of being struck by a large passing or falling objects.

Store cylinders in dry, well-ventilated areas. If practicable, the area should be resistant to fire.

Keep storage area temperature below 125 degree fahrenheit.

Store cylinders away from heat sources and combustible materials.

Protect cylinders stored in the open from the weather, dampness, and direct sunlight. Protect cylinders from corrosion, never store cylinders directly on the ground.

General Requirements for Safe Handling of Compressed Gas Cylinders in General Use.

Do not use containers not bearing a legible label identifying the contents.

Keep caps on cylinders at all times except when the cylinder is in use.

Do not place containers where they might become part of an electrical circuit.

Use the proper regulator for a particular gas.

If a leaking cylinder cannot be simply remedied, close the valve, tag, and remove to the outdoors or a well-ventilated location.

Discontinue use of high-pressure cylinders when the pressure approaches 30 psig, and clearly mark EMPTY.

Special Handling Procedures for Special Gases.

Oxygen

Oxygen containers, valves, regulators, hose and other oxygen apparatus should be kept free from oil or grease and should not be handled with oily hands, oily gloves, or with greasy equipment.

Oxygen and fuel gas regulators should be in proper working order while in use.

Oxygen containers in storage should be separated from flammable-gas containers or combustible materials (especially oil or grease) by a minimum distance of 20 feet.

Oxygen and acetylene (or other fuel gas) cylinders in storage should be separated from each other by 20 feet or by a five-foot barrier with a one-hour fire rating.

Acetylene

Keep acetylene away from any open flame or sources of heat as well as other combustible materials. Acetylene can explode with extreme violence if ignited.

Acetylene should not be used under more than 15 psig, since it may spontaneously decompose with explosive force. Note the red warning area on acetylene regulators.

Never use unalloyed copper pipe or fittings on acetylene systems. Fittings with more than 65% copper can react to form explosive, shock sensitive acetylides.

Always store and use acetylene cylinders in an upright position in order to avoid separation of the acetylene/acetone solution.

Chlorine

Extreme care must be taken when moving, storing, or using chlorine gas cylinders. The gas is a strong irritant to eyes, nose, throat, and lungs.

When hooking up chlorine gas cylinders, or working with any equipment which is attached

to a chlorine gas cylinder, a full faced respirator with appropriate cartridge filter is required.

Chlorine cylinders have fusible plugs that melt between 140 and 160 degrees fahrenheit. For this reason, chlorine gas cylinders must be kept away from any source of heat, and the plug must not be tampered with.

Flammable Gases

Do not store cylinders near flammable solvents, combustible material, or near unprotected electrical connections, gas flames, heat, or, or other sources of ignition.

Ground all manifolds for flammable gas cylinders.

Never use a flame to detect flammable gas leaks.

Do not store reserve stocks of flammable gas cylinders with cylinders containing oxygen. Store oxygen and fuel gas cylinders should be separated by a minimum of 20 feet.

Toxic Gases

Personnel handling and using toxic gases should have approved respiratory protection available for immediate use.

Toxic gases should be used only in forced ventilation areas or, preferable, in hoods with forced ventilation to out-of-doors.

Before using, read all label information and data sheets associated with the use of the particular toxic gases.

Summary

In order to safely deal with compressed gases pressure and chemical hazards must be considered. The procedures for transport, storage or use should be designed to protect the user from these two hazards. Always follow manufacture's recommendations and consult with experienced personnel if questions of storage, use or transport arise.

2.4.20 Traffic - FLD20

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD20 - Traffic

Related SPOPFLDS:

FLD01 Noise Protection
FLD02 Inclement Weather

2.4.20.1 Hazard

Traffic presents hazards in two ways 1) when site workers are working close to roadways, the potential exists to be hit by oncoming traffic and 2) driving to, from and on the site pose an accident hazard.

2.4.20.2 Recognition and Risk Assessment

In the planning stages of a project and safety plan, the potential for traffic hazards must be considered as physical hazards in the site specific Health and Safety Plan (HASP). Risk assessment can be accomplished in the development stages of a project by listing in the HASP, the most likely traffic hazards which may occur. The true determination of risk must often be made on-site by the Site Health and Safety Coordinator (SHSC). It is important that the SHSC be alert to these hazards, does not take them simply as a matter of fact, and has time to notice them.

2.4.20.3 Prevention and Protection Program

Roadway Workers

Roadway workers should be aware of their location in reference to roadways and avoid working close to traffic.

Workers near roadways must wear reflective vests.

The following guidance should be used in planning work that will be adjacent to or within roadways. In all cases the local police department or transportation department must be consulted in order to comply with applicable requirements.

When open highway conditions prevail on approach to the work site, advance warning signs should be placed approximately 1500 feet in advance of the condition to which they are calling attention. Where a series of advance warning signs are used, the warning signs nearest the work site should be placed approximately 500 feet from the point of restriction

with additional signs at 500-1000 foot intervals. On expressway and limited access facilities the advance warning distance should be increased to one-half mile or more. On city streets where more restrictive conditions generally prevail on the approach to the work area. Signs in the immediate vicinity of the work may be placed at closer spacings.

Flag persons may be required to control the speed of nearby traffic. Lights should be provided to mark flag person stations and barricading at night. Barricading is extended to the point where it is visible to approaching traffic.

Signs on fixed supports are usually mounted on a single post, although those wider than 36 inches or larger than 10 square feet in area should generally be mounted on two posts. Signs mounted on portable supports are suitable for temporary conditions.

Drivers

All drivers will be licensed regardless of whether they are operating on or off public highways. A government drivers license is required for WESTON employees and WESTON subcontractors if a government vehicle will be used.

If drivers are operating across state lines they should be familiar with laws governing traffic in states in which they will operate. All traffic rules and regulations, and all traffic control signs and devices should be followed. All operators are required to stay within posted speed limits at all times.

Drivers are required to make a daily inspection of their vehicles. The check should include steering, brakes, mirrors, lights, horn, tires, and windshield wipers. Any special safety items, such as back-up alarms, should also be checked to insure safe operation. Drivers should be required to report all defects, and repairs should be made promptly.
Drivers should make a visual check around a vehicle to assure clearance of objects and personnel before moving the vehicle.

Drivers should become familiar with all controls before operating an unfamiliar vehicle.

Drivers should operate vehicles defensively, and exercise special care when driving an unfamiliar roads, at night, and in inclement weather.

Drivers should give pedestrians the right of way.

Off-highway operation may require extra precautions to prevent shifting of load when crossing rough terrain.

Trucks should be backed under the direction of a signal person if the operator cannot view the area to the rear clearly.

Windshields, rear-view mirrors, and lights should be kept clean.

Based upon the size of the vehicle, or if specific quantities of hazardous materials are transported, the driver may be required to hold a Commercial Drivers License. If in doubt consult with the Shipping Department or Corporate Health and Safety.

Transporting Personnel

The SHSC will ensure that seat belts are installed and functional on all vehicles used by Weston personnel and Weston subcontractors, and that all passengers use them. The use of seat belts by all personnel is mandatory.

Some convenient means of mounting and dismounting the truck should be provided.

Personnel should be required to ride within the space provided, never on running boards, fenders, bumpers, or atop cabs.

Adequate wind protection should be provided for long distance trips, and during cold weather.

Personnel are not allowed to ride on the outside or back (such as in pickup trucks) of vehicles.

Transporting Materials

Materials loaded should be within the safe weight limit for the truck, and should not project beyond the truck body.
While being loaded, trucks should be properly blocked.

Trucks operated on public highways should conform to weight and clearance limitations of bridges, powerlines, overhead structures, and other restrictions.

No person should be permitted to remain in or on a truck being loaded by excavating equipment or cranes unless the cab is adequately protected against impact.

Pedestrian Protection Program

Pedestrians on-site should use discretion when crossing the streets or working near traffic. Pedestrians should use sidewalks whenever possible and not step from curbs unless vehicles are at a safe distance.

Vehicle Maintenance

Operators should immediately report any damage or failure of parts and accessories to the

SHSC. It is advantageous to have road flares, fire extinguishers, and other safety equipme on the vehicle at all times.
Vehicles should not be fueled from open cans or by other makeshift methods, as there is great danger of flash fire from hot engines.

Engines should be shut off while fueling.

2.4.21 Explosives - FLD21

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD21 - Explosives

Related SPOPSFLDS:

FLD01 Noise Protection
FLD30 Hazardous Materials Use and Storage

2.4.21.1 Hazard

Explosives, a special category of hazardous materials, contain large amounts of energy per unit mass. If improperly handled, processed, or stored, explosives can cause substantial property damage, injuries, or death. Thus, the safety of explosives operations must be a primary concern at Weston. It also applies to the use of metastable or exothermic materials that, although not intended for use as explosives, could react explosively.

2.4.21.2 Recognition and Risk Assessment

An explosive is a chemical compound or mixture of substances that undergoes a rapid chemical change when subjected to heat, impact, friction, shock, or other initiating stimulus. This change, in turn, generates large volumes of heated gases that exert pressures on the surrounding medium. The term "explosives" includes materials that may either detonate or deflagrate and applies to each chemical and its reaction product regardless of whether the substance was devised primarily for creating an explosive. A detonation is an explosion which produces a pressure wave which travels in excess of the speed of sound. Referred to by USDOT as a high or Class A explosive (Example TNT, Picric Acid). A deflagration is an explosion which if unconfined produces a shock wave which travels at less than the speed of sound and results in rapidly spreading fire.

Only personnel who are approved by the site manager and the Site Health and Safety Coordinator (SHSC) shall be allowed free access to an area where there is a high potential for explosives or where explosives are being used.

The site manager will be responsible for determining the hazards associated with explosive materials and a particular explosives operation, specify the appropriate control measures needed to mitigate those hazards, and participate in periodic inspections and to help ensure that appropriate control measures are in effect.

Weston personnel may also encounter explosives at hazardous waste sites, i.e., when handling potentially explosive drums or handling picric acid containers at abandoned laboratories.

2.4.21.3 Prevention and Protection Programs

Hearing protection devices will be used where there is a potential for noise exposure. Explosives are considered a hazardous material and, once used must be handled and disposed of in accordance with the Resource Conservation Recovery Act (RCRA).

Potentially Explosive Containers

Working near explosive or potentially explosive containers requires extreme caution.

Containers that are overpressurized to the extent that the container head (opening/bung) is swollen several inches above the level of the chime should not be moved. The practice of tapping containers to determine their contents is neither safe nor effective. A laser thermometer can be use to determine the level of liquid in a container. This monitoring device can be used at a distance using a laser and the surface temperature of the drum (liquid vs. nonliquid) as a detection method.

When sampling or venting is required, remotely operated tools are the safest available means of opening containers and is performed using a backhoe spike, hydraulic drum opener or pneumatic device. Critically swollen drums should be vented or opened in place. Drums which can be moved should be staged in an open area. Drums should be placed in rows with adequate aisle space to allow ease in backhoe maneuvering. Once staged, the drums are quickly opened by remotely punching a hole in the drum head or lid with the spike or pneumatic drill which removes the bung. SPOPSFLD48, Drum sampling provides more information on remote opening devices.

Heavy equipment shall be equipped with blast shields to protect against flying debris.

Site personnel should be far enough away from the potentially explosive containers to prevent being hit by debris if an explosion occurs.

Explosives as Monitoring Devices

Explosives are occasionally used for project work. For example an electronically detonated black powder shells (Betsy Seismic shells) are used as a seismic source for underground surveys. Material safety data sheets shall be obtained for explosive products intended for use at a site.

When using explosives for project work, the following items should be addressed:

Only trained and qualified personnel are authorized to perform explosives work.

Used explosives should be promptly returned to manufacturers.

Adequate security measures should be taken when storing explosives onsite. For example, padlocks should be used which are hooded or covered.

The explosives should not be stored behind doors which can be removed. Hinges may or may not be welded and could be removed by unauthorized personnel.

Signs indicating explosive hazards should be visible.

Detonators should be stored away from explosives.

Gasoline should not be carried in a vehicle containing explosives.

TABLE 1
EXPLOSIVES CLASSIFICATION SYSTEMS
EXPLOSIVES
SPOPSFLD21

HAZARD	EXAMPLE	DOT CLASSIFICATION
Blast and fragment	Bulk explosive or artillery shell	Class A
Intense heat/fire	Rocket motor	Class B
Minimal hazard	Squibs, small-arms ammunition detonators	Class C
Insensitive high explosives substance	———	Blasting agent

2.4.22 Heavy Equipment Operation - General - FLD22A

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD22A - Heavy Equipment Operation - General

Related SPOP: FLD23 - Cranes/Lifting Equipment
FLD24 - Aerial Lifts/Manlifts
FLD34 - Utilities
FLD35A - Electrical Safety - General
FLD35B - Electrical Safety - High Voltage

2.4.22.1 Machinery and Mechanized Equipment Safety

A. General

Before any machinery or mechanized equipment is placed in use, it will be inspected and tested by a competent mechanic and certified to be in safe operating condition.

The employer will designate a competent person to be responsible for the inspection of all machinery and equipment daily and during use to make sure it is in safe operating condition. Tests will be made at the beginning of each shift during which the equipment is to be used to determine that the brakes and operating systems are in proper working condition.

Preventative maintenance procedures recommended by the manufacturer will be followed.

Any machinery or equipment found to be unsafe will be deadlined and its use prohibited until unsafe conditions have been corrected.

Inspections or determinations of road conditions and structures will be made in advance to ensure that clearances and load capacities are safe for the passing or placing of any machinery or equipment.

Machinery and mechanized equipment will be operated only by designated personnel. Equipment deficiencies observed at any time that affect their safe operation will be corrected before continuing operation.

Seats or equal protection will be provided for each person required to ride on equipment.

Getting off or on any equipment while it is in motion is prohibited.

Machinery or equipment requiring an operator will not be permitted to run unattended.

A. General (Continued)

Machinery or equipment will not be operated in a manner that will endanger persons or property, nor will the safe operating speeds or loads be exceeded.

All machinery or equipment will be shut down and positive means taken to prevent its operation while repairs or manual lubrications are being done. Exemption:

Equipment designed to be serviced while running.

All repairs on machinery or equipment will be made at a location that will provide protection from traffic for repair persons.

Heavy machinery, equipment, or parts thereof that are suspended or held apart by slings, hoists, or jacks also will be substantially blocked or cribbed before personnel are permitted to work underneath or between them.

Bulldozer and scraper blades, end-loader buckets, dump bodies, and similar equipment will be either fully lowered or blocked when being repaired or when not in use. All controls will be in a neutral position, with the engines stopped and brakes set, unless work being performed on the machine requires otherwise.

Stationary machinery and equipment will be placed on a firm foundation and secured before being operated.

All points requiring lubrication during operation will have fittings so located or guarded to be accessible without hazardous exposure.

When necessary, all mobile equipment and the operating area will be adequately illuminated while work is in progress.

Mechanized equipment will be shut down prior to and during fueling operations. Closed systems, with automatic shutoff that will prevent spillage if connections are broken, may be used to fuel diesel powered equipment left running.

All towing devices used on any combinations of equipment will be structurally adequate for the weight drawn and securely mounted.

Persons will not be permitted to get between a towed and towing piece of equipment until the towing equipment has been stopped.

All equipment with windshields will be equipped with powered wipers. Vehicles that operate under conditions that cause fogging or frosting of windshields will be equipped with operable defogging or defrosting devices.

A. General (Continued)

All equipment left unattended at night, adjacent to a highway in normal use, or adjacent to construction areas where work is in progress, will have lights or reflectors, or barricades equipped with lights or reflectors, to identify the location of the equipment.

Whenever the equipment is parked, the parking brake will be set. Equipment parked on inclines will have the wheels chocked or track mechanism blocked and the parking brake set.

Lift trucks, stackers, etc., will have the rated capacity posted on the vehicle so as to be clearly visible to the operator. When auxiliary removable counterweights are provided by the manufacturer, corresponding alternate rated capacities also will be clearly shown on the vehicle. The ratings will not be exceeded.

Steering or spinner knobs will not be attached to the steering wheel unless the steering mechanism prevents road reactions from causing the steering handwheel to spin. When permitted, the steering knob will be mounted within the periphery of the wheel.

All industrial trucks in use will meet the requirements of design, construction, stability, inspection, testing, maintenance, and operation, defined in ANSI B56.1, Safety Standards for Powered Industrial Trucks.

The installation of live booms on material and personnel hoists is prohibited.

The controls of loaders, excavators, or similar equipment with folding booms or lift arms will not be operated from a ground position unless so designed.

Personnel will not work or pass under the buckets or booms of loaders in operation.

Cranes and any other equipment used for lifting must be inspected as required and records of inspection must be maintained.

2.4.23 Heavy Equipment Operation - Drill Rigs - FLD22B

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD22B - Heavy Equipment Operation - Drill Rigs

Related SPOP:
- FLD23 - Cranes/Lifting Equipment
- FLD24 - Aerial Lifts/Manlifts
- FLD34 - Utilities
- FLD35A - Electrical Safety - General
- FLD35B - Electrical Safety - High Voltage

WESTON will use the Drilling Safety Guide prepared by delegations of the Diamond Core Drilling Manufacturers Association and the National Drilling Contractors Association as published by the National Drilling Federation as the basic Safety Programs for all activities involving drill rigs or similar apparatus for the purpose of well installation or soil borings.

Copies of this document are available from Corporate Health and Safety.

2.4.24 Cranes/Lifting Equipment - FLD23

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD23 - Cranes/Lifting Equipment

Related SPOP: FLD22A - Heavy Equipment Operation - General
FLD24 - Aerial Lifts/Manlifts

Any piece of equipment used for lifting materials or personnel shall be used and maintained in strict accordance with manufacturer's directions and applicable OSHA regulations.

Load limits will be visibly posted on all lifting devices.

Only operators with demonstrated competence shall be permitted to operate lifting devices.

Lifting machinery and all elements of equipment involved in lifting or supporting loads must be inspected prior to use and at a minimum monthly. Inspections must be performed by a competent person and must be documented.

2.4.29 Materials Handling - FLD29

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD29 - Materials Handling

Related SPOPSFLDs
FLD02 - Inclement Weather
FLD22 - Heavy Equipment Operation
FLD23 - Cranes/Lifting Equipment

Materials must be stacked and stored to prevent sliding or collapsing.

Flammables and oxidizers must be stored in separate non-smoking areas and flammable gases must be stored away from combustible materials.

Tractor trailers must be chocked during loading and unloading. Deck plates and positive anchor systems must be used for delivery to elevated platforms at trailer floor level if unloaded by fork lifts. Trailers detached from tractors must have additional support if fork lifts will enter or unstability of load presents a hazard of front wheels collapsing.

Riders are prohibited on the outside of materials handling equipment.

Cranes and any other equipment used for lifting must be inspected as required, and records of inspection must be maintained.

2.4.30 Hazardous Materials Use and Storage - FLD30

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD30 - Hazardous Materials Use and Storage

Related SPOPSFLDs:
- FLD21 - Explosives
- FLD31 - Fire Prevention/Protection/Response Plans
- FLD32 - Fire Extinguishers Required and Requirements

2.4.30.1 Flammable Liquids

Flammable liquids shall be stored in approved containers in flammable storage cabinets or store rooms, or 25 feet from any other storage or office area or any ignition sources.

Fuels shall be separated from oxidizers and corrosives must be separated from flammables and stored in approved cabinets or store rooms or separated by 25 feet from other storage areas or buildings.

Approved grounding and bonding procedures shall be used for transfer of flammable liquids from one container to another.

Areas where flammable liquids are stored or flammable vapors may be released must be evaluated and classed by hazard class, group, and location (Division) according to the National Electric Code (National Fire Protection Association). Electrical equipment use must conform to these codes.

All tanks, containers, and pumping equipment, portable or stationary, used for the storage or handling of flammable and combustible liquids will be listed by UL or FM or approved by the MSHA.

As a minimum, a 10 lb fire extinguisher appropriate for the type of fire that could occur must be within 50 feet of any accumulation of five gallons or more of flammable liquids or gases.

2.4.30.2 Cylinders

- Cylinders must be stored upright and/or secured to prevent their falling over. The supplier of gas must be consulted prior to storing gas cylinders in other than an upright position.
- Cylinder caps must be in place, when cylinders are not in use.

- Cylinders should be stored out of direct sunlight.

- Cylinders containing fuels, e.g., acetylene, must be separated from oxidizers, e.g., oxygen, carbide, by 20 feet or a five (5) foot high fire wall with a minimum 1/2 hour fire resistance if outside or 1 hour rating if inside.

2.4.38 Fire Extinguishers Required and Requirements - FLD32

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD32 - Fire Extinguishers Required and Requirements

Related SPOPSFLDs:
- FLD09 - Hot Work (Permits)
- FLD21 - Explosives
- FLD22A - Heavy Equipment Operation - General
- FLD30 - Hazardous Materials Use and Storage
- FLD31 - Fire Prevention/Protection/Response Plans
- FLD36 - Welding/Cutting/Burning

Fire extinguishers appropriate in size and classification shall be present, readily accessible, and ready for use in all areas where there is potential for fires.

Fire extinguishers must be used in conjunction with an emergency response or contingency plan.

Health and Safety Plans must identify number, type, and location of all fire extinguishers related to a specific project.

2.4.34 Utilities - General - FLD34

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD34 - Utilities - General

Related SPOPSFLDS:

FLD03	Hot Processes - Steam
FLD22A	Heavy Equipment Operation
FLD23	Cranes/Lifting Equipment
FLD28	Excavating and Trenching
FLD35	Electrical Safety

2.4.34.1 Hazards

Injuries and deaths as a result of shock, electrocution, thermal burns and other utility hazards can be avoided through proper attention to, and knowledge of, overhead and underground utilities.

2.4.34.2 Recognition and Risk Assessment

Risk assessment can be accomplished during the planning stages of a project by developing a task/risk analysis for the hazards associated with specific utilities. The true determination of risk must be made onsite by the Site Health and Safety Coordinator (SHSC) who must be alert to these hazards, does not take them simply as a matter of fact, and has time to notice them.

Much of the responsibility for protection from utility hazards falls on the SHSC. The SHSC is responsible for ensuring a safe work environment when working around electrical devices, pressurized utilities, gas, steam, water, sewer and pipelines utilities. This job description requirement in no way, however, relieves any site personnel from their obligation to recognize and avoid unsafe conditions.

2.4.34.3 Prevention and Protection Programs

Survey for and Identification of Utilities

Prior to beginning intrusive work on sites, in or around facilities, buildings, or other structures that could be served by or connected to utilities, a search must be conducted by the SHSC, ideally in association with someone familiar with the facility, to identify any overhead, underground, and in-workplace utilities such as:

- Electrical lines and appliances
- Gas lines
- Pipelines
- Steam lines
- Water lines
- Sewer lines
- Pressured air lines

The location of any utility that could pose a risk to workers must be communicated to all workers during site safety indoctrination. Utilities should be marked or access otherwise restricted to avoid chance of accidental contact.

Utilities shall be considered "live" or active until a reliable source has documented them to be otherwise.

Overhead Utilities

Transmission and distribution lines carried on towers and poles normally provide safe clearance over roadways and structures. Clearances must be verified and proven adequate for the movement of vehicles and for the operation of construction equipment.

Overhead or aboveground electric lines shall be considered "live" or active until a reliable source has documented them to be otherwise.

Elevated work platforms, ladders, scaffolding, man-lifts, drill or vehicle superstructures shal be erected a minimum of 20 feet (The actual distance is dependant upon the voltage of the line) from overhead electrical lines until the line is either de-energized and grounded or shielded, and a competent electrician has certified that arcing can not occur between the workplace or superstructure.

For other overhead or in-workplace utilities, workers must be instructed to use care in working under or around utilities to avoid hot surfaces, pressured gases or air, leaking of pipelines, discharge of steam or hot liquids, and must work to prevent accidental contact or breakage.

Underground Utility Searches

No excavating, drilling, or boring shall be done until a thorough underground utility survey, conducted by knowledgeable persons or agencies, has been made and it is found safe to begin.

Even when a search is completed, drilling, boring and excavation should commence carefully until past the depth at which such utilities are usually located.

All underground utilities shall be considered "live" or active until reliable sources

2.4.35 Electrical Safety - FLD35

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD35 - Electrical Safety

Related SPOPSFLDs:
FLD02 - Inclement Weather
FLD08 - Confined Spaces Entry
FLD26 - Ladders
FLD27 - Scaffolding
FLD34 - Utilities
FLD35 - Electrical Safety
FLD38 - Hand and Power Hand Tools

2.4.35.1 General

Work areas shall be checked for the presence of high voltage and other hazardous electricity sources. Sources shall be labelled and work areas provided with shielding or located at sufficient distance from the sources to prevent contact or arcing to personnel or equipment.

Locate and ensure there will be no adverse contact with overhead utilities prior to positioning or moving any elevated work platform or rig superstructure.

When high voltage electrical service is required for site or project activities, service shall be connected by certified electricians in accordance with all applicable local and National Electric Codes.

Ground Fault Circuit Interrupters shall be used in the absence of properly grounded circuitry or when portable tools must be used around wet areas.

Electric lines, cables, and extension cords must be appropriately guarded and maintained in good condition.

No work will be done on electric lines or electrically activated equipment until the verification that service has been de-energized and/or the system has been locked and tagged out and each worker doing the work has sole possession of a key to a lock on the lock-out hasp.

demonstrate otherwise.

The SHSC is responsible for ensuring underground utility searches are performed and procedures are conformed with.

2.4.38 Hand and Power Hand Tools - FLD38

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD38 - Hand and Power Hand Tools

Related SPOPS:

FLD01	-	Noise Protection
FLD02	-	Inclement Weather
FLD08	-	Confined Spaces Entry
FLD09	-	Hot Work
FLD10	-	Manual Lifting and Handling of Heavy Objects
FLD12	-	Housekeeping
FLD16	-	Compressed Gases
FLD22	-	Heavy Equipment Operation
FLD24	-	Aerial Lifts/Manlifts
FLD29	-	Materials Handling
FLD30	-	Hazardous Materials Use and Storage
FLD31	-	Fire Prevention/Protection/ Response Plans
FLD32	-	Fire Extinguishers Required and Requirements
FLD34	-	Utilities
FLD35	-	Electrical Safety

Work with other than the simplest non-powered hand tool shall be performed only by those persons competent by reason of formal training or documented experience.

In addition to the above-related Physical Hazard Safety Procedures, the following procedures must be followed.

Unsafe hand tools shall not be issued or used. All hand tools will be kept in good repair and used only for the purposes for which they were designed. Wrenches with sprung jaws, where slippage could occur, impact tools with mushroomed heads, and wooden handled tools with cracks or splinters are examples of unsafe hand tools.

Tools having defects that will impair their strength or render them unsafe will be tagged or made inoperable and removed from service.

Guards must be in place during operation on all power tools designed to accommodate them. Guards and safety devices must remain in place on power tools unless removed according to manufacturer's instruction for maintenance by a competent person and must be replaced before use. Belts, gears, shafts, drums, fly wheels, chains or other rotating,

reciprocating or moving parts exposed to employee contact or representing other hazard must be guarded.

Proper PPE must be used when operating power tools or hand tools that may produce projectiles, cuts or abrasions, dusts, fume, mists or light, or which pose a risk of harm to arms, legs, or feet if dropped.

Throwing tools or materials from one location to another, from one person to another, or dropping them to lower levels is not permitted.

Only nonsparking tools will be used in locations where sources of ignition may cause a fire or explosion.

Power tools will be inspected, tested, and determined to be safe for operation prior to use. Continued periodic inspections will be made to ensure safe operating condition and proper maintenance.

Electric powered tools must be approved double insulated or grounded in accordance with 1926.404.

Rotating or reciprocating portable power tools will have a constant pressure switch that will shut off the power when the tool is released by the operator. A portable power tool may have a lock-on control provided turn-off can be accomplished by a single motion of the same finger or fingers that turned it on.

Hydraulic fluid used in powered tools will retain its operating characteristics at the most extreme temperatures to which it will be exposed.

Manufacturer's safe operating pressures for hydraulic hoses, valves, pipes, filters, and other fitting will not be exceeded.

All hydraulic or pneumatic tools that are used on or around energized lines or equipment will have nonconducting hoses having adequate strength for the normal operating pressures.

Loose and frayed clothing, loose long hair, dangling jewelry, rings, chains, and wrist watches will not be worn while working with any power tool or machine.

All woodworking tools and machinery will meet applicable requirements of ANSI 01.1, Safety Code for Woodworking Machinery.

Extension cords:

- Must meet UL or other rating criteria according to OSHA.
- Use will be limited to essential tasks.

- Must be tested for continuity before each use and must be connected t grounded outlets or ground fault current interrupters must be used.
- Must be inspected daily for loose insulation, broken or missing plugs, bared wires, etc.
- Grounding of outlets used for portable tools must be confirmed before use.
- Must not be allowed to become tripping or slipping hazards.
- Must not be used for lifting, tying off, and shall be disconnected by pulling or the plug.

Any piece of equipment used for lifting materials or personnel shall be used and maintained in strict accordance with manufacturer's directions and applicable OSHA regulations.

Load limits will be visibly posted on all lifting devices.

Only operators with demonstrated competence shall be permitted to operate lifting devices.

Lifting machinery and all elements of equipment involved in lifting or supporting loads must be inspected prior to use and at a minimum monthly. Inspections must be performed by a competent person and must be documented.

2.4.37 Pressure Washers - FLD37

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD37 - Pressure Washers

Related SPOPSFLDs:

FLD01	Noise Protection
FLD03	Hot Processes - Steam
FLD05	Heat Stress Prevention and Monitoring
FLD06	Cold Stress

2.4.37.1 Hazards

Steam is often used in equipment decontamination process at hazardous waste sites. Steam cleaning equipment have the same hazards as facility steam lines in that there are hot surfaces to contact, the steam itself is a thermal burn hazard, steam cleaners are often augmented by high pressure, and in enclosed areas steam may displace oxygen and increase heat stress risk.

2.4.37.2 Recognition and Risk Assessment

In the planning stages of a project and safety plan, the potential for injuries from stream must be considered as physical hazards in the site specific Health and Safety Plan (HASP). Risk assessment can be accomplished in the development stages of a project by listing in the HASP, the most likely steam injuries which may occur. The true determination of risk must often be made on-site by the Site Health and Safety Coordinator (SHSC). It is important that the SHSC be alert to these hazards, does not take them simply as a matter of fact, and has time to notice them. Four common heat stress disorders and treatment methods are identified below.

High pressure water washing (or cleaning, jetting) is defined as the use of high pressure water, with or without the addition of other liquids or solid particles, to remove unwanted matter from various surfaces, where the pressure of the liquid jet exceeds 1000 PSIG at the orifice (or nozzle). The lower limit of 1000 PSIG does not mean that pressures below 1000 PSIG cannot cause injury or require any less attention to the principal of these recommended practices. Adequate precautions, similar to those of these recommended practices, are required at all pressures. As a guideline, these recommended practices are applicable where the product of pressure times flow exceed 2000 PSIG.

Injuries caused by the impact of a water jet may appear insignificant and give little indication of the extent of the injury beneath the skin and the damage to deeper tissues.

Large quantities of water may have punctured the skin, flesh, and organs through a very small hole that may not bleed. If injured by a pressure washer, immediate hospital attention is required and medical staff must be informed of the cause of the injury. To insure that this is not overlooked, medical staff should be advised that, in previous cases of water jet punctures, unusual infections with micro-aerophillic organisms occurring at lower temperatures have been reported. These may be gram negative pathogen such as are found in sewage. Bacterial swabs and blood cultures may therefore be helpful.

This operating procedure provides only minimum general requirements. In addition the equipment manufacturer's manual should be read and followed.

2.4.37.3 Prevention and Protection Programs

Pressure Washing Equipment Requirements

Automatic pressure relief: The system shall be equipped with an automatic pressure relief device on the discharge side of the pump, adjusted so that the manufacturer's maximum allowable system pressure is not exceeded.

Pressure gauge: The system shall be equipped with a gauge to indicate the pressure being developed.

Electrical controls: All electrical controls shall be either fail safe, low voltage, or protected with an approved ground fault circuit interrupter.

Operator controls: The on - off control (trigger) used by the operator to control the flow of high pressure water to the nozzle shall include a "dead man" shut off feature which automatically stops the flow of high pressure water to the nozzle whenever the operator lets go of the control.

Personal Protection and Equipment Requirements

The following personnel protection equipment is to be available and worn as necessary based upon HASP requirements and/or direction of the SHSC. Additional equipment may be necessary if chemical or other hazards are present.

Whole Body: Splash protection. Liquid/Chemical resistant suits may be necessary based upon HASP requirements.
Head: Hard hat, as necessary
Eyes and Face: Face shield
Foot: Waterproof ANSI approved safety boots
Hearing: Ear plugs or ear muffs, as necessary.

Training

Only trained (experienced) personnel shall operate high pressure washing equipment, and supervise the training of new operators. Where equipment is rented or newly purchased and no one on the project team has prior experience with this equipment, the vendor shall be required to provide training in the proper use of the equipment. Training should include the following:

Cutting Action - Cutting action and potential hazard to the human body shall be demonstrated through the use of the equipment (cut through a piece of lumber, concrete block, etc.)

Personnel Protection Equipment - The minimum required personal protection equipment shall be explained.

System Operation - The operation of the system shall be explained pointing out potential problems and proper corrective action.

Control Devices - The operation of all control devices shall be explained, particularly pressure control and relief devices. The importance of not tampering with any control devices as well as the importance of keeping them functional shall be stressed.

Hose - The proper method of connecting hoses including laying out without kinks, protection from excessive wear, and proper methods for using couplings and fittings shall be explained.

Stance - The proper stance for sound footing shall be demonstrated.

Proficiency - Personnel being trained shall demonstrate this knowledge in the safe use of the equipment through practical application under the direction of the trainer.

Operational Rules

Never operate the equipment above the manufacturer's rated pressure maximum.

Increase pressure slowly until required working pressure is reached.

Always rope off the area to be cleaned.

Always be aware of nozzle location. Never point nozzle at a person. Remember that a water jet can puncture splash suits, safety boots and other personal protective clothing.

2.5 DRILLING SAFETY GUIDE

FLD 50

006851

2.5 DRILLING SAFETY GUIDE

2.5.1 An Introduction To Drilling Safety

The organization where you work is interested in your safety, not only when you are working on or around a drill rig, but also ,when you are traveling to and from a drilling site, moving the drill rig and tools from location to location on a site, or providing maintenance on a drill rig or drilling tools. This safety guide is for your benefit.

Every drill crew should have a designated safety supervisor. The safety supervisor should have the authority to enforce safety on the drilling site. A rig worker's first safety responsibility is to listen to the safety directions of the safety supervisor.

2.5.2 Governmental Regulations

All local, state, and federal regulations or restrictions, currently in effect or effected in the future, take precedence over the recommendations and suggestions that follow. Government regulations will vary from country to country and from state to state.

2.5.3 The Safety Supervisor

The safety supervisor for the drill crew, in most cases, will be the drill rig operator.

- The safety supervisor should consider the "responsibility" for safety and the "authority" to enforce safety to be a matter of first importance.
- The safety supervisor should be the leader in using proper personal safety gear and set an example in following the rules that are being enforced on others.
- The safety supervisor should enforce the use of proper personal protective safety equipment and take appropriate corrective action when proper personal protective safety equipment is not being used.
- The safety supervisor should understand that proper maintenance of tools and equipment and general "housekeeping" on the drill rig will provide the environment to promote and enforce safety.
- Before drilling is started with a particular drill, the safety supervisor must be ensured that the operator (who may be the safety supervisor) has had adequate training and is thoroughly familiar with the drill rig, its controls, and its capabilities.
- The safety supervisor should inspect the drill rig at least daily for structural damage, loose bolts and nuts, proper tension in chain drives, loose or missing guards or protective covers, fluid leaks, damaged hoses, and or damaged pressure gauges and pressure relief valves.

- The safety supervisor should check and test all safety devices, such as emergency shutdown switches, at least daily and preferable at the start of a drilling shift. Drilling should not be permitted until all emergency shutdown and warning systems are working correctly. Do not wire ground, bypass or remove an emergency device.
- The safety supervisor should check that all gauges, warning lights, and control levers are functioning properly and listen for unusual sounds on each starting of an engine.
- The safety supervisor should ensure that all new drill rig workers are informed of safe operating practices on and around the drill rig and should provide each new drill rig worker with a copy of the organization's drilling operations safety manual, and, when appropriate, the drill rig manufacturer's operations and maintenance manual. The safety supervisor should ensure that each new employee reads and understands the safety manual.
- The safety supervisor should carefully instruct a crew worker in drilling safety and observe the new worker's progress towards understanding safe operating practices.
- The safety supervisor should observe the mental, emotional, and physical capability of each worker to perform the assigned work in a proper and safe manner. The safety supervisor should dismiss any worker from the drill site whose mental and physical capabilities might cause injury to the worker or coworkers.
- The safety supervisor should ensure that there is first-aid kit and a fire extinguisher on each drill rig and on each additional vehicle, and ensure that they are properly maintained.
- The safety supervisor (and as many crew members as possible) should be well trained and capable of using first-aid kits, fire extinguisher, and all other safety devices and equipment.
- The safety supervisor should maintain a list of addresses and telephone numbers of emergency assistance units (ambulance services, police, hospitals, etc.) and inform other members of the drill crew of the existence and location of the list.

2.5.4 Individual Protective Equipment

For most geotechnical, mineral, and/or groundwater drilling projects, individual protective equipment should include a safety hat, safety shoes, safety glasses and close fitting but comfortable, without loose ends, straps, draw strings or belts, or otherwise unfastened parts that might catch on some rotating or translating component of the drill rig. Rings and jewelry should not be worn during a work shift.

- Safety Head Gear. Safety hats (hard hats) should be worn by everyone working or visiting at or near a drilling site. All safety hats should meet the requirements of ANSI Z89.1. All safety hats should be kept clean and in good repair with the headband and crown straps properly adjusted for the individual drill rig worker or visitor.
- Safety Shoes or Boots. Safety shoes or boots should be worn by all drilling personnel and all visitors to the drill site observing drilling operations within close proximity of the drill rig. All safety shoes or boots should meet the requirements of ANSI Z41.1.
- Gloves. All drilling personnel should wear gloves for protection against cuts and abrasion, which could occur while handling wire rope or cable and from contact with sharp edge and burrs on drill rods and other drilling or sampling tools. All gloves should be close fitting and not have large cuffs or loose ties that can catch on rotating or translating components of the drill rig.
- Safety Glasses. All drilling personnel should wear safety glasses. All safety glasses should meet the requirements of ANSI Z87.1.
- Other Protective Equipment. For some drilling operations, the environment or regulations may dictate that other protective equipment be used. The requirement for such equipment must be determined jointly by the management of the drilling organization and the safety supervisor. Such equipment might include face or ear protection or reflective clothing. Each drill rig worker should wear noise reducing ear protectors when appropriate. When drilling is performed in chemically-or radiologically-contaminated ground, special protective equipment and clothing may and probably will be required. The design and composition of the protective equipment and clothing should be determined as a joint effort of management and the client who requests the drilling services.

2.5.5 Housekeeping On and Around the Drill Rig

The first requirement for safe field operations is that the safety supervisor understands and fulfills the responsibility for maintenance and "housekeeping" on and around the drill rig.

- Suitable storage locations should be provided for all tools, materials, and supplies so that tools, materials, and supplies can be conveniently and safely handled without hitting or falling on a member of the drill crew or a visitor.
- Avoid storing or transporting tools, materials, or supplies within or on the mast (derrick) of the drill rig.

- Pipe, drill rods, casing, augers, and similar drilling tools should be orderly stacked on racks or sills t prevent spreading, rolling, or sliding.
- Penetration or other driving hammers should be placed a a safe location on the ground or be secured to prevent movement when not in use.
- Work areas, platforms, walkways, scaffol ng and other accessways should be kept free of materia , debris and obstructions, and substances such as ice, ease, or oil that could cause a surface to become sli or otherwise hazardous.
- Controls, control linkages, warning and c eration lights, and lenses should be stored free of oil grease, and/or ice.
- Gasoline should not be stored in any portable container other than a non-sparking, red container with flame arrester in the fill spout and having the word "gasoline" easily visible.

2.5.6 Maintenance Safety

Good maintenance will make drilling operations safer. Maintenance should be performed safely.

- Wear safety glasses when performing maintenance on a drill rig or on drilling tools.
- Shut down the drill rig engine to make repairs or adjustments to a drill rig or to lubricate fittin (except repairs or adjustments that can only be made wit the engine running). Take precautions to prevent accidentally starting of an engine during maintenance by removing or tagging the ignition key.
- Always block the wheels or lower the leveling jacks or both, and set hand brakes before working under a drill rig.
- When possible and appropriate, release all pressure on the hydraulic systems, the drilling fluid system, and the air pressure systems of the drill rig prior to performing maintenance. Reduce the drill rig and operating systems to a "zero energy state" before performing maintenance. Use extreme caution when opening drain plugs, radiator caps, and other pressurized plugs and caps.
- Do not touch an engine or the exhaust system of an engine following its operation until the engine and exhaust system have had adequate time to cool.
- Never weld or cut on or near a fuel tank.
- Do not use gasoline or other volatile, flammable liquids as a cleaning agent on or around a drill rig.
- Follow the manufacturer's recommendations for applying the proper quantity and quality of lubricants, hydraulic oils, and/or coolants.

- Replace all caps, filler plugs, protective guards or panels, and high pressure hose clamps, chains or cables that have been removed for maintenance before returning the drill rig to service.

2.5.7 Safe Use Of Hand Tools

There are almost an infinite number of hand tools that can be used on or around a drill rig and in repair shops. "Use the tool for its intended purpose" is the most important rule of proper use. The following are a few specific and some general suggestions that apply to safe use of several hand tools often used on and around drill rigs:

- Wear safety glasses and require all others around you to wear safety glasses when using a hammer.
- Wear safety glasses and require all others around you to wear safety glasses when using a chisel.
- Keep all tools cleaned and orderly stored when not in use.
- Use wrenches on nuts - don't use pliers on nuts.
- Use screwdrivers with blades that fit the screw slot.
- When using a wrench on a tight nut - first use some penetrating oil, use the largest wrench available that fits the nut, when possible pull on the wrench handle rather than pushing, and when possible apply force to the wrench with both hands while both feet are firmly placed.
- Don't push or pull with one or both feet on the drill rig or the side of a mud pit or some other blocking-off device. Always assume that you may lose your footing - check the place where you may fall for sharp objects.
- Keep all pipe wrenches clean and in good repair. The jaws of pipe wrenches should be wire brushed frequently to prevent an accumulation of dirt and grease that would otherwise build up and cause wrenches to slip.
- Never use pipe wrenches in place of a rod holding device.
- Replace hook and heel jaws when they became visibly worn.
- Position your hands so that your fingers will not be smashed between the wrench handle and the ground or the platform when breaking tool joints on the ground or on the drilling platform; the wrench may slip or the joint may suddenly let go.

2.5.8 Clearing the Work Area

Prior to drilling, adequate site clearing and leveling should be performed to provide a safe working area for the drill rig and supplies. Drilling should not be commenced when tree limbs, unstable ground, or site obstructions cause unsafe tool handling conditions.

2.5.9 Start-up

- All drill rig personnel and visitors are instructed t "stand clear" of the drill rig immediately prior to an during starting of an engine.
- Make sure all gear boxes are in neutral, all hois levers are disengaged, all hydraulic levers are in th correct nonactuating positions, and the cathead rope not on the cathead before starting a drill rig engine.
- Start all engines according to the manufacturer s manual.

2.5.10 Safety During Drilling Operations

Safety requires the attention and cooperation of every worker and site visitor.

- Do not drive the drill rig from hole to hole with the mast (derrick), in the raised position.
- Before raising the mast (derrick), check for overhead obstructions. (Refer to Section 2.5.11 an Overhead and Buried Utilities.)
- Before raising the mast (derrick), ensure all drill rig personnel (with exception of the operator) and visitors are cleared from the areas immediately to the rear and the sides of the mast. All drill rig personnel and visitors should be informed that the mast is being raised prior to raising it.
- Before the mast (derrick) of a drill rig is raised an drilling is commenced, level, and stabilize the drill ri with leveling jacks and/or solid cribbing. The drill rig should be releveled if it settles after initial set-up. Lower the mast (derrick) only when the leveling jacks are down, and do not raise the leveling jack pods until the mast (derrick) is lowered completely.
- Before starting drilling operations, secure and/or lock the mast (derrick) if required according to the drill manufacturer's recommendations.
- The operator of a drill rig will only operate a drill rig from the controls. If the operator of the drill rig must leave the area of the controls, the operator should shift the transmission controlling the rotary drive into neutral and place the feed control lever in neutral. The operator should shut down the drill engine before leaving the vicinity of the drill.
- Throwing or dropping tools is not permitted. All tools should be carefully passed by hand between personnel or a hoist line should be used.
- Do not consume alcoholic beverages or other depressants or chemical stimulants prior to starting work on a drill rig or while on the job.

- If it is necessary to drill within an enclosed area, make certain that exhaust fumes are conducted out of the area. Exhaust fumes can be toxic, and some cannot be detected by smell.
- Clean mud and grease from your boots before mounting a drill platform, and use hand holds and railings. watch for slippery ground when dismounting from the platform.
- During freezing weather, do not touch any metal parts of the drill rig with exposed flesh. Freezing of moist skin to metal can occur almost instantaneously.
- Drain all air and water lines and pumps when not in use if freezing weather is expected.
- Cover all unattended boreholes or otherwise protect to prevent drill rig personnel, site visitors, or animals from stepping or falling into the hole. All open boreholes should be covered, protected, or backfilled adequately according to local or state regulations on completion of the drilling project.
- Do not "horse around" within the vicinity of the drill rig and tool and supply storage areas even when the drill rig is shut down.
- When using a ladder on a drill rig, face the ladder and grasp either the side rails or the rungs with both hands while ascending or descending. Do not attempt to use one or both hands to carry a tool while on a ladder. Use a hoist line and a tool "bucket" or a safety hook to raise or lower hand tools.

An elevated derrick platform should be used with the following precautions:

- When working on a derrick platform, use a safety belt and a lifeline. The safety belt should be at least 4 in. (100 mm) wide and should fit snugly but comfortably. The lifeline, when attached to the derrick, should be less than 6 ft (2 m) long. The safety belt and lifeline should be strong enough to withstand the dynamic force of a 250 lb (115 kg) weight (contained within the belt) falling 6 ft (2 m).
- When climbing to a derrick platform that is higher than 20 ft (6 m), use a safety climbing device.
- When a rig worker is on a derrick platform, fasten the lifeline to the derrick just above the derrick platform and to a structural member that is not attached to the platform or to other lines or cables supporting the platform.
- When a rig worker first arrives at a derrick platform, inspect the platform for broken members, loose connections and loose tools, or other loose materials.
- Securely attach tools to the platform with safety lines. Do not attach a tool to a line attached to your wrist or any other part of your body.

- When you are working on a derrick platform, do not guide drill rods or pipe into racks or other supports by takin hold of a moving hoist line or a traveling block.
- Do not leave loose tools and similar items on the derrick platform or on structural members of the derrick.
- Ensure that a derrick platform over 4 ft (1.2 m) above ground surface has toe boards and safety rails that are in good condition.
- When working on the ground or the drilling floor, avoid being under rig workers on elevated platforms, whenever possible.

Be careful when lifting heavy objects:

- Before lifting any object without using a hoist, make sure the load is within your personal lifting capacity. If it is too heavy, ask for assistance.
- Before lifting a relatively heavy object, approach the object by bending at the knees, keeping your back vertical and unarched while obtaining a firm footing. Grasp the object firmly with both hands and stand slowly and squarely while keeping your back vertical and unarched. In other words, perform the lifting with the muscles in your legs, not with the muscles in your lower back.
- If a heavy object must be moved some distance without the aid of machinery, keep your back straight and unarched. Change directions by moving your feet, not by twisting your body.
- Move heavy objects with the aid of hand carts whenever possible.

Drilling operations should be terminated during an electrical storm, and the complete crew should move away from the drill rig.

2.5.11 Overhead And Buried Utilities

The use of a drill rig on a site within the vicinity of electrical power lines and other utilities requires that special precautions be taken by both supervisors and members of the exploration crew. Electricity can shock, burn, and cause death.

- Locate, note, and emphasize all overhead and buried utilities on all boring location plans and boring assignment sheets.
- When overhead electrical power lines exist at or near a drilling site or project, consider all wires to be alive and dangerous.
- Watch for sagging power lines before entering a site. Do not lift power lines to gain entrance. Call the utility and ask them to lift or raise the lines or deenergize (turn off) the power.

- Before raising the drill rig mast (derrick) on a site in the vicinity of power lines, walk completely around the drill rig. Determine what the minimum distance from any point on the drill rig to the nearest power line will be when the mast is raised and/or being raised. Do not raise the mast or operate the drill rig if this distance is less than 20 ft (6 m), or if known, the minimum clearance stipulated by federal, state, and local regulations.
- Keep in mind that both hoist lines and overhead power lines can be moved toward each other by the wind.
- Move the drill rig with the mast (derrick) down to avoid contact with power lines.
- If there are any questions whatever concerning the safety of drilling on sites in the vicinity of overhead power lines, call the power company. The power company will provide expert advice at the drilling site as a public service and at no cost.

Underground electricity is as dangerous as overhead electricity. Be aware and always suspect the existence of underground utilities such as electrical power, gas, petroleum, telephone, sewer and water. Ask for assistance:

- If a sign warning of underground utilities is located on a site boundary, do not assume that underground utilities are located on or near the boundary or property line under the sign: call the utility and check it out. The underground utilities may be considerable distance away from the warning sign.
- Always contact the owners of utility lines or the nearest underground utility location service before drilling. Determine jointly with utility personnel the precise location of underground utility lines, mark and flag the locations, and determine jointly with utility personnel what specific precautions must be taken to ensure safety.

2.5.12 Safe Use of Electricity

Drilling projects sometimes require around-the-clock operations and, therefore, require temporary electrical lighting. In general, all wiring and fixtures used to provide electricity for drilling operations should be installed by qualified personnel in accordance with the National Electrical Code (NFP A70-1984) with consideration of the American Petroleum Institute's recommended practices for electrical installations for production facilities (API-RP-500B). Lights should be installed and positioned to ensure that the work area and operating positions are well lit without shadows or blind spots. The following specific recommendations emphasize the safe use of electricity during land-bored drilling operations:

- Before working on an electrical power or lighting system, lock out the main panel box with your own lock and keep the key on your person at all times.
- Install all wiring using high quality connections, fixtures and wire, insulated and protected with consideration of the drilling environment. Makeshift wiring and equipment should not be permitted.
- All lights positioned directly above working areas should be enclosed in cages or similar enclosures to prevent loose or detached lamps or vapor tight enclosures from failing on workers.
- Install all lights to produce the least possible glare or "blind spots" on tools, ladders, walkways, platforms, and the complete working area.
- Locate and guard all electrical cables to prevent damage by drill operations or by the movement of personnel, tools, or supplies.
- Ensure that all plug receptacles are the three-prong, U-blade, grounded type and have adequate current carrying capacity for the electrical tools that may be used.
- Ensure that all electric tools have three-prong, U-blade, ground wire plugs and cords.
- Do not use electrical tools with lock-on devices.
- Ensure that all electrical welders, generators, control panels, and similar devices are adequately grounded.
- Avoid attaching electrical lighting cables to the derrick or other components of the drill rig. If this must be done, use only approved fasteners. Do not "string" wire through the derrick.
- Do not use poles used to hold wiring and lights for any other purpose.
- Power should be turned off before changing fuses or light bulbs.
- When a drilling area is illuminated with electrical lighting, wear safety head gear that protects the worker's head, not only against falling or flying objects, but also against limited electrical shock and burn according to ANSI Z89.1 and Z89.2.
- Ensure that all electrical equipment is operated by trained, designated personnel.
- If you are not qualified to work on electrical devices or on electric lines, do not go near them.

2.5.13 React to Contact with Electricity

If a drill rig makes contact with electrical wires, it may or may not be insulated from the ground by the tires of the carrier. Under either circumstance, the human body, if it simultaneously comes in contact with the drill rig and the ground, will provide a conductor of the electricity to the ground. Death or serious injury can be the result. If a drill rig or a drill rig carrier makes contact with overhead or underground electrical lines:

- Under most circumstances, the operator and other personnel on the seat of the vehicle should remain seated and not leave the vehicle. Do not move or touch any part, particularly a metallic part, of the vehicle or the drill rig.
- If it is determined that the drill rig should be vacated, then all personnel should jump clear and as far as possible from the drill. Do not step off - jump off, and do not hang on to the vehicle or any part of the drill when jumping clear.
- If you are on the ground, you should stay away from the vehicle and the drill rig, do not let others get near the vehicle and the drill rig, and seek assistance from local emergency personnel such as the police or a fire department.
- When an individual is injured and in contact with the drill rig or with power lines, only rescue with extreme caution. If a rescue is attempted, use a long, dry, unpainted piece of wood or a long, dry, clean rope. Keep as far away from the victim as possible and do not touch the victim until the victim is completely clear of the drill rig or electrical lines.
- When the victim is completely clear of the electrical source and is unconscious and a heart beat (pulse) cannot be detected, cardiopulmonary resuscitation (CPR) should be begun immediately.

2.5.14 Safe Use of Wire Line Hoists, Wire Rope and Hoisting Hardware

The use of wire line hoists, wire rope, and hoisting hardware should be as stipulated by the American Iron and Steel Institute Wire Rope Users Manual.

- All wire ropes and fittings should be visually inspected during use and thoroughly inspected at least once a week for: abrasion, broken wires, wear, reduction in rope diameter, reduction in wire diameter, fatigue, corrosion, damage from heat, improper reeving, jamming, crushing, bird caging, kinking, core protrusion, and damage to lifting hardware. Wire ropes should be replaced when inspection indicates excessive damage according to the Wire Rope Users Manual. All wire ropes that have not been used for a period of a month or more should be thoroughly inspected before being returned to service.
- End fittings and connections consist of spliced eyes and various manufactured devices. All manufactured end fittings and connections should be installed according to the manufacturer's instructions and loaded according to the manufacturer's specifications.

- If a ball-bearing type hoisting swivel is used to hoist drill rods, swivel bearings should be inspected an lubricated daily to ensure that the swivel freely rotate under load.
- If a rod slipping device is used to hoist drill rods, do not drill through or rotate drill rods through the slipping device, do not hoist more than 1 ft (0.3 m) of the drill rod column above the top of the mast (derrick), do not hoist a rod column with loose tool joints, and do not make up, tighten, or loosen tool joints while the rod column is being supported by a rod slipping device. If drill rods should slip back into the borehole, do not attempt to brake the fall of the rods with your hands or by tensioning the slipping device.
- Most sheaves on exploration drill rigs are stationary with single part line. The number of parts of line should not ever be increased without first consulting with the manufacturer of the drill rig.
- Wire ropes must be properly matched with each sheave - if the rope is too large, the sheave will pinch the wire rope - if the rope is too small, it will groove the sheave. Once the sheave is grooved, it will severely pinch and damage larger sized wire rope.

The following procedures and precautions must be understood and implemented for safe use of wire ropes and rigging hardware:

- Use tool handling hoists only for vertical lifting o tools (except when angle hole drilling). Do not use too. handling hoists to pull on objects away from the drill rig; however, drills may be moved using the main hoist if the wire rope is spooled through proper sheaves according to the manufacturer's recommendations.
- When stuck tools or similar loads cannot be raised with a hoist, disconnect the hoist line and connect the stuck tools directly to the feed mechanism of the drill. Do not use hydraulic leveling jacks for added pull to the hoist line or the feed mechanism of the drill.
- When attempting to pull out a mired down vehicle or drill rig carrier, only use a winch on the front or rear of the vehicle and stay as far as possible away from the wire rope. Do not attempt to use tool hoists to pull out a mired down vehicle or drill rig carrier.
- Minimize shock loading of a wire rope apply loads smoothly and steadily.
- Avoid sudden loading in cold weather.
- Never use frozen ropes.
- Protect wire rope from sharp corners or edges.
- Replace faulty guides and rollers.
- Replace worn sheaves or worn sheave bearings.
- Know the safe working load of the equipment and tackle being used. Never exceed this limit.

- Periodically inspect and test clutches and brakes of hoists.
- Know and do not exceed the rated capacity of hooks, rings, links, swivels, shackles, and other lifting aids.
- Always wear gloves when handling wire ropes.
- Do not guide wire rope on hoist drums with your hands.
- Following the installation of a new wire rope, first lift a light load to allow the wire rope to adjust.
- Never carry out any hoisting operations when the weather conditions are such that hazards to personnel, the public, or property are created.
- Never leave a load suspended in the air when the hoist is unattended.
- Keep your hands away from hoists, wire rope, hoisting hooks, sheaves and pinch points as slack is being taken up, and when the load is being hoisted.
- Never hoist the load over the head, body, or feet of any personnel.
- Never use a hoist line to "ride" up the mast (derrick) of a drill rig.
- Replace wire ropes with ones that conform to the drill rig manufacturer's specifications.

2.5.15 Safe Use of Cathead and Rope Hoists

The following safety procedures should be employed when using a cathead hoist:

- Keep the cathead clean and free of rust and oil and/or grease. The cathead should be cleaned with a wire brush if it becomes rusty.
- Check the cathead periodically, when the engine is not running, or rope wear grooves. If a rope groove forms to a depth greater then 1/8 inch (3 mm), the cathead should be replaced.
- Always use a clean, dry, sound rope. A wet or oily rope may "grab" the cathead and cause drill tools or other items to be rapidly hoisted to the top of the mast.
- Should the rope "grab" the cathead or otherwise become tangled in the drum, release the rope and sound an appropriate alarm for all personnel to rapidly back away and stay clear. The operator should also back away and stay clear. If the rope "grabs" the cathead, and tools are hoisted to the sheaves at the top of the mast, the rope will often break, releasing the tools. If the rope does not break, stay clear of the drill rig until the operator cautiously returns to turn off the drill rig engine and appropriate action is taken to release the tools. The operator should keep careful watch on the suspended tools and should quickly back away after turning off the engine.

- Protect the rope from contact with all chemicals. Chemicals can cause deterioration of the rope that ma not be visibly detectable.
- Never wrap the rope from the cathead (or any other rope, wire rope or cable on the drill rig) around a hand, wrist, arm, foot, ankle, leg, or any other part of your body.
- Always maintain a minimum of 18 inches of clearance between the operating hand and the cathead drum when driving samplers, casing or other tools with the cathead and rope method. Be aware that the rope advances toward the cathead with each hammer blow as the sampler or other drilling tool advances into the ground.
- Never operate a cathead (or perform any other task around a drill rig) with loose, unbuttoned, or otherwise unfastened clothing or when wearing gloves with large cuffs or loose straps or lacings.
- Do not use a rope that is any longer than necessary. A rope that is too long can form a ground loop or otherwise become entangled with the operator's legs.
- Do not use more rope wraps than are required to hoist a lead.
- Do not leave a cathead unattended with the rope wrapped on the drum.
- Position all other hoist lines to prevent contact with the operating cathead rope.
- When using the cathead and rope for driving or back-driving, make sure that all threaded connections are tight and stay as far away as possible from the hammer impact point.
- The cathead operator must operate the cathead standing on a level surface with good, firm footing conditions without distraction or disturbance.

2.5.16 Safe Use of Augers

The following general procedures should be used when starting a boring with continuous flight or hallow-stem augers:

- Prepare to start an auger boring with the drill rig level, the clutch or hydraulic rotation control disengaged, the transmission in low gear, and the engine running at low RPM.
- Apply an adequate amount of down pressure prior to rotation to seat the auger head below the ground surface.
- Look at the auger head while slowly engaging the clutch or rotation control and starting rotation. Stay clear of the auger.
- Slowly rotate the auger and auger head while continuing to apply down pressure. Keep one hand on the clutch or the rotation central at all times until the auger has penetrated about one foot or more below ground surface.

- Use the auger guide to facilitate the starting of a straight hole through hard ground or a pavement.

The operator and tool handler should establish a system of responsibility for the series of various activities required for auger drilling, such as connecting and - disconnecting auger sections, and inserting and removing the auger fork. The operator must ensure that the tool handler is well away from the auger column and that the auger fork is removed before starting rotation.

- Only use the manufacture's recommended method of securing the auger to the power coupling. Do not touch the coupling or the auger with your hands, a wrench, or any other tools during rotation.
- Whenever possible, use tool hoists to handle auger sections.
- Never place hands or fingers under the bottom of an auger section when hoisting the auger over the top of the auger section in the ground or other hard surfaces such as the drill rig platform.
- Never allow feet to get under the auger section that is being hoisted.
- When rotating augers, stay clear of the rotating auger and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason whatever.
- Use a long-handled shovel to move auger cuttings away from the auger. Never use your hands or feet to move cuttings away from the auger.
- Do not remove earth from rotating augers. Augers should be cleaned only when the drill rig is in neutral and the augers are stopped from rotating.

2.5.17 Safety During Rotary And Core Drilling

Rotary drilling tools should be safety checked periodically and replaced when necessary.

- Water swivels and hoisting plugs should be lubricated and checked for "frozen" bearings before use.
- Drill rod chuck jaws should be checked periodically and replaced when necessary.
- The capacities of hoists and sheaves should be checked against the anticipated weight to the drill rod string plus other expected hoisting loads.

Special precautions that should be taken for Safe rotary or core drilling involve chucking, joint break, hoisting, and lower of drill rods:

- Only the operator of the drill rig should brake or set a manual chuck so that rotation of the chuck will not occur prior to removing the wrench from the chuck.

- Drill rods should not be braked during lowering into the hole with drill rod chuck jaws.
- Drill rods should not be held or lowered into the hol with pipe wrenches.
- If a string of drill rods are accidentally or inadvertently released into the hole, an attempt should not be made to grab the falling rods with your hands or a wrench.
- In the event of a plugged bit or other circulation blockage, the high pressure in the piping and hose between the pump and the obstruction should be relieved or bled down before breaking the first tool joint.
- When drill rods are hoisted from the hole, they should be cleaned for safe handling with a rubber or other suitable rod wiper. Do not use your hands to clean drilling fluids from drill rods.
- If work must progress over a portable drilling fluid (mud) pit, no one should attempt to stand on narrow sides or cross members. The mud pit should be equipped with rough surfaced, fitted cover panels of adequate strength to hold drill rig personnel.
- Drill rods should not be lifted and leaned unsecured against the mast. Either provide some method of securing the upper ends of the drill rod sections for safe vertical storage or lay the rods down.

2.5.18 Safety During Travel

The individual who transports a drill rig on and off a drilling site should:

- Be properly licensed and should only operate the vehicle according to federal, state, and local regulations.
- Know the traveling height (overhead clearance), width, length, and weight of the drill rig with carrier and know highway and bridge load, width and overhead limits, making sure these limits are not exceeded with an adequate margin.
- Never move a drill rig unless the vehicle brakes are in sound working order.
- Allow for most overhang when cornering or approaching other vehicles or structures.
- Be aware that the canopies of service stations and motels are often too low for a drill rig mast to clear with the mast in the travel position.
- Watch for low hanging electrical lines, particularly at the entrances to drilling sites, restaurants, motels, or other commercial sites.
- Never travel on a street, road, or highway with the mast (derrick) of the drill rig in the raised or partially raised position.
- Remove all ignition keys when a drill rig is left unattended.

2.5.19 Loading and Unloading

When loading or unloading a drill rig on a trailer or a truck:

- Use ramps of adequate design that are solid and substantial enough to bear the weight of the drill rig with carrier - including tooling.
- Load and unload on level ground.
- Use the assistance of someone on the ground as a guide.
- Check the brakes on the drill rig carrier before approaching loading ramps.
- Distribute the weight of the drill rig, carrier, and tools on the trailer so that the center of weight is approximately on the centerline of the trailer and so that some of the trailer load is transferred to the hitch of the pulling vehicle. Refer to the trailer manufacturer's weight distribution recommendations.
- Secure drill rig and tools to the hauling vehicle with ties, chains, and/or load binders of adequate capacity.

2.5.20 Off-Road Movement

The following safety suggestions relate to off-road movement:

- Before moving a drill rig, first walk the route of travel, inspecting for depressions, stumps, gullies, ruts and similar obstacles.
- Always check the brakes of a drill rig carrier before traveling, particularly on rough, uneven, or hilly ground.
- Check the complete drive train of a carrier at least weekly for loose or damaged bolts, nuts, studs, shafts, and mountings.
- Discharge all passengers before moving a drill rig on rough or hilly terrain.
- Engage the front axle (for 4 x 4, 6 x 6, etc. vehicles or carriers) when traveling off highway on hilly terrain.
- Use caution when traveling side-hill. Conservatively evaluate side-hill capability of drill rigs, because the arbitrary addition of drilling tools may raise the center of mass. When possible, travel directly uphill or downhill. Increase tire pressures before traveling in hilly terrain (do not exceed rated tire pressure).
- Do not attempt to cross obstacles such as small logs and small erosion channels or ditches at an angle.
- Use the assistance of someone on the ground as a guide when lateral or overhead clearance is close.
- After the drill has been moved to a new drilling site, set all brakes and/or locks. When grades are steep, block the wheels.
- Never travel off-road with the mast (derrick) of the drill rig in the raised or partially raised position.

2.5.21 Tires, Batteries And Fuel

Tires on the drill rig must be checked daily for safety and during extended travel for loss of air, and they must be maintained and/or repaired in a safe manner. If tires are deflated to reduce ground pressure for movement on soft ground, the tires should be reinflated to normal pressures before movement on firm or hilly ground or on streets, roads, and highways. Under-inflated tires are not as stable on firm ground as properly-inflated tires. Air pressures should be maintained for travel on streets, roads, and highways according to the manufacturer's recommendations. During air pressure checks, inspect for:

- Missing or loose wheel lugs.
- Objects wedged between duals or embedded in the tire casing.
- Damage to or poorly fitting rims or rim flanges.
- Abnormal or uneven wear and cuts, breaks, or tears in the casing.

The repair of truck and off-highway tires should only be made with required special tools and following the recommendations of a tire manufacture's repair manual.

Batteries contain strong acid. Use extreme caution when servicing batteries.

- Service batteries in a ventilated area while wearing safety glasses.
- When a battery is removed from a vehicle or service unit, disconnect the battery ground clamp first.
- When installing a battery, connect the battery ground clamp last.
- When charging a battery with a battery charger, turn off the power source to the battery before either connecting or disconnecting charger loads to the battery posts. Cell caps should be loosened prior to charging to permit the escape of gas.
- Spilled battery acid can burn your skin and damage your eyes. Immediately flush spilled battery acid off of your skin with lots of water. Should battery acid get into someone's eyes, flush immediately with large amounts of water and see a medical physician at once.
- To avoid battery explosions, keep the cells filled with electrolyte, use a flashlight (not an open flame) to check electrolyte levels, and avoid creating sparks around the battery by shorting across a battery terminal. Keep lighted smoking materials and flames away from batteries.

Special precautions must be taken for handling fuel and refueling the drill rig or carrier.

- Only use the type and quality of fuel recommended by the engine manufacturer.
- Refuel in a well-ventilated area.
- Do not fill fuel tanks while the engine is running. Turn off all electrical switches.
- Do not spill fuel on hot surfaces. Clean any spillage before starting an engine.
- Wipe up spilled fuel with cotton rags or cloths - do not use wool or metallic cloth.
- Keep open lights, lighted smoking materials, and flames or sparking equipment well away from the fueling area.
- Turn off heaters in carrier cabs when refueling the carrier or the drill rig.
- Do not fill portable fuel containers completely full to allow expansion of the fuel during temperature changes.
- Keep the fuel nozzle in contact with the tank being filled to prevent static sparks from igniting the fuel.
- Do not transport portable fuel containers in the vehicle or carrier cab with personnel.
- Keep fuel containers and hoses in contact with a metal surface during travel to prevent the buildup of static charge.

2.5.22. First Aid

At least one member of the drill crew, preferably the drilling safety supervisor, should be trained to perform first aid. First aid is taught on a person-to-person basis, not by providing or reading a manual. Manuals should only provide continuing reminders and be used for reference. It is suggested that courses provided or sponsored by the American Red cross or a similar organization would best satisfy the requirements of first aid training for drill crews.

For drilling operations, it is particularly important that the individual responsible for first aid should be able to recognize the symptoms and be able to provide first aid for electrical shock, heart attack, stroke, broken bones, eye injury, snake bite, and cuts or abrasions to the skin. Again, first aid for these situations is best taught to drill crew members by instructors qualified by an agency such as the American Red Cross.

A first aid kit should be available and well maintained on each drill site.

2.5.23 Drill Rig Utilization

Do not attempt to exceed manufacturers' ratings of speed, force, torque, pressure, flow, etc. Only use the drill rig and tools for the purposes that they are intended and designed.

2.5.24 Drill Rig Alterations

Alterations to a drill rig or drilling tools should only be made by qualified personnel and only after consultation with the manufacturer.

2.6 DRILL RIG SAFETY INSPECTION LIST

006872

DRILL RIG INSPECTION CHECKLIST

Answer Yes or No, and make any additional comments you feel are necessary. Potions of this checklist should be filled out during drilling operations.

A. GENERAL HEALTH AND SAFETY

1. Does the Health and Safety Plan (HASP) address drilling hazards? _____

   Comments: _____

2. Have the hazards of drilling been communicated to all field personnel? _____

   Comments: _____

3. Have the drillers been informed not to wear rings, loose fitting clothes, straps, draw strings, or other items which may catch in rotating or moving parts? _____

   Comments: _____

4. Do all field personnel know where the emergency shut off is for the rig? _____

   Comments: _____

5. Has the drill crew been informed that only qualified drillers may operate the rig? _____

   Comments: _____

6. Have all field personnel been informed of the location of posted information, i.e., hospitals, emergency phone numbers, evacuation routes? _____

   Comments: _____

7. Do all field personnel know the location of safety equipment, i.e., first aid kits, fire extinguishers? _____

   Comment: _____

8. Do drillers know the air monitoring scheme, i.e., when samples are to be taken? _____

Comments: _____

_____

9. Have the geologist and the drill crew established a ./or been informed of the method for signaling an emergency? _____

Comment: _____

_____

B. PERSONAL PROTECTIVE EQUIPMENT

1. Do drillers have hard hats, safety glasses, and steel toed boots? _____

Comments: _____

_____

2. Does this equipment meet ANSI standards?
Hard hat (ANSI Z81.1) _____; safety glasses (ANSI Z87.1) _____; steel toed boots (ANSI Z41.1) _____

Comments: _____

_____

3. Do drillers have hearing protection available? _____

Comments: _____

_____

4. Do drillers have the personal protective equipment required in case of upgrade? _____

Comment: _____

_____

5. If respirators stored on the rig, are they clean and stored in plastic bags in a dry, safe place such that rubber components are not distorted? _____

Comments: _____

_____

6. Do drillers have gloves that are durable and will protect them from the chemical hazards? _____

Comments: _____

_____

7. Do the drillers have the correct respirator cartridge, as stated in the HASP? _____

Comments: _____

_____

8. Is this equipment used according to OSHA 29 CFR 1910.134? _____

Comments: _____

_____

C. HOUSEKEEPING

1. Is there adequate storage area for tools, augers, pipe, etc.? _____

Comments: _____

_____

2. Are pipes, augers and rods stacked in an area where they cannot roll or slide? _____

Comment: _____

_____

3. Are work areas and platforms free of tools, debris, and slick substances such as ice, mud, and grease? _____

Comments: _____

_____

4. Are controls free of slick substances such as mud, grease, and ice? _____

Comment: _____

_____

5. Is gasoline stored in OSHA approved containers? _____

Comments: _____

_____

D. MAINTENANCE

1. Do the drillers have a rig inspection program? _____

Comments: _____

_____

2. Are the inspections documented? _____

Comments: _____

_____

3. How often are the inspections performed? _____

Comments: _____

4. Who performs the inspections? _____

Comments: _____

5. Do the drillers perform daily checks on the equipment? _____

Comments: _____

E. RIG EQUIPMENT

1. Are parking brakes available and in use when the equipment is not in use? _____

Comments: _____

2. Are lights, mirrors, windshields and side windows in good condition and operational? _____

Comments: _____

3. Are back-up alarms and warning signals operational? _____

Comments: _____

4. Are mud flaps in place and in good condition? _____

Comments: _____

5. Are the necessary protective guards maintained in place where injury may result? _____

Comments: _____

6. Are cables in good condition and inspected often for, birdcaging, kinks, and flattened areas? _____

Comments: _____

7. Are other signs of wear apparent, such as broken or cut wires on the cable? _____

   Comments: _____

8. Do pulleys operate freely and are cable guards maintained in place? _____

   Comments: _____

9. Are cable eyes formed and constructed properly? _____

   Comments: _____

10. Are at least three saddle clips installed and spaced properly, with the "U" section of the clip on the dead end of the rope? _____

    Comments: _____

11. Are pulleys the proper size for the cable diameter? _____

    Comments: _____

12. Is the rope to the slide hammer free of worn or burned spots? _____

    Comments: _____

13. Are hydraulic lines in good condition and fittings tight? _____

    Comments: _____

14. Are hydraulic slides and guides lubricated adequately and frequently? _____

    Comments: _____

15. Is the cat head lubricated frequently during use to avoid damaging the rope? _____

    Comments: _____

16. Is the emergency shut off system working properly? _____

Comments: _____

_____

17. Is there a first aid kit with a daily inspection log on the rig? _____

Comments: _____

_____

18. Is there a 20 B-C fire extinguisher with a current inspection tag available in the work area? _____

Comments: _____

_____

F. CUTTING TORCHES AND WELDING

1. Are drillers who are using cutting/welding equipment properly trained or experienced? _____

Comments: _____

_____

2. Are hoses in good shape, with no cuts or worn spots? _____

Comments: _____

_____

3. Are oxygen and acetylene tanks used, stored upright and secured from dropping or falling? _____

Comments: _____

_____

4. Are oxygen, acetylene and other fuel tanks stored at least 25' apart when not in use? _____

Comments: _____

_____

5. Are appropriate eye shades provided? _____

Comments: _____

_____

6. Is a wrench provided for operating the valves on the tank? _____

Comments: _____

_____

7. Are potentially toxic coatings removed from the materials prior to cutting/welding? _____

Comments: _____

8. Is adequate ventilation provided when cutting/welding? _____

Comments: _____

9. Are electric cables and connectors in good shape? _____

Comments: _____

10. Is appropriate protective clothing worn when welding? _____

Comments: _____

11. Are combustible materials kept away from the area while welding activities are in progress? _____

Comments: _____

12. Is a Hot Work Permit program in effect when cutting/welding is performed? _____

Comments: _____

G. HAND TOOL SAFETY

1. Are hand tools being used for their designed? _____

Comments: _____

2. Are tools checked for signs of stress: cracked handles _____; loose handles _____; cracked or mushroomed metal _____; tips or points properly sharpened _____; wrenches _____; worn gripping surfaces _____.

Comments: _____

3. Are safety glasses being worn when hand tools that may produce flying fragments are in use? _____

Comments: _____

4. Are wrenches being used on nuts and bolts (pliers or pipe wrenches should not be used)? _____

Comments: _____

_____

5. Are pipe wrenches and other hand tools clean and in good condition? _____

Comments: _____

_____

H. ELECTRICITY AND POWER TOOLS

1. Is low voltage equipment used in tanks and wet area? _____

Comments: _____

_____

2. Are tools maintained, inspected and in good condition? _____

Comments: _____

_____

3. Are electrical tools and instruments approved for use in hazardous areas? _____ If yes, good for Class_____, Division _____, Groups _____

Comments: _____

_____

4. Is the insulation on cords in good condition, and plugs unbroken? _____

Comments: _____

_____

5. Are extension and power cords protected from vehicular traffic? _____

Comments: _____

_____

6. Has the grounding prong on any three prong plug been cut off? If not, is the extension cord made for a ground plug? _____

Comments: _____

_____

7. Are guards in place on portable electric tools?

Comments: _____

_____

I. SAFETY DURING SETUP AND DRILLING

1. Is bannerguard used to delineate the area around the rig (standard is one derrick length)? _____

Comments: _____

_____

2. Is the derrick lowered when the rig is moved from one place to another? _____

Comments: _____

_____

3. Have overhead and buried utilities been located and marked before drilling begins? _____

Comments: _____

_____

4. Are all personnel (except drillers) Cleared from the rear of and the sides of the rig when the derrick is being raised? _____

Comments: _____

_____

5. Are the jack pods lowered and leveled before the derrick is lowered? _____

Comments: _____

_____

6. Before drilling begins, is the derrick locked into place? _____

Comments: _____

_____

7. Does the driller shut down the operation of the rig when he is not at the controls? _____

Comments: _____

_____

8. Are open holes covered when left unattended? _____

Comments: _____

_____

9. Are drillers restricted from climbing the derrick? _____ If not do they use safety belts or harnesses? _____

Comments: _____

_____

10. Are all drilling operations shut down and workers required to be in safe locations during electrical storms? _____

Comments: _____

_____

11. Are drillers aware that the derrick must be a minimum of 20' from overhead power lines? _____

Comments: _____

_____

12. Have underground surveys been performed before drilling at each location? _____

Comments: _____

_____

13. If drilling is allowed after dusk, are 5 footcandles of light provided? _____

Comments: _____

_____

14. Is the entire drilling area illuminated so that personnel may see the hazards? _____

Comments: _____

_____

NOTE: Drilling after dusk is not recommended. CAR HEADLIGHTS ARE NOT AN ACCEPTABLE MEANS OF ILLUMINATION.

Health and Safety Plan Operating Procedures

Field Operating Procedure - FLD41 - Standard Hand and Emergency Signals

Hand Signals

SIGNAL	MEANING
Hands on top of head.	Need assistance
Grip partners wrist or place both hands around partners arm.	Leave area immediately.
Thumbs up.	OK; I'm all right
Thumbs down	No; Negative
Hand gripping throat.	Cannot breath, out of air
Pointed finger on extended arm.	Look in that direction
Wave hands over head from side-to-side.	Attention; Stand-by for the next signal
Swing hand from direction of person receiving signal to directly overhead and through in circle.	Come here
Clenched fist of extended arm.	Stop motion
Draw index finger across front of throat.	Shut off engine; cut off power

Emergency Signals

SIGNAL	MEANING
One long sound of the emergency Alarm signal	Emergency situation, face Safety watch and watch or listen for direction
Pause; followed by:	
A number of short sounds, 1, 2, 3 or 4	Evacuate to the pre-designated emergency meeting place indicated by the number of sounds.

006883

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

REMEDIAL INVESTIGATION/FEASIBILITY STUDY

CHEMICAL DATA ACQUISITION PLAN ADDENDUM

FOR AREA LHAAP-1A

Prepared for:

U. S. Army Corps of Engineers
Tulsa District
Contract No. DACA 56-93-D-0008
Delivery No. 1

Submitted by:

Roy F. Weston, Inc.
5599 San Felipe, Suite 700
Houston, Texas 77056
(713) 621-1620

September 1993

NOTICE

The information in this document has been funded by the U. S. Army Corps of Engineers (USACE) under Contract No. DACA-56-93-D-0008 to Roy F. Weston, Inc. (WESTON). This document has not been formally released by either WESTON or the USACE. This document should not be cited or quoted.

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

CHEMICAL DATA ACQUISITION PLAN

TABLE OF CONTENTS

SECTION	TITLE	PAGE
1.0	INTRODUCTION	1-1
2.0	PROJECT ORGANIZATION	2-1
3.0	QUALITY ASSURANCE OBJECTIVES	3-1
4.0	FIELD OPERATIONS	4-1
5.0	SAMPLE HANDLING AND TESTING	5-1
6.0	SAMPLE INTEGRITY	6-1
7.0	REDUCTION, VALIDATION, AND REPORTING	7-1
8.0	AUDITS	8-1
9.0	CORRECTIVE ACTION	9-1

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

CHEMICAL DATA ACQUISITION PLAN
TABLE OF CONTENTS
(continued)

APPENDICES

APPENDIX	TITLE
A	Longhorn Army Ammunition Plant RI/FS Chemical Data Acquisition Plan
B	WESTON's Analytics Division Program Plan
C	Forms Used in Field Sampling Activities Monitor Well Schematic Chain-of-Custody Form

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

CHEMICAL DATA ACQUISITION PLAN
TABLE OF CONTENTS
(continued)

FIGURES

FIGURE	TITLE	PAGE
2-1	Project Organization	2-2
4-1	WESTON Typical Monitoring Well Construction Diagram	4-2

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

CHEMICAL DATA ACQUISITION PLAN
TABLE OF CONTENTS
(continued)

TABLES

TABLE	TITLE	PAGE
5-1	Summary of Sampling and Analytical Parameters	5-2

SECTION 1.0

INTRODUCTION

A Remedial Investigation/Feasibility Study (RI/FS) is currently being implemented at 13 Solid Waste Management Units (SWMUs) at the Longhorn Army Ammunition Plant (LHAAP) located in Karnack, Texas. This work is required under a Federal Facilities Agreement (FFA) between the U.S. Environmental Protection Agency (EPA), Texas Water Commission (TWC), and Department of the Army (DA). The FFA requires a RI/FS under the Comprehensive Environmental Response, Compensation and Liability ACT (CERCLA) of 1980 to characterize the nature and extent of contamination at the 13 SWMUs and develop a remedy for remediation of each area. Site LHAAP-1 is one such site and is the subject of a field investigation and Site Characterization Summary (SCS) Report performed by Ebasco Services Incorporated. Site LHAAP-1A is a physical extension of site LHAAP-1. Roy F. Weston, Inc. (WESTON®) has been contracted by the U. S. Army Corps of Engineers (USACE) Tulsa District under Contract No. DACA56-93-0008, Delivery Order No. 1, to conduct a remedial investigation of area LHAAP-1A.

For reporting purposes, site LHAAP-1 and area LHAAP-1A will be referred to as a single site (combined site LHAAP-1). After completion of the RI field activities, WESTON will prepare a LHAAP-1A Sampling and Data Results (SDR) report. WESTON will

incorporate the data from the WESTON SDR Report and the Ebasco SCS Report into a combined site LHAAP-1 SCS Report. All work will be completed in accordance with the Delivery Order No. 1, the guidance and policy of CERCLA, the National Contingency Plan (NCP), the WESTON Health and Safety Plan (HASP), WESTON RI Work Plan, and this Chemical Data Acquisition Plan (CDAP).

This CDAP has been prepared as an addendum to the Longhorn Army Ammunition Plant RI/FS Work Plan Volume 2 - Chemical Data Acquisition Plan (USACE, June 1992), which describes the field investigation, sampling, analytical, and quality assurance/quality control (QA/QC) procedures for the RI/FS at LHAAP. The purpose of this CDAP Addendum is to describe the proposed deviations from the USACE CDAP and explain the rationale supporting the deviations. Additional details and clarification of certain procedures are also provided. A discussion of WESTON's project organization is included which outlines the responsibilities and lines of authority of personnel involved in the execution of the remedial investigation activities.

The USACE CDAP of June 1992 (Appendix A), the USACE Work Plan Addendum, and the Ebasco LHAAP RI CDAP Addendum of December 1992 were used as reference documents to prepare this LHAAP-1A CDAP Addendum.

SECTION 2.0

PROJECT ORGANIZATION AND RESPONSIBILITY

Quality assurance/quality control (QA/QC) for the site inspections will be organized as presented in Figure 2-1. The individuals shown are responsible for the collection of valid analytical data and/or the routine assessment of field and laboratory measurement systems for precision, accuracy, and completeness.

The duties and responsibilities of the aforementioned personnel are briefly described below:

Project Manager: WESTON Project Manager (PM) is responsible to the USACE Project Manager for overall performance and the quality of all work under Contract No. DACA56-93-0008.

Project Task Manager: WESTON Project Task Manager (PTM) has the responsibility of serving as the primary point of contact and liaison between the USACE and WESTON. The PTM will ultimately be responsible for the commitment of WESTON's resources and complete coordination of all work required by WESTON's contract with the USACE. It is the PTM's responsibility to continually monitor title and functional changes of all personnel working on the project.

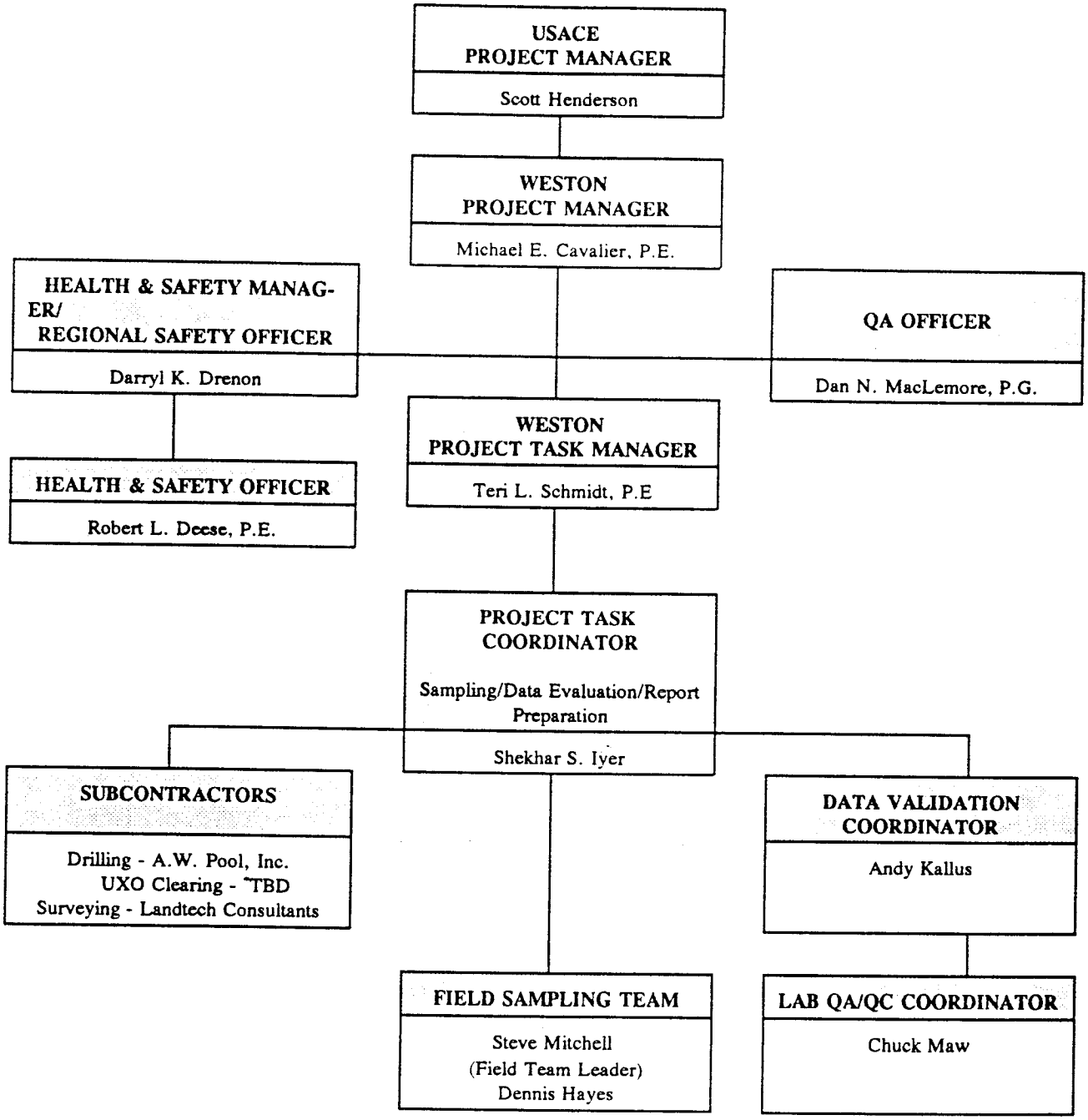
Project Task Coordinator: WESTON's Project Task Coordinator (PTC) has overall responsibility for the completion of all project activities. The PTC will direct and monitor the planning, scheduling, cost control, coordination and control of all work performed on this project. In this capacity, the PTC has overall responsibility for establishing and implementing the LHAAP-1A Work Plans.

Health and Safety Manager/Regional Safety Officer: The WESTON Health and Safety Manager/Regional Safety Officer (HSM/RSO) will ensure that all USACE, OSHA and WESTON health and safety concerns and requirements are followed and implemented. The HSM/RSO will be assisted by the project's Health and Safety Officer (HSO). The HSO is responsible for assisting the HSM/RSO during the preparation and the implementation of the LHAAP-1A site specific Health and Safety Plan (HASP). Health and safety responsibilities and lines of authority are discussed in more detail in the LHAAP-1A HASP.

Quality Assurance Officer: WESTON's Quality Assurance Officer (QAO) reports to the WESTON PM and provides technical guidance to other project personnel. The QAO will coordinate with the WESTON PTM and advise the PTM on the implementation of the CDAP. The QAO is responsible for monitoring and verifying that the work is performed in accordance with the CDAP and for assessing the project's overall

Figure 2-1

WESTON PROJECT ORGANIZATION
LONGHORN ARMY AMMUNITION PLANT
REMEDIAL INVESTIGATION
AREA LHAAP-1A
KARNACK, TEXAS



* To be Determined

performance. Specifically, the QAO is responsible for verifying personnel assigned to the project are trained on the requirements of the CDAP (this duty is shared with the WESTON Project Task Coordinator), reviewing and verifying the disposition of nonconformance and corrective action reports, and carrying out periodic project QA/QC audits.

Field Team Leader: WESTON's Field Team Leader (FTL) will be responsible for seeing that project personnel complete assigned project task activities in accordance with the LHAAP-1A Work Plan. The FTL will share responsibility with the QAO for training field team members in the provisions of the CDAP. The FTL will report to the WESTON PTC.

Laboratory QA/QC Coordinator: Laboratory chemical analyses and laboratory QA/QC procedures will be the responsibility of the WESTON Laboratory QA/QC Coordinator. The Laboratory QA/QC Coordinator will work with the project's Data Validation Coordinator who has the responsibility of coordinating the management and review of all field and analytical data generated for the LHAAP-1A RI.

During the selection of the analytical laboratory and subcontractors, emphasis was placed on accessing the organization's ability to provide quality laboratory, drilling, surveying, and Unexploded Ordnance Team (UXO) clearing services. The analytical laboratory is WESTON's Gulf Coast Laboratory located in Chicago, Illinois. A copy of WESTON's Analytics Division Program Plan is provided in Appendix B. The drilling company is

A.W. Pool, Inc. of Clinton, Oklahoma. The surveying subcontractor is Landtech Consultants of Houston, Texas. The UXO Team will be determined.

SECTION 3.0

QUALITY ASSURANCE OBJECTIVES

WESTON proposes no revisions to the procedures described in this section of the USACE CDAP.

SECTION 4.0

FIELD OPERATIONS

Clarifications, additional details, and proposed revisions to the procedures described in the USACE CDAP are discussed below.

USACE CDAP Section 4.2.1.3 Monitor Well Screens

Ebasco's recommendations in the December 1992, draft CDAP Addendum include well screens for the monitoring wells extending a minimum of 2 feet and a maximum of 5 feet above the water table. Therefore, WESTON will follow Ebasco's recommendations and proposes no additional changes to this section of the USACE CDAP.

USACE CDAP Section 4.2.1.5 Monitor Well Filter Pack

WESTON's typical monitoring well design requires the use of a well screen opening size of 0.01 inch and sand filter pack gradation of 20-40 sieve size to prevent the passage of the smaller-size particles through the well screen (See Figure 4-1). Considering that the LHAAP is situated on an outcrop of the Wilcox Group which consists mostly of fine-to-medium-grained sands interbedded with medium to high plasticity clay zones, WESTON feels that the proposed filter pack will be an appropriate filter for these soils. Before

placement, one sample of the bagged sand to be used for the filter pack will be tested chemically for the same parameters as in the monitoring wells.

USACE CDAP Section 4.2.4 Well Schematics and Reports

WESTON will prepare monitoring well schematics and geologic logs for each of the five (5) monitoring wells. WESTON's monitoring well schematics and geologic logs will be similar to those shown in Appendix C. The monitoring well schematics and geologic logs will be produced on AutoCAD.

USACE CDAP Section 4.4.1.2 Slug Tests

The rates of groundwater flow, hydraulic conductivity (k) and transmissivity (T) of the aquifer will be determined by conducting "slug" tests in the five new monitoring wells. The rate of recovery of the water level within each monitoring well will be recorded after a known volume or "slug" has been removed from the well. A 4-foot section of 2.5-inch diameter PVC pipe filled with concrete and capped at both ends will be completely submerged in the monitoring well. The water will be allowed to reach equilibrium at which point the "slug" will be quickly removed, causing the water level to drop instantaneously. The length of time required for a volume of water, equivalent to that displaced by the slug, to recharge the well will be recorded using a pressure transducer and an in-situ Hermit model 1000C datalogger.

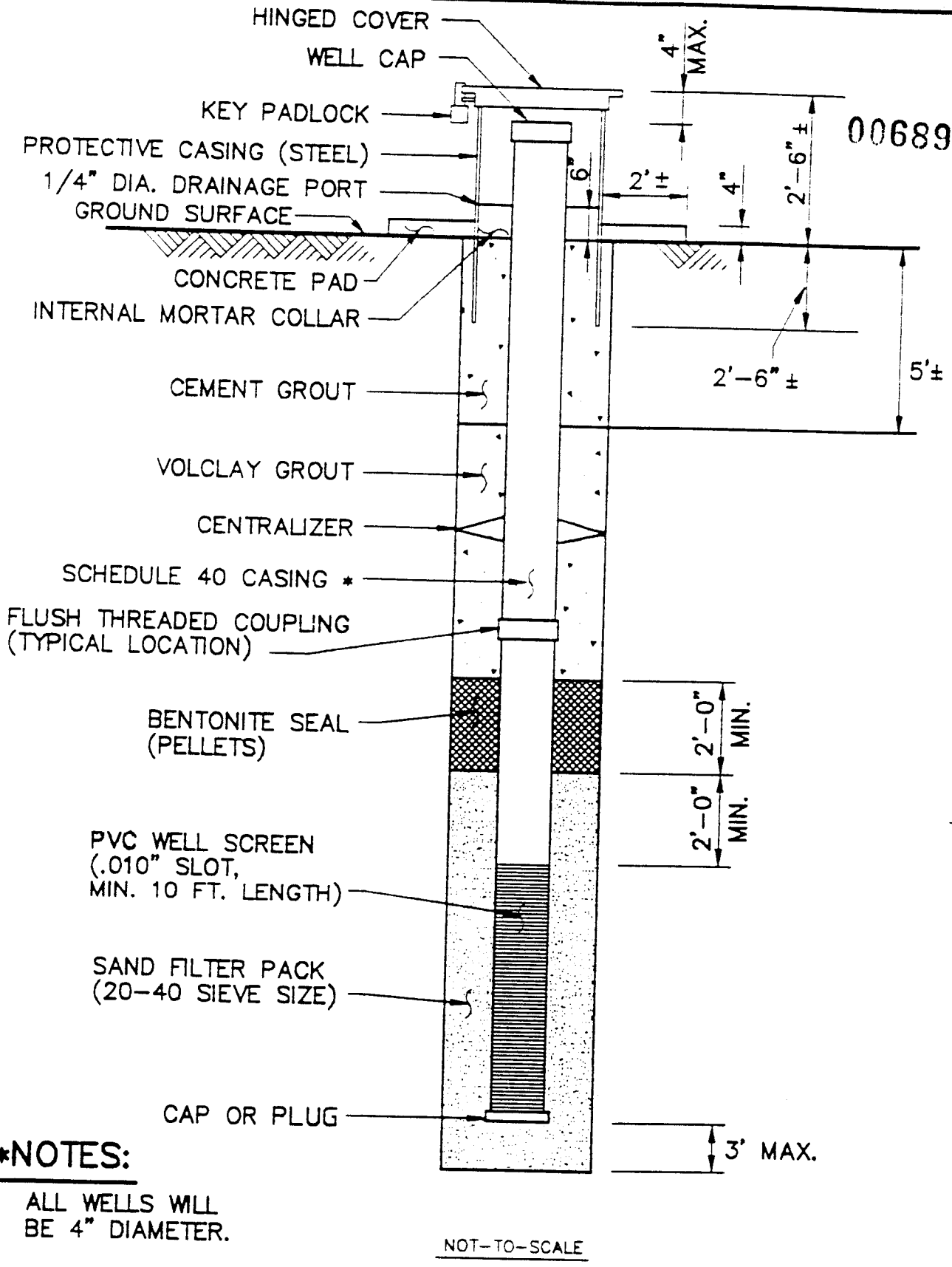


FIGURE 4-1 TYPICAL MONITORING WELL CONSTRUCTION DIAGRAM

Source: Roy F. Weston, Inc.

WESTON will use the Bouwer and Rice (1976) methodology to determine the hydraulic conductivity of each monitoring well. The procedure is applicable to both fully or partially penetrating wells and can be used for unconfined aquifers (Bouwer, 1989). The Bouwer and Rice method is based on the Thiem equation and assumes negligible drawdown of the aquifer around the well and no flow above the water table. The aquifer test solving program, AQTESOLV (Geraghty & Miller, 1989), will be used for the reduction of the "slug" test data.

USACE CDAP Section 4.5.1.2 Well Evacuation Procedures

Slowly recharging wells will be considered to be those wells that require more than one hour to recharge to the 50 percent water level. Purging of these wells will continue until one well casing volume has been removed, and sampling will take place as soon as sufficient recharge has occurred to fill the sample containers.

USACE CDAP Section 4.5.2 Surface Water and Sediment Sampling

If practicable given time and weather constraints, WESTON will perform surface water/sediment sampling during weather conditions that ensure that drainage ditches contain water. However, as described in the Longhorn Army Ammunition Plant RI/FS Work Plan Volume I - General, if a surface water sample location in a drainage ditch is dry, the sample location will be moved upstream or downstream as specified in the Work Plan to a location which contains enough water to sample.

USACE CDAP Section 4.5.3 Soil Sampling

WESTON has reviewed this section and proposes no changes or alternatives to the sampling procedures described in the USACE CDAP.

USACE CDAP Section 4.9.1.3 Replicate Samples

It is WESTON's understanding that, as described in Section 4.5.3.2, each soil sample shall consist of two jars of soil. Therefore, a field sample, its QA duplicate and its QC duplicate shall each consist of two jars of soil, for a total of six jars.

USACE CDAP General

Any changes or deviations from the USACE CDAP and this CDAP Addendum for the LHAAP-1A area will be approved by the USACE Project Manager and WESTON's PM and documented in the site logbook.

SECTION 5.0

SAMPLE HANDLING AND TESTING

The proposed RI field investigation activities for area LHAAP-1A (See Table 5-1) include the following:

- four 7-foot soil borings, including subsurface soil samples,
- four Groundwater grab samples from soil borings,
- five 25-foot monitoring wells to be installed,
- five Monitoring wells to be sampled, and
- three Surface water/sediment sample locations.*

* Includes one background location.

WESTON's proposed sample numbering system is described below. Each sample collected will have a unique number. The sample numbers will consist of a three-faceted alpha-numeric code, which will identify the sample type, the sample location, and the sampling event (monitor wells, surface water/sediment) or the sample depth (soil). A QA/QC modifier at the end of the sample number will identify whether the sample is a duplicate or a blank.

The sample types are:

MW - Monitor Well	SD - Sediment	CM - Construction Material
SB - Soil Boring	SW - Surface Water	GG - Groundwater Grab

The sample location will be identified by a two-digit number (i.e., 01, 02, etc.), which will be followed by a series number which identifies the sampling event. For example, the first time monitoring well MW-01 is sampled, the sample number will be:

MW-01-1.

If it is sampled another time, the sample number would become:

MW-01-2.

For soil borings, the two-digit number designating the boring location will be followed by a sample depth range in parenthesis. The sample collected at SB-01 from a depth of 5 to 10 feet would be designated:

SB-01(5-10).

TABLE 5-1
SUMMARY OF SAMPLING, ANALYTICAL PARAMETERS, STORAGE, HOLDING TIME AND PRESERVATION REQUIREMENTS
RI PHASE I FIELD INVESTIGATION

Media	No. of Samples	QA	QC	No. of Trip Blanks*	No. of Equipment Blanks	Total No. of Samples	Field Test (1)	Metals (2)	VOC's (3)	SVOC's (4)	Explosives (5)	Anions (6)	Total Organic Carbon (7)	Total Organic Halogen (8)	Total Phenols (9)	Geotech. Samples (10)	Asbestos (11)
SOIL**	27	3	3	3	2	38[12]	-	35[12]	35[12]	35[12]	35[12]	35[12]	-	-	-	27	-
WATER																	
Well	5	1	1	1	-	8	6	7	8	7	7	7	-	-	-	-	-
Ground	4	1	1	1	-	7	5	-	1	-	6	6	6	6	6	-	-
Surface	3	1	1	1	-	6	4	5	6	5	5	5	-	-	-	-	-
SEDIMENT***	3	1	1	****	-	5	-	5	5	5	5	5	-	-	-	-	-
CONSTRUCTION MATERIAL	3	1	1	-	0	5	-	-	-	-	-	-	-	-	-	-	5

* To include volatile organic compounds only

** For the proposed analyses 5-250 ml. straight side glass jars are required, Cool 4°C

*** For the proposed analyses a 5 liter wide mouth glass jar is required, Cool 4°C

**** Sampling performed in conjunction with surface water sampling

(1) Field tests to include Ph, conductivity and temperature, 1/2 pint glass. Any Ph and conductivity tests required for soil samples will be performed by the subcontract laboratory.

(2) Metals Analysis for Sb, As, Ba, Cd, Cr, Pb, Hg, Ni, Se, Ag, & Ti; EPA 6010 or SW-846 Methodologies as specified in Appendix B Table B-2 of CDAP, HNO_3 to Ph < 2 (liquids), Cool 4°C, 1 liter plastic

(3) Volatiles; EPA SW-846 8240, 4 drops HCL (liquid), Cool 4°C, 3-40 ml glass vial

(4) Semi Volatiles; EPA SW-846 8270, Cool 4°C, 2-1 liter amber glass

(5) Explosives; EPA SW-846 8330, Cool 4°C, 2-1 liter amber glass

(6) Anions to include nitrate, chloride & sulfate; EPA-600 (2) 300.0, Cool 4°C, 1-liter amber glass

(7) Total organic carbon; EPA SW-846 9060, H_2SO_4 to Ph < 2 (liquid), Cool 4°C, 1-liter amber glass

(8) Total organic halogen; EPA SW-846 9020, H_2SO_4 to Ph < 2 (liquid), Cool 4°C, 1-liter amber glass

(9) Total phenols; EPA SW-846 9066, H_2SO_4 to Ph < 2 (liquid), Cool 4°C, 1-liter amber glass

(10) Moisture Content; ASTM D2216, No preservative
Sieve Analysis; ASTM D 422, No preservative
Atterberg Limits (3 point); ASTM D 4318, No preservative

(11) Asbestos

(12) Three additional samples taken as duplicates and sent to USACE of Dallas, Texas as QA samples.

Source: Remedial Investigation/Feasibility Study Work Plan Addendum for Area LHAAP-1A". Ebasco Services Inc., 1993.

006903

The QA/QC modifiers are:

QA - Quality Assurance sample (duplicate for SWD laboratory)

QC - Quality Control sample (duplicate for WESTON laboratory)

EB - Equipment Blank

TB - Trip Blank (Volatile Organics only)

For QA duplicates, QC duplicates, equipment blanks (EB) and trip blanks (TB) a modifier will be added to the end of the sample number. For example, the QA duplicate of SB-01(5-10) would be designated:

SB-01(5-10)-QA

Field blanks are assigned numbers that correspond to the sampling equipment from which they are obtained. For example, a rinsate blank obtained from the split-spoon used to collect this sample would be designated:

SB-01(5-10)-EB

Trip blanks are assigned numbers that correspond to the last volatile organic sample packaged for shipment in the same cooler. For example, the last volatile organic TB sample for the first cooler's shipment may be designated SB-01(5-10)-TB.

WESTON believes that this sample numbering system, while somewhat different, incorporates the same information as the previous Ebasco system and is consistent with the USACE CDAP requirements.

SECTION 6.0

SAMPLE INTEGRITY

WESTON's Chain of Custody form is shown in Appendix C. This form allows samples from different matrices to be placed on the same sheet.

SECTION 7.0

REDUCTION, VALIDATION, AND REPORTING

WESTON proposes no revisions to the procedures described in this section of the USACE CDAP.

SECTION 8.0

AUDITS

WESTON proposes no revisions to the procedures described in this section of the USACE CDAP.

SECTION 9.0

CORRECTIVE ACTION

WESTON proposes no revisions to the procedures described in this section of the USACE CDAP.

Appendix A

Longhorn Army Ammunition Plant

RI/FS

Chemical Data Acquisition Plan

006911

LONGHORN ARMY AMMUNITION PLANT

RI/FS

WORK PLAN

VOLUME 2
CHEMICAL DATA ACQUISITION PLAN

PREPARED FOR:
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

PREPARED BY:
U.S. ARMY CORPS OF ENGINEERS

JUNE 1992

006912

TABLE OF CONTENTS

LIST OF ACRONYMS iv

1.0 INTRODUCTION 1

1.1 General 1
1.2 Organization 1

2.0 PROJECT ORGANIZATION 3

2.1 Field Personnel 4
2.2 Quality Control Personnel 4
2.3 Quality Assurance Personnel 4
2.4 Laboratory 4

3.0 QUALITY ASSURANCE OBJECTIVES 6

3.1 Accuracy 6
3.2 Precision 7
3.3 Completeness 8
3.4 Representativeness 8
3.5 Comparability 9
3.6 Sensitivity 9
3.7 Field Measurements 9

4.0 FIELD OPERATIONS 11

4.1 Drilling 11
4.2 Monitoring Wells 13
4.3 Location Surveys 16
4.4 Water measurements 16
4.5 Sampling 18
4.6 Geophysics 21
4.7 Field Screening 22
4.8 Decontamination 23
4.9 Field QA/QC 24

5.0 SAMPLE HANDLING AND TESTING 26

5.1 Sample Numbering System 26
5.2 Preparing Samples 26
5.3 Receiving Samples 26
5.4 Laboratory Procedures 27

6.0 SAMPLE INTEGRITY 28

6.1 Security 28
6.2 Custody 28
6.3 Sample Tracking and Identification 29

7.0 REDUCTION, VALIDATION, AND REPORTING 30

7.1 Analytical Data 30
7.2 Technical Data 30

8.0 AUDITS 31

8.1 Systems Audits 31
8.2 Performance Audits 31

9.0 CORRECTIVE ACTION 32

9.1 Field Activities 32
9.2 Field Data 32
9.3 Laboratory 32

10.0 REFERENCES 34

APPENDICES

Appendix A Forms Used in Field Sampling Activities

Chain of Custody Form for Groundwater A-1
Chain of Custody Form for Volatiles in Groundwater A-2
Chain of Custody Form for Soil A-3
Chain of Custody Form for Surface Water Samples A-4
Chain of Custody Form for Rinsate Samples A-5
Field Data Form for Water Samples A-6
Field Data Form for Soil Samples A-7
Rinsate Water Samples Parameter Sheet A-8
Geological Log Form A-9
State of Texas Well Report A-10
State of Texas Plugging Report A-11
Sample Jar Label A-12
Laboratory Traffic Report A-13
Cooler Receipt Form A-14

Appendix B Tables

B.1 Sample Containers, Preservation, and Preparation for Water Samples B-1
B.2 Maximum Holding Times and Analytical Methods in Soil and Water B-2
B.3 Methods for Physical Tests B-3
B.4 Required Quantitation Limits for Volatile Analyses in Soil and Water by Method 8240 ..... B-4
B.5 Required Quantitation Limits for Semivolatile Analyses in Soil and Water by Method 8270 ..... B-5
B.6 Required Quantitation Limits for Pesticide Analyses in Soil and Water by Method 8080 ..... B-7
B.7 Required Quantitation Limits for Explosives Analyses in Soil and Water by Method 8330 ..... B-8
B.8 Required Quantitation Limits for Other Analyses in Soil and Water B-9
B.9 Sampling Plan Summary B-10

Appendix C Investigation Derived Waste Management Plan

LIST OF ACRONYMS

ASTM	American Society of Testing Materials
CDAP	Chemical Data Acquisition Plan
COC	chain of custody form
DQO	data quality objective
EPA	U. S. Environmental Protection Agency
HTW	hazardous and toxic waste
HTW QA&IH	HTW Quality Assurance and Industrial Hygiene Section
QA	quality assurance
QC	quality control
MRD Lab	Corps of Engineers Missouri River Division Laboratory
NIOSH	National Institute of Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
RCRA	Resource Conservation and Recovery Act
RPD	relative percent difference
SSHP	Site Specific Health and Safety Plan
SWD Lab	Corps of Engineers Southwestern Division Laboratory
TAC	Texas Administrative Code

SECTION 1.0

INTRODUCTION

1.1 General. The purpose of this Chemical Data Acquisition Plan (CDAP) is to document the procedures required to ensure that all data obtained from the investigative activities at Longhorn are of acceptable quality. Quality assurance (QA) is the Government activity required to assure desired and verifiable levels of quality in all aspects of an investigation. Quality control (QC) is the functional mechanism to achieve quality data. The QA program, administered by the Government, will ensure that the QC program will result in high quality data. This document will describe the QA/QC procedures for each aspect of the investigations which will meet the data quality objectives of this project. Procedures in this CDAP came from Chemical Quality Data Management for Hazardous Waste Remedial Activities, ER-1110-1-263 (Ref. 3), a Corps of Engineers regulation, with additional guidance from Development of an RFI Work Plan for RCRA Facility Investigations, SW-87-001 (Ref. 8), and Minimum Chemistry Data Reporting Requirements (Ref. 2).

1.2 Site Location and Description.

1.2.1. Site Location. Longhorn AAP occupies 8,493 acres between State Highway 43 at Karnack, Harrison County, Texas, and Caddo Lake, as presented in Figure 1. The nearest major cities are Marshall, Texas, approximately 14 miles southwest, and Shreveport, Louisiana, approximately 40 miles east. Longhorn AAP is located in a region of moist, subhumid to humid, mild climate. The average annual rainfall is 46 inches. Average precipitation is fairly evenly distributed throughout the year; however, December through May could be considered the heavier season. Frequently, summer and fall are drought seasons. The facility is included on the National Priorities List (NPL).

1.2.2 Site Description. Longhorn AAP is a government-owned, contractor-operated industrial installation under the jurisdiction of the U. S. Army Armament, Munitions, and Chemical Command. Longhorn AAP was established in

October 1942 with the primary mission of production of 2,4,6-trinitrotoluene flake with supporting acid production for munitions production. Flake production was halted in 1945 and the primary mission changed to the load, assembly and pack of pyrotechnic and illuminating/signal munitions and solid propellant rocket motors. Industrial operations at Longhorn resulted in the disposal of various hazardous wastes into ditches, streams, and earthen impoundments where contamination has been identified. The Longhorn Division of Morton-Thiokol Corporation is the current operating contractor. Individual sites are described in detail in the work plan.

1.3 Organization. This document discusses the data quality procedures and techniques to be used in the work plan for investigations at Longhorn. The study will be accomplished through the sampling and analysis of soil, sediment, surface water, groundwater, and the installation of monitoring wells. Section 2 discusses project organization; Section 3 discusses the quality assurance objectives for this project; Section 4 discusses the procedures to be used in drilling, well installation, and sampling; and Section 5 discusses sample handling and testing. Sections 6 through 9 discuss sample integrity, data reduction and validation, audits, and corrective action.

SECTION 2.0

PROJECT ORGANIZATION

The U.S. Army Corps of Engineers (COE) will use a multi-disciplinary project team to oversee all project activities. Project management will be performed by Tulsa District. Project activities will be performed by Roy F. Weston, under contract to Fort Worth District and by Ebasco under contract to Tulsa District. This organizational structure is shown in Figure 1. Both contractors will submit a CDAP addendum which will address their organizational structure, subcontractors, laboratories, and any proposed deviations from this document.

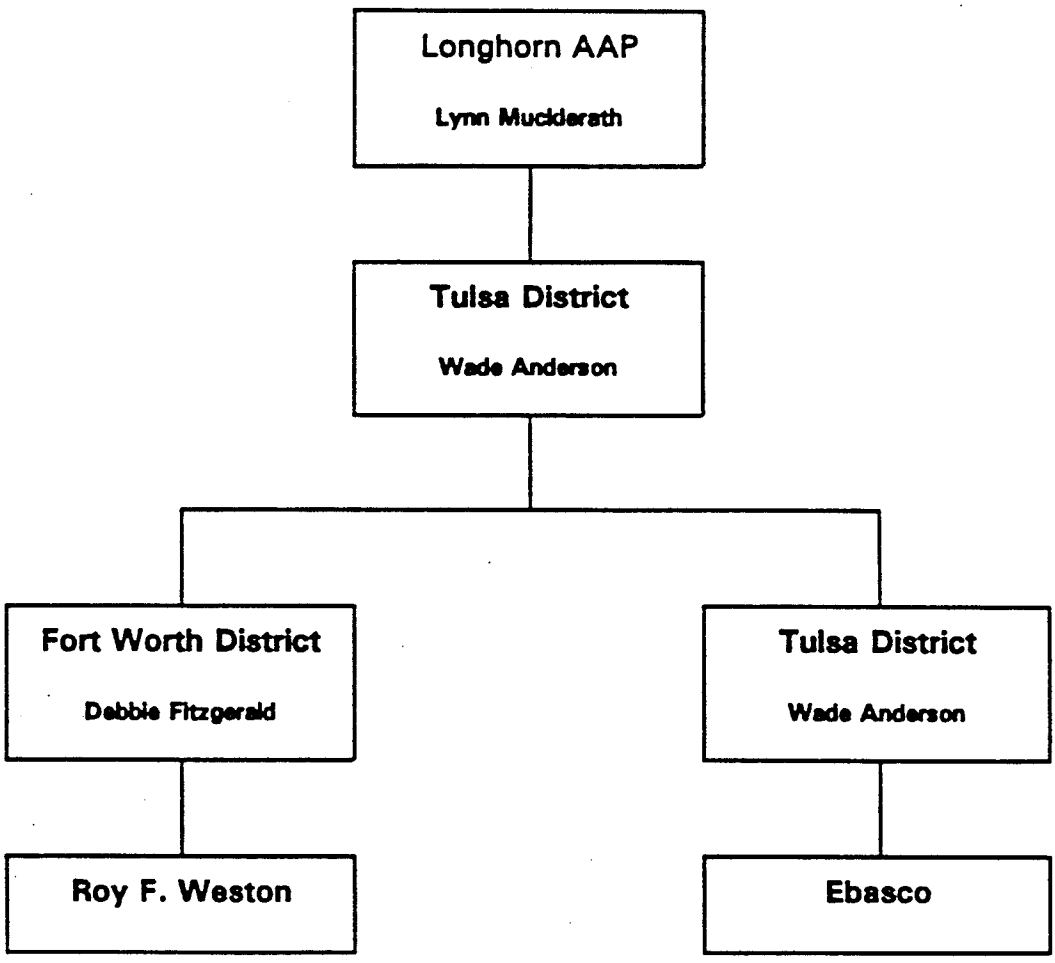


Figure 2.1. Organizational structure of the Longhorn remediation project.

2.1 Field Personnel. Field operations will be conducted by the contractors listed in Section 2.0 or their subcontractors. Later investigative phases will be performed by contractors or the COE.

2.2 Quality Control Personnel. All program personnel are responsible for monitoring and reviewing all procedures used in every stage of the work to ensure that data generated in the course of execution of the work plan is accurate, complete, precise and representative of the site studied. An individual on each field crew will be designated as the Quality Control Officer and will be responsible for the proper execution of field QC, as discussed in Section 4.9.

2.3 Quality Assurance Personnel. Quality assurance will be performed by the Tulsa District, Geotechnical Branch, HTW Quality Assurance and Industrial Hygiene Section (HTW QA&IH). This section reports to the Chief, Geotechnical Branch and will be responsible for performance and system audits of this investigative program, data validation, on-going reviews of QA procedures, and coordination of QA training for project personnel. Data validation reports will be prepared by each contractor. The Tulsa District will add the sections on comparability (based on the QA samples as discussed in section 2.4).

2.4 Laboratory. Analytical testing and quality control testing will be performed by laboratories selected by each contractor. Their labs will be identified in their CDAP addendum. QA testing will be performed by the Corps of Engineers Southwestern Division Laboratory (SWD Lab). Details on SWD Lab organization, responsibilities and key personnel are contained in their QA/QC Plan, which is on file in the Tulsa District office. Samples taken by the contractors will be sent to their laboratories, with the exception of the QA samples, which will be sent to SWD Lab. If sampling should be performed by COE field crews, SWD Lab will receive shipments of samples from the field, which it will pass on to its contract laboratories. Either SWD Lab or a separate contract lab will analyze the QA samples. These laboratories currently include NDRC Laboratories, Richardson, TX; ARDL, Mount Vernon, IL; and Eureka Lab, Sacramento, CA. All analytical laboratories used for this

work will be validated by the Corps of Engineers Missouri River Division Laboratory (MRD Lab). The validation process involves review of their laboratory quality management manual, laboratory performance on audit sample analyses, and an on-site inspection. This validation process is discussed in detail in Appendix C of ER-1110-1-263 (Ref. 3).

SECTION 3.0

DATA QUALITY OBJECTIVES

The data quality objectives (DQOs) of this project have been chosen to meet the goals of site characterization, risk assessment, and remedial design. DQOs are qualitative and quantitative statements which specify the quality of data required to support decisions made during remedial response activities. These DQOs will be used to develop a plan to be used throughout the RI/FS process. Data developed during the study will be used to determine the presence and lateral and vertical extent of contamination in the soil, surface water, and groundwater, as well as the rate of migration. The evaluation of this data will be used to screen remedial alternatives and to begin remediation. These goals can be achieved with analytical support between Level III and Level IV, as described in Ref. 7. Level I will be used for field testing. The minimum internal data reporting requirements (from Ref. 2) which will be required of all analytical laboratories includes the following:

- Sample identification numbers cross-referenced with laboratory ID's and QC sample numbers.
- Problems with arriving samples noted on an appropriate form.
- Each analyte reported as an actual value or less than a specified quantitation limit as listed in tables B.4 to B.8.
- Dilution factors, extraction dates, and analysis dates also reported.
- QC samples to be included as laboratory blanks, surrogate spikes, matrix spikes, laboratory duplicates, field duplicates, and field blanks.

The data developed from the investigations described in this work plan will meet the objectives discussed below with respect to precision, representativeness, accuracy, completeness, and comparability. The majority of this data will be developed in the laboratory from the analysis of field samples and the remainder will be measured in the field.

3.1 Accuracy. Accuracy is the degree to which a measurement agrees with the actual value, i.e., the amount of measurement bias. Accuracy is expressed as a percent recovery of a known concentration of reference material. The

accuracy of an analytical procedure is determined by the addition of a known amount of material (matrix spike) to a field sample matrix or a standard matrix. A standard matrix is made up of distilled water or sterile, clean soil with approximately the same physical properties (porosity, permeability, plasticity, grain size, etc.) as the field sample. The field sample matrix is described as all components of the sample mixture except the analyte (the compound being analyzed). The lab will be required to perform matrix spiking on 10% of field samples, as well as on 5 to 10% of standard matrix samples. Field sample matrix and standard matrix sample spiking show how the sample matrix-analyte chemical interactions affect the analytical results. The matrix behavior of the spiked field sample will be comparable to that of the matrix of the original sample. After analysis for the spike is completed, the accuracy of the procedure is expressed as a percent recovery as shown by the following equation:

$$\text{PERCENT RECOVERY} = \frac{(C_2 - C_1)}{C_0} \times 100\%$$

where C_0 = amount of analyte added to the sample matrix,
C_1 = amount of analyte present in the unspiked sample matrix (equal to zero for the standard matrix),
and C_2 = amount of spiked material recovered in the analysis.

Typically, the amount of a reference analyte spiked into a field sample matrix is specified by the laboratory quality control program, or 3 to 5 times the background concentration of the analyte in the sample matrix. Samples cannot be spiked for all organic compounds which could possibly exist in the field sample matrix, however, a set of surrogate compounds, each of whose physical and chemical properties is similar, is used as surrogate matrix spikes, or surrogates. Acceptable recovery ranges for each class of organic compounds are discussed in the analytical methods for each parameter.

3.2 Precision. Precision is a measure of the degree of reproducibility of an analytical value and is used as a check on the quality of the sampling and analytical procedures. Precision is determined by analyzing replicate samples. The significance of a precision measurement depends on whether the sample is a field replicate, lab replicate, or a matrix spike replicate.

Field replicates are taken at the rate of 10% or one per batch (each daily shipment of samples from a site), whichever is greater. Precision of the analytical method, at each stage, is determined by calculation of a relative percent difference (RPD) between duplicate analytical recoveries of a sample component, relative to the average of those recoveries:

$$RPD = \frac{|C_2 - C_1|}{(C_2 + C_1)/2} \times 100\%$$

where C_1 = analyte concentration in the sample,
C_2 = analyte concentration in the sample replicate,

and $|\ |$ = an absolute value (It is customary to express RPD as a positive number).

These calculations are usually performed on matrix spikes and matrix spike duplicates.

3.3 Completeness. Field completeness will be assessed by comparing the number of samples collected to the number of samples planned. Analytical completeness will be assessed by comparing the total number of samples with valid analytical results to the number of samples collected. The overall project completeness is, therefore, a comparison between the total number of valid samples to the number of samples planned. The results will be calculated following data validation and reduction. Completeness (C) is determined by:

$$C = \frac{P_1}{P_0} \times 100\%$$

where P_0 = total number of samples planned,
and P_1 = number of valid data points.

A value of 90% or higher is the goal. For values less than 90%, problems in the sampling or analytical procedures will be examined and possible solutions explored.

3.4 Representativeness. Representativeness expresses the degree to which sample data accurately and precisely represent actual site conditions. The determination of the representativeness of the data will be performed by

- Comparing actual sampling procedures and chain of custody forms to those described in the work plan,
- Identifying and eliminating nonrepresentative data in site

characterization activities,
- Evaluating holding times and condition of samples on arrival at the laboratory,
- Examining blanks for cross contamination.

Representativeness is a qualitative determination. The representativeness objective of this work plan is to eliminate all non-representative data.

3.5 Comparability. Comparability is a qualitative measure of the confidence with which one data set can be compared to another. These data sets include data generated by different laboratories performed under this work plan, data generated by laboratories in previous investigative phases, data generated by the same laboratory over a period of several years, or data obtained using differing sampling techniques or analytical protocols. The comparability objectives of this work plan are (1) to generate consistent data using standard test methods; and (2) to salvage as much previously generated data as possible. Comparability will be evaluated by comparing the QA sample analyzed by an independent laboratory to its field replicate.

3.6 Sensitivity. Sensitivity is a general term which refers to the calibration sensitivity and the analytical sensitivity of a piece of equipment. The calibration sensitivity is the slope of the calibration curve evaluated in the concentration range of interest. The analytical sensitivity is the ratio of the calibration sensitivity to the standard deviation of the analytical signal at a given analyte concentration. The detection limit, which is based on the sensitivity of the analysis, is the smallest reported concentration in a sample within a specified level of confidence. Quantitation limits represent the sum of all of the uncertainties in the analytical procedure plus a safety factor. The detection limit is a part of the quantitation limit. Quantitation limits are given in tables B.4 to B.8.

3.7 Field measurements. Field measurements will be performed to Level I standards. These will include measurements of pH, conductivity, and temperature on groundwater samples. Precision on field measurements will be assessed by four replicate measurements to determine reproducibility. These consecutive readings should be ± 1° for temperature, ± 0.02 units for pH, and ± 10% for conductivity.

THIS PAGE BLANK

SECTION 4.0

FIELD OPERATIONS

This section discusses drilling, well installation, sampling, decontamination, waste disposal, other field procedures, and field QA/QC.

4.1 Drilling. An experienced geologist, engineer or technician will serve as an inspector for all drilling activities. The inspector will prepare and describe samples and cuttings, monitor drilling operations, oversee well installation, record groundwater data, and prepare well diagrams and geologic logs. Drilling of most borings will be done by hollow stem auger. This drilling technique utilizes hollow flight augers with a cutting head attached to penetrate the formation. Sampling of these borings will be performed by split spoon, shelby tube, or from the auger flights. Drilling of 3 deep 150-foot borings for geophysical logging will be performed by rock bit or by hollow stem auger, and will be supplemented with a core barrel or denison barrel as needed to obtain samples. Drill pipe, augers, and other equipment used below ground will be steam cleaned as discussed in Section 4.8. It is not anticipated that drilling mud or additives will be needed. Static water levels will be taken from each open borehole after completion of drilling and immediately prior to grouting.

4.1.1 Soil Sampling Equipment. Sampling equipment to be used in conjunction with the drilling techniques discussed above is described in this section. Sampling techniques for sediments are discussed in Section 4.5.2. Samples will be taken at a minimum of one every five feet or every change of lithology, whichever occurs more frequently. Drill action and examination of the materials on the auger flights will be used to determine the location of stratigraphic changes.

4.1.1.1 Split Spoon. A split spoon is a small diameter sampling device which is driven into the soil with a drive hammer. It is frequently used inside hollow stem augers or other types of casing. The sample is representative of the materials encountered, but is not undisturbed. It can

be used for samples for chemical tests or physical tests not requiring an undisturbed sample such as Atterberg limits.

4.1.1.2 Shelby Tube. A Shelby tube is a thin-walled sampler which is pushed into the soil. It takes samples primarily in unconsolidated, cohesive materials. A Shelby tube might be useful in sampling near surface materials or overburden sediments. It also does not produce an undisturbed sample.

4.1.1.3 Auger. Samples for physical tests can be taken off of the auger flights if it is done carefully. Each run with the auger will be limited to two feet. After the auger is removed completely from the boring, cave-in on top of the flights is removed and discarded. The remaining material is examined, and representative samples are taken from the interior of the auger flights, avoiding soil which is in contact with the wall of the boring. This technique works best when the soil is soft and the auger can be "screwed" into the ground rather than drilled into the ground at a high rotation rate. Samples for chemical tests will not be taken from the auger.

4.1.2 Protection of Lower Aquifers. If a perched aquifer is encountered that is potentially contaminated, that water bearing zone will be cased off with the casing thoroughly seated into the lower permeability materials beneath. Drilling will continue through the casing. Surface casings will be installed to a depth of five feet in all cases where the water table is greaer than five feet in depth. Surface casings will also be installed through any obviously contaminated zones. Continuous flight augers, which act as casing, will reduce the potential for contaminated soil into aquifers beneath a contaminated zone.

4.1.3 Geological Logs. The strata encountered during drilling will be described in detail, using the Corps of Engineers geological log form (Eng Form 1836). The log will describe each lithologic unit encountered, groundwater information, sample depths, and drilling methods. The descriptions will include lithology, color, grain size, plasticity, stiffness, cementation, moisture content, sedimentary structures, presence and general orientation of

fractures, and other data determined to be pertinent by the geologist. Boring descriptions will be determined from geological logs or from characterization of cuttings and drill action, where samples are not taken. A geologic log form is shown in Appendix A. It will be used for all soil borings, monitoring wells, and shallow soil samples.

4.1.4 Borehole Abandonment. All borings not converted into monitoring wells will be abandoned by filling with a cement grout. The grout will have the composition as described in Section 4.2 and 31 TAC 287. After the grout has dried, the settlement depression will be filled to the surface with additional grout.

4.2 Monitoring Wells.

4.2.1 Drilling and Installation. Monitoring wells for this project will be drilled by an auger as discussed in Section 4.1. Wells can be installed in borings dedicated for that purpose or in borings drilled for environmental samples, geologic, or water information, as long as the minimum diameter is 8 inches. A typical well schematic is shown in Figure 4.1. If more than one water bearing zone is found, then well clusters will be installed to monitor each zone. In such a case, the upper zone will be cased and/or grouted. Large diameter casing will be installed through the upper water bearing zone to an underlying clay bed, and the annulus will be grouted to the surface.

4.2.1.1 Well Casing. Four-inch nominal diameter, flush-threaded, schedule 40 PVC casing will be installed from the screen to approximately three feet above the surface. Centralizers may be used near the well screen to keep the casing centered in the well bore.

4.2.1.2 Riser and Cap. Surface construction of well pads, covers, etc., will comply with Corps of Engineers requirements as well as requirements of the Technical Enforcement Guidance Document, Ref. 5. Approximately 3 feet of well casing will be left above ground and enclosed in a protective steel casing. The protective casing will extend below the ground surface and will have a locking cover to prevent entry of rainwater and

unauthorized personnel. It will also have a drainhole near the base. A four by four-foot concrete pad, four to six inches thick, will be poured around the protective casing at the ground surface, and will be sloped to promote drainage. A cage or metal posts will be placed in the concrete pad to protect the well.

Figure 4-1. Typical well schematic.

4.2.1.3 Screen. Wells will be screened with 4-inch diameter schedule 40 PVC slot screen. The exact depth of the screen will be determined by the inspector within the guidelines established in the work plan. Screen opening size will be 0.01 inches unless formation grain size indicates this is inappropriate. Screens will be a maximum of 20 feet in length. The entire saturated thickness of the aquifer will be screened to a maximum of 20 feet.

4.2.1.4 Sump. A two-foot long, 4-inch diameter schedule 40 PVC sump below the screen will be used in all wells to serve as a sediment trap.

4.2.1.5 Filter Pack. A sand filter will be placed in the annulus between the well screen and the borehole from the bottom of the hole to approximately two feet above the top of the screen with a tremie pipe. The sand will be either bagged or purchased from a batch plant and will have a 40-60 gradation. The sand will be tested chemically for the same parameters as in the monitoring wells before placement.

4.2.1.6 Bentonite Seal. An approximately two-foot thick bentonite seal will be placed above the filter sand in the well annulus. This will be accomplished by using pellets installed via a tremie pipe or by dropping them directly into the annulus. Bentonite pellets will be hydrated with reagent-free water.

4.2.1.7 Grout. Grout will be used to fill the annulus between the bentonite seal and the top of the ground, as well as for borehole abandonment. The grout will consist of a pumpable mixture of water, cement, and approximately 5% bentonite. Grout will be pumped or poured through a tremie or into an open hole or pipe. The quantities of grout used will be recorded. Grouting will be accomplished in an appropriate manner for the specific application.

4.2.2 Development. After the monitoring well installation has been completed for at least 24 hours, wells will be developed to remove drill fluid and cuttings as well as any fines from the sand filter which might clog up the well screen. Each well will be surged, bailed and/or pumped until the sediments in the water are reduced substantially. At least 5 well volumes

must be removed and temperature, pH, and conductivity must have stabilized over three consecutive readings as discussed in Section 4.5.1.2. Water and cuttings will be disposed of in accordance with Appendix C.

4.2.3 Well Acceptance. It is the responsibility of the drilling agency to drill and install a monitoring well which meets the criteria of Section 4.2. If a well is not constructed of the proper materials by the proper methods or if the well does not perform in such a manner to yield water representative of the aquifer which it monitors, then that well shall not be accepted by the Corps.

4.2.4 Well Schematics and Reports. A well diagram will be prepared for each well which will contain all pertinent information concerning the well, such as diameter, casing materials, depth, locations of the bentonite seal, screen length and opening size, filter pack length and gradation, grout, and the riser pipe height. A geologic log will also be prepared for each well. A typical well schematic is shown in Figure 4.1. A Texas Well Driller's Report, also shown in Appendix A, will be prepared for each well.

4.2.5 Well Abandonment. Wells which have been abandoned because of construction problems or because they are no longer needed will be backfilled in the following manner:

- Well construction materials will be removed.
- The hole will be overdrilled.
- The hole will be grouted with a tremie pipe from the bottom of the boring to the top.

4.3 Location Surveys. All borings, monitoring wells, and sampling points will be physically located by survey. The survey contractor will be required to meet or exceed a Third Order Class 1 survey, with an accuracy of 1 in 10,000. This accuracy equates to approximately 0.01 foot horizontally and vertically. The contractor will use bench marks set from approved established control monumentation in the area. Horizontal control will be in accordance with NAD 1983, and vertical control will be referenced to the NGVD, 1929.

4.4 Water Measurements.

4.4.1 Groundwater.

4.4.1.1 Water Level Measurements. Once the well is completed,

both the water level and bottom of well will be measured to the nearest 0.01 foot. Measurements will be made from a notch or mark at the top of the casing and recorded in the field journal and other appropriate forms. An electric probe will be used to establish equilibrium water levels. Depth to bottom of well will also be measured. The probe will be rinsed in Type II reagent grade water immediately before being lowered into the well and immediately after removing it from the well. If the well is heavily contaminated, additional cleaning of the probe may be required as described in Section 4.8.

4.4.1.2 Slug Tests. Slug tests are performed to determine the hydraulic properties of the aquifer. The purpose of this test is to determine the permeability of the water-bearing strata, taking into account bedding planes, fractures, and other discontinuities. Slug tests can give a more reliable indication of permeability than a laboratory test, which is performed on a very small test specimen. A known volume (slug) of water is removed from a well and the rate of recharge is recorded. Also, a mechanical slug could be added to the well, and the rate that the water level drops would be recorded. Groundwater removed from a slug test will be disposed of in accordance with Appendix C.

4.4.1.3 Pump Tests. A pump test is also used to determine aquifer characteristics. One well is designated as the pump well and additional wells are used for measuring water levels during the test. The test is conducted for a sufficient period of time to establish equilibrium conditions. During the pumping period, water levels are measured in all of the wells with enough frequency to establish a drawdown rate. After pumping has ceased, the wells are again measured to establish a recovery rate. A pump test is more expensive and difficult to administer than slug tests, but yields information pertinent to an area, rather than just a point as is the case with the above. It can also determine a cone of depression and boundary conditions, such as permeability distribution. Groundwater removed from a pump test will be disposed of in accordance with Appendix C.

4.4.2 Pondwater. Elevations of water samples and sediment samples will

be determined by subtracting the depth of the sample from the elevation of the water surface as determined by a survey stake at the water's edge.

4.5 Sampling. The number of samples taken from each medium are given in Table B.9. Each of these media are discussed below.

4.5.1 Groundwater Sampling. Groundwater samples will be collected both from monitoring wells and open bore holes.

4.5.1.1 Sampling from Monitoring Wells.

4.5.1.1.1 Open and Dedicated Wells. Open wells are wells which will not be fitted with dedicated purging and sampling equipment. They will be purged with a portable purging system and sampled with teflon bailers. The portable system typically consists of a submersible or purge pump and a discharge pipe. The purge pump will be operated by a portable generator. The generator will not introduce oils into the well during purging operations. After purging is completed, the equipment will be removed from the well and cleaned thoroughly with distilled water and a nylon brush. The bailers will be taken to the field lab and cleaned as described in Section 4.8. If the well shows evidence of heavy contamination, the purging system will cleaned in the same manner as the bailers. Dedicated wells are wells which have permanently installed sampling and/or purging equipment. Several of the existing wells have dedicated bailers. Newly installed wells are not anticipated to have dedicated equipment at Longhorn.

4.5.1.1.2 Well Evacuation Procedures. Prior to sampling, the stagnant water within the well (five casing volumes) will be removed so that fresh formation water can enter. If after removing five volumes of water, pH , temperature, and conductivity have not stabilized, then additional volumes will be removed. These parameters will be considered to be stabilized if temperature for three consecutive readings is ± 1°, pH is ± 0.5 units, and conductivity is ± 10%. Handling and disposal of purge water is discussed in Appendix C. The well will be sampled as soon as possible after purging, but not before 85% recovery. For slowly recharging wells, sampling will take place as soon as sufficient recharge has occurred to fill sampling containers.

In all cases, sampling will take place within 24 hours of purging. The sampling crew will record the recharge rate, the date, time, and rate of purging, and any unusual conditions noted with this operation. Non-dedicated purging equipment will be thoroughly scrubbed and rinsed with Type II reagent grade water each time it is used. Under heavily contaminated or unknown conditions, additional rinses will be performed, as discussed in Section 4.8.

4.5.1.1.3 Sampling. Wells will be sampled with a teflon bailer, which will be slowly lowered into the well. Each sample container will be filled directly from the bailer. A common container will not be used to fill sample bottles. Sampling equipment and containers will be kept from ground contact, and may be laid on plastic sheets on the ground. Upgradient wells will be sampled before downgradient wells. Samples of groundwater for chemical analysis are taken in the following order:

- Field parameters
- Volatile organics
- Semivolatile organics
- High explosives
- Pesticides and herbicides
- Metals
- Anions

Table B.1 lists container, preservation, and handling requirements for each parameter and Table B.2 lists holding times. Quality assured containers will be used. The sequence of operations for groundwater sampling is as follows:

- Purge slow-recharging wells (if any) at the outset of the sampling day.
- Purge and sample other wells.
- Sample slow rechargers, if possible.
- Preserve the samples.
- Package and ship the samples to the laboratory.

4.5.1.1.4 Immiscible Layers. Immiscible liquid layers are not expected to be encountered; however, procedures for dealing with immiscible layers in groundwater are included in this plan and are listed below.

- The level of the immiscible layer surface and water interface will be determined with an electronic probe. The apparent thickness of the immiscible layer is defined as the difference between the liquid level and the interface level.
- A sample will be collected, using a transparent Teflon bailer. Presence of the immiscible layer will be confirmed visually.

4.5.1.2 Sampling from an Open Bore Hole. All soil borings will be made into the water table and a grab sample of groundwater will be collected prior to plugging the boring. The sample will be collected for the purpose of screening the groundwater to determine the need for groundwater monitoring and to optimize the siting for any required monitoring wells. The groundwater will not be purged prior to sampling and sample collection procedures will be in accordance with the requirements of Section 4.5.1.1.3. The order of sampling shall be as follows:

- Field parameters
- Total organic halogen
- Total organic carbon
- High explosives
- Phenols
- Anions

4.5.2 Surface Water and Sediment Sampling. Water samples will be collected directly into the sampling bottle or by such sampling devices as a Kemmerer sampler or a plexiglass Van Dorn sampler and will be taken several feet below the surface of the ponds. Water samples will also be taken from drainage ditches as described in the work plan. If the ditches are dry, then sampling will be done after a rainfall when the ditches are again flowing. Sediment samples will be taken by a push tube or other suitable device composed of stainless steel or other inert material. After extraction from the tube, the upper five inches of sediment will be composited and placed in glass jars with teflon-lined lids for chemical testing. Samples for volatiles, however, will be discrete with as little disturbance as possible. Sample locations will be accessed by a small boat or by wading.

4.5.3 Soil Sampling. Samples of soil from drill holes will be taken using a split spoon, shelby tube, or auger flights, as discussed in Section 4.1.1.3. Shallow soil samples will be taken with clean, stainless steel shovel, sample push tube, or drill rig sampling equipment. For each shallow soil sample, a composite of the uppermost foot will be taken. Samples taken for volatile analysis, however, will not be composites, but discrete samples with as little disturbance as possible.

4.5.3.1 Physical Testing. Soil samples will be described in the field and classified using the Unified Soil Classification System. They will be tested for Atterberg limits, grain size distribution, and moisture content. Samples will be taken every five feet or change of material and shipped to SWD Lab or to a contract laboratory in plastic or glass jars for testing. All samples will be as representative of the strata as possible. Replicates will be taken as needed for QA/QC purposes by splitting a sample into three portions or taking three grabs from the sampler. The two additional samples will consist of a QC sample to be tested by the same lab and a QA sample to be tested by SWD Lab. Testing for friable asbestos will be performed on sites where there is the potential for contact with asbestos. The laboratory analyst should be certified through NIOSH for asbestos identification. Methods for physical tests are given in Table B.3.

4.5.3.2 Chemical Testing. Samples will be placed in pre-cleaned glass jars with teflon-lined caps. Each sample shall consists of 2 jars of soil. The samples will be taken at a minimum every five feet at discrete depths from borings and as composites for shallow soil samples. The samples will be packed in ice-filled ice chests, and shipped to the laboratory by bus or overnight carrier to SWD Lab. QA/QC samples for soil and rock consist of equipment blanks and replicates as discussed in Section 4.8.

4.6 Geophysics.

4.6.1 Electromagnetic Survey. Electromagnetic surveys measure the electrical conductivity of the subsurface soil, rock, and groundwater. Electrical conductivity is a function of the soil type, porosity, permeability, and the type of fluids which fill the pore spaces. This technique can determine subsurface hydrogeologic conditions, map contaminant plumes when the contaminants alter the conductivity of the groundwater, and locate trench boundaries, buried wastes, and drums.

4.6.2 Downhole Geophysics. Geophysical logging will be performed in the deeper borings at LHAAP, as discussed in the Work Plan. Geophysical logs will be used to yield information on lithology and stratigraphy, and to allow

correlation of boreholes. Specific types of logs which may be employed during the investigations are discussed below.

4.6.2.1 Spontaneous Potential. This log is applicable in water or mud filled open holes. Natural electrical potential resulting from the interaction of borehole fluids, formation matrix, and formation fluids are measured such that the log records vertical variation of this voltage. Typically this log is used for correlation and to define bed thickness.

4.6.2.2 Natural Gamma Ray. This log can be run in dry holes or liquid filled holes, and can be run through PVC or metal casing. A detector in the borehole measures natural radiation in the formations intercepted by the borehole. The natural radiation is a function of the concentration of gamma emitters present (potassium, thorium, uranium). Generally, the concentration of these elements is higher in clays than other lithologies. The log is used for correlation, defining bed thickness, and in lithologic determination.

4.6.2.3 Resistivity Logs. This type of log is applicable in fluid-filled open holes. An electrical current is either applied directly to the borehole environment or induced. A variety of this type of electrical source logs are available commercially, e.g. induction logs, multiple point and spacing resistivity logs, laterlogs, microresistivity logs, and microlaterlogs. Typical uses include thin bed recognition, correlation, and estimation and/or calculation of water saturation.

4.7 Field Screening.

4.7.1 Headspace Analysis. A headspace analysis tests the air in a sampling jar for volatile organics. A sample will be placed in a glass jar, which will be covered with foil, and warmed for one to two hours. At the end of the warming period, the vapor space in the jar will be tested with Draeger tubes or a photo-ionization detector. This test gives an indication of presence or absence of volatiles. It will be used, along with visual and olfactory observations, to make a field determination of the depth and

relative degree of contamination. Headspace analysis may also be used to make preliminary separations of drilling waste into potentially contaminated and uncontaminated fractions.

4.7.2 Soil Gas Surveys. Air-filled voids in the soil may contain compounds which volatilize from the groundwater below. A soil gas survey is a systematic sampling, analysis, and interpretation of the soil gas and what it represents. Sampling devices are placed in the ground on a grid to obtain samples of soil gas, which is analyzed either on site or in the laboratory. Soil gas surveys can detect contaminant plumes, the parent product, and the degree of weathering.

4.7.3 Air Monitoring for Worker Protection. Air monitoring with a photoionization detector, combustible gas meter, or flame ionization detector, will be used as discussed in the Site Specific Health and Safety Plan (SSHP).

4.8 Decontamination.

4.8.1 Drilling Equipment. Drilling equipment (augers, bits, split spoons, rods, and tools) will be steam cleaned or hot water pressure cleaned prior to use in each boring. A decontamination station will be established for the washing of drilling and sampling equipment at each drillsite. Waste wash water will be collected and disposed of as discussed in Appendix C. Each member of the drilling crew will don a new pair of gloves before beginning each soil boring. The person taking the samples will wear disposable plastic gloves and will change them between each sampling interval. Used gloves will be bagged and disposed of in a manner which meets RCRA guidelines, as discussed in Appendix C.

4.8.2 Well casing. All casing and screens used in monitoring well construction will remain in the factory-sealed containers until use. These materials will be placed on a clean, dry tarp or on blocks during assembly. If contact with the ground does occur, the affected sections will be cleaned with potable water.

4.8.3 Sampling Equipment. Bailers will be cleaned at the end of the work day. Enough clean bailers will be taken to the field each day so that

none needs to be reused in that day's sampling. The sampling equipment will be transported in sealed, clean containers, and care will be taken to avoid contamination. Sampling equipment will be washed with a non-phosphate detergent, tap water, distilled water, and hexane, in that order, allowed to air dry, and sealed back into clean containers. A cleaning seal will accompany each bailer with the following information: equipment identification number, date and time cleaned, and signature of the person who cleaned the equipment. The inclusion of the cleaning seal and numbering of the equipment allows for the tracking of any cleaning or cross contamination problems between samples. Each member of the sampling crew will don a new pair of gloves at each sampling location. The person who actually takes the samples will wear disposable plastic gloves and will change them between each sampling interval for each sampling site.

4.9 Field QA/QC.

4.9.1 Chemical Samples. QA/QC samples for water, sediment, and soil will be used to verify that the sampling and analytical techniques are being performed properly. QC samples are taken in the field and analyzed with the field samples by the same laboratory. QA samples are analyzed by SWD Lab to check the performance of the contract laboratory. QC samples required for soils and water sampling include travel blanks, equipment blanks, and replicates. QA samples also include replicates. QA/QC samples are described below.

4.9.1.1 Travel Blanks. Travel blanks consist of American Society of Testing Materials (ASTM) Type II reagent water sealed into a sample vial in the field laboratory. The blank is not opened again until it is received in the laboratory. One travel blank will be prepared for each shipment of water samples containing volatiles, all of which are shipped in the same ice chest to the lab each day. Travel blanks measure cross contamination during shipment and contamination sources contacted during shipment. They are only analyzed for volatiles.

4.9.1.2 Equipment Blanks. Equipment blanks for water or soil

samples will consist of ASTM Type II water which has been poured over or through non-dedicated sampling equipment such as augers, knives, spoons, or bailers. They will be shipped in the ice chest with the associated samples from the site. Equipment blanks will be prepared and preserved in the same manner as a water sample. Equipment blanks measure the effectiveness of equipment decontamination. Equipment blanks are taken at a rate of 1 for every 20 samples and are analyzed for the same constituents as the associated soil or water samples.

4.9.1.3 Replicate Samples. Replicate samples or splits are extra samples as identical as possible to the original. They may consist of a composite, or as a series of grab samples from the same source. Every tenth sample is taken in triplicate. One of each set of these replicates will be sent to SWD Lab as an audit sample (QA sample) for the contract laboratory, and the other two samples will be sent to the analytical lab as a field sample and a QC sample, each with a unique sample number. In cases where only sufficient sample exists for a duplicate set, every fifth sample is a duplicate. This duplicate alternates as a QC and QA sample.

4.9.2 Samples for Physical Testing. QA/QC on samples for physical testing consists of replicate samples as described in Section 4.9.1.3.

SECTION 5.0

SAMPLE HANDLING AND TESTING

5.1 Sample Numbering System. Sample numbers are assigned by the project manager and are unique to each site. Sample numbers identify the site, well or boring, and type of blank or replicate. Sample numbers are assigned as follows:

LHss-hhhh-xaaa-bb

LHss refers to the site being investigated at Longhorn,
hhhh is the well or boring number,
x describes the sample medium, where

- 1 = groundwater
- 2 = soil or rock
- 3 = sediment
- 4 = surface water,

aaa is the sample number,
bb is a QA/QC modifier, when needed, where

- QA = a QA sample (split for SWD Lab)
- QC = a QC sample (split for contract lab)
- TB = travel blank
- EB = equipment blank.

For example, a QA split from the third soil sample of the second boring from site 32 would look like this: LH32-0002-2003-QA.

5.2 Preparing Samples. When samples are taken in the field, they are preserved according to Table B.1. They are then placed in the ice chest in styrofoam inserts which have cutouts to accommodate the jars. The ice chest is filled with ice and the chain of custody form and field data form are placed inside in a zip-lock plastic bag placed on top of the ice. The ice chest is wrapped with strapping and a seal is placed on the strapping. The samples are then delivered to the bus station or shipper. Samples are shipped on the day they are sampled if possible.

5.3 Receiving Samples. After the ice chests are received at the laboratory, the samples are logged in, the COC is signed, and a cooler receipt form is filled out. This form documents the condition of the samples as received. The samples are checked for breakage or leakage and the temperature of the ice bath is checked. If the temperature exceeds 4°C or if any other problems are

noted, this information is recorded on the COC and the District office is notified of the problem. Samples are repackaged and shipped to contract laboratories using similar procedures as described in Section 5.2.

5.4 Laboratory Procedures. Laboratory analytical procedures come from the following sources: U. S. Environmental Protection Agency (SW 846 and EPA-600, Refs. 6 and 4), and Standard Methods (Ref. 1). Analytical methods from these sources are given in Table B.2. Quantitation limits are given in Tables B.4 through B.8. Quantitation limits, however, are dependent on the concentration of the components in the matrix to be analyzed.

SECTION 6.0

SAMPLE INTEGRITY

The quality of analytical data is suspect if the integrity of the sample cannot be ensured. Integrity includes the procedures and written records which, when taken together, verify that the sample is as represented.

6.1 Security. Security involves procedures which ensure sample integrity. Security is required until final disposal of the sample after laboratory analysis is complete. Aspects of sample security are discussed below.

6.1.1 Security of the Well and Samples in the Field. Each well will have a locking cap and keys will be given out only to those who need them. Samples, once taken, will be in the possession of the sampling crew or locked in the field laboratory. QA and QC samples will be taken, which, when analyzed, will also document the integrity of the sample.

6.1.2 Security of the Sample in the Lab. Samples will be stored in a secure area in the laboratory with limited access to authorized laboratory personnel. Upon receipt of the ice chests, laboratory personnel will check the temperature of the ice bath, the condition of the samples, and the accuracy of the accompanying paperwork.

6.2 Custody. Custody consists of formal records which document integrity. These records are described below.

6.2.1 Chain of Custody Form. The chain of custody form (COC) is a record which describes the sample, the date and method of sampling, and the analyses required. It has spaces for signatures of those receiving and relinquishing the samples. The form is normally signed by the sampler, the individual preparing the samples for shipment, and the receiving individual at the laboratory. The individual preparing the samples for shipment maintains a copy. The original COC is incorporated into the hard copy laboratory report, where it is placed on file. An example of this form is given in Appendix A.

6.2.2 Laboratory Traffic Report. Samples which are sent from SWD Lab to a contract lab are sent with this form. It is a laboratory chain of custody form which gives the sampling date, the analyses to be performed and the date the results are needed. Because various fractions of the sample

might be sent to several contract labs, the original COC cannot be used. The traffic reports are incorporated into the hard copy laboratory reports.

6.2.3 Bill of Lading. A bill of lading (bus bill or airbill) documents receipt of the samples by the carrier. It is not possible for the carrier's representative to sign the COC since it is sealed in the ice chest. Bills of lading are kept on file in the District Office.

6.2.4 Cooler Receipt Form. The cooler receipt form is completed by the laboratory and documents the condition of the samples as received by the lab. This form is available in the hard copy laboratory report.

6.3 Sample Tracking and Identification. Other than the items listed in 6.2, there is additional documentation which demonstrate sample integrity. These are listed as follows:

6.3.1 Field Log Book. The field log book is a bound record, kept by the water sampling crew, in which water sampling information is recorded. It is taken to the wells to record purging and sampling data, water levels, and other items of interest. It is used in the field lab to record preservation and preparation procedures for shipment. It is also used to record equipment calibration and decontamination of sampling equipment. In case of concurrent operations, sampling information will be transferred to the field log book in the field lab. The information for the COC and field data form comes from the field log book.

6.3.2 Field Data Form. The field data form transmits necessary information about the sample to the lab. Field measurements such as pH, conductivity, and water levels as well as problems with the location or the sample are noted on this form. Field data forms are taken for all sampling events. Examples are shown in Appendix A.

6.3.3 Sample Labels. Labels on each jar contain the well or boring number or surface sample location, the sample number, preservation (if any), the analysis to be performed, and the sampler's initials. Examples are provided in Appendix A.

SECTION 7.0

DATA REDUCTION, VALIDATION, AND REPORTING

7.1 Analytical Data.

7.1.1 Field Data. Field data reduction will be performed by the contractor or the COE. Data validation in the field is determined primarily by making several readings (QC checks for reproducibility). Periodic QA oversight is also a part of the validation process. The field data is sent to the lab on the field data form and is returned to the District in the hard copy lab reports.

7.1.2 Laboratory Data. Laboratory data are reduced at the contract lab, which generates a laboratory report containing the analytical data and field and lab QC. Tulsa District performs a QA validation and generates a summary report, which is submitted to the project staff. Laboratory deliverables include the following:

- analytical data, results of field and laboratory blanks, matrix spikes, and matrix spike duplicates, surrogate recoveries, field splits, and COC forms;
- QA validation report;
- ASCII or DBASE format data files.

Calibration and internal standards information, raw data, and all instrumentation graphs and traces will be available from the laboratory, if needed.

7.2 Technical Data. Technical data refers to data of several types, such as groundwater flow calculations, stratigraphic maps generated from geologic and geophysical field data, isopleth profiles of contaminants, and groundwater models. Technical data will be reduced, validated, and reported by the project staff.

SECTION 8.0

AUDITS

Audits, which are QA procedures designed to meet the data quality objectives discussed in Section 4, are of two basic types as discussed below. Table 8.1 gives the audit elements for the Longhorn investigations.

8.1 Systems Audits. A systems audit is a qualitative evaluation of all components of a project to determine if each component is properly performed. Systems audits are generally performed at the outset of investigations and periodically during the life of a project. Systems audits for office and fieldwork will be performed by the Tulsa District, and system audits for laboratory work will be performed by the MRD Lab. These audits consist primarily of site inspections.

8.2 Performance Audits. Performance audits are quantitative evaluations of the components of a project. These consist of audit samples to be checked by MRD as a part of the laboratory validation process, QA replicates taken as a part of the sampling process and analyzed by SWD Lab, and laboratory QA procedures as specified by the analytical method.

TABLE 8.1 AUDIT ELEMENTS FOR Longhorn INVESTIGATIONS

Element	By	Frequency
laboratory site inspection	MRD Lab	at laboratory selection and then every 18 months
field inspections	COE	at least monthly at first less frequently thereafter
technical data inspections	COE	as needed
laboratory check samples	MRD Lab	at laboratory selection and then every 18 months
analysis of field replicates	SWD Lab	every 10 samples
laboratory QA summary report	SWD Lab	one for each lab report

SECTION 9.0

CORRECTIVE ACTION

9.1 **Field Activities**. Field activities which are improper will be corrected as quickly as possible. The inspector or crew chief will be responsible to see that corrective action is initiated and documented whenever the error has the potential to compromise the quality of the data being generated or whenever there is a possibility that the error might be repeated.

9.2 **Field Data**. Corrective action for poor field data quality (as determined by replicate measurements or prior expectation) consists of remeasurement until successive readings agree within reasonable limits. Examples of frequently made measurements and limits to which they should agree include:

- PH - Measurements should agree within 0.02 pH unit.
- Conductivity - Measurements should agree within two numbers of the last significant digit.
- Depth and water level measurements - Readings should agree within 0.01 foot.

If remeasurement is not successful, then instrument calibration and operation and the user's technique will be evaluated.

9.3 **Laboratory**. Laboratory corrective action is described in the analytical method for that analysis.

9.4 **Implementing and Reporting**. Corrective action should be initiated at the lowest level possible. Corrective action which involves correcting a mistake for little potential of repetition need not be reported as long as the error was not reported. For example, an erroneous water level measurement, such as 40 feet in a 30 foot well, would be corrected by making several additional readings which agreed with each other and looked reasonable. It would not be necessary to report this error. Corrective action involving a potentially repetitive error or one which had been reported should be documented in writing. For example, an erroneous water level measurement due to a low battery in the water level indicator, should be documented because previous suspect water levels may need to be flagged and/or checked. The corrective action report would state the nature of the problem and the potential ramifications as well as what actions have been taken. In this case, it would be to replace the battery and check the last several days of readings of the

indicator. This report will be sent to the project manager.

SECTION 10

REFERENCES

1. American Public Health Association, 1989, "Standard Methods for the Examination of Water and Wastewater", 17th Ed., APHA, Washington, DC.

2. U. S. Army Corps of Engineers, August, 1989, "Minimum Chemistry Data Reporting Requirements for DERP and Superfund HTW Projects", CEMRD-ED-GC Memorandum.

3. U. S. Army Corps of Engineers, January, 1990, "Chemical Data Quality Management for Hazardous Waste Remedial Activities", ER-1110-1-263.

4. U. S. Environmental Protection Agency, March, 1983, "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79-020.

5. U. S. Environmental Protection Agency, September, 1986, "RCRA Ground Water Monitoring Technical Enforcement Guidance Document.

6. U. S. Environmental Protection Agency, November, 1986, "Test Methods for Evaluating Solid Waste", SW 846, 3rd Ed.

7. U. S. Environmental Protection Agency, May, 1987, "Data Quality Objectives for Remedial Response Activities: Development Process", EPA 540/G-87/003.

8. U. S. Environmental Protection Agency, 1987, "Development of an RFI Work Plan and General Considerations for RCRA Facility Investigations", SW-87-001.

9. U. S. Department of Health and Human Services, 1985, "NIOSH/OSHA Pocket Guide to Chemical Hazards".

APPENDIX A

FORMS USED IN FIELD SAMPLING ACTIVITIES

MIPR#	SWD LAB#	Chest#	Temp.

006950

GROUNDWATER MONITORING WELL CHAIN OF CUSTODY

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

Location: Longhorn AAP Date:_____ Time:_____

Site: _____ Well #: _____

Proj. Engineer: _____ Ext#: _____

CONTAINERS

Glass	Plastic	Vial	Chest#	C/Seal#
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

VOA	Chest#
___	_____
Int:	

PARAMETERS SAMPLED

	pH, Conductivity & Temperature	EPA Method	(0)
	Semi-Volatiles	8270	(2)
	Explosives	8330	(2)
	Herbicides/Pesticides & PCB's (2,4-D & 2,4,5-TP)	8150/8080	(2)
	Nitrate	353.1	(1)
	Total Metals (Ag, As, Ba, Cd, Cr, Hg, Ni, Pb, Sb, Se & Tl)	6010/7041 7060/7470 7740/7841	[1]
	Volatile Organics	8240	{3}

* Containers: () = Amber Glass [] = Plastic {} = Vials

CUSTODY RECORD

Relinquished by	Received by	Date	Time
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

LHAAP/GW/FM1/27JAN92

006951

MIPR#	SWD LAB# [1]	Chest#	Temp.

CHAIN OF CUSTODY
for
VOLATILE ORGANICS

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

Location: Longhorn AAP	Site:

TRAVEL BLANK DATA

Sample#:_____ Date:_____ Time:_____

Water Source:_____

Analysis Requested: **Volatile Organics**

Date Mfg:_____ Bottle#:_____ C/Seal#:_____

pH:_____ Meter#:_____ Condt:_____ Meter#:_____

Signature of Sampler: _____

SAMPLES CONTAINED IN THIS SHIPMENT

Sample ID Code Number	VOA	Alt#	X-Chest#	SWD Lab #
LHAAP - - 100 - TB				[1]
- - -				
- - -				
- - -				
- - -				
- - -				
Total Samples Shipped				

CUSTODY RECORD

Relinquished by:	Date	Time
Chest#: / C/Seal#: / Bus Bill#:		
Received by:	Date	Time

LHAAP/FM2/15JAN92

006952

MIRP #	SWD LAB #				Chest #	C/Seal	Temp.
						[Y] [N]	
						[Y] [N]	

SOIL SAMPLE
CHAIN OF CUSTODY

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

Project: Longhorn AAP Proj/Engr: _____ Ext: _____

Site: _____ Boring # _____

Sample depths: _____ to _____ FDF# _____

Start: _____ (Date) / _____ (Time) to _____ (Date) / _____ (Time)

CONTAINERS

Jars	Sample No.(s)				Total #	Chest #	C/Seal #
(2)							
each							

PARAMETERS SAMPLED

	Semi-Volatiles	8270
	Explosives	8330
	Nitrate	353.1
	Herbicides, Pesticides & PCB's (2,4-D & 2,4,5-TP)	8150/8080
	Total Metals (Ag, As, Ba, Cd, Cr, Hg, Ni, Pb, Sb, Se & Tl)	6010/7041 7060/7470 7740/7841
	Volatile Organics	8240

* Containers: () = Wide Mouth Glass Jars w/Teflon Liner.

CUSTODY RECORD

Relinquished by	Received by	Date	Time
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

LHAAP/SS/FM1/27JAN92

MIPR#	SWD LAB#	Chest#	Temp.

SURFACE WATER SAMPLE CHAIN OF CUSTODY

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

Location: Longhorn AAP Date:_____ Time:_____

Site: _____ Location #: _____

Proj. Engineer: _____ Ext#: _____

CONTAINERS

Glass	Plastic	Vial	Chest#	C/Seal#
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

VOA	Chest#
_____	_____
Int:	

PARAMETERS SAMPLED

	pH, Conductivity & Temperature	EPA Method	(0)
	Semi-Volatiles	8270	(2)
	Explosives	8330	(2)
	Herbicides/Pesticides & PCB's (2,4-D & 2,4,5-TP)	8150/8080	(2)
	Nitrate	353.1	(1)
	Total Metals (Ag, As, Ba, Cd, Cr, Hg, Ni, Pb, Sb, Se & Tl)	6010/7041 7060/7470 7740/7841	[1]
	Volatile Organics	8240	{3}

* Containers: () = Amber Glass [] = Plastic {} = Vials

CUSTODY RECORD

Relinquished by	Received by	Date	Time
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

LHAAP/SW/FM1/27JAN92

MIPR#	SWD LAB#	Chest#	Temp.

RINSATE WATER SAMPLE CHAIN OF CUSTODY

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

Location: Longhorn AAP Date: _____ Time: _____

Site: _____ Blank #: _____

Proj. Engineer: _____ Ext#: _____

CONTAINERS

Glass	Plastic	Vial	Chest#	C/Seal#
____	_____	____	_____	_____
____	_____	____	_____	_____

VOA	Chest#
____	_____

Int:

PARAMETERS SAMPLED

	pH, Conductivity & Temperature	EPA Method	(0)
	Semi-Volatiles	8270	(2)
	Explosives	8330	(2)
	Herbicides/Pesticides & PCB's (2,4-D & 2,4,5-TP)	8150/8080	(2)
	Nitrate	353.1	(1)
	Total Metals (Ag, As, Ba, Cd, Cr, Hg, Ni, Pb, Sb, Se & Tl)	6010/7041 7060/7470 7740/7841	[1]
	Volatile Organics	8240	{3}

* Containers: () = Amber Glass [] = Plastic {} = Vials

CUSTODY RECORD

Relinquished by	Received by	Date	Time
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

LHAAP/RB/FM1/27JAN92

WATER SAMPLES FIELD DATA FORM

PROJECT: _____ DATE: __/__/__

SITE: _____ TYPE OF SAMPLE: WATER

WELL NO: _____ LOCATION: _____

CSG DIAMETER: _____ CSG TYPE: _____

RISER ELEVATION: _____

DEPTH TO WATER FROM TOP OF CASING: _____ TIME: __:__

RATE OF RECHARGE: _____

DEPTH TO WATER AT TIME OF SAMPLING: _____ TIME: __:__

WATER TABLE: _____ MEASURING DEVICE: _____

PH: _____ _____ TIME: __:__ TYPE: _____

PH: _____ _____

CONDUCTIVITY, umhos/cm TIME: __:__ TYPE: _____

_____ _____ TEMPERATURE: _____

_____ _____ TURBIDITY: _____

CHEST# _____ C/SEAL# _____ BUS BILL# _____

CHEST# _____ C/SEAL# _____ BUS BILL# _____

NOTES CONCERNING CONDITION OF WELL, ODOR, COLOR, AND PROBLEMS

_____

_____

_____

_____

_____

_____

_____

SAMPLE COLLECTOR: _____

SOIL SAMPLE
FIELD DATA FORM
No:_____

Project: **Longhorn AAP** Proj/Engr: _____ Ext: _____

Site: _____ Boring #:_____

Sample depths:_____ to _____ Total Samples:_____

Start: _____ (Date) /_____ (Time) to _____ (Date) / _____ (Time)

Top of Hole Elev: _____ Water Table: _____

Depth	Description	Jar No.
to		A & B
to		A & B
to		A & B
to		A & B
to		A & B
to		A & B
to		A & B
to		A & B
Page of	Total samples on this form	

Chest #	No/Jars	C/Seal #	Bus bill #

Remarks:

LHAAP/SS/FM2/17JAN92

Sample Collector: _____

LONGHORN AAP
RINSATE WATER SAMPLES
PARAMETER SHEET
FY - 92

CONTAINERS		PARAMETERS	EPA METHOD	PRESERVATIVES
NO.	SIZE		NO./SHIP	
GLASS			(7)	
1	w/m jar	pH, Conductivity, & Temp. (4 sets)	*****	dispose
2	1 liter	Semi-Volatiles	8270	Brim full & 4°C
2	1 liter	Explosives	8330	Brim full & 4°C
2	1 liter	Herbicides, Pesticides & PCB's (2,4-D & 2,4,5-TP)	8150/8080	4°C
1	1 liter	Nitrate	353.1	4°C
PLASTIC			[1]	
1	1 liter	Total Metals (Ag, As, Ba, Cd, Cr, Hg, Ni, Pb, Sb, Se & Tl)	6010/7041/7060 7470/7740/7841	pH<2 w/HNO_3
VIALS			{3}	
3	40 ml vials	Volatile Organics	8240	4 drops HCl, n/a, n/b & 4°C

LH/RB/PAR/27JAN92

One rinsate sample should be taken for every (20) soil samples. The rinsate must be taken on the actual piece of equipment used to obtain the soil sample, (split spoon, auger, knife, etc.) and should have the same I.D. as the corresponding boring/depth number taken with that equipment.

006958

Hole No.

DRILLING LOG	Division	INSTALLATION	SHEET OF SHEETS
1. PROJECT		10. SIZE AND TYPE OF BIT	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (MSL or USC)	
3. DRILLING AGENCY		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and file number)		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED	
5. NAME OF DRILLER		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN		16. DATE HOLE: STARTED / COMPLETED	
8. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE	
9. TOTAL DEPTH OF HOLE		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Descriptions) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.

006959

Send original copy by certified mail to: Texas Water Commission, P.O. Box 13087, Austin, Texas 78711

Please use black ink.

ATTENTION OWNER: *Confidentiality Privilege Notice on Reverse Side*

State of Texas
WELL REPORT

Texas Water Well Drillers Board
P.O. Box 13087
Austin, Texas 78711

1) OWNER _____ (Name) ADDRESS _____ (Street or RFD) (City) (State) (Zip)

2) LOCATION OF WELL:
County _____ . _____ miles in _____ (NE, SW, etc.) direction from _____ (Town)

Driller must complete the legal description below with distance and direction from two intersecting section or survey lines, or he must locate and identify the well on an official Quarter- or Half-Scale Texas County General Highway Map and attach the map to this form.

☐ LEGAL DESCRIPTION:

Section No. _____ Block No. _____ Township _____ Abstract No. _____ Survey Name _____

Distance and direction from two intersecting section or survey lines _____

☐ SEE ATTACHED MAP

3) TYPE OF WORK (Check):
☐ New Well ☐ Deepening ☐ Reconditioning ☐ Plugging

4) PROPOSED USE (Check):
☐ Domestic ☐ Industrial ☐ Monitor ☐ Public Supply ☐ Irrigation ☐ Test Well ☐ Injection ☐ De-Watering

5) DRILLING METHOD (Check):
☐ Driven ☐ Mud Rotary ☐ Air Hammer ☐ Jetted ☐ Bored ☐ Air Rotary ☐ Cable Tool ☐ Other _____

6) WELL LOG:
Date Drilling:
Started _____ 19 __
Completed _____ 19 __

DIAMETER OF HOLE

Dia. (in.)	From (ft.)	To (ft.)
	Surface	

7) BOREHOLE COMPLETION:
☐ Open Hole ☐ Straight Wall ☐ Underreamed
☐ Gravel Packed ☐ Other _____
If Gravel Packed give interval . . . from _____ ft. to _____ ft.

From (ft.)	To (ft.)	Description and color of formation material

(Use reverse side if necessary)

8) CASING, BLANK PIPE, AND WELL SCREEN DATA:

Dia. (in.)	New or Used	Steel, Plastic, etc. Perf., Slotted, etc. Screen Mfg., if commercial	Setting (ft.) From	Setting (ft.) To	Gage Casing Screen

9) CEMENTING DATA [Rule 287.44(1)]
Cemented from _____ ft. to _____ ft. No. of Sacks Used _____
_____ ft. to _____ ft. No. of Sacks Used _____
Method used _____
Cemented by _____

10) SURFACE COMPLETION
☐ Specified Surface Slab Installed [Rule 287.44(2)(A)]
☐ Specified Steel Sleeve Installed [Rule 287.44(3)(A)]
☐ Pitless Adapter Used [Rule 287.44(3)(B)]
☐ Approved Alternative Procedure Used [Rule 287.71]

11) WATER LEVEL:
Static level _____ ft. below land surface Date _____
Artesian flow _____ gpm. Date _____

12) PACKERS: Type Depth

13) TYPE PUMP:
☐ Turbine ☐ Jet ☐ Submersible ☐ Cylinder
☐ Other _____
Depth to pump bowls, cylinder, jet, etc., _____ ft.

14) WELL TESTS:
Type Test: ☐ Pump ☐ Bailer ☐ Jetted ☐ Estimated
Yield: _____ gpm with _____ ft. drawdown after _____ hrs.

15) WATER QUALITY:
Did you knowingly penetrate any strata which contained undesirable constituents?
☐ Yes ☐ No If yes, submit "REPORT OF UNDESIRABLE WATER"
Type of water? _____ Depth of strata _____
Was a chemical analysis made? ☐ Yes ☐ No

I hereby certify that this well was drilled by me (or under my supervision) and that each and all of the statements herein are true to the best of my knowledge and belief. I understand that failure to complete items 1 thru 15 will result in the log(s) being returned for completion and resubmittal.

COMPANY NAME _____ (Type or print) WELL DRILLER'S LICENSE NO. _____

ADDRESS _____ (Street or RFD) (City) (State) (Zip)

(Signed) _____ (Licensed Well Driller) (Signed) _____ (Registered Driller Trainee)

Please attach electric log, chemical analysis, and other pertinent information, if available.

For TWC use only: Well No. _____ Located on map _____

WWD-012 (Rev. 05-18-90)

TEXAS WATER COMMISSION COPY

006960

Please use BLACK INK.	State of Texas	
File WHITE COPY with: Texas Water Commission P.O. Box 13087 Austin, Texas 78711 Phone (512) 371-6299	**PLUGGING REPORT** (This form must be completed and filed with the TWC within 30 days following the date the well is plugged as required by current statutory law.)	Texas Water Well Drillers Board P.O. Box 13087 Austin, Texas 78711 Phone (512) 371-6299

A. Well Identification and Location Data

1) Owner _____ (Name) Address _____ (Street or RFD) (City) (State) (Zip)

2) Owner's Well Number _____

3) Location of Well: County _____ _____ miles in _____ (N.E., S.W., etc.) direction from _____ (Town)

Driller or other person performing the plugging operations must complete the legal description to the right with distance and direction from two intersecting section or survey lines, or he must locate and identify the well on an official Quarter- or Half-Scale Texas County General Highway Map and attach the map to this form.

☐ Legal description:

Section No. _____ Block No. _____ Township _____

Abstract No. _____ Survey Name _____

Distance and direction from two intersecting section lines or survey lines: _____

☐ See Attached map.

B. Historical Data on Well To Be Plugged (if available)

4) Driller _____ License Number _____ City _____

5) Drilled _____ 19___; 6) Diameter of hole _____ inches; 7) Total depth of well _____ feet.

C. Current Plugging Data

8) Date well plugged _____, 19_____.

9) Sketch of well: Using space at right, show method of plugging the well including all casing and cemented intervals.

10) Name of Driller or other person actually performing the plugging operations _____

_____;

if a water well driller plugged the well, give the driller's license no. _____.

11) Casing and cementing data relative to the plugging operations:

Diameter (inches)	Casing Left in Well	
	From (feet)	To (feet)

Cement Plug(s) Placed in Well		Sack(s) of cement used
From (feet)	To (feet)	

D. Validation of Information Included in Form

I hereby certify that this well was plugged by me (or under my supervision) and that all of the statements herein are true and accurate to the best of my knowledge and belief.

Company or Individual's Name _____ (Type or Print)

Address _____ (Street or RFD) (City) (State) (Zip)

(Signed) _____ (Person performing plugging operations) (Signed) _____ (Owner of Well)

For TWC use only
Well No. _____
Location on map _____

WWD-009 (Rev. 07/27/88) TEXAS WATER COMMISSION'S COPY

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

PANTEX PLANT (DOE)

MONITOR WELLS

BURNING GROUND WELL #_____

DATE:_____TIME:_____

SEMI-VOLATILES

METHOD: 8250/8270

REFRIGERATED @ 4'C BRIM FULL

CHECKED FOR BUBBLES? [Y] [N]

SIGNATURE:_____

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

PANTEX PLANT (DOE)

BURNING GROUND WELL #

DATE:_____TIME:_____

NITRATES

4'C

SIGNATURE:_____

006962

QC REPORT ORIGINAL

SOUTHWESTERN DIVISION LABORATORY, CORPS OF ENGINEERS
4815 CASS STREET
DALLAS, TEXAS 75235-8011
(214) 905-9130

CASE NARRATIVE REQUIRED

REQUEST FOR ANALYSES

LABORATORY: NDRC LABORATORY

PROJECT: FORT SILL

DATE RESULTS REQUIRED: 7 APRIL 1992

DATE SAMPLES SENT: 24 MARCH 1992

Must have Due 4/3/92
2 Ambers & water ~~liquid~~ per SX WC

TEST THE FOLLOWING SAMPLES AS INDICATED BELOW:

FIELD ID	SWD NO.	DATE SAMPLED	2858
FS43-01	2- 1018	23 MARCH 1992	-1
FS43-02	2- 1019	23 MARCH 1992	2
FS43-03	2- 1020	23 MARCH 1992	3
FS43-03/EB	2- 1021	23 MARCH 1992	4
FS43-03/DC	2- 1022	23 MARCH 1992	5
	MS		6
	MSD		7
	method Blank		8
	Blank spike		9

ANALYZE FIVE WATER SAMPLES FOR EXPLOSIVES INCLUDING: HMX, RDX, TNT, TNB, 2-4 DNT, 2-6 DNT) (8330)

**** THESE SAMPLES ARE TWO WEEK TURN AROUND. REQUEST THE HARD COPY REPORT BY DUE DATE. ****

RELINQUISHED BY:	RECEIVED BY	DATE	TIME
Judy A. Johns	[illegible]	3-24-92	1220
[illegible]	[illegible]	3/24/92	1:15

COOLER RECEIPT FORM

Date Received _____ Project _____

Number of Coolers _____ Cooler Numbers _____

Date Checked in _____ By (sign) _____

1. Shipping slip.....Yes.....No

   If yes, carrier and bill number _____

2. Custody seals on cooler.....Yes.....No

   If yes, how many and where _____

3. Custody seals intact.....Yes.....No

4. Chain-of-Custody in plastic.....Yes.....No

5. Chain-of-Custody filled out properly.....Yes.....No

6. SWD signed Chain-of-Custody properly.....Yes.....No

7. Enough ice and packing.....Yes.....No

   Type of packing _____

8. All bottles sealed.....Yes.....No

9. Any bottles broken.....Yes.....No

10. Labels in good condition and complete.....Yes.....No

11. Labels agree with COC.....Yes.....No

12. Correct containers used.....Yes.....No

13. Preserved properly.....Yes.....No

14. Sufficient sample.....Yes.....No

15. Bubbles absent from VOA.....Yes.....No

16. Client called.....Yes.....No

    Details _____

_____

17. Comments _____

_____

_____

_____

APPENDIX B

TABLES

TABLE B.1 SAMPLE CONTAINERS, PRESERVATION, AND PREPARATION FOR WATER SAMPLES

PARAMETER	SIZE AND TYPE OF CONTAINER	# OF CONTAINERS	ICE	METHOD OF PRESERVATION
pH	½ pint glass	1	N	field test
conductivity	½ pint glass	1	N	field test
temperature	½ pint glass	1	N	field test
metals	liter plastic	1	Y	nitric acid to pH <2
volatiles	40 ml glass vial	3	Y	no head space, air bubbles or agitation
semivolatiles	liter amber glass	2	Y	
explosives	liter amber glass	2	Y	
anions	liter glass	1	Y	
pesticides/PCBs	liter amber glass	2	Y	
herbicides	liter amber glass	1	Y	
total organic carbon	liter amber glass	1	Y	sulfuric acid to pH <2
total organic halogen	liter amber glass	1	Y	sulfuric acid to pH <2
phenols	liter amber glass	1	Y	sulfuric acid to pH <2
TCLP (See note 1)				
volatiles				
semivolatiles				
pesticides				
herbicides				
metals				

Note 1. Sample containers for aqueous samples to be analyzed for TCLP are identical to the sample containers for the corresponding total analysis.

TABLE B.2 MAXIMUM HOLDING TIMES AND ANALYTICAL METHODS IN SOIL AND WATER

ANALYTICAL METHOD PARAMETER	EXTRACTION	ANALYSIS	REFERENCE	METHOD #
Field tests				
pH	-	immediate		
conductivity	-	immediate		
temperature	-	immediate		
Metals				
antimony	-	6 months	SW-846(1)	7041
arsenic	-	6 months	SW-846	7060
selenium	-	6 months	SW-846	7740
lead	-	6 months	SW-846	7421
mercury in water	-	28 days	SW-846	7470
mercury in soil	-	28 days	SW-846	7471
thallium	-	6 months	SW-846	7841
others	-	6 months	SW-846	6010
Volatiles	-	14 days	SW-846	8240
Semivolatiles			SW-846	8270
in water	7 days	40 days		
in soil	14 days	40 days		
Explosives				
in water	7 days	40 days	SW-846	8330
in soil	14 days	40 days	SW-846	8330
Anions			EPA-600(2)	300.0
nitrate	-	14 days		
chloride	-	28 days		
sulfate	-	28 days		
Pesticides/PCBs				
in water	7 days	40 days	SW-846	8080
in soil	14 days	40 days	SW-846	8080
Herbicides				
in water	7 days	40 days	SW-846	8150
in soil	14 days	40 days	SW-846	8150
Total Organic Carbon		28 days	SW-846	9060
Total Organic Halogen		14 days	SW-846	9020
Phenols		28 days	SW-846	9066
TCLP				
volatiles		14 days	SW-846	1311/8240
semivolatiles	7 days(3)	40 days	SW-846	1311/8270
pesticides	7 days(3)	40 days	SW-846	1311/8080
herbicides	7 days(3)	40 days	SW-846	1311/8150
metals (except mercury)		6 months	SW-846	1311/various
(mercury)		28 days	SW-846	1311/7470

(1) SW-846 reference 6;
(2) EPA-600 reference 4
(3) There is a holding time of 7 days from field collection to TCLP extraction, 7 days from TCLP extraction to preparative extraction and 40 days from preparative extraction to determinative analysis for a total elapsed time of 54 days.

TABLE B.3 METHODS FOR PHYSICAL TESTS

TEST	METHOD SOURCE
grain size	ASTM D421, D422, D1140
atterberg limits	ASTM D4318
moisture content	ASTM D2216
asbestos	NIOSH/OSHA

NIOSH/OSHA National Institute of Occupational Safety and Health/ Occupational Safety and Health Administration
ASTM American Society of Testing and Materials.

TABLE B.4 QUANTITATION LIMITS FOR VOLATILE ANALYSES IN SOIL AND WATER BY METHOD 8240

PARAMETER	WATER (ug/l)	LOW LEVEL SOIL/SEDIMENT (ug/kg)
chloromethane	10	10
bromomethane	10	10
vinyl chloride	10	10
chloroethane	10	10
methylene chloride	5	5
acetone	10	10
carbon disulfide	5	5
1,1-dichloroethane	5	5
1,1-dichloroethene	5	5
cis-1,2-dichloroethene	5	5
trans-1,2-dichloroethene	5	5
chloroform	5	5
1,2-dichloroethane	5	5
2-butanone (MEK)	10	10
1,1,1-trichloroethane	5	5
carbon tetrachloride	5	5
vinyl acetate	10	5
bromodichloromethane	5	5
1,2-dichloropropane	5	5
trichloroethene	5	5
dibromochloromethane	5	5
1,1,2-trichloroethane	5	5
benzene	5	5
trans-1,3-dichloropropene	5	5
4-methyl-2-pentanone	10	10
2-hexanone	10	10
tetrachloroethene	5	5
toluene	5	5
1,1,2,2-tetrachloroethane	5	5
chlorobenzene	5	5
ethylbenzene	5	5
styrene	5	5
xylenes (total)	5	5
acrolein	5	5
acrylonitrile	10	10
dibromomethane	5	5
dichlorodifluoromethane	5	5
1,4-dichloro-2-butene	10	10
ethyl methacrylate	5	5
1,2,3-trichloropropane	5	5
dichloromethane	5	5
iodomethane	10	10
trichlorofluoromethane	5	5

TABLE B.5 QUANTITATION LIMITS FOR SEMIVOLATILE ANALYSIS IN SOIL AND WATER BY METHOD 8270

PARAMETER	WATER (ug/l)	LOW-LEVEL SOIL/SEDIMENT (ug/kg)
phenol	10	330
bis(2-chloroethyl) ether	10	330
2-chlorophenol	10	330
1,3-dichlorobenzene	10	330
1,4-dichlorobenzene	10	330
benzyl alcohol	10	330
1,2-dichlorobenzene	10	330
2-methylphenol	10	330
bis(2-chloroisopropyl) ether	10	330
4-methylphenol	10	330
n-nitrosodi-n-propylamine	50	1600
hexachloroethane	10	330
nitrobenzene	10	330
isophorone	10	330
2-nitrophenol	10	330
2,4-dimethylphenol	10	330
benzoic acid	50	1600
bis(2-chloroethoxy) methane	10	330
2,4-dichlorophenol	10	330
1,2,4-trichlorobenzene	10	330
naphthalene	10	330
4-chloroaniline	10	330
hexachloro-1,3-butadiene	10	330
4-chloro-3-methylphenol	10	330
2-methylnaphthalene	10	330
hexachlorocyclopentadiene	10	330
2,4,6-trichlorophenol	10	330
2,4,5-trichlorophenol	50	1600
2-chloronaphthalene	10	330
2-nitroaniline	50	1600
dimethyl phthalate	10	330
acenaphthylene	10	330
2,6-dinitrotoluene	10	330
3-nitroaniline	50	1600
acenaphthene	10	330
2,4-dinitrophenol	50	1600
4-nitrophenol	50	1600
dibenzofuran	10	330
2,4-dinitrotoluene	10	330
diethyl phthalate	10	330
4-chlorophenyl phenyl ether	10	330
fluorene	10	330
4-nitroaniline	50	1600
4,6-dinitro-2-methylphenol	50	1600
N-nitrosodiphenylamine	10	330
4-bromophenyl phenyl ether	10	330
hexachlorobenzene	10	330
pentachlorophenol	50	1600
phenanthrene	10	330
anthracene	10	330
di-n-butyl phthalate	10	330
fluoranthene	10	330
pyrene	10	330
butyl benzyl phthalate	10	330
3,3'-dichlorobenzidine	20	660
benzo(a)anthracene	10	330
chrysene	10	330
bis(2-ethylhexyl)phthalate	10	330

TABLE B.5 (cont.) QUANTITATION LIMITS FOR SEMIVOLATILE ANALYSIS IN SOIL AND WATER BY METHOD 8270

PARAMETER	WATER (ug/l)	LOW-LEVEL SOIL/SEDIMENT (ug/kg)
di-n-octyl phthalate	10	330
benzo(b)fluoranthene	10	330
benzo(k)fluoranthene	10	330
benzo(a)pyrene	10	330
indeno(1,2,3-cd)pyrene	10	330
dibenz(a,h)anthracene	10	330
benzo(g,h,i)perylene	10	330
1-chloroanaphthalene	10	660
3-methylphenol	10	330
diphenylamine	20	1000
1,2-diphenylhydrazine	50	1600

Medium soil/sediment quantitation limits are 60 times the low soil/sediment quantitation limits.

TABLE B.6 QUANTITATION LIMITS FOR PESTICIDE ANALYSES IN SOIL AND WATER BY METHOD 8080

PARAMETER	WATER (ug/l)	LOW-LEVEL SOIL/SEDIMENT (ug/kg)
aldrin	0.4	63.2
alpha-BHC	0.3	47.4
beta-BHC	0.6	94.8
delta-BHC	0.9	142.2
gamma-BHC	0.4	63.2
chlordane	1.4	221.2
4,4'-DDD	1.1	173.8
4,4'-DDE	0.4	63.2
4,4'-DDT	1.2	189.6
dieldrin	0.2	31.6
endosulfan I	1.4	221.2
endosulfan II	0.4	63.2
endosulfan sulfate	6.6	1042.8
endrin	0.6	94.8
endrin aldehyde	2.3	363.4
heptachlor	0.3	47.4
heptachlor epoxide	8.3	1311.4
methoxychlor	18	2844
toxaphene	24	3792
arochlor-1018	1	158
arochlor-1221	1	158
arochlor-1232	1	158
arochlor-1242	1	158
arochlor-1248	1	158
arochlor-1254	1	158
arochlor-1260	1	158

TABLE B.7 REQUIRED QUANTITATION LIMITS FOR EXPLOSIVES IN SOIL AND WATER BY METHOD 8330

PARAMETER	WATER (ug/l)	LOW-LEVEL SOIL/SEDIMENT (ug/g)
	EXPLOSIVES	
HMX		2.2
RDX	0.836	1.0
1,3,5-TNB	0.258	0.25
1,3-DNB	0.108	0.25
Tetryl		0.65
NB		0.26
2,4,6-TNT	0.113	0.25
4-Am-DNT	0.060	
2-Am-DNT	0.035	
2,6-DNT	0.314	0.26
2,4-DNT	0.021	0.25
2-NT		0.25
4-NT		0.25
3-NT		0.25

TABLE B.8 QUANTITATION LIMITS FOR OTHER ANALYSES IN SOIL AND WATER

PARAMETER	WATER (mg/l)	LOW-LEVEL SOIL/SEDIMENT (mg/kg)
METALS		
antimony	0.03	1.0
arsenic	0.01	1.0
barium	0.02	10.0
cadmium	0.005	1.0
chromium	0.01	1.0
lead	0.002	1.0
mercury	0.002	0.1
nickel	0.05	1.0
selenium	0.01	1.0
silver	0.07	1.0
thallium	0.01	1.0
COMMON ANIONS		
nitrate	0.1	0.1
chloride	2.0	-
sulfate	2.0	-
HERBICIDES		
2,4-D	0.01	1.0
2,4,5-TP	0.002	0.2
MISCELLANEOUS		
total organic carbon	1.0	
total organic halogen	0.005	
phenols	0.002	

TABLE B - 9
CHEMICAL SAMPLING PLAN SUMMARY
RI PHASE I FIELD INVESTIGATIONS

SITE	TYPE OF SAMPLE																										
	SURFACE WATER			SEDIMENT			SHALLOW SOIL / WASTE			SOIL FROM SOIL BORINGS (SB) AND WELL BORINGS (MW)									GROUND WATER FROM SOIL BORINGS (SB) AND WELLS (MW)						TRAVEL BLANK	EQUIP BLANK
LHAAP NO.	SAMPLE TYPE			SAMPLE TYPE			SAMPLE TYPE			LOCATION		EST. AVG. DEPTH WTR.	EST. AVG. DEPTH		SAMPLING FREQUENCY	SAMPLE TYPE			LOCATION		SAMPLE TYPE			TB	EB
	WATER	QA	QC	SOIL	QA	QC	SOIL	QA	QC	SB	MW		SB	MW		SOIL	QA	QC	SB	MW	WATER	QA	QC		
	QTY	QTY	QTY	QTY	QTY	QTY	QTY	QTY	QTY	QTY	QTY	FEET	FEET	FEET	FEET	QTY	QTY	QTY	QTY	QTY	QTY	QTY	QTY	QTY	QTY
11	2	0	0	2	0	0	0	0	0	6	0	16	18	-	5.0	30	3	3	6	0	6	1	1	4	2
13	0	0	0	0	0	0	0	0	0	4	1	25	27	45	5.0	30	3	3	4	1	5	1	1	4	2
14	0	0	0	0	0	0	0	0	0	2	1	24	26	45	5.0	18	2	2	2	1	3	1	1	3	2
16	5	1	1	5	1	1	0	0	0	4	11	19	21	40	5.0	75	8	8	25	12	37	4	4	12	4
17	3	2	0	3	0	0	0	0	0	7	1	5	7	25	2.5	24	3	3	7	3	10	1	1	6	3
18 & 24	8	1	1	8	1	1	0	0	0	0	0	-	-	-	-	0	0	0	0	39	39	4	4	13	3
29	17	2	2	17	2	2	8	1	1	15	0	20	22	-	5.0	75	8	8	15	6	21	3	3	10	4
12	3	0	0	3	0	0	2	0	0	0	7	18	-	40	5.0	35	4	4	0	9	9	1	1	8	3
32	7	1	1	7	1	1	4	0	0	13	0	10	12	-	2.5 & 5.0	39	4	4	8	1	9	1	1	7	3
1	7	1	1	7	1	1	0	0	0	8	0	5	7	-	2.5	24	3	3	8	1	9	1	1	7	2
XX	7	1	1	7	1	1	0	0	0	7	0	20	22	-	2.5 & 5.0	29	3	3	4	2	6	1	1	6	2
27	4	0	0	4	0	0	4	1	1	10	0	8	10	-	5.0	30	3	3	10	2	12	2	2	6	3
TOTALS	63	7	7	63	7	7	18	2	2	76	21	-	-	-	-	409	44	44	89	77	166	21	21	86	33

- DENOTES NOT APPLICABLE

NOTES:

1. ALL SAMPLES WILL BE ANALYZED FOR VOLATILE ORGANIC COMPOUNDS (VOC'S), SEMIVOLATILE ORGANIC COMPOUNDS (SVOC'S), EXPLOSIVE COMPOUNDS, 11 SELECTED METALS, NITRATE, CHLORIDE, AND SULFATE, WITH THE FOLLOWING EXCEPTIONS:
   a. TRIP BLANKS WILL BE ANALYZED FOR VOC'S ONLY.
   b. GROUND WATER FROM SOIL BORINGS WILL BE ANALYZED FOR TOTAL ORGANIC HALIDES (TOX), TOTAL ORGANIC HALIDES (TOX), EXPLOSIVE COMPOUNDS, NITRATE, CHLORIDE, SULFATE, AND TOTAL PHENOLS ONLY.
2. SITES LHAAP 13, 32, AND 27 WILL INCLUDE PESTICIDES AND HERBICIDE ANALYSES.
3. BACKGROUND MONITOR WELL GROUND-WATER SAMPLE AT LHAAP 16 WILL BE ANALYZED FOR VOCS, SVOCS, EXPLOSIVE COMPOUNDS, 11 SELECTED METALS, NITRATE, CHLORIDE, SULFATE, TOX, TOC, AND TOTAL PHENOLS.
4. SITE LHAAP 16 ALSO INCLUDES THREE 150-FT DEEP STRATIGRAPHIC TEST BORINGS FOR GEOPHYSICAL LOGGING. GROUND-WATER SAMPLES WILL BE TAKEN EVERY 20 FEET.

006974

APPENDIX C

INVESTIGATION-DERIVED WASTE MANAGEMENT PLAN

006976

LONGHORN ARMY AMMUNITION PLANT

RI/FS WORKPLAN

INVESTIGATION-DERIVED WASTE

MANAGEMENT PLAN

PREPARED BY:

U.S. ARMY CORPS OF ENGINEERS
Tulsa District

JUNE 1992

PREPARED FOR:

Longhorn Army Ammunition Plant
Karnack, Texas

TABLE OF CONTENTS

1. Introduction. C-1
1.1. Purpose of Management Plan. C-1
1.2. IDW Management Approach. C-1
1.3. Facility Description Summary. C-2
1.3.1. Climate. C-2
1.3.2. Terrain. C-2
1.3.3. Regional Groundwater. C-2
1.4. Current Sites To Be Investigated. C-3
1.5. Past investigations. C-3
1.6. Site Descriptions. C-8
1.6.1. (11) Suspected TNT Burial Site at Ave.'s P & Q. C-8
1.6.2. (13) Suspected TNT Burial Site Between Old & Active Landfills/Acid Dump. C-8
1.6.3. (14) Area 54 Burial Ground. C-9
1.6.4. (16) Old Landfill. C-9
1.6.5. (17) Burning Ground No. 2 /Flashing Area. C-10
1.6.6. (18 & 24) Burning Ground No. 3 & Unlined Evaporations Pond/Rocket Motor Washout Lagoon. C-11
1.6.7. (29) Former TNT Production Area. C-12
1.6.8. (12) Active Landfill. C-13
1.6.9. (32) Former TNT Disposal Plant. C-14
1.6.10. (1) Inert Burning Grounds. C-15
1.6.11. (xx) Ground Signal Test Area. C-16
1.6.12. (27) South Test Area. C-16
1.7. Investigation Summary. C-17
1.8. Methods of Waste Quantity Minimization. C-18

2. Waste Description. C-21
2.1. Types and Estimated Quantities of IDW. C-21
2.1.1. Drill Cuttings. C-21
2.1.2. Purge and Development Water. C-21
2.1.3. Decontamination Fluids. C-21
2.1.4. Personnel Protective Equipment (PPE). C-22
2.2. IDW Applicable of Relevant and Appropriate Requirements (ARARs). C-22
2.3. Methods for Characterizing RCRA Hazardous/Non-hazardous IDW. . C-22

3. Area of Contamination Description. C-23
3.1. AOC-A. C-23
3.2. AOC-B. C-23

006978

3.3. AOC-C. C-23
3.4. AOC-D. C-23
3.5. AOC-E. C-23
3.6. AOC-F. C-23
3.7. AOC-G. C-23
C-23

4. Waste Management Plan (WMP). C-37
4.1. Drill Cuttings WMP. C-37
4.1.1. Containerization. C-37
4.1.2. Sampling. C-37
4.1.3. Storage. C-38
4.1.4. Disposal. C-38
4.2. Development, Purge, and Decontamination Water WMP. C-39
4.2.1. Containerization. C-39
4.2.2. Sampling. C-40
4.2.3. Storage. C-40
4.2.4. Disposal. C-40
4.3. Personnel Protective Equipment (PPE) and Disposable Equipment (DE) WMP. C-40
4.3.1. Containerization. C-40
4.3.2. Sampling. C-41
4.3.3. Storage. C-41
4.3.4. Disposal. C-41
4.5. Documentation/Notification. C-41

5. References. C-43

FIGURES

Figure C-1. . . . . C-4
Figure C-2. . . . . C-24
Figure C-3. . . . . C-25
Figure C-4. . . . . C-26
Figure C-5. . . . . C-27
Figure C-6. . . . . C-28
Figure C-7. . . . . C-29
Figure C-8. . . . . C-30
Figure C-9. . . . . C-31
Figure C-10. . . . . C-32
Figure C-11. . . . . C-33
Figure C-12. . . . . C-34
Figure C-13. . . . . C-35
Figure C-14. . . . . C-36

TABLES

Table C-1 . . . . . C-5
Table C-2 . . . . . C-19

1. Introduction. Longhorn Army Ammunitions Plant (LHAAP) was placed on the National Priority List (NPL) in August 1990. This document will serve as an Investigations-Derived Waste (IDW) management plan for the investigations to be performed per the Remedial Investigations/Feasibility Study (RI/FS) Workplan under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Twelve locations have been identified as having 13 sites within the installation.

1.1. Purpose of Management Plan. The purpose of this plan is to describe the anticipated approach and procedures for IDW management. During the investigations,waste will be generated that may contain hazardous substances as defined by CERCLA, be characteristically hazardous under the Resource Conservation and Recovery Act (RCRA), listed hazardous waste under RCRA, or industrial solid waste. The intent of the IDW management is to leave the site in no worse condition after the investigation than existed prior to the investigation and to comply with ARARS to the extent practicable. In accordance with the guidance this document will be written as a stand-alone plan but will only provide the briefest details other than those specific to waste management. Detailed information about facility, the sites, and the investigations is provided in the Volume 1 of the RI/FS Workplan.

1.2. IDW Management Approach. The approach will be to utilize the Area of Contamination (AOC) unit concept as outlined in the EPA guidance document, Superfund Management of Investigation-Derived Wastes During Site Inspections, May 1991, (Appendix C-1). The most important elements of the IDW management approach as listed in the above referenced guidance are as follows:"

- Leaving a site in no worse condition than existed prior to the investigations.
- Removing those waste that pose an immediate threat to human health or the environment.

- Leaving on-site wastes that do not require off-site disposal or extended above-ground containerization.
- Storing on site waste that is contaminated but is not hazardous for treatment during the remedial action.
- Complying with federal ARARs, to the extent practicable.
- Complying with state ARARs, to the extent practicable.
- Careful planning and coordination for IDW management.
- Minimizing the quantity of generated wastes."

1.3. Facility Description Summary. LHAAP is a US Army facility with restricted access. It is located in the northeast corner of Harrison County of east Texas. The facility consists of 8,493 acres located between State Highway and the western shore of Caddo Lake. It's primary mission is to load, assemble, and packout pyrotechnic and illuminating/signal ammunition and solid propellant rocket motors. The facility was established in 1942 and has a long history of producing high explosives (HE), pyrotechnic and illuminating ammunition by various contractors.

1.3.1. Climate. LHAAP is located in a moist, humid, mild climate and receives an average rainfall of 46 inches.

1.3.2. Terrain. It is situated on gently rolling land with an average slope of 3 percent. All surface water drains into Caddo Lake via four drainage systems across the facility.

1.3.3. Regional Groundwater. Groundwater is generally unconfined, it can vary in depth beneath land surface (BLS) from 1 to 20 feet and is approximately 120 to 130 feet thick.

1.4. Current Sites To Be Investigated. There are thirteen separate operable units located at twelve sites included in this investigation. The locations of the project sites are provided as Figure C-1. The LHAAP designation numbers and names of the thirteen sites are:

LHAAP 11 - Suspected TNT Burial Site at Avenues P & Q

LHAAP 13 - Suspected TNT Burial Site between the Old and Active Landfills/Acid Dump

LHAAP 14 - Area 54 Burial Ground

LHAAP 16 - Old Landfill

LHAAP 17 - Burning Ground No.2/Flashing Area

LHAAP 18 - Burning Ground No. 3 and Unlined Evaporation

LHAAP 24 - Pond/Rocket Motor Washout Lagoon (same site as LHAAP 18)

LHAAP 29 - Former TNT Production Area

LHAAP 12 - Active Landfill

LHAAP 32 - Former TNT Disposal Plant

LHAAP 01 - Inert Burning Grounds

LHAAP XX - Ground Signal Test Area

LHAAP 27 - South Test Area

1.5. Past investigations. The facility has been shown by past investigations to contain contaminated surface soils, sediment, vadose zone soils, groundwater, and surface water to varying degrees at the different sites as described in Volume 1. Table C-1 provides a brief summary of the highest concentrations of contaminants at the individual sites from past investigations.

Figure C-1.

Table C-1
SITE PAST CONTAMINATION SUMMARY
LONGHORN RI IDW MANAGEMENT INFORMATION

LHAAP UNIT NO.	SITE NAME	SOIL CONTAMINATION TYPE (depth)	SOIL MAXIMUM CONC. (mg/Kg)	DEPTH TO GROUND WATER	GROUND WATER CONTAMINATION TYPE	GROUND WATER MAXIMUM CONC. (ug/l)
11	Suspected TNT Burial Site at Ave.'s P & Q	2,4,6,-TNT (2.5') 1,3,5-TNB (1.5')	1.86 117.0	3.0'	NO INFORMATION (NI)	NI
13	Suspected TNT Burial Site Between Old & Active Landfills/Acid Dump	(Suspected) 2,4,6,-TNT Acidic waste	NI	25.0'	NI	NI
14	Area 54 Burial Ground	Suspected Demolition Debris Explosives/Acidic waste	NI	24.0'	1,3,5-TNB (BH-12)	6.1
16	Old Landfill	1,3-DNB (sed./017) 2,6-DNT (sed./017) 2,4,6-TNT(sed./017) 1,3,5-TNB(SS/Q-II) 2,4,6-TNT(SS/704T) 2,4-DNT (15'/Q-IV) 2,6-DNT (10'/Q-IV) TCE (15'/Q-I) DCE (10'/Q-I) VCI (10'/Q-I) 1,1-DCA (15'/Q-IV)	12.2 15.0 3.9 0.153 13.6 73.0* 173.0 1.0 1.9 2.1 2.6	8.5'	Strontium (SW-017) Sulphate (SW-017) 2,6-DNT (MW-122) VCI (MW-122) Cadmium (MW-122) Chromium(MW-122) Barium (MW-122) Nitrate (BH-12) Phosphates (BH-13) Sulphate (BH-13) Stronium (BH-16)	80.0 8,170.0 8.6 10.5 6.84 55.8 217.0 1213.0 3930.0 122,000.0 1,790.0
17	Burning Ground No. 2 /Flashing Area	1,3,5-TNB /SS 2,4,6-TNT /SS 1,3-DNB /SS MEC /SS TCE /SS 1,4-DCB /SS 1,3-DNB (5') 2,4,6-TNT (5') 1,3,5-TNB (5') 2,4-DNT (5') 2,6-DNT (5') MEC (5') TCE (5') 1,4-DCB (5')	.127 .153 .180 .26 .53* .21 .470 .040 .060 .14* .053 .13 .56* .86	5.0'	Phenol (sw-016) Chromium (sw-016) Nitrate (sw-016) Sulphate (sw-016) Chloride (sw-016) MEC (mw130) Tetrahydrofuran (mw130) Chloride (BG-2) Strontium (BG-2) Chloroform (mw130)	14.0 34.5 940.0 10,500.0 4,000.0 153.0 46.0 2,348,000.0 1,116.0 16.0

Table C-1
SITE PAST CONTAMINATION SUMMARY
LONGHORN RI IDW MANAGEMENT INFORMATION

LHAAP UNIT NO.	SITE NAME	SOIL CONTAMINATION TYPE (depth)	SOIL MAXIMUM CONC. (mg/Kg)	DEPTH TO GROUND WATER	GROUND WATER CONTAMINATION TYPE	GROUND WATER MAXIMUM CONC. (ug/l)
18 & 24	Burning Ground No. 3 & Unlined Evaporations Pond/ Rocket Motor Washout Lagoon	Tetryl (8A-902, 14') TNT (8A-905, 8') MEC (8A-940, 10') TCE (8A-940, 4') 1,2-DCE (8A-902, 14') Toluene (8A-940, 4')	26.6 9.5 420.0 430.0* 153.3 34.0	22'	MEC (120) Acetone 1,2-DCE 1,2-DCA TCE (120) PCA Barium (MW-2) Chloride (MW-2) TOX (MW-2) Nitrates (123)	17,000,000.0 810.0 120.0 52.0 1,400,000.* 17,000.0 3,600.0 890,000.0 3,644,000.0 6,300.0
29	Former TNT Production Area	2,4,6-TNT (sediment) 1,3-DNB (SS) 2,4,6-TNT (SS) 1,3,5-TNB (SS) 2,4-DNT (SS) 2,6-DNT (SS) 1,3-DNB (1'-3.5') 2,4,6-TNT (2.5') 1,3,5-TNB (3.5') 2,4-DNT (1.5') 2,6-DNT (1-3.5')	0.78 0.52 7645.68 64.65 16.8* <0.61 <.01 .73 0.63 0.093 <.01	20'	2,4,6-TNT (SW) 2,4-DNT (SW) 2,6-DNT (SW) 1,3,5-TNB (MW-114 & 118) (All other groundwater samples below detection limit.)	206.9 23.4 13.6 1.4
12	Active Landfill	Sediment samples taken in 1991 investigations - no results over detection limits for explosives, VOC, and SVO.		12'-19'	1,3-DNB (BH-18) Aluminum (MW-103) Manganese (BH-17) Strontium BH-19) Chloride (BH-19) Sulphate (BH-18) Nitrate (BH-17) MEC (BH-17)	2.25 361.0 1,990.0 1,160.0 2,725,000.0 235,000.0 1,120.0 48.0
32	Former TNT Disposal Plant	Soil samples taken indicate no results over detection limits for explosives.		10'	2,4,6-TNT (SW)	7.6

Table C-1
SITE PAST CONTAMINATION SUMMARY
LONGHORN RI IDW MANAGEMENT INFORMATION

LHAAP UNIT NO.	SITE NAME	SOIL CONTAMINATION TYPE (depth)	SOIL MAXIMUM CONC. (mg/Kg)	DEPTH TO GROUND WATER	GROUND WATER CONTAMINATION TYPE	GROUND WATER MAXIMUM CONC. (ug/l)
1	Inert Burning Grounds	Soil samples taken indicate no results over detection limits for explosives and anions. No high samples were reported for metals. Nitrate (103) Sulphate (103)	 8.33 40.48	5'	1,3,5-TNB (104) Nitrobenzene (104) Strontium (104) Chloride (104) Nitrate (104) Sulphate (104) No VOC's or SVO detected.	9.74 1.82 96.0 8,000.0 3,500.0 5,710.0
xx	Ground Signal Test Area	Soil samples taken indicate no results over detection limits for explosives and anions.No high results were reported for metals. Aluminum (0102)	 1,435.0	10'-15'	Manganese (127) Strontium (104) Chloride (104) Sulphate (104) No Explosives, VOC's or SVO detected.	1,860.0 4,120.0 1,000,000.0 1,622,000.0
27	South Test Area	2,4,6-TNT (0401)	10.15	4'	Aluminum (MW-132) Manganese (MW-132) Strontium (MW-132) Chloride (MW-131) Sulphate (MW-132)	232.0 1,448.0 2,640.0 850,000.0 387,000.0

DCA = dichloroethane
DCB = dichlorobenzene
DCE = dichloroethene
DNB = dinitrobenzene
DNT = dinitrotoluene
MEC = methylene chloride
PCA = tetrachlorethane
TCE = trichloroethylene
TNB = trinitrobenzene
TNT = trinitrotoluene
VCl = vinyl chloride
VOC = volatile organic carbons
SVO = semivolatile organic carbon
TOX = total organic halides
MW = monitoring well
SB = soil boring
NI = no information available
* = concentration greater then the TCLP regulatory limits

1.6. Site Descriptions.

1.6.1. (11) Suspected TNT Burial Site at Ave.'s P & Q. This site consists of a cleared, grassy area at the intersection of two roads. The site was reported by USATHAMA as a possible burial site used to dispose of TNT in the 1940's. A borrow pit was later created in the central part to the wooded area north of the site, leaving a depression approximately 5 feet deep. This depression is apparent in aerial photographs taken in 1963, is inactive at present, and is not a candidate for the investigation. There is no operational activity presently scheduled at the suspected burial site.

The explosive compounds 2,4,6-TNT and 1,3,5-TNB have been found in soils at this site down to at least 5-foot depths, the maximum depth sampled. Maximum concentrations were 1.86 ug/g of TNT and 117 ug/kg of TNB.

1.6.2. (13) Suspected TNT Burial Site Between Old & Active Landfills/Acid Dump. This site is located in a clearing in a heavily wooded area immediately south of a power line easement. Based on conversations with employees at LHAAP, there was a suspected one-time disposal of TNT and/or acid at this site. No other known or suspected disposals have occurred.

The site contains a number of bare patches that support little of no vegetation. The patches vary in size from 1 to 10 feet in diameter. The three larger bare patches stand out very well in the surrounding grass which is 1 to 2 feet tall. Based on the presence of the bare patches it appears reasonable to suspect something may have been disposed of at these locations which is preventing the native grasses from re-establishing themselves.

The site has not been previously investigated. Based on the statements of plant employees and the continued presence of bare spots at the site, it is reasonable to investigate the site for possible soil and groundwater contamination due to the suspected burial of explosives and associated wastes, or the possible dumping of pesticides, herbicides, or acids.

1.6.3. (14) Area 54 Burial Ground. This site is approximately 150 feet in size and contains a small 25 by 30 foot asphalt parking lot. It was reportedly used during the 1940's and early 1950's for the disposal of demolition debris, explosives, and acids. The parking lot may cap the burial pit.

The site has not been previously investigated. Based on the statements of plant employees and the presence of contaminants which have been found near the site, possible soil and groundwater contamination will be investigated for explosives, demolition debris, and acids.

1.6.4. (16) Old Landfill. This site is defined as an open area bounded along the western and northern edges by a gravel road and along the eastern and southern edges by a wooded area. A large rectangular paved area that is designated as the Retail Sales Area for LHAAP is located on the western edge of the site. In the past, equipment auctions were held at this location. A tributary of Harrison Bayou runs closely along the eastern edge of the site.

The Old Landfill area was used for the disposal of inert materials and mission related hazardous wastes. The area was used to dispose of TNT redwater ash material from 1942 to 1944. In the mid to late 1950's, three rocket motor casings were burned and possibly buried on the eastern side of this landfill. A large bermed depression, once located near the center of the Old Landfill, served as an all-purpose junkyard for the disposal of such materials as substandard TNT, barrels of chemicals, oil, paint, scrap iron and wood. This area was filled in and the pond no longer exists. The landfill operation started at original ground level at the north-south mid-line of the site and ended 15 feet above original grade at the eastern edge of the site. Currently, all inert solid wastes are disposed of in the Active Landfill located elsewhere on the installation. The Old Landfill site is now used for the deposition of inert rubble only.

Soil contamination due to explosives has been verified at the site to depths of at least 15 feet. Sediments in the adjacent tributary to Harrison

Bayou also are contaminated with explosive compounds. No explosives have been detected in groundwater downgradient of the site, and none have been found in surface waters. The only contaminant exceeding TDH drinking water standards identified in the groundwater downgradient of the landfill is cadmium. Major contaminants and their maximum concentrations are presented in Table C-1. Reference: Longhorn Army Ammunition Plant RI/FS Workplan, Volume 1, February 1992.

1.6.5. (17) Burning Ground No. 2 /Flashing Area. This site is situated within a heavily wooded section of LHAAP. It consists of two 185 by 305 foot cleared areas separated by a gravel entrance road. The east area of the entrance road was once fenced, and the area west of the road is open. Harrison Bayou flows approximately 1200 feet northwest of the site.

Burning Ground No. 2 was used for burning bulk TNT, photo flash powder, and reject material when LHAAP was operated by Universal Match Corporation. Although it has been reported that bulk TNT was uncovered at the site in 1954, there is no documentation to support bulk TNT burial at the site. In 1959, all of the materials removed from the TNT Production Area (LHAAP 29) during razing were burned or flashed at this site. A 1958 aerial photograph shows a possible man-made pond on the western side of the road entering the site. This depression does not appear in 1954 or 1963 photos. There are no records of the pond's existence or the nature of its use over this 9 year period other than the 1958 photo. It is suspected that this was a burn pit or trenching operation. The site was used until 1980 as a flashing area to decontaminate recoverable metal by products. Burning trenches were located around the inside perimeter of the fenced area. As each trench filled with ash, the trench was covered and a new trench was dug. The waste residues were reportedly removed in 1984 and the site was allowed to revegetate. The site is presently inactive.

Soils at the location of the suspected pond have been identified as being contaminated with explosives, metals, and trace amounts of volatile organic compounds to a depth of at least 5 feet, the maximum sampling depth. Although a

monitoring well exists downgradient of the previously fenced flashing area, it is inconclusive whether groundwater has been impacted. It is possible that explosive residues and other contaminants may be present in the surface soils of old burn trenches that have not been investigated. Some of the significant contaminant maximum concentrations found at the site are presented in Table C-1.
Reference: Longhorn Army Ammunition Plant RI/FS Workplan, Volume 1, February 1992

1.6.6. (18 & 24) Burning Ground No. 3 & Unlined Evaporations Pond/Rocket Motor Washout Lagoon. Burning Ground No. 3 is a fenced 34.5 acre secured area currently used for the disposal of explosives and explosive-contaminated wastes through open burning. It is a cleared area within a heavily wooded section of LHAAP. The UEP, now closed and capped, is located in the northern corner of Burning Ground No. 3. Harrison Bayou flows within 1,000 feet of the western edge and within 500 feet of the northern edge of the burning grounds site.

Burning Ground No. 3 has been in operation since 1955. The area has been used for the treatment, storage, and disposal of solid and liquid explosive, pyrotechnic, and combustible solvent wastes by open burning, incineration, evaporation, and burial. Historical waste management units include open burning pits, an unlined evaporation pond (UEP), stockpiles of solvent soaked sawdust, and suspected waste burial pits. The UEP was constructed at the burning grounds in 1963 as a holding pond to store explosive wastes resulting from the washout of rocket motor casings, which was performed at the northern corner of the pond. In 1973, the pond also began receiving wash water containing solvent residues and solids collected from LHAAP operations involving pyrotechnic material preparation and mixing. Sawdust soaked with methylene chloride and other solvents that were used to clean and scour mixers used for mixing illuminants were stockpiled along the southern berm of the pond as well as burned in trenches in the western portion of the burning ground. An air curtain destructor (ACD) was built in 1979 in the western corner of the burning grounds

for the purpose of disposing of explosive and explosive-contaminated wastes by burning. Use of burn pits and trenches was reportedly discontinued in 1984. Use of the UEP was discontinued in 1984 when it was discovered that the pond was contaminating groundwater beneath the site. The UEP was closed as a RCRA interim status surface impoundment in 1986 by removing all waste and capping the impoundment. As part of the INF Treaty activities being conducted at LHAAP, a burn cage was added in 1989 for the open burning of Pershing II missile motors. Current operations include disposal of explosive and explosive-contaminated wastes by burning in the ACD, three open burning cages, and two open burning pans, as well as a burn cage for Pershing II motor elimination.

A summary of the major contaminants detected in groundwater and their maximum concentrations is provided in Table C-1. Contaminants found in shallow soils include tetryl (26.6 ug/g), TNT (5.7 ug/g), and reportedly high concentrations of unspecified volatile compounds.

Reference: Longhorn Army Ammunition Plant RI/FS Workplan, Volume 1, February 1992.

1.6.7. (29) Former TNT Production Area. The Former TNT Production Area is an 85-acre site located in the west central portion of LHAAP. With the exception of the former Bulk Toluene Storage Area, the site is bounded by Avenue E on the southwest, 1st Street on the northwest, 18th Street on the southeast and Avenue D on the northeast. The Former Bulk Toluene Storage Area, once a part of the TNT production area, is a 500 by 500 foot area located across Avenue D from the production area. It is a wooded area bounded by 33rd Street on the north and Avenue D on the west.

The Former TNT Production Area operated from April 1943 until August 1945 as a six line plant with a supporting acid plant which produced over 180 million kg of TNT. All six production lines, lines A through F, operated throughout this period with line F used as a reserve line for production when other lines were inactive. Redwater from the wash houses associated with each of these lines flowed via underground wood stave pipelines to a pumphouse located on the

northern end of the site adjacent to 16th Street, and then on to the TNT Waste Disposal Plant. Cooling water (blue water) drain lines from the former production lines flow to the northeast and empty into an open ditch alongside 16th Street approximately 550 feet from Avenue D. A toluene bulk storage facility, servicing the TNT production operation, was located across Avenue D from the production area. The TNT production plant was not operated after World War II and was razed, except for foundations, in 1959. There are presently no industrial activities conducted in these two areas.

The site contains high levels of TNT in the surface soil. Explosives were also found in sediments and surface water drainage from the production area site. The abandoned Bulk Toluene Storage Area has not been investigated. Explosives have been identified in soils down to at least 42 inches at random locations across the production area site. Pieces of crystallized DNT have been found in the abandoned cooling water drain line and where the line discharges into an open ditch. Two locations have been identified where sediments are contaminated with 2,4,6-TNT. One of these locations also had surface water contaminated with low levels of various explosive compounds. Groundwater has apparently not been impacted by soil contamination at the production area site. It is not known if contamination from the bulk storage of toluene at the storage area exists. Major contaminants and their maximum concentrations are provided in Table C-1.

Reference: Longhorn Army Ammunition Plant RI/FS Workplan, Volume 1, February, 1992.

1.6.8. <u>(12) Active Landfill</u>. The Active Landfill is located in the central portion of LHAAP. The center of the site is about 1,700 feet east-northeast of the intersection of Avenue P and Avenue Q. The entrance to the site's graveled access road is on Avenue Q about 0.2 mile east of Avenue P.

Aerial photography taken in 1954 reveals the construction of a diversion ditch between Central Creek and one of its principal tributaries which collects surface runoff from the southern part of the Magazine Area. The apparent

purpose of the ditch was to divert flow in the area where a railroad crossed the tributary system, eliminating the need for a bridge. The diversion ditch remained functional until 1963 when aerial photography shows waste material disposed in the ditch system. 1970 photographs show that enough waste material had been disposed to block the flow of the system, but the site appeared to be inactive. Sometime between 1970 and 1978, the site was reactivated for waste disposal. By 1978 the entire ditch system had been filled with waste material and an adjacent undisturbed hillside had also been used for disposal. Since 1978, the site has been in continuous use for disposal of industrial solid wastes generated at LHAAP. An area southeast of the original ditch system has been cleared and is now used for the disposal of non-hazardous combustible and non-combustible wastes. The types of waste disposed of at this site since 1963 are largely unknown. It is possible that the Active Landfill site has been used for the disposal of similar wastes which were disposed of at the Old Landfill which include substandard TNT, barrels of chemicals, oils, paints, scrap iron, and wood.

The site contains elevated concentrations of metals in the soil and groundwater along with trace amounts of 1,3-DNB at one monitoring well location and volatile organics at three locations. Major contaminants and their maximum Reference: LHAAP RI/FS Workplan, Volume 1, February 1992.

1.6.9. <u>(32) Former TNT Disposal Plant</u>. The site is situated in the west central portion of LHAAP and is located approximately 400 feet northwest of Avenue C and 600 feet southeast of 6th Street.

The Former TNT Waste Disposal Plant was constructed in 1942 to treat and dispose of wastewaters generated at the nearby Former TNT Production Area (LHAAP 29). The disposal plant was operated by Monsanto Chemical Co. from April 1943 until August 1945 and disposed of wastewaters resulting from the production of over 397 million pounds of 2,4,6-TNT. The plant was not operated after August 1945. In 1959, most of the buildings and tanks used in the disposal process were removed, leaving only the concrete foundations, access roads, underground

utilities, and constructed surface water drainage. The disposal process involved neutralization and storage of the waste until it could be burned by incineration.

Explosive compounds were not detected at the site with the exception of 7.6 ug/l of 2,4,6-TNT found in surface water adjacent to the former Neutralized Wastes Storage Tank. Concentrations of aluminum, chromium, lead, manganese, and nickel are also present in surface water above local background levels. Major contaminants and their maximum concentrations are provided in Table C-1. Reference: Longhorn Army Ammunition Plant RI/FS Workplan, Volume 1, February 1992.

1.6.10. (1) Inert Burning Grounds. This site is situated in the extreme northwestern portion of LHAAP. The center of the site is at least 2,000 feet from the LHAAP boundary and approximately 400 feet west of the intersection of Avenue P and 32nd Street.

The Inert Burning Grounds was originally used during World War II by Monsanto Chemical Company for burning trash, ashes, scrap lumber, and waste from burned 2,4,6-TNT. Bulk 2,4,6-TNT may also have been burned at the site. The site was not used between August 1945 and February 1952 when LHAAP was is a standby status. Universal Match Corporation later used the site to burn wastes, including photo flash powder, for a few years during the 1950's until most burning operations were transferred to the Burning Ground No. 2/Flash Area (LHAAP 17). Intermittent, small-scale burning may have continued into the early 1960s. Burn residues were most likely not removed. It is also suspected that some wastes may have been dumped without burning and were subsequently covered by or mixed with fill material.

Previous investigations indicate elevated levels of metals in the soil and groundwater. Explosives nitrobenzene and 1,3,5-TNB exceed background levels in the groundwater at concentrations of 1.82 and 9.74 ug/l respectively. Major contaminants and their maximum concentrations are provided in Table C-1. Reference: Longhorn Army Ammunition Plant RI/FS Workplan, Volume 1,

February 1992.

1.6.11. (xx) Ground Signal Test Area. This site is located in the southeastern portion of LHAAP. Access to the site is provided by an asphalt gravel road that intersects Long Point Road just east of its intersection with Avenue Q.

The Ground Signal Test Area is currently used for aerial and on-ground testing of various pyrotechnic, illuminant, and signal devices manufactured at LHAAP. Since late in 1988, the site has also been used for the burn-out of Pershing missile rocket motors destroyed in accordance with the INF Treaty.

The site has been used intermittently since April 1963 for aerial and on-ground testing and destruction of a variety of devices, including red phosphorus smoke wedges, infrared flares, illuminating 60 and 81 mm mortar shells, illuminating 40 to 155 mm cartridges, button bombs, and various types of explosive simulators. Prior to 1963 the site was used intermittently for testing and burn-out of rocket motors from Nike-Hercules, Pershing, and Sargent missiles. In 1970 a rocket motor was inadvertently destroyed when it exploded in the center of the site. Debris from the explosion was placed in the crater and backfilled.

Previous investigations indicate elevated levels of metals in the soil and groundwater. No detectable levels of explosives or organics where found at the site. Major contaminants and their maximum concentrations are provided in Table C-1.

Reference: Longhorn Army Ammunition Plant RI/FS Workplan, Volume 1, February 1992.

1.6.12. (27) South Test Area. This site is located in the south central portion of LHAAP. The earthen test pad is approximately 2,000 feet southeast of Avenue P and the Magazine Area. A deteriorated asphalt and gravel road runs from the entrance to the Test Pad. The concrete bunkers and Observation Building are situated alongside the road about halfway between the

entrance and the Test Pad. A circular, 50 foot wide fire lane with a 2,000 foot diameter is centered at the Test Pad. The fire lane is now overgrown with brush and small trees.

The South Test Area was constructed in 1954 and was used by Universal Match Corporation for testing photo flash bombs that they produced at LHAAP until about 1956. The bombs were tested by exploding them in the air over an elevated, semi-elliptical earthen Test Pad with the floodplain of Harrison Bayou. During the late 1950s, illuminating devices were demilitarized within pits excavated in the vicinity of the Test Pad. During the early 1960s, leaking 3 to 4 pound canisters of white phosphorus were possibly demilitarized in the vicinity of the Test Pad. In the early 1980s photo flash cartridges were demilitarized in an area just east of the Observation Building.

Aerial photographs taken in 1954 when the area was under construction indicate an area of apparent vegetation distress. This area may have been used for toxic waste disposal during early stages in construction. The vegetation distress has persisted for over 37 years.

Previous investigations indicate elevated levels of metals in the soil along with low levels of 2,4,6-TNT. Elevated levels of metals are also present in the groundwater along with trace amounts of semivolatile organic compounds. Major contaminants and their maximum concentrations are provided in Table C-1. Reference: Longhorn Army Ammunition Plant RI/FS Workplan, Volume 1, February 1992.

1.7. Investigation Summary. This IDW Management Plan pertains to the following investigations:

- Soil sampling from bore holes at 76 locations
- Soil sampling from monitoring well bore holes at 21 locations
- Groundwater sampling from the 68 soil borings
- Groundwater sampling from the 21 new wells and the 56 existing monitoring wells for a total of 77 samples
- Surface water sampling from 63 locations

- Sediment sampling from 63 locations
- Shallow soil/waste sampling from 18 locations

Detailed information about the investigations is provided in Volume 1 and Volume 2, Chemical Data Acquisition Plan (CDAP38) of which this plan is an Appendix. Information about the investigations on an individual site basis is provided in Table C-2.

1.8. Methods of Waste Quantity Minimization. There are many ways in which waste generation will be kept to a minimum. During the investigations personnel are directed to:

- Avoid walking through areas of obvious or known contamination
- Avoid handling or touching materials directly
- Take care to limit the amount of contamination that comes in contact with equipment
- If contaminated tools are to be placed on non-contaminated equipment for transport use plastic to keep non-contaminated surfaces clean to limit decontamination waste

Table C-2
SITE SUMMARY SHEET
LONGHORN RI WASTE MANAGEMENT INFORMATION

LHAAP UNIT NO.	SITE NAME	INVESTIGATIONS						ESTIMATED WASTE QUANTITIES			
		Monitoring wells (depth)	Borings (depth)	samples				SOIL CUTTINGS (cf)	PURGE WATER (gal)	DECON. FLUIDS (gal)	PPE & DISP. EQUIPMENT (20 gal bags)
				Sediment	Soil	Groundwater	Surface water				
11	Suspected TNT Burial Site at Ave.'s P & Q	0	6 (18')	2	30	6 [6(SB) + 0(mw)]	2	25.92	0	363	26
13	Suspected TNT Burial Site Between Old & Active Landfills/Acid Dump	1 (45')	4 (27')	0	30	5 [4(SB) + 1(MW)]	0	49.77	658.24	323.25	23
14	Area 54 Burial Ground	1 (45')	3 (26')	0	18	3 [2(SB) + 1(MW)]	0	42.57	691.16	241.75	15
16	Old Landfill	5 (40') 6 (+40')	3 (150') 4 (21')	5	75	16 [4(SB) + 12(MW)]	5	361.36	11,922.03	1,208.5	69
17	Burning Ground No. 2 /Flashing Area	1 (25')	7 (7')	3	24	10 [7(SB) + 3(MW)]	3	25.01	1,316.48	445.5	28
18 & 24	Burning Ground No. 3 & Unlined Evaporations Pond/ Rocket Motor Washout Lagoon	0	0	8	0	39 [0(SB) + 39(MW)]	8	0	16,365.49	219	28
29	Former TNT Production Area	0	15 (22')	17	75	21 [15(SB) + 6(MW)]	17	79.2	1,777.25	988.5	80
12	Active Landfill	7 (40')	0	3	35	9 [0(SB) + 9(MW)]	3	148.4	6,450.74	474	32

000599

Table C-2
SITE SUMMARY SHEET
LONGHORN RI WASTE MANAGEMENT INFORMATION

LHAAP UNIT NO.	SITE NAME	INVESTIGATIONS						ESTIMATED WASTE QUANTITIES			
		Monitoring wells (depth)	Boringe (depth)	samples				SOIL CUTTINGS (cf)	PURGE WATER (gal)	DECON. FLUIDS (gal)	PPE & DISP. EQUIPMENT (20 gal bags)
				Sediment	Soil	Groundwater	Surface water				
32	Former TNT Disposal Plant	0	5 (5') 8 (12')	7	39	9 [8(SB) + 1(MW)]	7	29.04	329.12	694.25	44
1	Inert Burning Grounds	0	8 (7')	6	24	9 [8(SB) + 1(MW)]	6	13.44	164.56	445.0	31
xx	Ground Signal Test Area	0	3 (5') 4 (22')	7	29	6 [4(SB) + 2(MW)]	7	24.72	82.28	414.75	32
27	South Test Area	0	4 (1') 9 (10')	4	30	12 [10(SB) + 2(MW)]	4	22.56	362.03	675.5	38
		21	83	61	409	68 (SB) 77 (MW) 145 TOTAL	61	821.99	40,119.38	6,493.0	446

006998

2. Waste Description.

2.1. Types and Estimated Quantities of IDW. Table C-2 provides a listing of the estimated waste quantities for each site and the sections below provide a description and total amount for each type.

2.1.1. Drill Cuttings. The drill cutting will consists of soil removed from borings and monitoring well installations. All of the bore holes will be drilled at least 2 feet into the saturated groundwater zone. To prevent spread of contamination the bore holes will be grouted after soil and bore hole water sampling. All borings and monitoring wells will be drilled in the AOC's with the exception of the background investigations that by nature is not expected to be contaminated. No borings or monitoring wells are planned for outside the facility. A total of 30.44 cubic yards of drill cuttings are expected to be generated.

2.1.2. Purge and Development Water. The new monitoring wells will be purged of at least 5 volumes of water during development and an additional five volumes of water prior to sampling new and existing monitoring wells as described in the CDAP, section 4.5. The soil borings will not be purged for water sampling. This water will be taken directly from the saturated groundwater zone. A total of 40,120 gallons of purge and development water is expected to be generated.

2.1.3. Decontamination Fluids. The drilling equipment will be decontaminated between each hole as described on page 23 of the CDAP.

Purging equipment will be scrubbed and rinsed with Type II reagent grade water each it is used.

Sampling equipment will be washed with a non-phosphate detergent, tap water, distilled water, and hexane, in that order, allowed to air dry, and sealed back in clean containers prior to use.

Personnel decontamination will be minimal with the use of disposable suits, gloves, and boot covers. A boot wash will be utilized, if chemically resistent boots (rather than covers) are used. If PPE Level C or higher is implemented additional decontamination washes will be utilized.

A total of 6,493 gallons of purge and development water is expected to be generated.

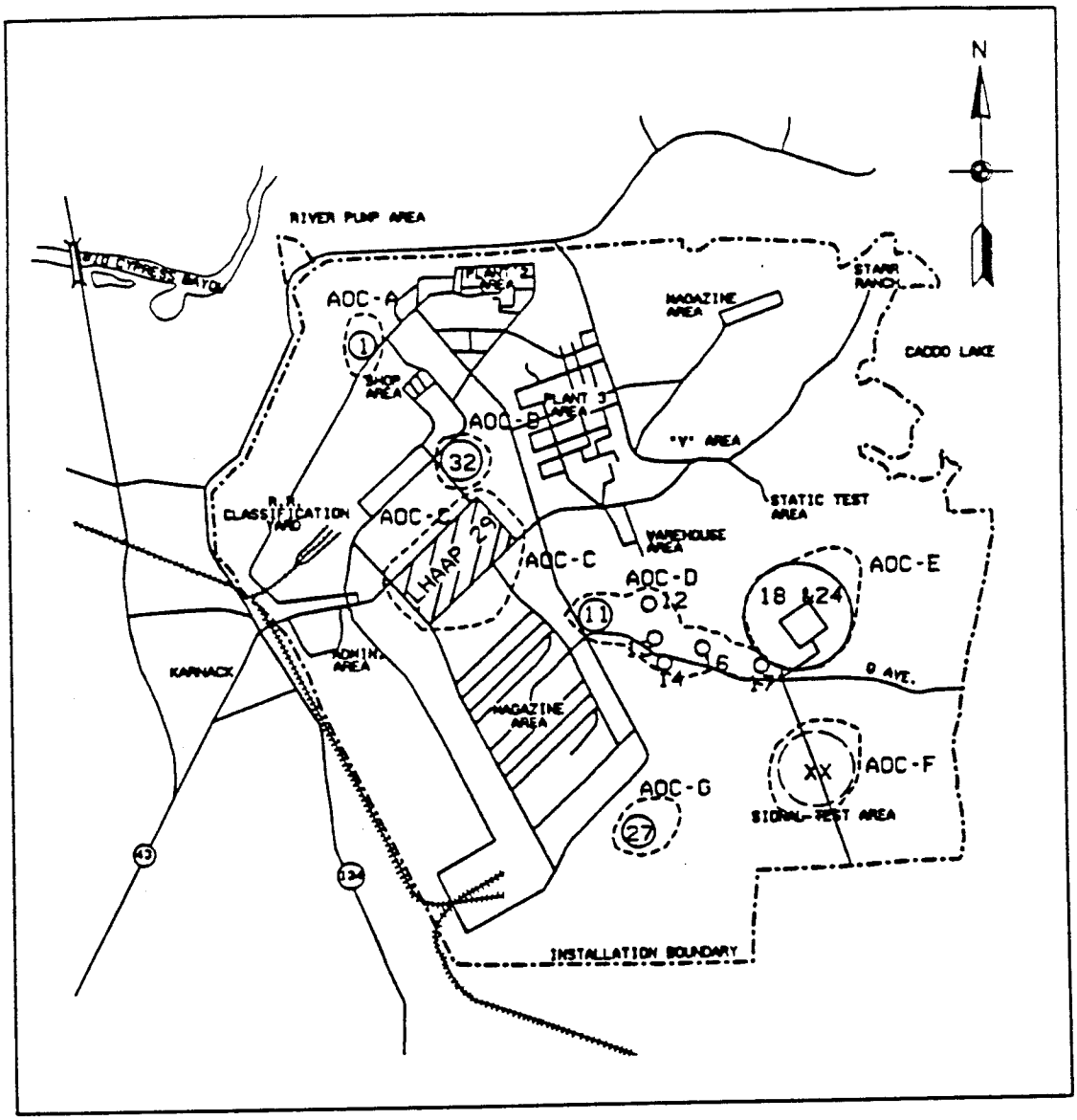
2.1.4. Personnel Protective Equipment (PPE). A modified Level D PPE will initially apply for all intrusive investigations. This is described in detail in the Site Safety and Health Plan in Volume III of this workplan. Disposable items will include the following items:

- Tyvek full body coveralls
- Chemically resistant surgical type gloves (inner)
- Cotton work gloves (outer)
- Chemical resistent boot covers
- Respiratory dual cartridge filters for air purifying and a combination organic vapor/HEPA filter (respirators will be added if needed based upon the air monitoring action levels)

A total of 446 20 gallon plastic bags are expected to be generated.

2.2. IDW Applicable of Relevant and Appropriate Requirements (ARARs). A comprehensive list of ARARs is presented in Section 7 of the Workplan.

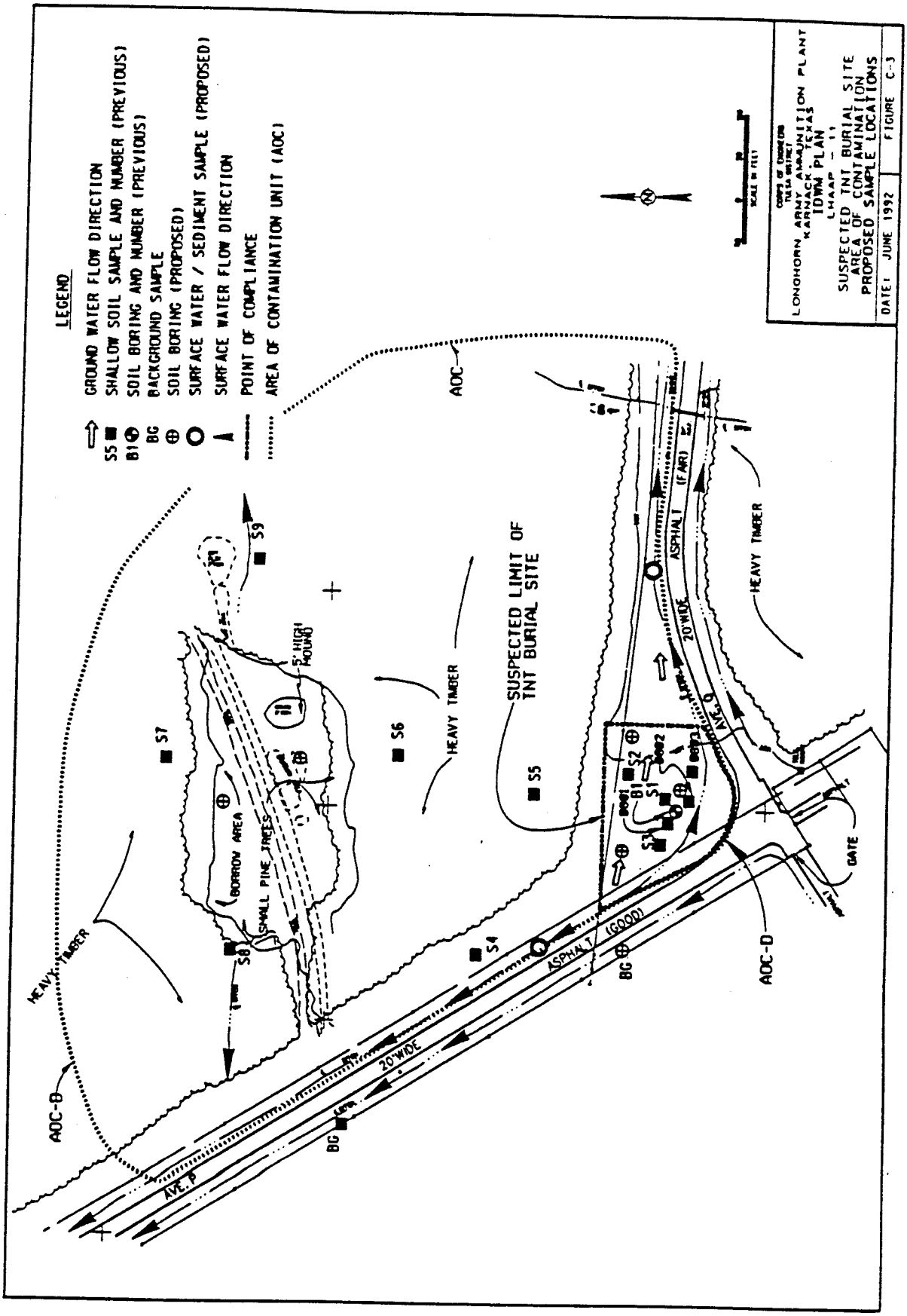
2.3. Methods for Characterizing RCRA Hazardous/Non-hazardous IDW. The primary method for characterizing the IDW has been review of historical use of the sites and past investigation results. For LHAAP 13 that has no past investigation the assumption was made that the waste would be similar to LHAAP 11 and 14. Past experience and professional judgement was also utilized. All liquid waste will be tested for TCLP parameters to determine if it is characteristically hazardous.

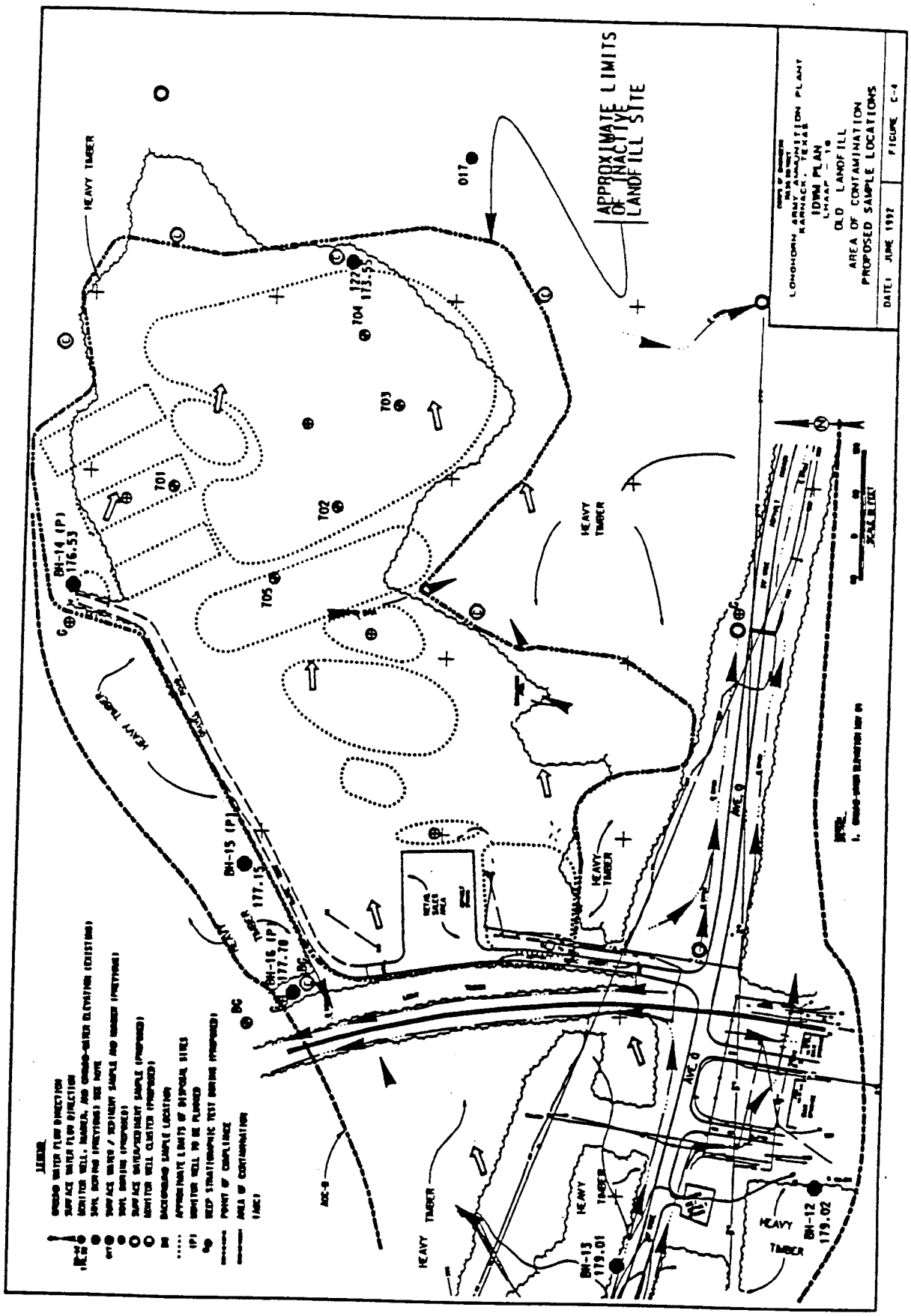


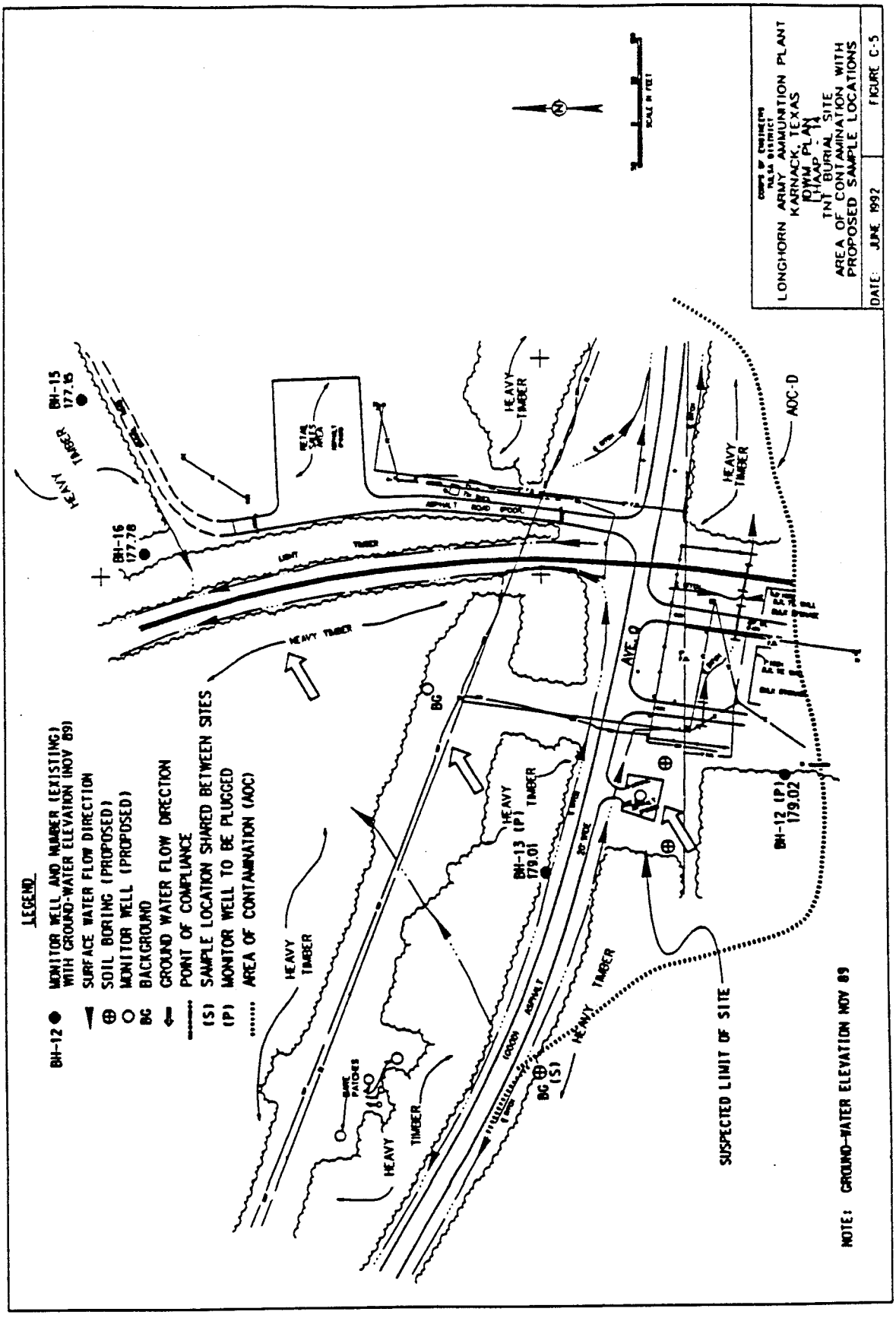
0 2000 4000
APPROX. SCALE IN FEET

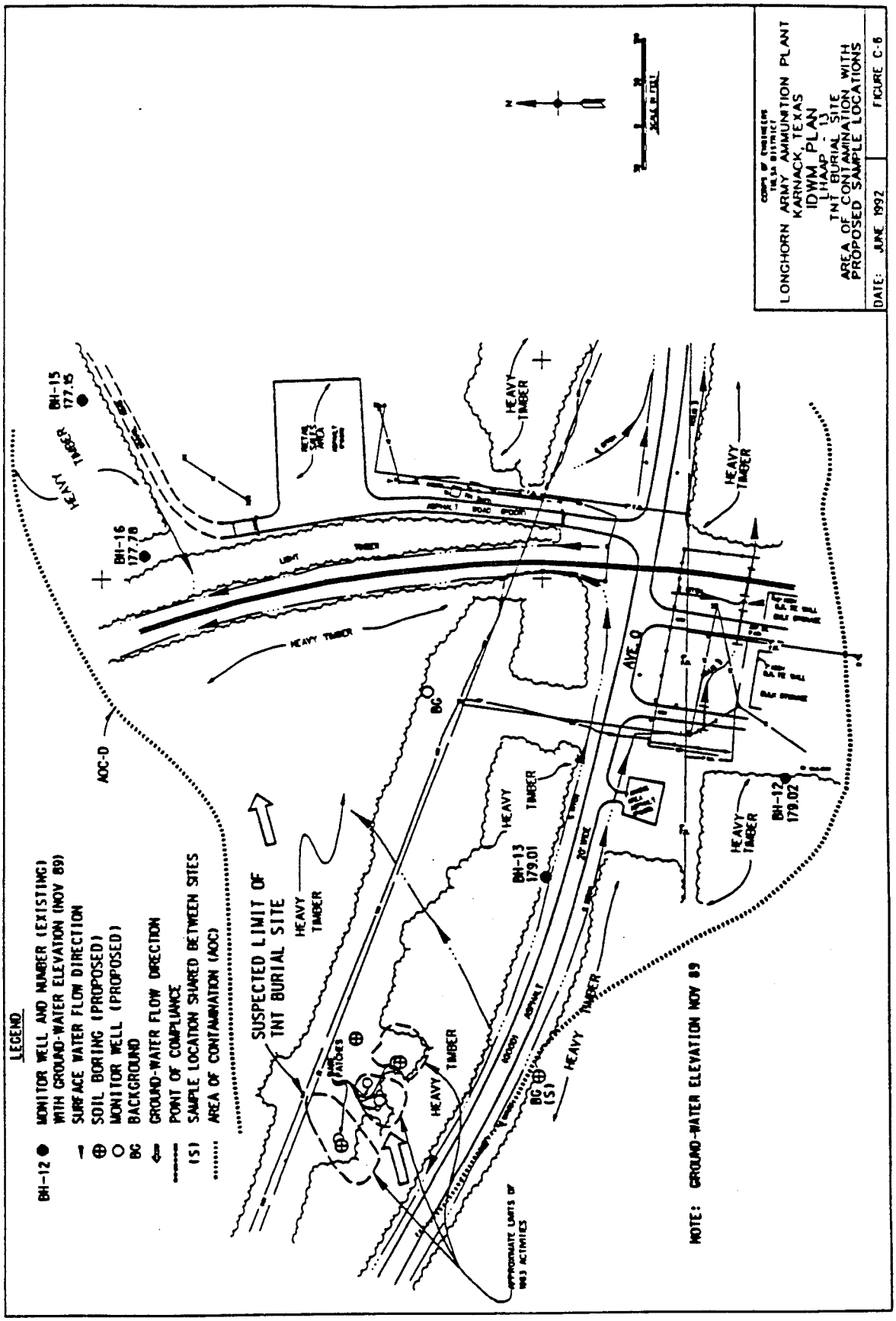
LONGHORN ARMY AMMUNITION PLANT
RI/FS WORK PLAN
LOCATION MAP FOR AREA OF CONTAMINATION UNITS
WITH LHAAP CERCLA SITES
IDW MANAGEMENT PLAN

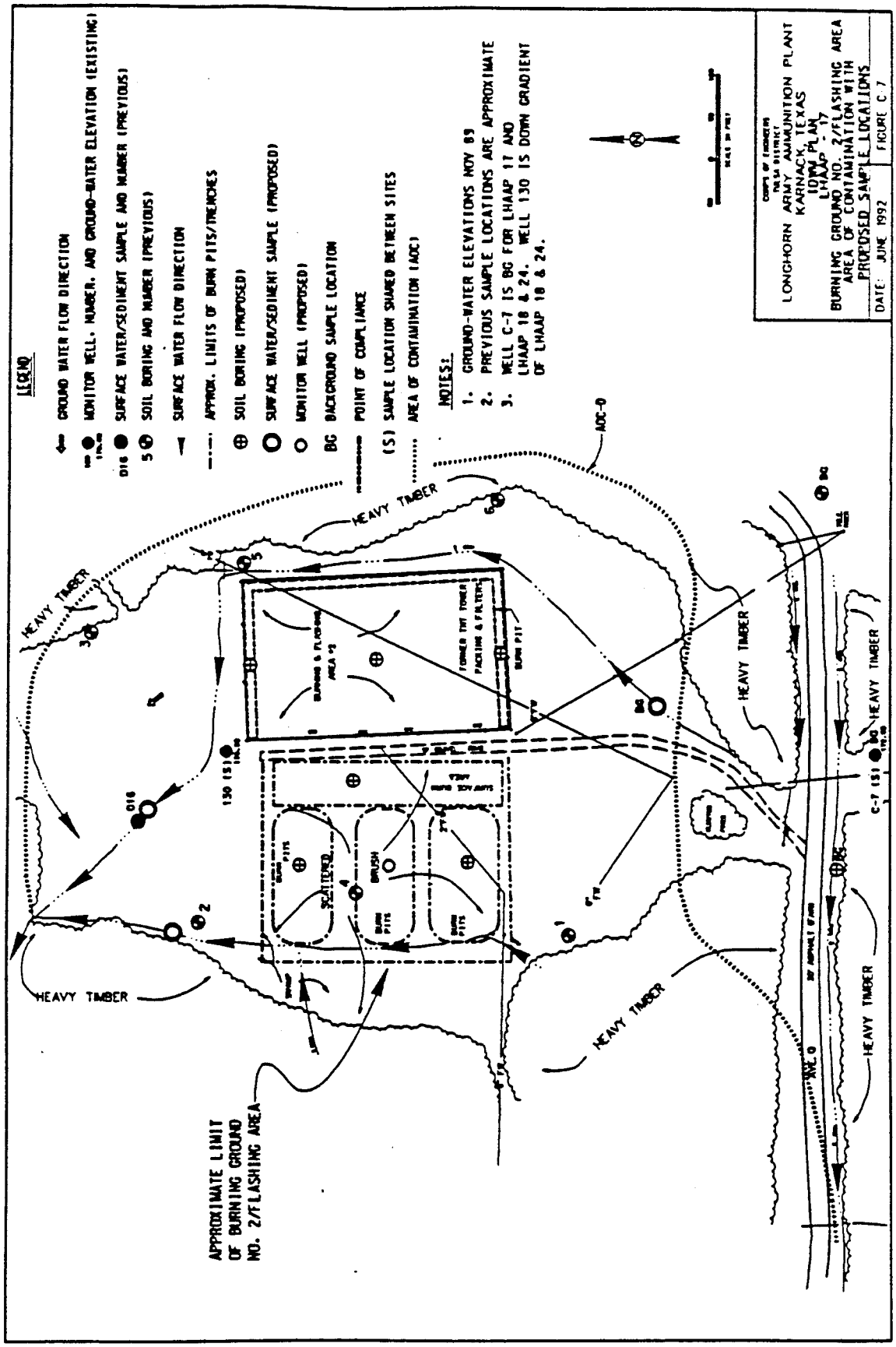
FIGURE C-2

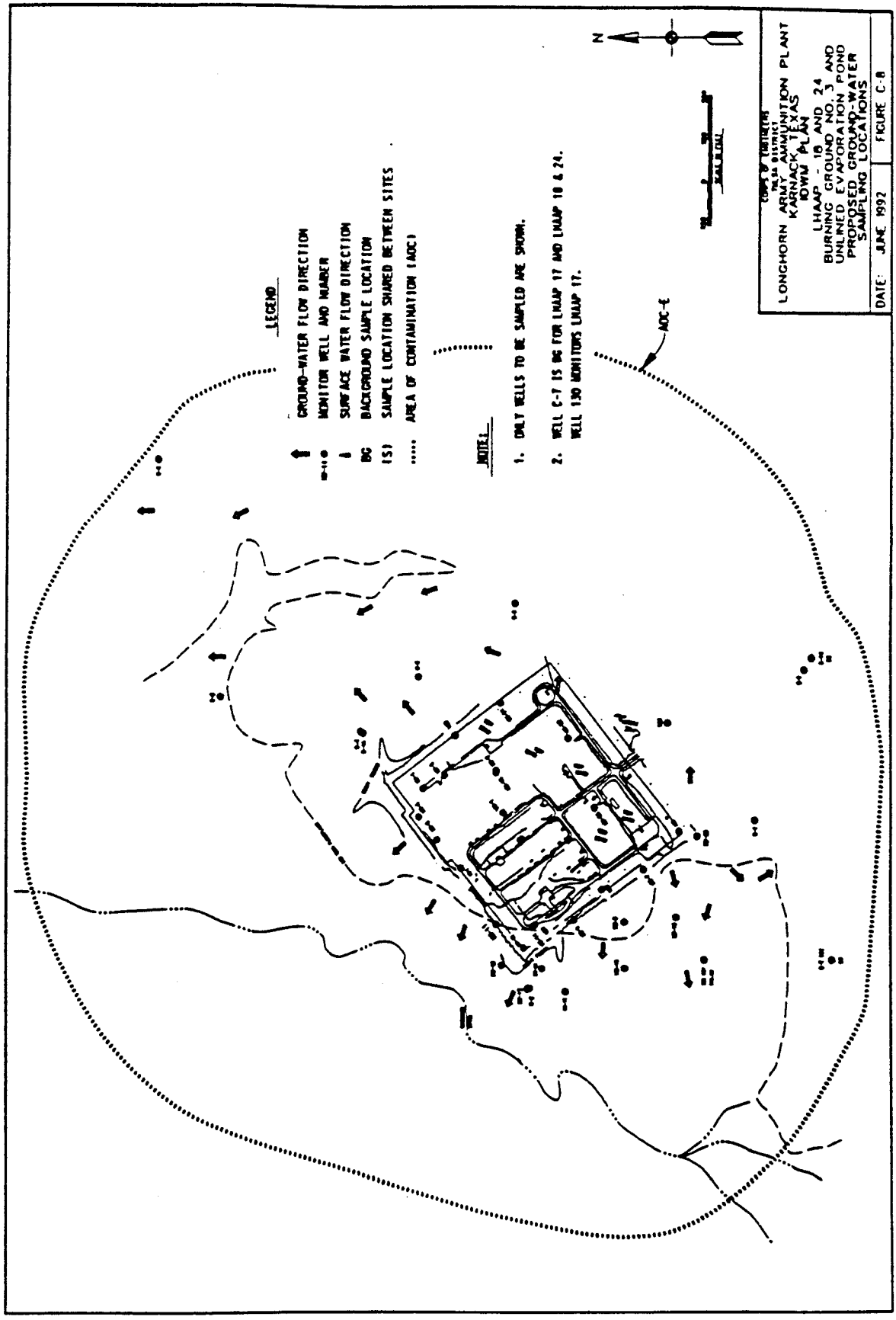

LEGEND
GROUND WATER FLOW DIRECTION
SHALLOW SOIL SAMPLE AND NUMBER (PREVIOUS)
SOIL BORING AND NUMBER (PREVIOUS)
BACKGROUND SAMPLE
SOIL BORING (PROPOSED)
SURFACE WATER / SEDIMENT SAMPLE (PROPOSED)
SURFACE WATER FLOW DIRECTION
POINT OF COMPLIANCE
AREA OF CONTAMINATION UNIT (AOC)
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
IDW PLAN
LHAAP - 11
SUSPECTED TNT BURIAL SITE
AREA OF CONTAMINATION
PROPOSED SAMPLE LOCATIONS
DATE: JUNE 1992
FIGURE C-3
SUSPECTED LIMIT OF TNT BURIAL SITE
AOC
AOC-B
AOC-D
HEAVY TIMBER
BORROW AREA
SMALL PINE TREES
5' HIGH MOUND
ASPHALT (FAIR)
ASPHALT (GOOD)
20' WIDE
AVE. P
AVE. Q
GATE
BG
S1
S2
S3
S4
S5
S6
S7
S8
S9
B1
B2

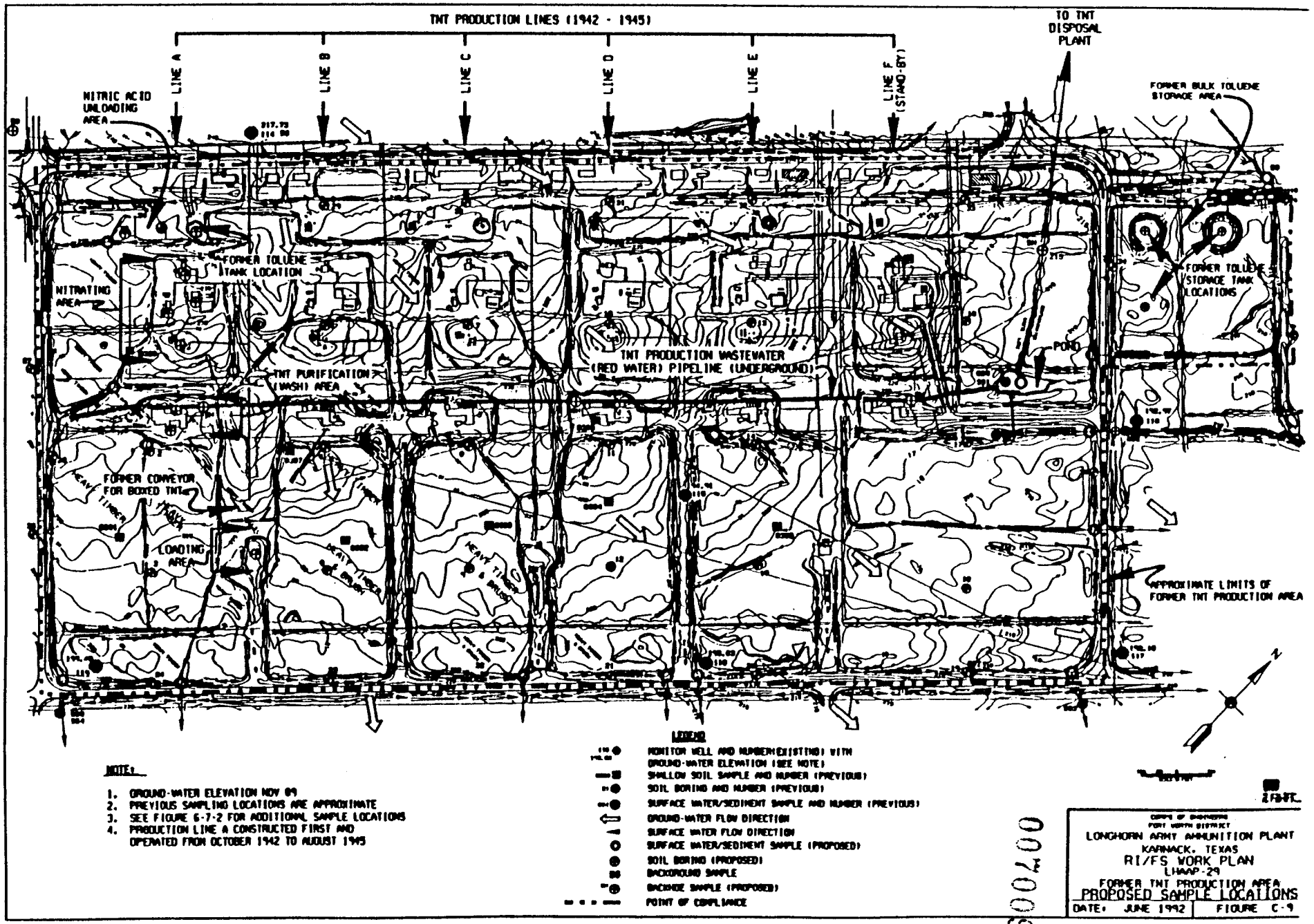

APPROXIMATE LIMITS OF INACTIVE LANDFILL SITE
HEAVY TIMBER
T01
T02
T03
T04
T05
017
BH-14 (P)
176.53
BH-15 (P)
177.15
BH-16 (P)
177.70
BH-13
179.01
BH-12
179.02
AVE. G
AVE. F
AVE. E
AVE. D
AVE. C
AVE. B
AVE. A
DC
SCALE IN FEET
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
IRPM PLAN
LHAAP - 16
OLD LANDFILL
AREA OF CONTAMINATION
PROPOSED SAMPLE LOCATIONS
DATE: JUNE 1992
FIGURE C-4

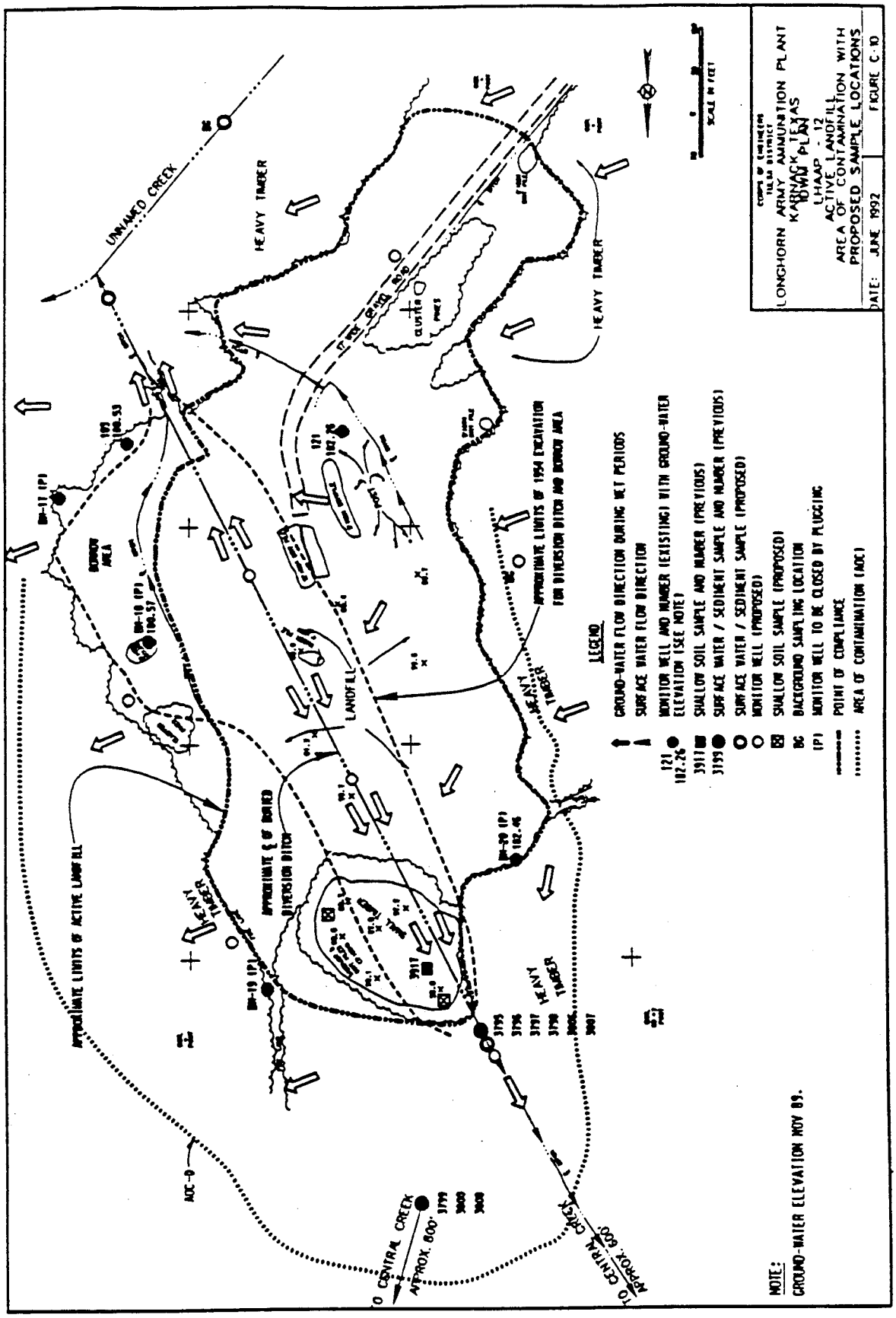

LEGEND
BH-12 ● MONITOR WELL AND NUMBER (EXISTING) WITH GROUND-WATER ELEVATION (NOV 89)
SURFACE WATER FLOW DIRECTION
⊕ SOIL BORING (PROPOSED)
○ MONITOR WELL (PROPOSED)
BG BACKGROUND
GROUND WATER FLOW DIRECTION
POINT OF COMPLIANCE
(S) SAMPLE LOCATION SHARED BETWEEN SITES
(P) MONITOR WELL TO BE PLUGGED
AREA OF CONTAMINATION (AOC)
BH-15 177.15
BH-16 177.78
BH-13 (P) 179.01
BH-12 (P) 179.02
BG
BG (S)
AOC-D
AVE. Q
HEAVY TIMBER
SUSPECTED LIMIT OF SITE
NOTE: GROUND-WATER ELEVATION NOV 89
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
TOWN PLAN
TNT BURIAL SITE
AREA OF CONTAMINATION WITH
PROPOSED SAMPLE LOCATIONS
DATE: JUNE 1992
FIGURE C-5

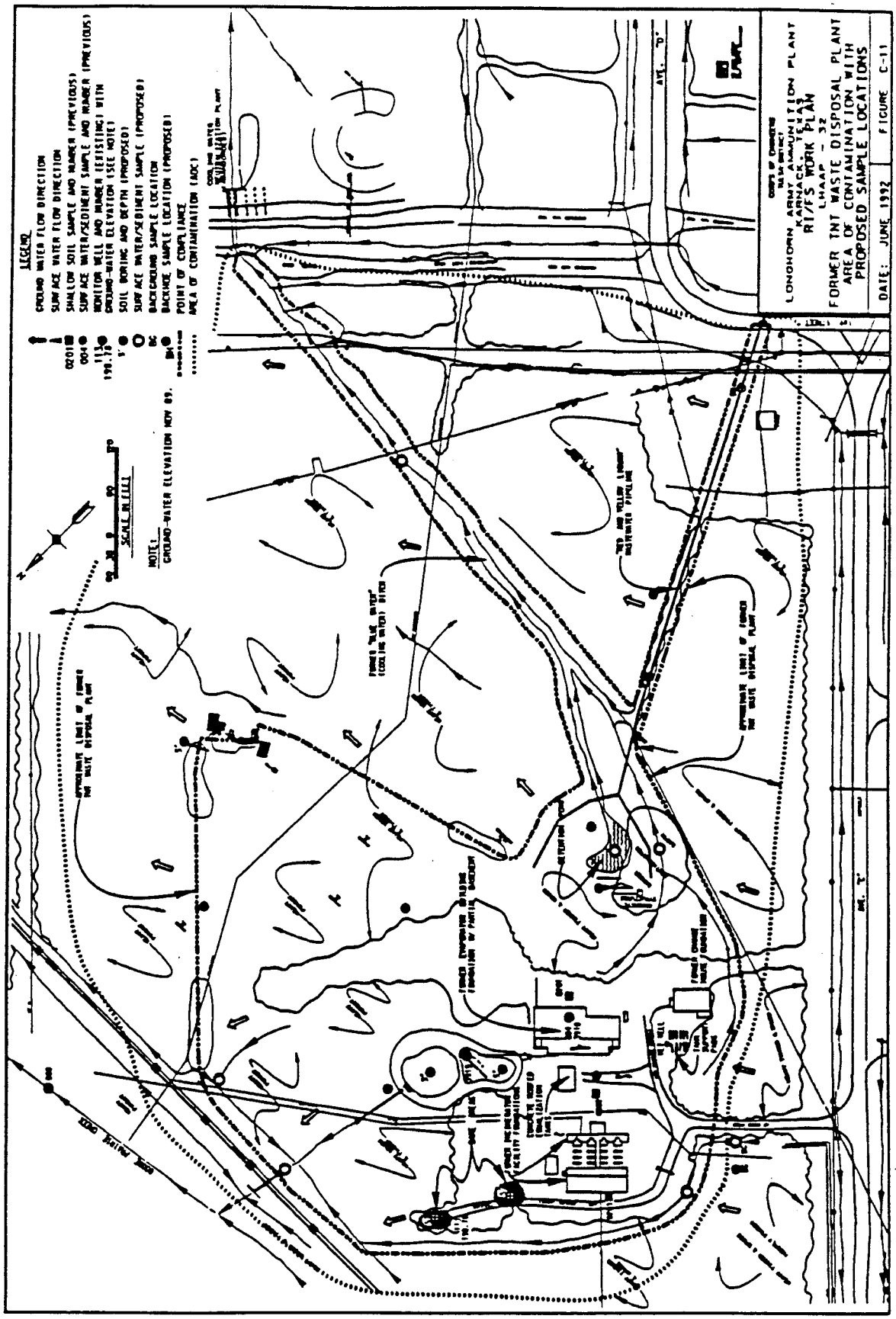

LEGEND
BH-12 ● MONITOR WELL AND NUMBER (EXISTING) WITH GROUND-WATER ELEVATION (NOV 89)
SURFACE WATER FLOW DIRECTION
⊕ SOIL BORING (PROPOSED)
○ MONITOR WELL (PROPOSED)
BG BACKGROUND
GROUND-WATER FLOW DIRECTION
POINT OF COMPLIANCE
(S) SAMPLE LOCATION SHARED BETWEEN SITES
AREA OF CONTAMINATION (AOC)
SUSPECTED LIMIT OF TNT BURIAL SITE
AOC-D
BH-15 177.15
BH-16 177.78
BH-13 179.01
BH-12 179.02
HEAVY TIMBER
BG
BG (S)
AVE. D
NOTE: GROUND-WATER ELEVATION NOV 89
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
IDWM PLAN
LHAAP 13
TNT BURIAL SITE
AREA OF CONTAMINATION WITH PROPOSED SAMPLE LOCATIONS
DATE: JUNE 1992
FIGURE C-6

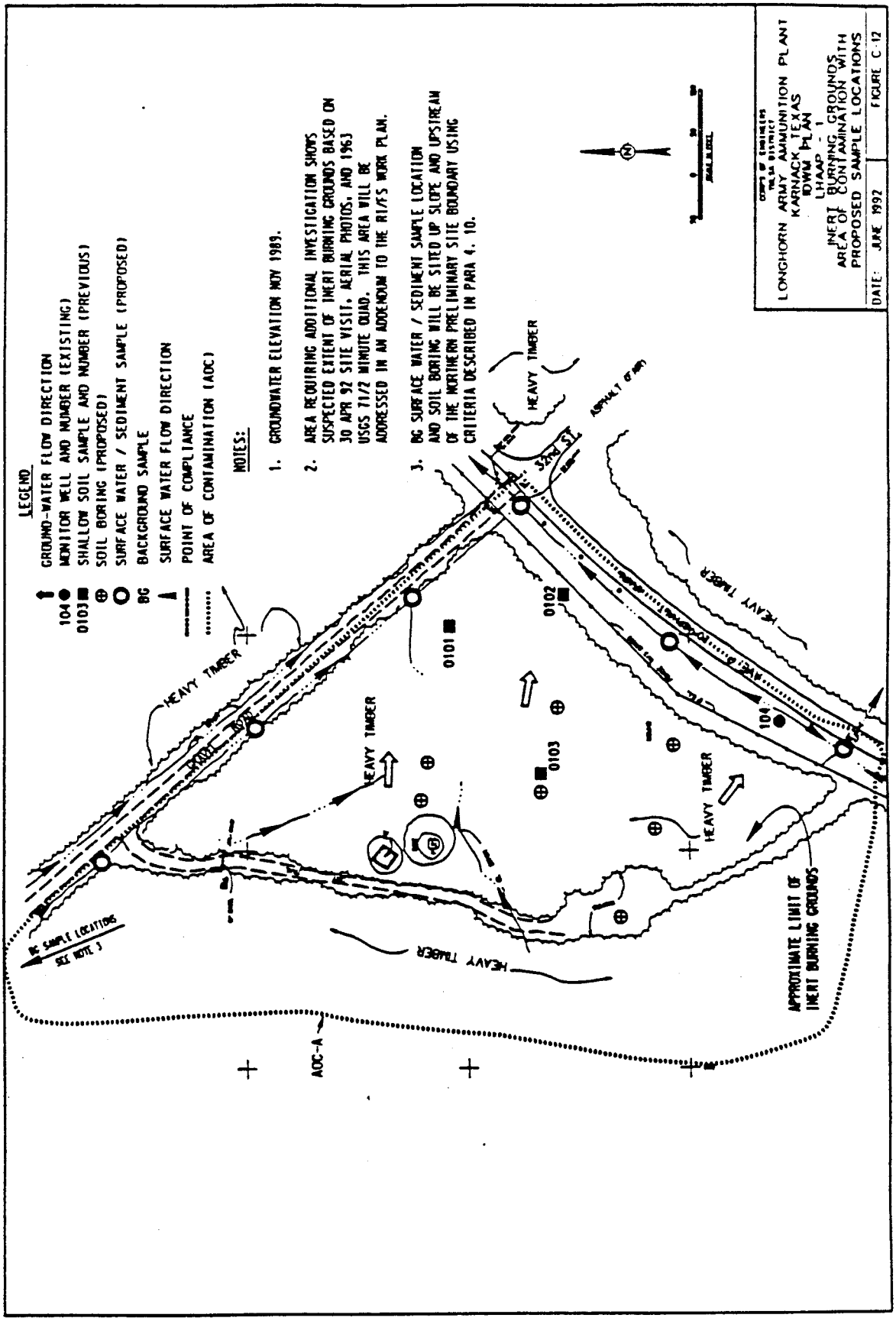

LEGEND
GROUND WATER FLOW DIRECTION
MONITOR WELL, NUMBER, AND GROUND-WATER ELEVATION (EXISTING)
SURFACE WATER/SEDIMENT SAMPLE AND NUMBER (PREVIOUS)
SOIL BORING AND NUMBER (PREVIOUS)
SURFACE WATER FLOW DIRECTION
APPROX. LIMITS OF BURN PITS/TRENCHES
SOIL BORING (PROPOSED)
SURFACE WATER/SEDIMENT SAMPLE (PROPOSED)
MONITOR WELL (PROPOSED)
BG BACKGROUND SAMPLE LOCATION
POINT OF COMPLIANCE
(S) SAMPLE LOCATION SHARED BETWEEN SITES
AREA OF CONTAMINATION (AOC)
NOTES:
1. GROUND-WATER ELEVATIONS NOV 89
2. PREVIOUS SAMPLE LOCATIONS ARE APPROXIMATE
3. WELL C-7 IS BG FOR LHAAP 17 AND LHAAP 18 & 24. WELL 130 IS DOWN GRADIENT OF LHAAP 18 & 24.
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
IDW PLAN
LHAAP - 17
BURNING GROUND NO. 2/FLASHING AREA
AREA OF CONTAMINATION WITH
PROPOSED SAMPLE LOCATIONS
DATE: JUNE 1992
FIGURE C-7
HEAVY TIMBER
APPROXIMATE LIMIT
OF BURNING GROUND
NO. 2/FLASHING AREA
AOC-0
C-7 (S)

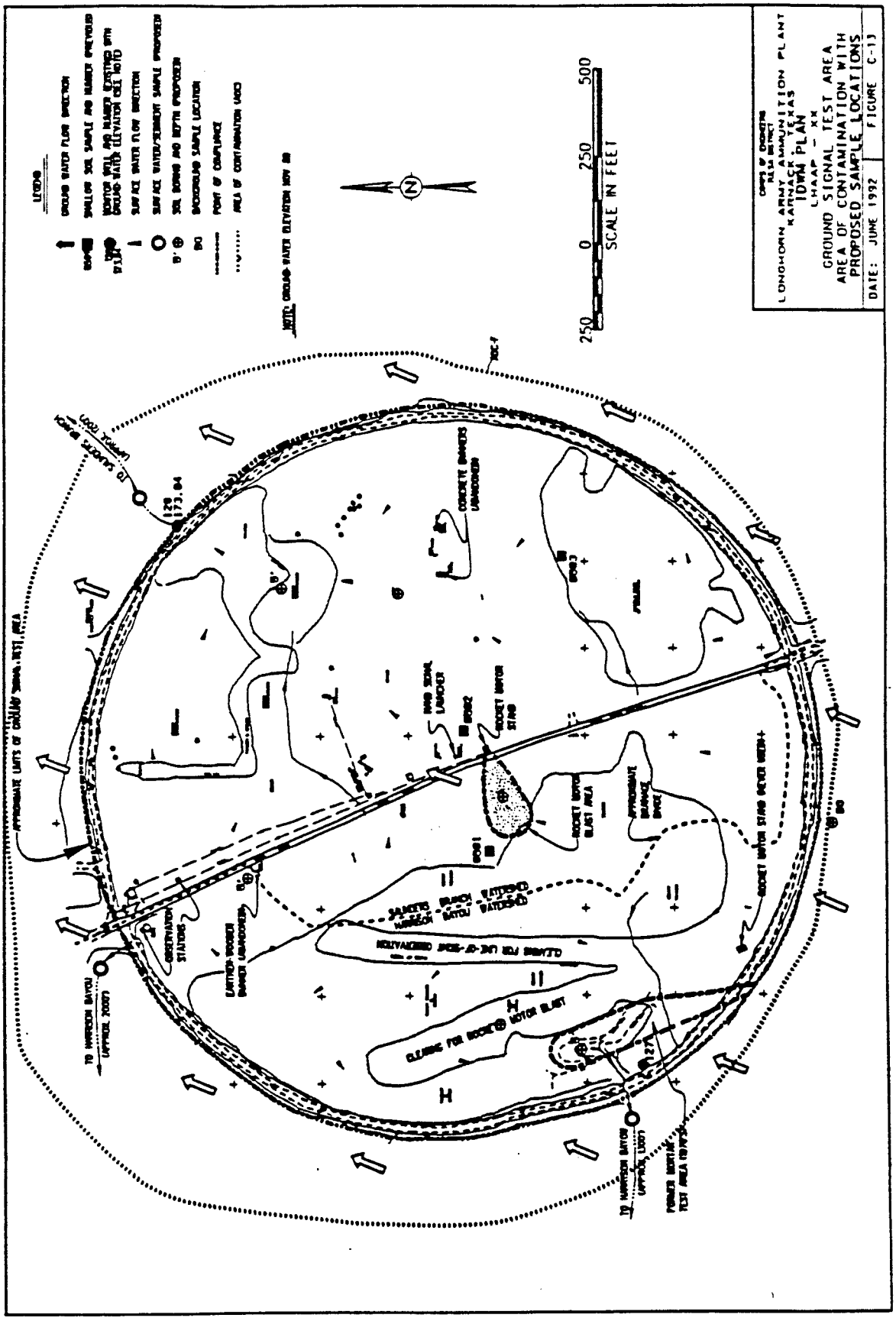

LEGEND
GROUND-WATER FLOW DIRECTION
MONITOR WELL AND NUMBER
SURFACE WATER FLOW DIRECTION
BG BACKGROUND SAMPLE LOCATION
(S) SAMPLE LOCATION SHARED BETWEEN SITES
AREA OF CONTAMINATION (AOC)
NOTES:
1. ONLY WELLS TO BE SAMPLED ARE SHOWN.
2. WELL C-7 IS BG FOR LHAAP 17 AND LHAAP 18 & 24.
WELL 130 MONITORS LHAAP 17.
AOC-E
N
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
LHAAP - 18 AND 24
BURNING GROUND NO. 3 AND
UNLINED EVAPORATION POND
PROPOSED GROUND-WATER
SAMPLING LOCATIONS
DATE: JUNE 1992
FIGURE C-8

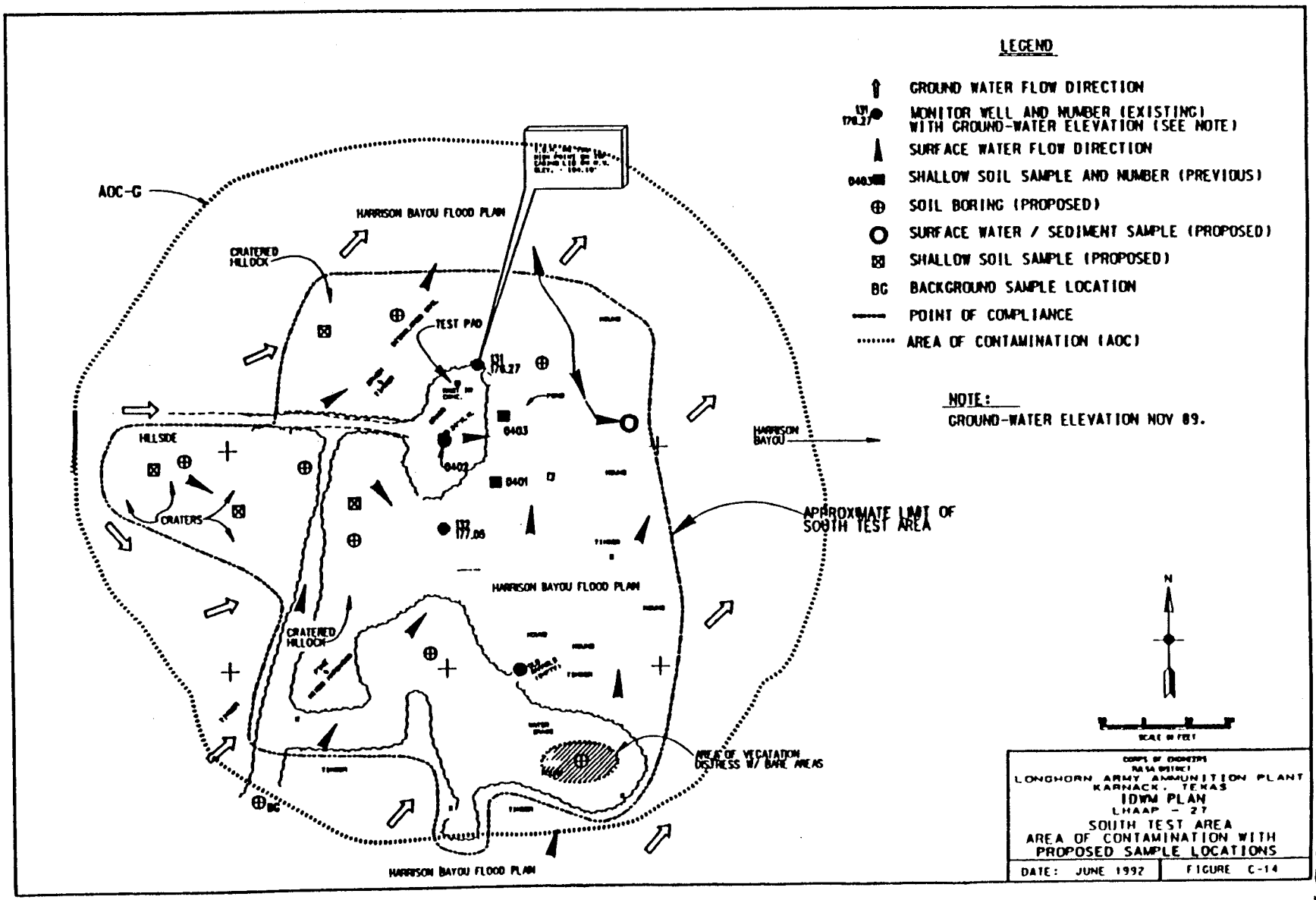

TNT PRODUCTION LINES (1942 - 1945)
LINE A
LINE B
LINE C
LINE D
LINE E
LINE F (STAND-BY)
TO TNT DISPOSAL PLANT
NITRIC ACID UNLOADING AREA
FORMER BULK TOLUENE STORAGE AREA
FORMER TOLUENE TANK LOCATION
NITRATING AREA
FORMER TOLUENE STORAGE TANK LOCATIONS
TNT PRODUCTION WASTEWATER (RED WATER) PIPELINE (UNDERGROUND)
POND
TNT PURIFICATION (WASH) AREA
FORMER CONVEYOR FOR BOXED TNT
LOADING AREA
APPROXIMATE LIMITS OF FORMER TNT PRODUCTION AREA
N
NOTE:
1. GROUND-WATER ELEVATION NOV 89
2. PREVIOUS SAMPLING LOCATIONS ARE APPROXIMATE
3. SEE FIGURE 6-7-2 FOR ADDITIONAL SAMPLE LOCATIONS
4. PRODUCTION LINE A CONSTRUCTED FIRST AND OPERATED FROM OCTOBER 1942 TO AUGUST 1945
LEGEND
MONITOR WELL AND NUMBER (EXISTING) WITH GROUND-WATER ELEVATION (SEE NOTE)
SHALLOW SOIL SAMPLE AND NUMBER (PREVIOUS)
SOIL BORING AND NUMBER (PREVIOUS)
SURFACE WATER/SEDIMENT SAMPLE AND NUMBER (PREVIOUS)
GROUND-WATER FLOW DIRECTION
SURFACE WATER FLOW DIRECTION
SURFACE WATER/SEDIMENT SAMPLE (PROPOSED)
SOIL BORING (PROPOSED)
BACKGROUND SAMPLE
BACKHOE SAMPLE (PROPOSED)
POINT OF COMPLIANCE
CORPS OF ENGINEERS FORT WORTH DISTRICT
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RI/FS WORK PLAN
LHAAP-29
FORMER TNT PRODUCTION AREA
PROPOSED SAMPLE LOCATIONS
DATE: JUNE 1992
FIGURE C-9


LONGHORN ARMY AMMUNITION PLANT
KARNACK TEXAS
IOWAY PLANT
LHAAP - 12
ACTIVE LANDFILL
AREA OF CONTAMINATION WITH
PROPOSED SAMPLE LOCATIONS
DATE: JUNE 1992
FIGURE C-10
LEGEND
GROUND-WATER FLOW DIRECTION DURING WET PERIODS
SURFACE WATER FLOW DIRECTION
MONITOR WELL AND NUMBER (EXISTING) WITH GROUND-WATER ELEVATION (SEE NOTE)
SHALLOW SOIL SAMPLE AND NUMBER (PREVIOUS)
SURFACE WATER / SEDIMENT SAMPLE AND NUMBER (PREVIOUS)
SURFACE WATER / SEDIMENT SAMPLE (PROPOSED)
MONITOR WELL (PROPOSED)
SHALLOW SOIL SAMPLE (PROPOSED)
BACKGROUND SAMPLING LOCATION
MONITOR WELL TO BE CLOSED BY PLUGGING
POINT OF COMPLIANCE
AREA OF CONTAMINATION (AOC)
NOTE:
GROUND-WATER ELEVATION NOV 89.
UNNAMED CREEK
HEAVY TIMBER
BURROW AREA
LANDFILL
APPROXIMATE LIMITS OF ACTIVE LANDFILL
APPROXIMATE LIMITS OF 1954 EXCAVATION FOR DIVERSION DITCH AND BORROW AREA
APPROXIMATE LOCATION OF BURIED DIVERSION DITCH
AOC-9
CENTRAL CREEK
APPROX. 600'
APPROX. 600'


LEGEND
GROUND WATER FLOW DIRECTION
SURFACE WATER FLOW DIRECTION
SHALLOW SOIL SAMPLE AND NUMBER (PREVIOUS)
SURFACE WATER/SEDIMENT SAMPLE AND NUMBER (PREVIOUS)
MONITOR WELL AND NUMBER (EXISTING) WITH GROUND-WATER ELEVATION (SEE NOTE)
SOIL BORING AND DEPTH (PROPOSED)
SURFACE WATER/SEDIMENT SAMPLE (PROPOSED)
BACKGROUND SAMPLE LOCATION
BACKHOE SAMPLE LOCATION (PROPOSED)
POINT OF COMPLIANCE
AREA OF CONTAMINATION (AOC)
NOTE:
GROUND-WATER ELEVATION NOV 89.
SCALE IN FEET
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RI/FS WORK PLAN
LHAAP - 32
FORMER TNT WASTE DISPOSAL PLANT
AREA OF CONTAMINATION WITH
PROPOSED SAMPLE LOCATIONS
DATE: JUNE 1992
FIGURE C-11


LEGEND
GROUND-WATER FLOW DIRECTION
MONITOR WELL AND NUMBER (EXISTING)
SHALLOW SOIL SAMPLE AND NUMBER (PREVIOUS)
SOIL BORING (PROPOSED)
SURFACE WATER / SEDIMENT SAMPLE (PROPOSED)
BACKGROUND SAMPLE
SURFACE WATER FLOW DIRECTION
POINT OF COMPLIANCE
AREA OF CONTAMINATION (AOC)
NOTES:
1. GROUNDWATER ELEVATION NOV 1989.
2. AREA REQUIRING ADDITIONAL INVESTIGATION SHOWS SUSPECTED EXTENT OF INERT BURNING GROUNDS BASED ON 30 APR 92 SITE VISIT, AERIAL PHOTOS, AND 1963 USGS 7 1/2 MINUTE QUAD. THIS AREA WILL BE ADDRESSED IN AN ADDENDUM TO THE RI/FS WORK PLAN.
3. BG SURFACE WATER / SEDIMENT SAMPLE LOCATION AND SOIL BORING WILL BE SITED UP SLOPE AND UPSTREAM OF THE NORTHERN PRELIMINARY SITE BOUNDARY USING CRITERIA DESCRIBED IN PARA 4. 10.
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RDWW PLAN
LHAAP - 1
INERT BURNING GROUNDS
AREA OF CONTAMINATION WITH
PROPOSED SAMPLE LOCATIONS
DATE: JUNE 1992
FIGURE C-12
HEAVY TIMBER
ASPHALT RD
SAND ST
0101
0102
0103
104
BG SAMPLE LOCATIONS
SEE NOTE 3
AOC-A
APPROXIMATE LIMIT OF
INERT BURNING GROUNDS


LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
IDW PLAN
LHAAP - XX
GROUND SIGNAL TEST AREA
AREA OF CONTAMINATION WITH
PROPOSED SAMPLE LOCATIONS
DATE: JUNE 1992
FIGURE C-13
SCALE IN FEET
250
0
250
500
LEGEND
GROUND WATER FLOW DIRECTION
SHALLOW SOIL SAMPLE AND NUMBER PROPOSED
SURFACE WATER FLOW DIRECTION
SURFACE WATER/SEDIMENT SAMPLE PROPOSED
SOIL BORING AND DEPTH PROPOSED
BACKGROUND SAMPLE LOCATION
POINT OF COMPLIANCE
AREA OF CONTAMINATION (AOC)
NOTE: GROUND WATER ELEVATION NOT AVAILABLE
TO HARRISON BAYOU
TO SHAMROCK BAYOU
CONCRETE BUNKERS
LAUNCHERS
SIGNAL LAUNCHER
ROCKET MOTOR STAND
ROCKET MOTOR BLAST AREA
ROCKET MOTOR STAND
OBSERVATION STATIONS
CLEARING FOR ROCKET MOTOR BLAST
FORMER MORTAR TEST AREA


LEGEND
GROUND WATER FLOW DIRECTION
MONITOR WELL AND NUMBER (EXISTING) WITH GROUND-WATER ELEVATION (SEE NOTE)
SURFACE WATER FLOW DIRECTION
SHALLOW SOIL SAMPLE AND NUMBER (PREVIOUS)
SOIL BORING (PROPOSED)
SURFACE WATER / SEDIMENT SAMPLE (PROPOSED)
SHALLOW SOIL SAMPLE (PROPOSED)
BG BACKGROUND SAMPLE LOCATION
POINT OF COMPLIANCE
AREA OF CONTAMINATION (AOC)
NOTE:
GROUND-WATER ELEVATION NOV 89.
AOC-G
HARRISON BAYOU FLOOD PLAIN
CRATERED HILLOCK
TEST PAD
HILLSIDE
CRATERS
HARRISON BAYOU
APPROXIMATE LIMIT OF SOUTH TEST AREA
AREA OF VEGETATION DISTRESS W/ BARE AREAS
N
SCALE IN FEET
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
IDWM PLAN
LHAAP - 27
SOUTH TEST AREA
AREA OF CONTAMINATION WITH PROPOSED SAMPLE LOCATIONS
DATE: JUNE 1992
FIGURE C-14

007014

4. Waste Management Plan (WMP).

4.1. Drill Cuttings WMP. On site disposal immediately upon generation is planned at background investigations. On-site disposal of containerized soil cuttings will occur after test results from site characterization soil samples indicate that hazardous constituents are all below regulatory limits at sites LHAAP 11, 13, 14, 16, 17, 29, 12, 32, 1, xx, and 27, where the borings and monitoring wells will be installed within the AOC's and there is no evidence indicating that the disposal of drill cuttings on-site will in any way degrade the surface conditions at the site or cause harm to human health or the environment beyond what is presently existing at these sites. No cuttings will be generated from LHAAP 18 & 24. If borings are performed at LHAAP 18 & 24 during the second phase of investigations, the cuttings will be managed as RCRA hazardous waste.

4.1.1. Containerization. The cuttings from all investigations except background investigations will be containerized within D.O.T. approved drums, containers, roll-off bins, dumpsters, or vessels and properly labeled stored. The containers will be made of material that is non-reactive with the waste constituents present at the site. The labels will include the type of material contained, (soil, water, etc.) site name, boring or well number, accumulation start date, EPA waste number (obtained from the EPA) and telephone number(s) for the site manager and/or installation site coordinator. The containers will be labeled using a permanent, non-soluble substance or devise. Containers will be labeled on the side not on the top, or lid. Cuttings from different borings will not be mixed.

4.1.2. Sampling. The IDW cutting samples will be collected in accordance with the CDAP and TCLP testing will be performed to determine if cuttings are characteristically hazardous waste. TCLP testing will include inorganic and organic species identification and quantification by the method described in the CDAP under procedures set forth in 40 CFR 260.20 and 260.21.

° LHAAP 11, 13, 14, 17, 29, 12, 32, 1, xx, and 27 - only required if site characterization samples indicate that TCLP constituents are present within

regulatory limits (samples will be taken every five feet as part of the site characterization)

° Background sites - not required (these sites are by definition in non-contaminated areas)

° LHAAP 16 (and 18 & 24 if later borings) - required

4.1.3. Storage. After filling or when the boring is completed the containers will be stored, on a location within the AOC that is outside the floodplain limits, until test results are received. If no storage area outside of the floodplain is available at an AOC the waste will be stored at an adjacent AOC storage area. If metal drums are utilized, they will be stored on pallets and covered with a plastic tarp. After test results are received if any of the waste are determined to be above the TCLP regulatory limits, that container will be taken to the LHAAP 90 day RCRA storage facility to await TCLP results and disposal. Waste that is determined to be contaminated but not characteristically hazardous will be stored on site until the remedial activity is constructed. If remedial construction is expected to take over 1 year to begin, a more permanent storage facility will be required. IDW cuttings from LHAAP 16 (and 18 & 24, if later borings are required) will be stored as hazardous waste at the LHAAP 90 day RCRA storage facility.

4.1.4. Disposal.

° LHAAP 11, 13, 14, 17, 29, 12, 32, 1, xx, 27, and background - On-Site if not contaminated - Off-Site if characteristically hazardous

° LHAAP 16 (and 18 & 24 if later borings) - Off-Site

4.1.4.1. On-Site. If the cuttings are not contaminated disposal will be on site. The cuttings will be spread around the bore hole and monitoring well locations in such a manner to minimize wind or surface water erosion. This will be accomplished by spreading the soil out over a minimum area at least 10 feet from the well in a downgradient area within the AOC. If the cuttings are spread thicker than 4 inches then, grass seed suitable for the area will be spread over the cuttings and raked in.

4.1.4.2. RCRA Hazardous Waste. If the test results (or for LHAAP 18 & 24 there is listed RCRA hazardous waste) indicate that cuttings are

characteristically hazardous, the waste will be disposed of at a fully permitted RCRA Subtitle C facility that is permitted to receive CERCLA waste. The facility must meet the requirements of Land Disposal Restrictions (LDR) (waste may require pretreatment for constituents listed in the LDR before disposal) and the CERCLA section 121(d)(3) and the Off-Site Policy.

4.1.4.3. Contaminated Non-Hazardous. If the test results indicate that cuttings are not characteristically hazardous but do contain hazardous constituents, the waste will be stored and treated on-site during remediation at the site.

4.1.4.4. Stored Off-Site Non-Contaminated. If the test results do not indicate the presence of any contamination, the cuttings will be disposed on the LHAAP facility as inert materials.

4.2. Development, Purge, and Decontamination Water WMP. On site storage of water is planned at 11 of the sites (LHAAP 11, 13, 14, 16, 17, 29, 12, 32, 1, xx, and 27) and at background investigations outside of the AOC's in accordance with Reference 1. On site disposal will occur at the sites where the water is determined to be non-contaminated. Contaminated non-hazardous IDW water will be stored on site and processed during the remedial action. Off-site disposal is anticipated at one site (LHAAP 18 & 24) in accordance with the EPA guidance document, Superfund Management of Investigation-Derived Wastes During Site Inspections, May 1991. Review of past investigations and site history indicate that the IDW water at this site will be classified as hazardous waste after the test results are in.

4.2.1. Containerization. The IDW water will be containerized within D.O.T. approved drums, containers, roll-off bins, dumpsters, or vessels and properly labeled. The labels will include the type of material contained, (soil, water, etc.) site name, boring or well number, accumulation start date, EPA waste number (obtained from the EPA) and telephone(s) for the site manager and/or installation site coordinator. The containers will be labeled using a permanent, non-soluble substance or devise. Containers will be labeled on the side not on the top, or lid.

4.2.2. Sampling. The IDW samples will be collected in accordance with the CDAP. TCLP testing will be performed to determine if the IDW waters are characteristically hazardous waste. TCLP testing will include inorganic and organic species identification and quantification by the method described in the CDAP under procedures set forth in 40 CFR 260.20 and 260.21.

If contaminated, IDW water from LHAAP 18 & 24 will be classified as listed hazardous waste due to the contained in rule from the F listed waste code present in the soil and groundwater.

4.2.3. Storage. On site storage of IDW water is planned at 11 of the sites (LHAAP 11, 13, 14, 16, 17, 29, 12, 32, 1, xx, and 27) and at background investigations outside of the AOC's. After filling or when the purging of site wells are completed the containers from LHAAP 18 & 24 will be taken to the LHAAP 90 day RCRA storage facility to await test results.

4.2.4. Disposal.

4.2.4.1. RCRA Hazardous Waste. If the test results (or for LHAAP 18 & 24 there is listed RCRA hazardous waste) indicate that cuttings are characteristically hazardous, the waste will be disposed of at a fully permitted RCRA Subtitle C facility that is permitted to receive CERCLA waste. The facility must meet the requirements of Land Disposal Restrictions and the CERCLA section 121(d)(3) and the Off-Site Policy.

4.2.4.2. Contaminated Non-Hazardous. If the test results indicate that the water is not characteristically hazardous but is contaminated with hazardous constituents, the water will be classified according to TWC rules, and then treated along with the other water present at the site during remedial action.

4.2.4.3. Non-Contaminated. If the test results indicate that the water is not contaminated, it will be placed in the on-site waste water treatment plant facility.

4.3. Personnel Protective Equipment (PPE) and Disposable Equipment (DE) WMP.

4.3.1. Containerization. At sites LHAAP 11, 13, 14, 16, 17, 29, 12,

32, 1, xx, and 27 the PPE and DE from each site will be contained in double, ultraviolet degradation resistant, 20 gallon plastic bags. The bags will be tagged with a label that gives date, sample location, and site name. Review of the past investigations results does not indicate that this IDW will be hazardous. PPE and DE from LHAAP will be bagged as above and placed in a dumpster (or other suitable container).

4.3.2. Sampling. No sampling of this IDW is required.

4.3.3. Storage. At sites LHAAP 11, 13, 14, 16, 17, 29, 12, 32, 1, xx, and 27 the PPE and DE from each site will be stored in a dumpster on site. PPE and DE from LHAAP 18 & 24 will be stored at the LHAAP RCRA 90-day storage facility.

4.3.4. Disposal. At sites LHAAP 11, 13, 14, 16, 17, 29, 12, 32, 1, xx, and 27 the PPE and DE from each site will be disposed in the LHAAP active landfill. PPE and DE from LHAAP 18 & 24 will be disposed of at a fully permitted RCRA Subtitle C facility that is permitted to receive CERCLA waste. The facility must meet the requirements of Land Disposal Restrictions and the CERCLA section 121(d)(3) and the Off-Site Policy.

4.5. Documentation/Notification. The information contained in this section applies to all IDW managed during these investigations. Field records will be kept of all disposal activities the logs will contain the following information:

1) Description Generating Activities
2) Location of Generation (including depth if applicable)
3) Type of Waste
4) Date and Time of Generation
5) Date and Time of Disposal of each Type
6) Disposal Location of each Type
7) Disposal Method
8) Description of any waste sampling including:
   type of test
   laboratory sample to be sent to
   sampling method

name of sampler

9) Name of person recording information

10) Name of Field Manager at time of Generation and at time of Disposal

11) The test results must also be provided

4.5.1. RCRA Hazardous Waste. All hazardous waste must be accompanied by a Hazardous Waste Manifest (and other forms required by Texas Law). The treatment, disposal (not restricted waste), storage (TDS) facility must be notified prior to sending the IDW. The following items must accompany the Notification:

1) EPA hazardous waste codes

2) Manifest number

3) Wasted analysis data

4) If the waste is also restricted, corresponding concentration-based or technology-based treatment standards, or prohibition

4.5.2. Contaminated Non-Hazardous. If it is transported off-site the IDW must have a Bill of Lading.

4.5.3. Non-Contaminated. No notification or other documentation is required.

5. **References.**

1. USEPA/540/G-91/009, Superfund Management of Investigation-Derived Wastes During Site Inspections, May 1991.

2. USEPA, OSWER 9934.0-1A, Land Disposal Restrictions, Summary of Requirements, February 1991.

3. USACE, Longhorn Army Ammunitions Plant RI/FS Work Plan Volume 1, General, February 1992.

APPENDIX C-1

EPA/540/G-91/009, Superfund Management of Investigation-Derived Wastes During Site Inspections, May 1991

United States
Environmental Protection
Agency

Office of Research and
Development
Washington, DC 20460

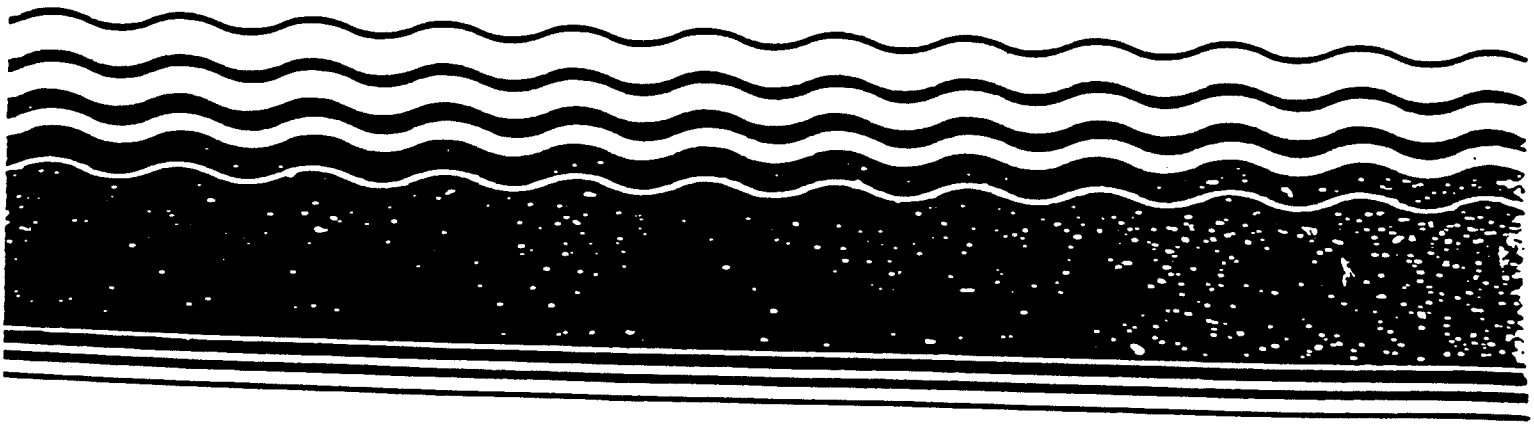
EPA/540/G-91/009
May 1991

WA007026 Region So.7
007023

Superfund

EPA

Management of Investigation-Derived Wastes During Site Inspections



007024

EPA/540/G-91/009
OERR Directive 9345.3-02
May 1991

Management of Investigation-Derived Wastes During Site Inspections

Office of Emergency and Remedial Response
U.S. Environmental Protection Agency
Washington, DC 20460

Printed on Recycled Paper

NOTICE

The policies and procedures set forth here are intended as guidance to Agency and other government employees. They do not constitute rulemaking by the Agency, and may not be relied on to create a substantive or procedural right enforceable by any other person. EPA officials may decide to follow the guidance provided in this directive, or to act at variance with the guidance, based on analysis of specific site circumstances. The Agency also reserves the right to change this guidance at any time without public notice.

APPENDIX A: Relevant Parts of the NCP A-1

APPENDIX B: OSWER Directive 9347.3-05 FS - Superfund LDR Guide #5 ..... B-1

APPENDIX C: OSWER Directive 9330.2-04 - Discharge of Wastewater from CERCLA Sites into POTWs C-1

APPENDIX D: TCLP Constituents D-1

APPENDIX E: Glossary of Terms E-1

LIST OF FIGURES

1. "Plan for IDW Handling" 22

2. "On-Site Handling" 23

3. "Off-Site Disposal" 24

- Containerizing and disposing of RCRA hazardous ground water, decontamination fluids, and PPE and DE (if generated in excess of 100 kg/month) at RCRA Subtitle C facilities.

- Leaving on-site RCRA nonhazardous soil cuttings, ground water, and decontamination fluids preferably without containerization and testing.

EPA does not recommend removal of wastes from all sites and, in particular, from those sites where IDW do not pose any immediate threat to human health or the environment. Removing wastes from all sites would not benefit human health and the environment and would result in spending a significant portion of the total funds available for the site assessment program, thus impairing EPA's ability to successfully meet the goals of the program.

Blank

additional hazards at the site. (For example, leaving highly contaminated soil cuttings on the surface could create an additional risk of direct exposure.)

Potential ARARs include (but are not limited to) RCRA[2], TSCA, CWA, CAA, and state legally enforceable regulations. The most important ARARs for managing IDW are RCRA and TSCA (addressed in Sections 2.4 and 2.5 of this guidance). The preamble to the NCP discusses when CERCLA actions (including activities during SIs) constitute "land disposal," which triggers several significant requirements, including RCRA land disposal restrictions (LDRs)[3] (55 FR 8759-8762).

Section 300.400(g)(4) of the NCP defines state ARARs as "those state standards that are promulgated, are identified by the state in a timely manner, and are more stringent than federal requirements." Section 2.7 of this guidance discusses the issue of state ARARs.

Before ARARs can be determined, it is necessary to determine what contaminants, if any, are present in the IDW. Section 3.0 of this guidance discusses the process of identifying contaminants. In general, such identification should be done based on available information about the site and professional judgment rather than testing.

In brief, compliance with the NCP can generally be assured by:

(1) Identifying contaminants, if any, present in IDW based on existing information and best professional judgment; testing is not required in most circumstances.

(2) Determining ARARs (particularly RCRA and state laws), and the extent to which it is practicable to comply with them.

(3) Delineating an area of contamination (AOC) unit based on existing information and visual observation if soil cuttings are RCRA hazardous (see Section 2.4.2).

(4) Burying RCRA hazardous soil cuttings within the AOC unit, so long as no increased hazard to human health and the environment will be created. Containerization and testing are not required.

(5) Containerizing RCRA hazardous ground water and other RCRA hazardous IDW such as PPE, DE, and decontamination fluids for off-site disposal.

The following sections of this guidance provide guidelines for determining ARARs and identifying IDW.

2.2 OFF-SITE RESPONSE ACTIONS POLICY

CERCLA Section 121 (d)(3) requires that hazardous substances, pollutants, or contaminants that are transferred off-site for treatment, storage, or disposal during CERCLA response actions must be sent to facilities operating in compliance with RCRA and other applicable laws or regulations. In 1987, EPA issued a more detailed policy (the "off-site policy" – OSWER Directive No. 9834.11, November 13, 1987[4]) that describes procedures that must be followed when a response action under CERCLA involves off-site management of CERCLA wastes. This policy applies to all IDW that are transported to an off-site disposal facility, but does not itself require that all RCRA hazardous wastes and CERCLA hazardous substances be disposed off-site. Sections 2.4.3, 2.4.4, 2.5 and 2.6 of this guidance present the criteria that RCRA Subtitle C facilities, RCRA Subtitle D facilities, TSCA and CWA-regulated facilities must meet. The off-site policy is complex, and questions that arise should be referred to the appropriate EPA Office of Regional Counsel.

The off-site policy provides acceptability criteria for facilities that receive wastes from CERCLA-authorized or -funded response actions, including RCRA land disposal, treatment, storage, and permit-by-rule facilities, and for

2.4.1 LAND DISPOSAL RESTRICTIONS

Land disposal, as defined by RCRA Section 3004 (k), includes any placement of RCRA hazardous waste in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome or salt bed formation, or underground mine or cave. For LDR purposes, the Agency commonly uses "land disposal" and "placement" as synonymous terms.

For the purpose of the LDRs, HSWA divides RCRA hazardous wastes into several groups (e.g., First Third, Second Third, California list wastes) and specifies dates, referred to as the statutory deadlines, by which treatment standards for each group must be established. The final statutory deadline for wastes listed or identified before November 8, 1984 was May 8, 1990. For wastes identified after November 8, 1984, EPA must determine whether these wastes will be prohibited from land disposal within 6 months of listing or identification. If EPA fails to promulgate treatment standards within 6 months for newly identified wastes, the wastes can be land disposed without restriction until the appropriate treatment standards are promulgated. After the statutory deadline for wastes identified before November 8, 1984, the wastes are "restricted" or "prohibited" and cannot be disposed in land unless:

- The wastes are treated to meet promulgated treatment standards.
- It can be demonstrated that hazardous constituents will not migrate from the land disposal unit as long as the wastes remain hazardous.
- The wastes are subject to treatment standard variances.
- The specific waste has received a national capacity variance.

It should be noted that the NCP establishes a presumption that treatment to best demonstrated available technology (BDAT) standards is inappropriate as a standard for soil removed from CERCLA sites, and that a treatability variance is appropriate in such circumstances (see 55 FR 8760-8762).

To determine if LDRs are applicable to IDW management, the SM must evaluate whether:

(1) The IDW are RCRA hazardous waste.

(2) The RCRA hazardous waste is regulated under the LDRs.

(3) The anticipated approach to IDW management constitutes "placement" (land disposal) of the generated wastes. (For the purpose of the LDRs, EPA considers itself a waste generator when the response action involves treatment, storage, or disposal of RCRA hazardous wastes. If the SI does not involve RCRA hazardous IDW disposal, RCRA regulations are not triggered.)

LDRs apply only if the answer to all three questions is "yes." In some cases, as discussed in section 2.3, LDRs may be "relevant and appropriate" even if not strictly applicable.

2.4.2 AREA OF CONTAMINATION CONCEPT AND ITS IMPLICATIONS

An important consideration in determining whether LDRs apply is whether land disposal of IDW has occurred. If IDW are merely being moved within the same "area of contamination" (AOC), EPA does not consider "land disposal" to have occurred, so that LDRs are not triggered, even if IDW contain RCRA hazardous material. Therefore, if IDW are being moved only within an AOC, it is unnecessary to determine whether they are subject to LDRs.

trigger RCRA regulations, unless the SM determines that the wastes would significantly increase risks to human health and the environment (e.g., fire or explosion) and must be disposed of off-site.

- RCRA hazardous ground water, decontamination fluids, PPE, and DE should be containerized and disposed off-site.

- Moving RCRA hazardous soil cuttings from one AOC to another AOC triggers the LDRs.

If IDW cannot be deposited within the delineated AOC, the site manager must comply with all LDRs to the extent practicable. This means that the IDW should be transferred to an off-site RCRA Subtitle C hazardous waste treatment, storage, or disposal facility that complies with the off-site policy.

2.4.3 REQUIREMENTS FOR RCRA SUBTITLE C TREATMENT, STORAGE, AND DISPOSAL FACILITIES

The RCRA Subtitle C standards[2] cover hazardous waste treatment, storage, and disposal (TSD) facilities. The specific standards govern installation, operation, inspection, and closure of containers, tanks, surface impoundments, waste piles, land treatment units, landfills, incinerators, and other units.

Off-site TSD facilities receiving IDW must have RCRA permits to operate. Facilities that are permitted under another statute to receive hazardous wastes are eligible for RCRA permits without filing RCRA permit applications. These facilities, referred to as "permit-by-rule," include ocean disposal barges or vessels, injection wells, and publicly-owned treatment works (POTWs). The NCP exempts EPA from the RCRA permitting requirement while conducting CERCLA actions on-site. However, EPA should attempt to consider RCRA storage regulations as relevant and appropriate when containerizing and storing wastes on-site, even though a permit application will not be filed.

Generally, the RCRA storage regulations require a generator to: (1) place the waste in containers or tanks; (2) satisfy the standards for containers or tanks; (3) clearly indicate the waste accumulation date on the containers; (4) mark the containers and tanks as "hazardous waste"; and (5) comply with the requirements for owners and operators of hazardous waste TSD facilities. In addition, LDRs prohibit the storage of RCRA restricted waste unless the storage is to accumulate sufficient quantities of the waste to promote proper disposal, treatment, or recovery. When storing hazardous waste for more than 90 days, the SM should consider the storage requirements of 40 CFR Parts 262 and 264 as relevant and appropriate and comply with them to the extent practicable unless the site falls within one of the following categories of waste generators:

1. Conditionally exempt small quantity generators (producing no more than 100 kilograms of hazardous waste in a calendar month), and

2. Small quantity generators producing between 100 kg and 1,000 kg of hazardous waste in a calendar month.

In the cases listed above, the SM will have to comply with the guidelines provided in 40 CFR Part 261.5(g)(2) and 40 CFR Part 262.34.

Any facility receiving IDW containing hazardous wastes must comply with all RCRA Subtitle C design, operation, and closure requirements. In addition, the off-site policy presents additional criteria for selecting an appropriate disposal facility. The most important criteria[4] that a RCRA Subtitle C facility must meet if it receives RCRA hazardous IDW are:

- There must be no record of any relevant violations at or affecting the receiving unit.

- There must be no releases at receiving units of land disposal, treatment, or storage facilities. Note that

2.5 TOXIC SUBSTANCES CONTROL ACT

RCRA nonhazardous IDW containing PCBs or asbestos must, in certain circumstances, be disposed of at facilities regulated under the Toxic Substances Control Act (TSCA). While asbestos is not a common contaminant at CERCLA sites, PCBs can be found at about 17 percent of CERCLA sites. Regulations governing the management of IDW containing PCBs, which are generally based on PCB concentrations in waste, are found at 40 CFR 761.60.

TSCA requirements for handling PCBs[m] call for incineration of PCB-contaminated liquid material with concentrations greater than 500 ppm. For liquid material with PCB concentrations between 50 and 500 ppm, the principal alternative to incineration is disposal in a TSCA chemical waste landfill. Any receiving unit must meet the compliance and release criteria for non-RCRA units as set out in the off-site policy, in order to be acceptable. These PCBs may also be destroyed by using a TSCA-approved method that provides a level of performance equivalent to incineration. Nonliquid PCBs at concentrations greater than or equal to 50 ppm may be incinerated, treated by a equivalent TSCA-approved method, or disposed in a TSCA chemical landfill. PCB-contaminated material with concentrations less than 50 ppm are generally not regulated under TSCA, and may be disposed in acceptable Subtitle D facilities.

Even though IDW containing PCBs alone are not RCRA hazardous wastes, IDW containing PCBs mixed with RCRA hazardous wastes are regulated under RCRA LDRs as part of the California list wastes[4,5]. Since PCBs can be governed by RCRA and TSCA, the SM must determine whether RCRA (in the case of PCBs mixed with RCRA wastes) or TSCA regulations, or both, are applicable.

2.6 CLEAN WATER ACT

The Clean Water Act (CWA) addresses site-specific pollutant discharge limitations and performance standards for specified industries to protect surface water quality. At the SI, the most likely situation involves indirect discharge of IDW water, regulated under CWA, to POTWs for treatment and disposal. A less likely situation may involve direct discharge, either on-site or off-site, to surface water.

RCRA hazardous wastewater can be disposed of at POTWs that have a RCRA permit-by-rule and that meet the off-site policy criteria for a facility receiving RCRA hazardous waste. Disposal at a POTW of nonhazardous wastewaters from CERCLA sites is an option[7,8] if the POTW is acceptable under the off-site policy (Appendix C). EPA regulations cover general and specific prohibitions on discharges[m] to POTWs.

The following criteria [m] should be used in selecting an appropriate POTW facility:

- Compliance with all applicable laws.
- The quantity and quality of the CERCLA IDW must be compatible with the POTW.
- The POTW must have no unpermitted "releases."
- The concentration of any hazardous substance must meet applicable pretreatment standards (CERCLA IDW cannot upset the facility's operation and violate the permit).
- The POTW must be in compliance with its National Pollutant Discharge Elimination System (NPDES) permi
- The transport of IDW to the POTW and its placement in an impoundment must not create a potential for ground water contamination.

Blank

management decisions due to RCRA regulations (particularly the LDRs). EPA recommends using knowledge of IDW rather than testing the wastes to characterize them.

The SM should not assume that all IDW contaminated with CERCLA hazardous substances are RCRA hazardous wastes, in the absence of positive evidence (e.g., manifests, records, knowledge of generation processes) to support such an assumption. At the same time, however, the SM should determine whether IDW are RCRA hazardous wastes, to the extent practicable, as discussed above.

The most important characterization decision is whether IDW contain "hazardous waste" under RCRA. This is relevant to the ARAR status of LDRs and other RCRA requirements, and whether waste disposed of off-site must be disposed of in a Subtitle C or Subtitle D facility. A solid waste is a RCRA hazardous waste[2] if it contains a listed waste or exhibits any of the hazardous characteristics and is not excluded from regulation as a hazardous waste. (For purposes of the RCRA Subtitle C regulations, a solid waste is any discarded material (solid, sludge, liquid, and compressed gas) that is not excluded under SWDA.) IDW generated during the SI may either exhibit a RCRA characteristic or contain RCRA listed waste.

Under EPA regulations, soil and ground water may be considered contaminated environmental media. If they contain listed hazardous waste, they must be managed as RCRA hazardous wastes as long as they "contain" the listed waste. If IDW exhibit RCRA characteristics, they also have to be managed as RCRA hazardous wastes.

To properly handle IDW, the SM must make a reasonable effort to ascertain if they are RCRA hazardous. When the SM determines that IDW do not fall in any listed waste category and does not display RCRA characteristics, the wastes are not RCRA hazardous. Sections 3.2.1 and 3.2.2 help determine if IDW are RCRA characteristic wastes or if they contain RCRA hazardous listed wastes.

Even if the IDW do not contain RCRA "hazardous waste," the SM should determine whether they contain other CERCLA hazardous substances. CERCLA hazardous substances include, in addition to RCRA hazardous wastes, substances, elements, compounds, solutions, or mixtures designated as hazardous or toxic under CERCLA itself or under the authority of other laws such as TSCA, CWA, CAA, and SDWA. Therefore, even where RCRA is not applicable, one of these statutes may be an ARAR. EPA presents a list of these hazardous substances in 40 CFR Part 302.4, Table 302.4.

3.2.1 RCRA CHARACTERISTIC WASTES

A solid waste is a RCRA characteristic hazardous waste if it exhibits the characteristic of ignitability, corrosivity, reactivity (as defined in 40 CFR Part 261, Subpart C), or toxicity (toxicity characteristic leaching procedure, TCLP, as described in 55 FR 11796-11877, March 29, 1990[11]).

IDW exhibit ignitability if:

- They are a liquid, other than an aqueous solution containing less than 24 percent alcohol by volume, and have a flash point lower than 60°C (140°F).
- They are not a liquid and are capable, under standard temperature and pressure, of causing fire and, when ignited, create a hazard.
- They are an ignitable compressed gas as defined in 49 CFR 173.300.
- They are an oxidizer as defined in 49 CFR 173.151.

- Wastes from nonspecific sources (F wastes). Examples include spent halogenated solvents (tetrachloroethylene, methylene chloride), nonhalogenated solvents (xylene, acetone, ethyl ether), still bottoms from the recovery of these spent solvents, and some wastewater treatment sludges.

- Wastes from specific sources (K wastes). Examples include wastewater treatment sludges from the production of zinc yellow and chrome green pigments, and still bottoms from the distillation of benzyl chloride.

- Discarded commercial chemical products, manufacturing intermediates, off-specification (off-spec) chemicals (which, if they met specifications, would be listed), and container and spill residues that are "acutely hazardous" (P-wastes). Examples include aldrin and phosgene.

- Discarded commercial chemical products, manufacturing chemical intermediates, or off-spec commercial chemical products that are "toxic" (U-wastes). Examples include chlorobenzene and mercury.

To ascertain whether IDW constitute RCRA listed hazardous waste, the SM must first determine if the IDW contain a component that may be a listed hazardous waste, and then decide whether that component meets the regulatory description of that listed waste.

For example, to determine if solvents contaminating IDW are RCRA spent solvent F001-F005 wastes, the SM must know if:

- The solvents are spent and cannot be reused without reclamation or cleaning.

- The solvents were used exclusively for their solvent properties.

- The solvents are spent mixtures and blends that contained, before use, a total of 10 percent or more (by volume) of the solvents listed in F001, F002, F004, and F005.

If the solvents contained in the IDW are RCRA listed wastes, the IDW are RCRA hazardous waste. When the SM does not have guidance information on the use of the solvents and their characteristics before use, the IDW cannot be classified as containing a listed spent solvent. When the solvents are not listed and IDW are not a characteristic waste, the IDW should be declared nonhazardous.

For other F and K wastes, the SM must know the generation process information (about each waste contained in the RCRA waste) described in the listing. For example, for IDW to be identified as containing K001 wastes that are described as "bottom sediment sludge from the treatment of wastewaters from wood preserving processes that use creosote and/or pentachlorophenol," the SM must know the manufacturing process that generated the wastes (treatment of wastewaters from wood preserving process), feedstocks used in the process (creosote and pentachlorophenol), and the process identification of the wastes (bottom sediment sludge).

P and U wastes cover only unused and unmixed commercial chemical products, particularly spilled or off-spec products. Not every waste containing a P or U chemical is a hazardous waste. To determine whether a CERCLA IDW contains a P or U waste, the SM must have direct evidence of product use. In particular, the SM should ascertain, if possible, whether the chemicals are:

- Discarded (as described in 40 CFR 261.2(a) (2)).

- Either off-spec commercial products or a commercially sold grade.

- Not used (soil contaminated with spilled unused wastes is a P or U waste).

Blank

Note, however, that some site circumstances may warrant exceptions to the IDW management approach outlined in this guidance. The SM should use professional judgment in recognizing situations where special steps are required to avoid creating additional threats to human health and the environment. When substantial doubt exists regarding the scope of EPA's authority to carry out the proposed plan for IDW management, the SM should consult legal counsel.

4.2 WASTE MINIMIZATION

The SM should select investigation methods that minimize the generation of IDW, particularly RCRA hazardous wastes. The SI team should limit contact with contaminants, and use drilling and decontamination methods (such as steam cleaning) that minimize PPE, DE, decontamination fluids, and soil cuttings. In particular, the inspection team should minimize the amounts of solvents used for decontamination or eliminate solvents. Minimizing the amount of wastes generated reduces the number of IDW handling problems and costs of disposal. The waste minimization approach should be addressed in the SI workplan.

4.3 TYPES, HAZARDS, AND QUANTITIES OF IDW

To handle IDW properly, the SM must determine the types (such as soil cuttings, ground water, decon fluids, PPE or DE), characteristics (whether RCRA hazardous or containing other CERCLA hazardous substances), and quantities of anticipated wastes. As discussed in Section 3.1, testing will generally not be required to characterize waste to the extent appropriate for an SI. In addition to direct observation of the IDW for evidence of contamination, the SM should review and analyze all available information about the site such as:

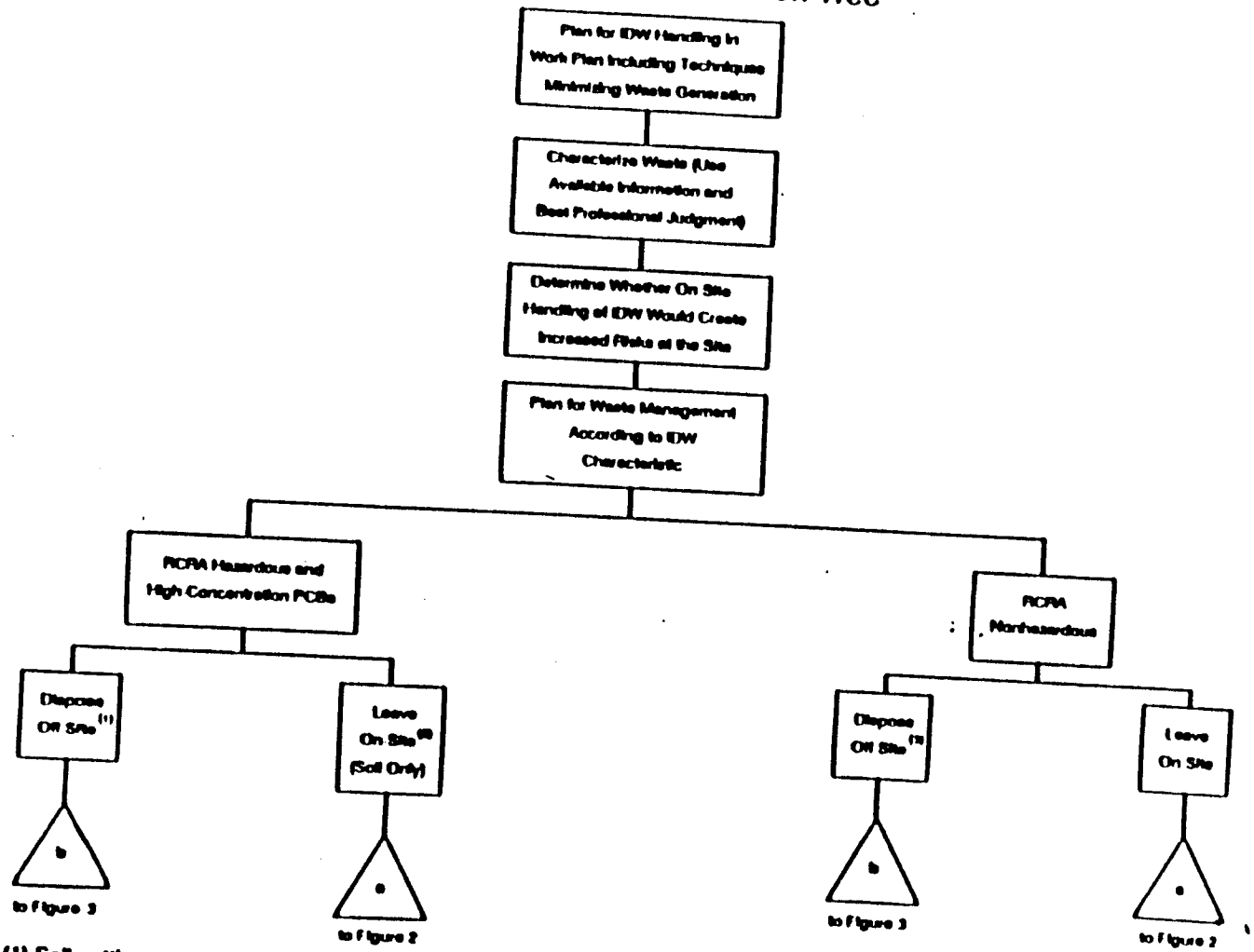
- Results of previous EPA preliminary assessments or site investigations.
- Environmental permits.
- Results of inspections by state, local, or federal agencies, or private parties.
- Records from community relations interviews.
- Any other helpful data such as tax records or aerial photography.

Upon ascertaining the types of anticipated IDW, the SM should determine IDW characteristics, in particular whether the anticipated waste is RCRA hazardous (see Section 3.2 of this guidance) or contains high concentrations of PCBs. For RCRA hazardous IDW, the SM should determine whether the IDW pose an increased hazard to human health and the environment relative to conditions that existed prior to the SI. Whenever field analytical screening instruments are used during the SI, the SM may plan to evaluate the analytical results as helpful indicators of IDW characteristics. However, the SM must remember that most of these tests are not RCRA tests, and that the test results usually do not identify RCRA hazardous wastes. The SM must also determine the exact properties of RCRA nonhazardous IDW to select an appropriate disposal facility (e.g., POTW) when the circumstances require off-site disposal.

Upon determining the types and characteristics of IDW to be generated, the SM must assess the anticipated quantities which vary depending on the size of a site and the scope of the SI. As a point of reference, a typical SI may result in generating a range of 1 to 3 drums of PPE and DE, 50 to 1,500 gallons of decontamination water, 1 to 3 pints of other decontamination fluids (e.g., organic solvents) and, depending on the number of wells installed or sampled, 0 to 13 drums of soil cuttings and 0 to 200 gallons of well purge water. The SM should calculate the quantity of the anticipated soil cuttings and ground water from the dimensions of wells and the depth to the ground water table. The SM should use experience to assess the amount of decontamination fluids (decontamination water and organics), PPE, and DE.

Figure

IDW Management Decision Tree



(1) Soil cuttings, ground water, and decontamination fluids creating increased hazards at the site should be disposed off site. Before and after the SI, determine anticipated waste quantity and applicable regulations for waste generators.

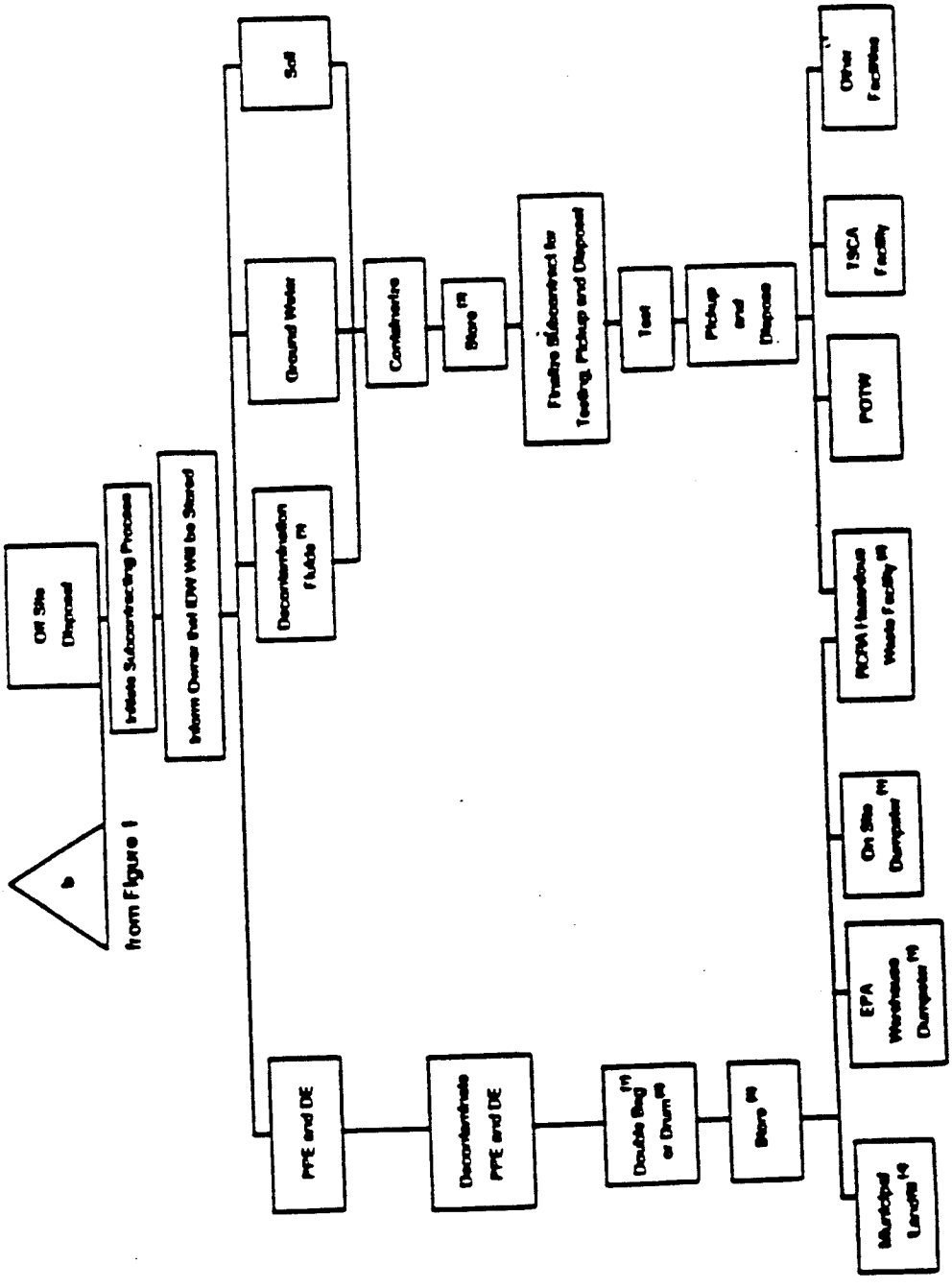
(2) If not prohibited by other legally enforceable requirements such as state ARARs.

(3) Justified only in rare circumstances when a RCRA nonhazardous waste is a state hazardous waste and state legally enforceable requirements call for waste removal, or if leaving the waste on site would significantly affect human health and the environment.

007038

Figure 3

IDW Management Decision Tree



(1) Only RCRA nonhazardous waste.
(2) Only RCRA hazardous waste generated in quantities greater than 100 kg/month when sent off-site.
(3) In accordance with accumulation requirements for RCRA hazardous wastes.
(4) Only if the conditionally exempt small quantity generator exception applies.
(5) If the conditionally exempt small quantity generator exception applies, off-site disposal of decon fluids may not require subcontracting

Another alternative for handling RCRA hazardous soil is disposal in a TDU located on the same property as the AOC under investigation. If the TDU is outside the AOC, it must comply with the off-site policy. If any organic decon fluids are generated (which are RCRA hazardous wastes), they should be disposed of off-site in compliance with the off-site policy or in compliance with the conditionally exempt small quantity generator exemption. Small quantities (i.e., no more than 100 kg/month) of organic decon fluids may be containerized off-site prior to delivery to a hazardous waste facility.

4.6 OFF-SITE DISPOSAL OF IDW AND MANAGEMENT OPTIONS

IDW should be disposed off-site in the following situations:

- They are RCRA hazardous water.
- They are RCRA hazardous soil that may pose a substantial risk if left at the site.
- They are RCRA hazardous PPE and DE.
- If leaving them on-site would create increased risks at the site.

RCRA nonhazardous wastes could be disposed of off-site at appropriate RCRA nonhazardous facilities that are in compliance with CERCLA section 121(d)(3) and the off-site policy when it is necessary to comply with legally enforceable requirements such as state ARARs that preclude onsite disposal. IDW designated for off-site disposal must be properly containerized, tested, and stored before pick-up and disposal. Decontaminated PPE and DE should be double-bagged if sent to an off-site dumpster or a municipal landfill.

Planning for off-site disposal should include the following EPA guidelines:

- Incorporating a provision in the site access agreement form to inform the site owner that containerized IDW may be temporarily stored on-site while awaiting pickup for off-site disposal. The agreement should also request the owner's cooperation.
- Initiating the bidding process for IDW testing, pick-up, and disposal. If there are any subcontracting needs in planning for off-site disposal, EPA should specify what means of disposal will be needed (i.e. various types of treatment, landfilling, etc.). Since RCRA hazardous IDW must go to RCRA hazardous waste disposal facilities that comply with the off-site policy, the SM should obtain a list of available facilities from the RPO. Each EPA region maintains a list of RCRA hazardous TSD facilities that meet the conditions of the off-site policy. The recent addition of 25 new toxicity characteristic constituents to the list of toxic chemicals subject to RCRA hazardous waste regulations may result in fewer facilities available to handle IDW in the future. The SM must also check the selected facility's compliance before IDW pick-up. If IDW are RCRA nonhazardous, the SM must also check if the receiving RCRA nonhazardous waste facility complies with the off-site policy.
- Coordinating IDW generation with testing and pick-up. IDW samples should be collected in accordance with the "Test Methods for Evaluating Solid Waste" guidance manual (SW 846), and shipped for RCRA tests (and other tests, if necessary) as early as possible during the SI. This approach shortens the storage time and reduces the number of site visits to pick up waste. IDW need not be analyzed by a CLP laboratory. The SM should use the laboratory services of the pickup and disposal subcontractor, obtain an EPA ID number and manifest form for RCRA hazardous IDW, and a bill of lading for RCRA nonhazardous IDW.

Blank

- Disposing at a disposal facility.
- Documenting the process.

Coordination of IDW handling is important because it affects the schedule and costs of the SI. Most coordination must be done before field activity starts. Before starting the field work, a subcontractor should be selected so the SM can coordinate field work and IDW generation with the subcontractor's sampling, testing, pick-up, and disposal activities. Before containerizing IDW, the SM should check the containers to ensure they are clean and do not contain any residues from past use. All filled containers should be dated and labeled as either RCRA hazardous or RCRA nonhazardous and stored in a safe manner in compliance with relevant regulations. The SM should also obtain an EPA ID number for a RCRA hazardous waste from the RPO.

If a temporary storage facility must be constructed, the SM should have all construction materials, such as chain-link fencing, posts, and other needed materials, delivered to a location agreed upon with the site owner before the SI. The SM should ensure that the storage time is short and never exceeds the regulatory 90 days for RCRA hazardous waste even if the small quantity generator exemption applies.

The SM should check that the subcontractor collects IDW analytical samples for the disposal facility "profile analysis" using EPA-recommended methods described in "Test Methods for Evaluating Solid Waste Physical/Chemical Methods" - SW 846. One composite sample should be collected from each large container or from a group of drums. Small samples of soil cuttings or drilling mud should be taken from several locations and depths of the handling containers, homogenized in a decontaminated bucket, and placed in sampling jars. Sampling of PPE and DE should be avoided. The SM should also ensure that the chain-of-custody form for shipping IDW samples is used. When the subcontractor's analysis confirms that IDW is a RCRA restricted hazardous waste, the SM should check that the subcontractor:

- Treats the IDW to meet the treatment standards (if needed) before land disposal.
- Complies with the LDR notification requirements of 40 CFR Part 268.

Containerized and tested RCRA hazardous IDW must be accompanied by a Hazardous Waste Manifest (and other forms required by state laws) if hauled off-site. RCRA nonhazardous IDW should have a bill of lading if transported off-site. The SM must obtain all required forms, fill them out clearly and completely, and have the forms signed by the RPO. The SM, if authorized, may sign the forms on behalf of EPA. Before transporting IDW to the selected facility, the SM must verify the facility's compliance with the off-site policy at the time of disposal. If the facility's status has changed since the award of the contract, (due to receiving citations or fines), the SM is responsible for finding a replacement facility without delay. The SM must receive a copy of the IDW analytical results and a confirmation of disposal from the subcontractor.

The costs of disposal depend on the waste hazard, matrix, and amount. The ranges of costs per drum are presented below:

- RCRA nonhazardous liquid: $12.50 - 345/drum
- RCRA hazardous liquid: $155 - 550/drum
- RCRA nonhazardous solid: $66 - 135/drum
- RCRA hazardous solid: $145 - 615/drum

Additional costs of handling IDW off-site include:

- Storage.
- Field trips (to assist in waste sampling and pickup).
- Procurement expenses.

If IDW on-site storage is not available before pickup, a chain-link fence can be built at an average cost of $600 ($300 for the materials and $300 for labor). The cost of procurement is estimated at about $300 per site. The cost of the field trips depends on the coordination of waste generation, testing, and pickup.

The site manager must select a subcontractor before field work is completed, so the subcontractor can collect IDW samples for the "profile analysis" while the SM is still on-site. This approach requires only one more field trip to assist in the waste pickup. If two additional trips are needed (one for collecting IDW samples and one for IDW pickup), the costs of IDW disposal increase significantly. For example, if there are two drums to dispose of, the transportation, testing, and disposal cost is $700, and one field trip costs $500, the total cost of IDW handling is $1,200. An additional field trip would result in a total cost of $1,700, a 42 percent increase.

The approximate cost ranges of managing one drum of IDW off-site, depending on the waste hazard, are presented below:

WASTE	CONTAINER ($)	TEST ($)	TRANSPORTATION ($)	DISPOSAL ($)	STORAGE PROCUREMENT AND FIELD TRIPS ($)	TOTAL* ($)
RCRA Hazardous Solid	50	20-150	35-600	145-615	233	500-1650
RCRA Non-Hazardous Solid	50	20-150	35-600	66-135	233	400-1200
RCRA Hazardous Liquid	50	20-150	35-600	155-550	233	500-1600
RCRA Non-Hazardous Liquid	50	20-150	35-600	12.50-345	233	350-1400

* Based on the following assumptions: (1) 6 drums/site, (2) 1 sample/2 drums and, (3) only one field trip required for waste pickup at a cost of $500/6 drums ($83/drum).

Blank

APPENDIX A to EPA/540/G-91/009

RELEVANT PARTS OF THE NCP

007046

Federal Register

Thursday
March 8, 1990

Part II

Environmental Protection Agency

40 CFR Part 300
National Oil and Hazardous Substances Pollution Contingency Plan; Final Rule

Printed on Recycled Paper

300.420(c)(5) describes the information contained in a lead-agency report following completion of a remedial site investigation, including documentation as well as sampling data and potential risks to humans and the environment.

Response to comments: A commenter asked that the NCP state that reasonable efforts will be made during the site investigation phase to identify PRPs and provide them copies of the preliminary assessment/site investigation (PA/SI) report and an opportunity to comment.

The removal and remedial processes as currently outlined in the NCP provide PRPs with a reasonable opportunity to review and comment on lead agency actions at a site when the proposed plan is made available. Before this time, documents placed in the administrative record, including the PA/SI, are available for public inspection. In addition, PRPs that are interested in more extensive involvement in the investigation process may agree to undertake removal or remedial actions through a settlement agreement with EPA. They may be granted substantially more site involvement than non-settling PRPs.

Extending the formal review and comment period to PRPs as far back in the removal and remedial process as the PA/SI stage would unnecessarily slow down preliminary fact-gathering at a site. In cases where removal actions are considered emergency or time-critical, such review and comment time would unjustifiably delay response to a dangerous situation. Also, in most cases, the PRP search has not been completed or even started in a comprehensive manner at the time of the PA/SI. Accordingly, specifying formal procedures for PRP involvement at that time is not practical.

Final rule: EPA is promulgating §§ 300.410(c)(2) and 300.420(c)(5) as proposed.

Name: Section 300.410(g). Notification of natural resource trustee.

Final rule: Section 300.410(g) is revised as follows (see preamble discussion on § 300.615):

> If natural resources are or may be injured by the release, the OSC or lead agency shall ensure that state and federal trustees of the affected natural resources are promptly notified in order that the trustees may initiate appropriate actions, including those identified in subpart G of this part. The OSC or lead agency shall seek to coordinate necessary assessments, evaluations, investigations, and planning with such state and federal trustees.

Name: Sections 300.415(b)(4) and

Proposed rule: Proposed § 300.415 did not describe sampling requirements. Proposed § 300.420(c)(4) described the procedures necessary for preparing a site-specific sampling plan for a remedial site inspection.

Response to comments: One commenter stated that EPA should revise § 300.420(c)(4) to specify review of the sampling plan to ensure that appropriate sampling and quality control procedures are followed. In response, EPA is revising the description of the site-specific sampling plan in proposed § 300.420(c)(4) to conform with the purpose of the quality assurance project plan (QAPP) defined in § 300.5 and the QAPP and sampling and analysis plan described in § 300.430(b)(8), which states that such plans will be approved by EPA. This change emphasizes the similarity of these activities in the site evaluation and remedial investigation parts of the program. In addition, EPA believes that, when samples will be taken, it is appropriate to describe sampling requirements for non-time-critical removal actions to ensure that data of sufficient quality and quantity will be collected for this type of action.

EPA also notes that portions of the QAPP may incorporate by reference non-site-specific standardized portions of already-approved QAPPs, especially those portions addressing policy and organization, or describing general functional activities to be conducted at a site to ensure adequate data. This eliminates the necessity to reproduce non-site-specific quality assurance procedures for every site.

Final rule: Proposed §§ 300.415(b)(4) and 300.420(c)(4) are revised as follows:

1. In § 300.415(b)(4), a requirement has been added for developing a sampling and analysis plan, when samples will be taken.

2. Section 300.420(c)(4) is revised to better describe the required contents of the sampling and analysis plan.

Section 300.415. Removal Action.

Name: Section 300.415(b)(5)(ii). Removal action statutory exemption.

Proposed rule: CERCLA section 104(c)(1)(C) provides a new exemption to the statutory limits on Fund-financed removal actions of $2 million and 12 months. This exemption, stated in the NCP in § 300.415(b)(5)(ii), is applicable when continued response is otherwise appropriate and consistent with the remedial action to be taken. EPA expects to use the exemption primarily for proposed and final NPL sites, and only rarely for non-NPL sites (see 53 FR

Response to comments: One commenter supported EPA's proposal to allow waiver of the limits on Fund-financed removal payments if such an exemption is consistent with remedial actions.

One commenter stated that the decision to engage in a removal action should be based on site conditions and their impact on health and the environment, not cost or time; that once EPA concludes that a removal action is appropriate, the various alternatives should be analyzed at both likely NPL and non-NPL sites equally. The commenter felt that EPA should use the consistency exemption more liberally where time, rather than money, was the complicating factor.

In response, Congress has made the determination that cost and time are relevant factors in deciding how extensive a Fund-financed removal action may be; thus, contrary to the commenter's remark, EPA will continue to consider such factors. Further, Congress did not differentiate between time and dollar limits in setting the exemptions; EPA notes that exceeding the time limit will often also increase the cost of a removal action, even though it does not necessarily raise the cost to over $2 million. Thus, EPA does not believe it should set different criteria for their use.

The new exemption from the time and dollar limits applies to any Fund-financed removal and thus encompasses state-lead as well as EPA-lead responses. Actions where EPA has the lead, but is to be reimbursed by private parties or other federal agencies, are still subject to the statutory limits and provisions for exemption.

Because the exemption requires consistency with the remedial action to be taken, its use is well suited to proposed or final NPL sites where remedial action is likely to be taken. It may also be appropriate to use this exemption at some non-NPL sites where justified on a case-by-case basis.

Final rule: EPA is promulgating the rule as proposed.

Name: Section 300.415(i). Removal action compliance with other laws

Existing rule: The current NCP in § 300.65(f) requires that Fund-financed removal actions and removal actions pursuant to CERCLA section 106 attain or exceed, to the greatest extent practicable considering the exigencies of the circumstances, applicable or relevant and appropriate federal public health and environmental requirements. Other federal criteria, advisories, and

responses and responses conducted by PRPs (emergency and time-critical removals are not covered by this policy). This notification should specify the type and quantity of waste involved, the name and location of the receiving facility and the expected schedule for the transfer of the CERCLA waste. Such notification will enable the recipient state to obtain from its permitted facilities any other information it may need in order to support the out-of-state action. Although this notification is neither mandated by CERCLA nor required by this regulation, EPA believes that adherence to this procedure will help to ensure that these waste transfers occur in a safe and expedient manner. The policy is explained in more detail in OSWER Directive No. 9330.2-07 (September 14, 1989).

Because CERCLA actions may be carried out under a number of mechanisms and by a number of parties (e.g., lead state agencies, other federal agencies, PRPs), EPA plans to issue additional guidance or regulations, if appropriate, to implement this notification policy.

Final rule: There is no rule language on this issue.

Applicable or Relevant and Appropriate Requirements

Introduction. The November 20, 1985 revisions to the NCP required that, for all remedial actions, the selected remedy must attain or exceed the federal applicable or relevant and appropriate requirements (ARARs) in environmental and public health laws. It also required removal actions to attain ARARs to the greatest extent practicable, considering the exigencies of the circumstances. The preamble to the 1985 revisions to the NCP stated that ARARs could be determined only on a site-by-site basis, and it included from EPA's October 2, 1985 Compliance Policy a list of potentially applicable or relevant and appropriate requirements. The preamble also provided a list of federal non-promulgated criteria, advisories and guidance, and state standards "to be considered," called TBCs. EPA also provided five limited circumstances in which ARARs could be waived.

On October 17, 1986, CERCLA was reauthorized with additional new requirements. Section 121 of CERCLA requires that, for any hazardous substance that will remain on-site, remedial actions must attain requirements under federal environmental or state environmental or facility siting laws that are applicable or relevant and appropriate under the circumstances of the release or threatened release at the completion of the remedial action. The statute also retained most of the waivers, with a few additions.

Although section 121(d)(2) basically codified EPA's 1985 policy regarding compliance with other laws, the section also requires that state standards are also potential ARARs for CERCLA remedial actions when they are promulgated, more stringent than federal standards, and identified by the state in a timely manner.

Furthermore, the CERCLA amendments provide that federal water quality criteria established under the Clean Water Act (CWA) and maximum contaminant level goals (MCLGs) established under the Safe Drinking Water Act must be attained when they are relevant and appropriate under the circumstances of the release.

Today's revision to the NCP continues the basic concept of compliance with ARARs for any remedy selected (unless a waiver is justified). ARARs will be determined based upon an analysis of which requirements are applicable or relevant and appropriate to the distinctive set of circumstances and actions contemplated at a specific site. Unlike the 1985 revisions to the NCP, where alternatives were developed based on their relative attainment of ARARs, in today's rule recognition is given to the fact that ARARs may differ depending on the specific actions and objectives of each alternative being considered (for more discussion of this point, see preamble of proposal at 53 FR 51438, section 9).

In today's rule, EPA retains its policy established in the 1985 NCP of requiring attainment of ARARs during the implementation of the remedial action (where an ARAR is pertinent to the action itself), as well as at the completion of the action, and when carrying out removal actions "to the extent practicable considering the exigencies of the situation."

For ease of identification, EPA divides ARARs into three categories: chemical-specific, location-specific, and action-specific, depending on whether the requirement is triggered by the presence or emission of a chemical, by a vulnerable or protected location, or by a particular action. (More discussion of these types can be found in the preamble of the proposal at 53 FR 51437, section 8).

Response to comments: EPA received a few comments on general ARARs policies. One commenter argued that the remedial action should not necessarily have to attain the most stringent applicable or relevant and appropriate requirement if a less stringent requirement provides adequate protection of human health and the environment.

EPA disagrees. CERCLA requires that remedial actions comply with all requirements that are applicable or relevant and appropriate. Therefore, a remedial action has to comply with the most stringent requirement that is ARAR to ensure that all ARARs are attained. In addition, CERCLA requires that the remedies selected be protective of human health and the environment *and* attain ARARs. A requirement does not have to be determined to be necessary to be protective in order to be an ARAR. Conversely, the degree of stringency of a requirement is not relevant to the determination of whether it is an ARAR at a site and must be attained (except for state ARARs).

Another commenter asked for confirmation that variance or exemption provisions in a regulation can be potential ARARs as well as the basic standards. EPA agrees that meeting the conditions and requirements associated with a variance or exemption provision can be a means of compliance with an ARAR. For example, EPA expects that CERCLA sites will frequently be complying with the terms of the treatability variance under the RCRA land disposal restrictions (LDR) for soil and debris when LDR is an ARAR.

Limitations in a regulation, such as the quantity limitations that define small quantity generators under RCRA and affect what requirements a generator must comply with, will also affect what requirements are applicable at a CERCLA site. However, it is possible that a requirement could be relevant and appropriate even though the requirement is not applicable because of a limitation in the regulation.

Indian tribe commenters contended that ARARs should not be defined as promulgated laws, regulations, or requirements because some Indian tribe laws, which could apply to a Superfund cleanup, may not be promulgated in the same fashion as state or federal laws. CERCLA section 126 directs EPA to afford Indian tribes substantially the same treatment as states for certain specified subsections of CERCLA sections 103, 104 and 105. EPA believes, as a matter of policy, that it is similarly appropriate to treat Indian tribes as states for the purpose of identifying ARARs under section 121(d)(2). EPA realizes that tribal methods for promulgating laws may vary, so any evaluation of tribal ARARs will have to

water; thus, the removal action might be limited to removal of the drums and surface debris and excavation of highly contaminated soil. Requirements pertaining to the cleanup of groundwater contamination would not be ARARs for that action because the removal action is not intended to address ground water; rather, requirements pertaining to the drums, surface debris, or contaminated soil may be ARARs for the specific removal action. Once the lead agency makes the determination that the requirements are ARARs for a removal, then it must determine whether compliance is practicable.

It will generally be practicable for removal actions to comply with ARARs that are consistent with the goals and focus of the removal. However, as stated above, removals are intended to be responses to near-term threats, with the ability to respond quickly when necessary; thus, ARARs that would delay rapid response when it is necessary, or cause the response to exceed removal goals, may be determined to be impracticable. Of course, even where compliance with specific ARARs is not deemed practicable, the lead agency for a removal must use its best judgment to ensure that the action taken is protective of human health and the environment within the defined objectives of the removal action.

In order to better explain how a lead agency can determine when compliance with an ARAR is practicable, the preamble to the proposed NCP included three factors for consideration: Exigencies of the situation, scope of the removal action and the statutory limits (53 FR 51410-11). Upon consideration of comments, EPA has decided to enumerate in the rule only two of those three factors as important for determining practicability: Urgency (simply renaming exigencies) of the situation, and scope of the removal action. EPA believes that statutory limits, because they relate to the authority to conduct removal actions, are easier to consider within, rather than apart from, the factor of scope of the removal action when determining whether compliance with an ARAR is practicable.

The factor of urgency of the situation relates to the need for a prompt response. In many cases, appropriate response activities must be identified and implemented quickly in order to ensure the protection of human health and the environment. For example, if leaking drums pose a danger of fire or explosion in a residential area, the drums must be addressed immediately, and it will generally be impracticable to identify and comply with all potential ARARs.

The second factor, the scope of the removal action relates to the special nature of removals in that they may be used to minimize and mitigate potential harm rather than totally eliminate it. Removals are further limited in the amount of time and Fund money that may be expended at any particular site in the absence of a statutory exemption. Again, using the example above, even though standards requiring cleanup of the lower level soil contamination would be an ARAR to that medium, they would be outside the scope of the removal action when such cleanup is not necessary for the stabilization of the site, or when it would cause an exceedance of the statutory limits and no exemption applied. Hence, such soil standards, while ARARs, would not be practicable to attain considering the exigencies of the situation. Of course, such standards may be ARARs for any remedial action that is subsequently taken at the site.

EPA disagrees with the comment that requiring PRPs to comply with ARARs to the extent practicable discourages PRPs from conducting removals because the statutory limits do not apply to non-Fund-financed actions. Although the limits apply by law to Fund-financed actions only, EPA has the discretion under CERCLA section 104(c)(1) to take removal actions that exceed those limits, in emergency situations or where the action is otherwise appropriate and consistent with the remedial action that may be taken at the site. EPA will select the appropriate remedy, even where an extensive removal action is warranted, regardless of whether the site is Fund-lead or PRP-based. The only difference is that if the site is Fund-lead, an exemption must first be invoked in order to proceed with the action. Thus, the time and dollar limitations generally will not result in PRPs performing a more extensive removal than EPA itself would conduct. That is, EPA's selection of a removal action, including what ARARs will be attained, will not be based on who will be conducting the removal.

Finally, as stated in the preamble to the proposed NCP (53 FR 51411), even if attainment of an ARAR is practicable under the factors described above, the lead agency may also consider whether one of the statutory waivers from compliance with ARARs is available for a removal action. EPA is developing guidance on the process of complying with ARARs during removal actions. EPA generally will only require documentation of ARARs for which compliance is determined to be practicable, in order not to burden OSCs with substantial paperwork requirements.

Final rule: Proposed § 300.415(j) (renumbered as final § 300.415(i)) is revised as follows:

1. The following has been added to identify factors that are appropriate for consideration in determining the practicability of complying with ARARs:

In determining whether compliance with ARARs is practicable, the lead agency may consider appropriate factors, including the following:

(1) The urgency of the situation; and

(2) The scope of the removal action to be conducted.

2. The reference to advisories, criteria or guidance has been modified (see preamble section below on TBCs).

3. The description of ARARs has been reworded (see preamble section below on the definition of "applicable.")

Name: Sections 300.5, 300.415(g) and (h), 300.500(a), 300.505 and 300.525(a). State involvement in removal actions.

Existing rule: Sections 300.61 and 300.62 of the current NCP encourage states to undertake actions authorized under subpart F. Such actions include removal and remedial actions pursuant to CERCLA section 104(a)(1). The regulation notes further that CERCLA section 104(d)(1) authorizes the federal government to enter into contracts or cooperative agreements with the state to take Fund-financed response actions authorized under CERCLA, when the federal government determines that the state has the capability to undertake such actions.

Proposed rule: Proposed § 300.415(h) and (i) (renumbered as final § 300.415(g) and (h)) and § 300.525(a) would codify EPA's existing policy of entering into cooperative agreements with states to undertake Fund-financed removal actions, provided that states follow all the provisions of the NCP removal authorities. The preamble to the proposed rule suggested that non-time-critical actions are the most likely candidates for state-lead removals (53 FR 51410). Proposed § 300.510(b) provided further that facilities operated by a state or political subdivision require a minimum cost share of 50 percent of the total response costs if a remedial action is taken. Section 300.505 describes what EPA and a state may agree to in a Superfund Memorandum of Agreement (SMOA) regarding the nature and extent of interaction on EPA-lead and state-lead response. The preamble clarified that, where practicable, a SMOA may include general provisions

be made on a case-by-case basis. Tribal requirements, however, are still subject to the same eligibility criteria as states, as described in § 300.400(g)(4).

Another commenter disagreed with EPA's position that environmental laws do not apply to a CERCLA response action unless incorporated by CERCLA section 121(d). This commenter argued that EPA has confused the ARARs concept with one of preemption of state law.

In response, SARA established a process, in CERCLA sections 121(d)(2) and (d)(4), for how federal and state environmental laws should apply to on-site CERCLA remedial actions, i.e., the ARARs process. Based on these provisions, CERCLA remedies will incorporate (or waive) state standards, as appropriate under CERCLA. Thus, although other environmental laws do not independently apply to CERCLA response actions, the substantive requirements of such laws will be applied to such actions, consistent with section 121(d) and NCP § 300.400(g).

EPA's interpretation that CERCLA response actions are required to meet state (and other federal) environmental law standards only to the limited degree set out in CERCLA is also necessary to comply with the special mandates in CERCLA to respond quickly to emergencies, and to perform Fund-balancing. The position that on-site CERCLA response actions are not independently subject to other federal or state environmental laws is a long-standing one, based on a theory of implied repeal or pre-emption. See, e.g., 50 FR 47912, 47917-18 (Nov. 20, 1985); 50 FR 5862, 5865 (Feb. 12, 1985); "CERCLA Compliance With Other Environmental Laws" Opinion Memorandum, Francis S. Blake, General Counsel, to Lee M. Thomas, Administrator, Nov. 22, 1985.

Following are summaries of major comments and EPA's responses on specific sections of the ARARs policy.

Name: Sections 300.5 and 300.400(g)(1). Definition of "applicable."

Proposed rule: "Applicable requirements" means those cleanup standards, standards of control, or other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. The preamble to the proposed rule pointed out that there is generally little discretion in determining whether the circumstances at a site match those specified in a requirement (53 FR 51435-37).

Response to comments: One commenter suggested that language used in § 300.400(g)(4) of the proposed NCP which provides that "only those state standards that are promulgated and more stringent than federal requirements may be applicable or relevant and appropriate" be added to the definition of ARARs found in § 300.5.

In response, EPA notes that the definition it proposed already includes the condition that standards, whether federal or state, must be promulgated in order to be potential ARARs. EPA accepts this comment on stringency and has revised both §§ 300.5 and 300.400(g) to specify that in order to be considered ARARs, state requirements must be more stringent than federal requirements. EPA notes that, in general, state regulations under federally authorized programs are considered federal requirements.

A commenter supported the discussion of ARARs in the preamble to the proposed NCP, but remarked that the definitions of ARARs do not adequately reflect many of the important aspects mentioned in the preamble. EPA believes that the definitions stated in the rule are sufficiently comprehensive and that the information contained in the preamble to the proposed and final rules will help the public in applying the definitions.

One commenter asked why EPA had deleted rule language that applicable requirements are those requirements that would be legally applicable if the response action were not undertaken pursuant to CERCLA. In working with this definition, EPA found the previous definition confusing because it was stated in the conditional, i.e., requirements that would apply if the action were not under CERCLA. EPA revised the definition to explain more specifically what it means by applicable requirements to avoid any confusion. However, the 1985 wording is still a correct statement of the applicability concept. EPA is modifying the definition, however, to make it clear that the standards, etc. do not have to be promulgated specifically to address CERCLA sites.

Final rule: The proposed definition of "applicable" in §§ 300.5 and 300.400(g)(1) are revised as follows:

1. Consistent with the language in CERCLA section 121(d)(2), the description of federal and state laws in § 300.5 is revised to read:

"* * * requirements, criteria or limitations promulgated under federal *environmental* or state *environmental or facility siting law* * * *"

[Comparable changes are made in §§ 300.415(i), 300.430(e)(2)(i)(A), 300.430(e)(9)(iii)(B) and 300.430(f)(1)(ii)(C).]

2. The following sentence is added to § 300.5: "Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable."

3. In §§ 300.5 and 300.400(g)(1), the word "found" is added before "at a CERCLA site."

Name: Sections 300.5 and 300.400(g)(2). Definition of "relevant and appropriate."

Proposed rule: "Relevant and appropriate requirements" means those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site.

Section 300.400(g)(2) identified criteria that must be considered, where pertinent, to determine whether a requirement addresses problems or situations that are sufficiently similar to the circumstances of the release or remedial action that it is relevant and appropriate. The preamble to the proposed rule emphasized that a requirement must be both relevant and appropriate; this determination is based on best professional judgment. Also, the preamble stated that with respect to some statutes or regulations, only some of the requirements may be relevant and appropriate to a particular site, while others may not be (53 FR 51436-37).

Response to comments: 1. *General.* Several commenters expressed support in general for the revised definition of relevant and appropriate requirements and for the approach described in the proposal to identifying such requirements. Commenters in particular supported statements that a requirement must be both relevant, in that the problem addressed by a requirement is similar to that at the site, and appropriate, or well-suited to the circumstances of the release and the site, to be considered a relevant and appropriate requirement.

A few commenters recommended changes to the definition of relevant and appropriate requirements. One commenter suggested adding to the proposed definition that a relevant and appropriate requirement must be

007051

(8744)

that this criterion should be dropped. EPA disagrees and has discussed this issue in the section of this preamble on RCRA ARARs.

(iv): The entities or interests affected or protected by the requirement. This factor compared the entities or interests addressed by a requirement and those affected by a CERCLA site. Two commenters expressed concern about this factor. One commenter was concerned that it could be used to disqualify standards from being relevant and appropriate simply because the requirement regulated entities different from those at a CERCLA site. In contrast, another commenter was concerned that EPA would broadly apply requirements to entities that were never intended to be subject to the requirement. EPA agrees that this factor is confusing. EPA believes that the characteristics intended to be addressed by this factor are adequately covered under other factors, such as purpose and type of facility. Therefore, this factor has been eliminated.

(v): The actions or activities regulated by the requirement. This factor compared the actions or activities addressed by a requirement to those undertaken in the remedial action at a CERCLA site. No comments were received on this factor, and the final rule is essentially unchanged from the proposal.

(vi): Any variances, waivers, or exemptions of the requirement. This factor considered the availability of variances, waivers, or exemptions from a requirement that might be available for the CERCLA site or action. One commenter asked for clarification on this factor and expressed his view that the CERCLA waiver provisions for ARARs were the only waivers allowable. However, EPA believes that it is reasonable to consider the existence of waivers, exemptions, and variances under other laws because generally there are environmental or technical reasons for such provisions. These provisions are generally incorporated into national regulations because there are specific circumstances where compliance with a requirement may be inappropriate for technical reasons or unnecessary to protect human health and the environment. Again, this factor is only one that should be considered; even if a waiver provision in a requirement matches the circumstances at the CERCLA site, there may be other reasons why the requirement is still relevant and appropriate.

(vii): The type and size of structure or facility regulated by the requirement. This factor compared the characteristics of the structure or facility addressed by a requirement to that affected by or contemplated by the remedial action. One commenter argued that regulations routinely contain cut-offs based on type or size of the structure or facility for administrative or enforcement convenience. EPA agrees that cut-offs based solely on administrative reasons may not be critical in determining whether a requirement is relevant and appropriate. However, EPA believes that it is necessary and appropriate to consider the physical type or size of structure regulated because requirements may be neither relevant nor appropriate to structures or facilities that are dissimilar to those that the requirement was intended to regulate. In many cases, this factor is a very basic one: in identifying requirements relevant to landfills, one would turn to standards for landfills, not for tanks.

(viii): Consideration of use or potential use of affected resources in the requirement. This factor compared the resource use envisioned in a requirement to the use or potential use at a CERCLA site. One commenter objected to this factor based primarily on opposition to EPA's proposed ground water policy, which, along with the comments EPA has received on this issue, is discussed in the section on ground-water policy in the preamble discussion of § 300.430. EPA believes it is appropriate to compare the resource use considerations in a requirement with similar considerations at a CERCLA site.

Final rule: 1. The following sentence is added to the proposed definition of "relevant and appropriate" in § 300.5 (see preamble discussion above on "applicable"): "Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be relevant and appropriate."

2. Proposed § 300.400(g)(2) is revised as follows:

(2) If, based upon paragraph (g)(1) of this section, it is determined that a requirement is not applicable to a specific release, the requirement may still be relevant and appropriate to the circumstances of the release. In evaluating relevance and appropriateness, the factors in paragraphs (g)(2)(i) through (viii) shall be examined, where pertinent, to determine whether a requirement addresses problems or situations sufficiently similar to the circumstances of the release or remedial action contemplated, and whether the requirement is well-suited to the site, and therefore is both relevant and appropriate. The pertinence of each of the following factors will depend, in part, on whether a requirement addresses a chemical, location, or action. The following comparisons shall be made, where pertinent, to determine relevance and appropriateness:

(i) The purpose of requirement and the purpose of the CERCLA action.

(ii) The medium regulated or affected by the requirement and the medium contaminated or affected at the CERCLA site.

(iii) The substances regulated by the requirement and the substances found at the CERCLA site;

(iv) The actions or activities regulated by the requirement and the remedial action contemplated at the CERCLA site.

(v) Any variances, waivers, or exemptions of the requirement and their availability for the circumstances at the CERCLA site;

(vi) The type of place regulated and the type of place affected by the release or CERCLA action.

(vii) The type and size of structure or facility regulated and the type and size of structure or facility affected by the release or contemplated by the CERCLA action;

(viii) Any consideration of use or potential use of affected resources in the requirement and the use or potential use of the affected resource at the CERCLA site.

Name: Section 300.400(g)(3). Use of other advisories, criteria or guidance to-be-considered (TBC).

Proposed rule: The preamble to the proposed rule provided that advisories criteria or guidance to-be-considered (TBC) that do not meet the definition of ARAR may be necessary to determine what is protective or may be useful in developing Superfund remedies (53 FR 51436). The ARARs preamble described three types of TBCs: health effects information with a high degree of credibility, technical information on how to perform or evaluate site investigations or remedial actions, and policy.

For example, proposed § 300.400(g)(3) stated that other advisories, criteria, and guidance to be considered (TBCs) shall be identified, as appropriate, because they may be useful in developing CERCLA remedies. Proposed § 300.415(j)(§ 300.415(i) in the final rule) stated that other federal and state criteria, advisories, and guidance shall, as appropriate, be considered in formulating the removal action. Proposed § 300.430(b) stated that during project scoping the lead agency shall initiate a dialogue with the support agency on potential ARARs and TBCs. Proposed § 300.430(e)(2) provided that other pertinent information may be used to develop remediation goals. Proposed § 300.430(e)(8) provided that the lead agency shall notify the support agency of the alternatives to be analyzed to facilitate the identification of ARARs and TBCs. Proposed § 300.430(f) on selecting a remedy, however, referred to compliance with ARARs only, not TBCs. Proposed subpart F required that the

Final rule: References to TBCs will be changed in the following sections to make it clear that their use is discretionary rather than mandatory: §§ 300.400(g)(3), 300.415(i), 300.430(b)(9), 300.430(d)(3), 300.430(e) (8) and (9), 300.505(d)(2)(iii), 300.515(d) and (d) (1) and (2), and 300.515(h)(2).

Name: Sections 300.400 (g)(4) and (g)(5), ARARs under state laws.

Proposed rule: Section 300.400(g) specified that only promulgated state standards may be considered potential ARARs. A promulgated state standard must be legally enforceable and of general applicability. The term "legally enforceable," according to the preamble to the proposed NCP, means that state laws or standards which are considered potential ARARs must be issued in accordance with state procedural requirements and contain specific enforcement provisions or be otherwise enforceable under state law. The preamble also explained that "of general applicability" means that potential state ARARs must be applicable to all remedial situations described in the requirement, not just CERCLA sites (53 FR 51437–38).

The preamble also discussed a dispute resolution process to be followed if there is disagreement about the identification of ARARs, as well as policies to be followed if a state insists that a remedy attain a requirement not determined to be ARAR (see 53 FR 51437 and 51457).

Response to comments: Commenters on this subject called for EPA to establish a formal procedure to be followed by states to demonstrate that proposed state ARARs are legally enforceable and of generally applicability. Commenters suggested that states be required to provide legal citations from appropriate sections of state laws, as well as appropriate citations to legal authority for issuing compliance orders, obtaining injunctions, or imposing civil or criminal penalties in the event of noncompliance. These citations, according to commenters, would demonstrate that proposed ARARs are legally enforceable.

Commenters suggested that general applicability could be demonstrated by requiring states to identify the chemicals, locations, and cleanup actions to which a proposed ARAR would apply.

The proposed NCP did not prescribe a specific procedure to be used in evaluating state standards as potential ARARs. A formal process for demonstrating that state requirements are promulgated is not required by CERCLA. EPA believes that the imposition of a formal procedure on states would be a large administrative burden and could impede the cleanup process.

EPA expects, however, that states will substantiate submissions of potential ARARs by providing basic evidence of promulgation, such as a citation to a statute or regulation and, where pertinent, a date of enactment, effective date, or description of scope. Because a citation is the minimum needed to positively identify a requirement, EPA has added regulatory language requiring both lead and support agencies to provide citations when identifying their ARARs.

Section 300.400(g)(4) specifies that only promulgated state standards that are more stringent than federal requirements and are identified by the state in a timely manner may be considered potential ARARs. If a question is raised as to whether a requirement identified by a state conforms to the requirements for being a potential state ARAR, or is challenged on the basis that it does not conform to the definition, the state would have the burden of providing additional evidence to EPA to demonstrate that the requirement is of general applicability, is legally enforceable, and meets the other prerequisites for being a potential ARAR. If EPA does not agree that a state standard identified by a state is an ARAR, EPA will explain the basis for this decision.

Furthermore, the language of CERCLA section 121(d)(2)(A) makes clear, and program expediency necessitates, that the specific requirements that are applicable or relevant and appropriate to a particular site be identified. It is not sufficient to provide a general "laundry" list of statutes and regulations that might be ARARs for a particular site. The state, and EPA if it is the support agency, must instead provide a list of requirements with specific citations to the section of law identified as a potential ARAR, and a brief explanation of why that requirement is considered to be applicable or relevant and appropriate to the site.

Other comments on this section raised objections to EPA's acceptance of general goals as potential ARARs. One commenter questioned whether such general goals were implementable and satisfied the requirements of a promulgated standard, requirement, criteria, or limitation contained in CERCLA section 121(d). Another commenter argued that attempts to interpret compliance with a general goal will lead to confusion and delay. Several commenters requested clarification of the status of state nondegradation goals and whether such goals qualified as potential ARARs.

In response, it is necessary to examine the nature of a general goal in order to determine whether it may be an ARAR. General goals that merely express legislative intent about desired outcomes or conditions but are non-binding are not ARARs. EPA believes, however, that general goals, such as nondegradation laws, can be potential ARARs if they are promulgated, and therefore legally enforceable, and if they are directive in intent. The more specific regulations that implement a general goal are usually key in identifying what compliance with the goal means.

For example, in the preamble to the proposed NCP, EPA cited the example of a state antidegradation statute that prohibits the degradation of surface water below a level of quality necessary to protect certain uses of the water body (53 FR 51438). If promulgated, such a requirement is clearly directive in nature and intent. State regulations that designate uses of a given water body and state water quality standards that establish maximum in-stream concentrations to protect those uses define how the antidegradation law will be implemented are, if promulgated, also potential ARARs.

Even if a state has not promulgated implementing regulations, a general goal can be an ARAR if it meets the eligibility criteria for state ARARs. However, EPA would have considerable latitude in determining how to comply with the goal in the absence of implementing regulations. EPA may consider guidelines the state has developed related to the provision, as well as state practices in applying the goal, but such guidance or documents would be TBCs, not ARARs.

Final rule: 1. EPA has revised § 300.400(g)(4) as follows:

(4) Only those state standards that are promulgated, are identified by the state in a timely manner, and are more stringent than federal requirements may be applicable or relevant and appropriate. For purposes of identification and notification of promulgated state standards, the term "promulgated" means that the standards are of general applicability and are legally enforceable

2. Also, language has been added to § 300.400(g)(5) requiring that specific requirements for a particular site be identified as ARARs, and that citations be provided.

Name: Section 300.515(d)(1), Timely identification of state ARARs.

Proposed rule: Section 300.515(d)(1) stated that the lead and support agencies shall identify their respective

case of "applicable" requirements. However, the determination of whether a requirement is relevant and appropriate is not based on its stringency; rather, other criteria are used, as discussed in the section on relevance and appropriateness, and the remedy must comply with the most stringent requirement determined to be ARAR. EPA also believes that, in some situations, the availability of certain requirements that more fully match the circumstances of the site may result in a decision that another requirement is not relevant and appropriate. EPA believes that one such situation is when an MCL or non-zero MCLG and an FWQC for human health are available for the same contaminant when a current or potential source of drinking water is of concern, and there are no impacts to aquatic organisms.

As discussed in this preamble, EPA believes that an MCL or non-zero MCLG is generally the relevant and appropriate requirement for ground water that is a current or potential source of drinking water. EPA also believes that an MCL or non-zero MCLG, promulgated specifically to protect drinking water, generally is the appropriate standard for ground water even if an FWQC for human health is also available for the contaminant, for the following reasons.

CERCLA section 121(d)(2)(B)(i) lists, among other factors, the purpose for which the criteria were developed and the designated or potential use of the water as factors in determining whether FWQC are relevant and appropriate. Since FWQC for human health are promulgated for exposures that include drinking water and consuming fish, on the one hand, and consuming fish only, on the other, it is not directly the purpose of such criteria to provide drinking water standards per se, although levels that protect such a use can be mathematically derived from these two values. Furthermore, such derived values for drinking water will not reflect the contribution of other sources (through an apportionment factor), as MCLs and MCLGs do. Finally, for carcinogens FWQC are recommended at zero, although values corresponding to risks of 10^{-6}, 10^{-6}, and 10^{-7} are also given. For the reasons given in the discussion of MCLs and MCLGs above, the zero value is not considered relevant and appropriate under CERCLA; MCLs, however, represent a level determined to be both protective of human health for drinking water and attainable by treatment.

For the same reasons, EPA believes that MCLs or non-zero MCLGs generally will be the relevant and appropriate standards for surface water designated as a drinking water supply, unless the state has promulgated water quality standards (WQS) for the water body that reflect the specific conditions of the water body. However, surface water bodies may be designated for uses other than drinking water supply, and therefore an FWQC intended to be protective of such uses, such as the FWQC for consumption of fish or for protection of aquatic life, may very well be relevant and appropriate in such cases. Also, where a contaminant does not have an MCL or MCLG, FWQC adjusted to reflect drinking water use may be used as relevant and appropriate requirements.

Final rule: EPA is including in the final rule at § 300.430(e)(2)(i)(E) language stating that FWQC are to be attained where relevant and appropriate under the circumstances of the release or threatened release.

Name: Section 300.435(b)(2). Compliance with applicable or relevant and appropriate requirements (ARARs) *during* the remedial action.

Proposed rule: CERCLA section 121 requires that, at the completion of a remedial action, a level or standard of control required by an ARAR will be attained for wastes that remain on-site. However, consistent with the 1985 NCP (§ 300.68(i), § 300.435(b)) of the proposed NCP also required compliance with ARARs during implementation of the action, stating that *during the course of the remedial design/remedial action (RD/RA)*, the lead agency shall be responsible for ensuring that all federal and state ARARs identified for the action are being met, unless a waiver is invoked. Examples of such requirements given in the preamble to the proposed rule included RCRA treatment, storage, and disposal requirements, Clean Air Act national ambient air quality standards, and Clean Water Act effluent discharge limitations (53 FR 51440).

Response to comments: EPA received a number of comments that the NCP should not require compliance with ARARs during the remedial action. Commenters argued that this policy is inconsistent with the statute, which requires compliance with ARARs only at the completion of the remedial action, and questioned EPA's authority to require compliance with ARARs during remedial design/remedial action.

Several commenters pointed out that CERCLA section 121(d)(1) states that remedial actions must be protective and "must be relevant and appropriate under the circumstances," and argued that this standard should govern how the action itself is carried out. Design and operation of the remedial action should be based on best professional judgment and undertaken in a manner that is protective. Other commenters suggested requiring compliance only with those ARARs that "can reasonably be achieved," or listing specific types of ARARs that must be met during RD/RA.

Commenters were particularly concerned about problems created by requiring compliance with RCRA requirements and the land disposal restrictions in particular for remedial actions.

EPA disagrees with these commenters. EPA believes that it is appropriate to require that remedial activities comply with the substantive requirements of other laws that apply or are relevant and appropriate to those activities. The reasons for complying with such laws during the conduct of the remediation are basically the same as the reasons for applying ARARs as remediation objectives: the laws help define how the activity can be carried out safely and with proper safeguards to protect human health and the environment. EPA is concerned that, if the narrowest possible interpretation were applied to ARARs compliance, compliance with laws critical to protection of health and the environment would become subject to debate. laws such as those that govern surface water discharges or air emissions, or that set operational standards for incineration of hazardous waste.

Several commenters also stated that chemical-specific ARARs used as remediation goals, such as MCLs as ARARs for ground water remediation, cannot be attained during implementation. EPA wants to clarify that it recognizes that ARARs that are used to determine final remediation levels apply only at the completion of the action.

It is worthwhile to point out, in the context of this policy on complying with ARARs pertaining to the remedial activity itself, that CERCLA provides waiver from ARARs for interim actions provided the final action will attain waived standard. If there is doubt at whether an ARAR represents a final remediation goal or an interim standard and it cannot be met during the action this waiver could be invoked.

Comments were also received on EPA's discussion of compliance with ARARs during remedial investigations in the preamble to the proposed NCP (53 FR 51442-43). In that discussion, EPA stated that on-site handling, treatment or disposal of investigation-derived waste must satisfy ARARs and that

At the same time, EPA recognizes the benefits of consultation, reporting, etc. To some degree, these functions are accomplished through the state involvement and public participation requirements in the NCP. In addition, EPA has already strongly recommended that its regional offices (and states when they are the lead agency) establish procedures, protocols or memoranda of understanding that, while not recreating the administrative and procedural aspects of a permit, will ensure early and continuous consultation and coordination with other EPA programs and other agencies. CERCLA Compliance with Other Laws Manual, OSWER Directive No. 9234.1-01 (August 8, 1988), in working with states, EPA generally will coordinate and consult with the state Superfund office. That state superfund office should distribute to or obtain necessary information from other state offices interested in activities at Superfund sites.

The basis for this recommendation is a recognition that such coordination and consultation is often useful to determine how substantive requirements implemented under other EPA programs and by other agencies should be applied to a Superfund action. For example, although the Superfund office will make the final decisions on using ARARs, a water office may provide information helpful in determining ARARs when a surface water discharge is part of the Superfund remedy. Such information may include surface water classifications, existing use designations, technology-based requirements, and water quality standards. A water office may also be able to provide advice during the detailed analysis of alternatives on the effectiveness and implementability of treatment alternatives and the likely environmental fate and effects of surface or ground-water discharges. Other offices or agencies with different environmental responsibilities may similarly provide useful information, if it is given in a timely manner.

EPA also recognizes the importance of providing information to other programs and agencies that maintain environmental data bases. This is particularly true where the remedy includes releases of substances into the air or water and the extent of such releases is integral for air and water programs to maintain accurate information on ambient air and surface water quality in order to set statutorily-specified standards. Monitoring requirements themselves are considered substantive requirements and are necessary in order to document attainment of cleanup levels and compliance with emission limitations or discharge requirements identified as ARARs in the decision document. EPA strongly encourages its OSCs or RPMs, or the agency that is responsible for maintaining the operation and maintenance of an action (e.g., pump and treat system), to provide reports on monitoring activities to other offices in a form usable to those offices.

In summary, cleanup standards must be complied with, although administrative procedures such as consultation are not required, they should be observed when, for example, they are useful in determining the cleanup standards for a site. EPA believes that in order to ensure that Superfund actions proceed as rapidly as possible it must maintain a distinction between substantive and administrative requirements.

Final rule: EPA is promulgating the reference to "substantive" in the § 300.5 definitions of "applicable" and "relevant and appropriate" as proposed.

Name: Section 300.430(f)(1)(ii)(B). Consideration of newly promulgated or modified requirements.

Proposed rule: The preamble to the proposed rule discussed how new requirements or other information developed subsequent to the initiation of the remedial action should be addressed (53 FR 51440). It explained that new requirements or other information should be considered as part of the five-year review (as provided for in § 300.430(f)(3)(v)) (renumbered as final § 300.430(f)(5)(iii)(C)) to ensure that the remedial action is still protective of human health and the environment. That is, if a requirement that would be applicable or relevant and appropriate to the remedy is promulgated after the initiation of remedial action, the remedy will be evaluated in light of the new requirement to ensure that the remedy is still protective.

Response to comments: Several commenters objected to EPA's policy requiring consideration of new requirements on the grounds that the statute requires the five-year review only to determine that a remedy is still protective. These commenters were concerned that consideration of new requirements would require additional analysis and perhaps drastic changes in design; would impose an open-ended liability on PRPs; and would violate PRPs' right to due process. Two commenters suggested that making new requirements part of a negotiation process based on a reopener in the settlement agreement could alleviate the second and third concern.

Based on the comments and its experience in carrying out remedies, EPA is modifying its policy on considering newly promulgated or modified requirements to address those requirements that are promulgated or modified after the ROD is signed, rather than those requirements promulgated or modified after the initiation of remedial action, as discussed in the proposal. Once a ROD is signed and a remedy chosen, EPA will not reopen that decision unless the new or modified requirement calls into question the protectiveness of the selected remedy. EPA believes that it is necessary to "freeze ARARs" when the ROD is signed rather than at initiation of remedial action because continually changing remedies to accommodate new or modified requirements would, as several commenters noted, disrupt CERCLA cleanups, whether the remedy is in design, construction, or in remedial action. Each of these stages represents significant time and financial investments in a particular remedy. For instance, the design of the remedy (treatment plant, landfill, etc.) is based on ARARs identified at the signing of the ROD. If ARARs were not frozen at this point, promulgation of a new or modified requirement could result in a reconsideration of the remedy and a re-start of the lengthy design process, even if protectiveness is not compromised. This lack of certainty could adversely affect the operation of the CERCLA program, would be inconsistent with Congress' mandate to expeditiously cleanup sites and could adversely affect PRP negotiations, as noted by commenters. The policy of freezing ARARs will help avoid constant interruption, re-evaluation, and re-design during implementation of selected remedies.

EPA believes that this policy is consistent with CERCLA section 121(d)(2)(A), which provides that "the remedial action selected * * * shall require, at the completion of the remedial action," attainment of ARARs. EPA interprets this language as requiring attainment of ARARs identified at remedy selection (i.e., those identified in the ROD), not those that may come into existence by the completion of the remedy.[81] Neither the explicit statutory language nor the legislative history supports a conclusion that a ROD may be subject to indefinite revision as a result of shifting

[81] No commenters objected to the position in the preamble to the proposed rule that CERCLA remedial actions should attain ARARs identified at the initiation—versus completion—of the action

Blank

007056

will allow the excavation and redeposition of waste within very large areas without ever meeting RCRA design and operating standards and LDR. One commenter asserted that EPA concerns on LDRs stem from an unjustifiable belief that LDR cleanup levels cannot be achieved.

Other commenters believed that the definition of "placement" should provide more flexibility. One asserted that replacement of treated residuals in the proximate area should not constitute placement. The commenter argued that Congress intended to address, preventively or prospectively, the original act of disposal, and that an innocent government or public entity should not be required to assume the entire environmental responsibility of the original disposers. The commenter also argued that establishing that replacement of treated waste triggers LDRs will be a serious disincentive to treating wastes. Some commenters argued that LDRs should not be relevant and appropriate where the CERCLA waste to be disposed on land is merely similar in composition to RCRA banned waste.

Other commenters argued that LDRs are inappropriate for CERCLA remedial actions. They noted an inherent conflict between LDRs, which require treatment to BDAT levels, and the CERCLA process, and claimed that LDRs will supplant CERCLA's "carefully articulated and balanced approach to remedy selection." Commenters asserted that compliance with LDRs will create technical problems because of differences between CERCLA wastes and those evaluated for LDRs. The solutions recommended by these commenters primarily focused on narrowing or eliminating RCRA applicability, but included suggestions for creating treatability groups for CERCLA-type waste and seeking legislative waivers from LDRs, e.g., a waiver from LDRs for Superfund actions at NPL sites.

One commenter believed that the concept of "unit" is not readily transferable to CERCLA sites due to the age and former uses of many of the sites undergoing remediation. Given the ramifications of LDRs, the commenter argued, it may be more reasonable to create a presumption of treating the entire site as one "unit," even if remediation includes a series of operable units.

Some comments were received on EPA's statements on consolidating waste. One stated that consolidation of small amounts of waste across units should not be considered placement because that will lead to less environmentally sound and less cost-effective solutions, particularly if LDRs are triggered. Another recommended that EPA should allow consolidation of small volumes of waste anywhere on-site, for purposes of storage or treatment, without triggering otherwise applicable RCRA standards. Another commenter requested clarification that consolidation within a unit included normal earthmoving and grading operations.

1. *Actions constituting land disposal.* EPA disagrees with commenters who considered EPA's interpretation of the definition of "land disposal" under RCRA section 3004(k) to be too narrow. These commenters argued that any movement of waste should be considered "placement" of waste, and thus "land disposal" under RCRA section 3004(k).

The definition of "land disposal" is central to determining whether the RCRA LDRs are applicable to a hazardous waste which is being managed as part of a CERCLA response action, or RCRA closure or corrective action. The term "land disposal" is defined under RCRA section 3004(k) as including, but not limited to, "any placement of such hazardous waste in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, salt bed formation, or underground mine or cave." The terms "landfill", "surface impoundment," and the others, refer to specific types of units defined under RCRA regulations. Thus, Congress generally defined the scope of the LDR program as the placement of hazardous waste in a land disposal unit, as those units are defined under RCRA regulations.

EPA has consistently interpreted the phrase "placement * * * in" one of these land disposal units to mean the placement of hazardous wastes into one of these units, not the movement of waste within a unit. See e.g., 51 FR 40577 (Nov. 7, 1986) and 54 FR 41566–67 (October 10, 1989)(supplemental proposal of possible alternative interpretations of "land disposal"). EPA believes that its interpretation that the "placement * * * in" language refers to a transfer of waste into a unit (rather than simply any movement of waste) is not only consistent with a straightforward reading of section 3004(k), but also with the Congressional purpose behind the LDRs. The central concern of Congress in establishing the LDR program was to reduce or eliminate the practice of disposing of untreated hazardous waste at RCRA hazardous waste facilities. The primary aim of Congress was prospective rather than directed at already-disposed waste within a land disposal unit. See 51 FR 40577 (Nov. 7, 1986). Moreover, interpreting section 3004(k) to require application of the LDRs to any movement of waste could be difficult to implement and could interfere with necessary operations at an operating RCRA facility. For instance, when hazardous waste is disposed of in a land disposal unit at an operating RCRA facility, there may well be some "movement" of the waste already in the unit. Under the commenters' approach, such movement without pretreatment of the moved waste could be in violation of the LDRs. Thus, under the commenters' interpretation, virtually no operational activities could occur at any RCRA land disposal unit containing hazardous waste without pretreatment of any waste disturbed by the operation; clearly an infeasible approach.

EPA also believes that this interpretation of section 3004(k) is supported by the legislative history for this provision (see 129 Cong. Rec. H8139 (Oct. 6, 1983)(statement of Rep. Breaux)), and by the Congressional choice to define "land disposal" more narrowly for purposes of application of the LDRs than the already-existing term "disposal", which has a much broader meaning under RCRA. Under RCRA section 1004(3), the term "disposal" is very broadly defined and includes any "discharge, deposit, injection, dumping, spilling, leaking, or placing" of waste into or on any land or water. Thus, "disposal" (in a statutory, rather than the regulatory subtitle C meaning of the term) would include virtually any movement of waste, whether within a unit or across a unit boundary. In fact, the RCRA definition of "disposal" has been interpreted by numerous courts to include passive leaking, where no active management is involved (see, e.g., *U.S. v. Waste Industries, Inc.*, 734 F.2d 159 (4th Cir. 1984)). However, Congress did not use the term "disposal" as its trigger for the RCRA land disposal restrictions, but instead specifically defined the new, and more narrow, term "land disposal" in section 3004(k). The broader "disposal" language continues to be applicable to RCRA provisions other than those in subtitle C, such as section 7003. Thus, for the reasons outlined above, EPA believes that the existing interpretation, that movement of waste within a unit does not constitute "land disposal" for purposes of application of the RCRA LDRs, is reasonable.

With respect to the commenter who asked whether normal earthmoving and grading operations within a land disposal unit constitute "placement into

Blank

APPENDIX B to EPA/540/G-91/009

OSWER DIRECTIVE 9347.3-05 FS
SUPERFUND LDR GUIDE #5

United States Environmental Protection Agency | Office of Solid Waste and Emergency Response | Superfund Publication: 9347.3-05FS July 1989

EPA

Superfund LDR Guide #5

Determining When Land Disposal Restrictions (LDRs) Are Applicable to CERCLA Response Actions

CERCLA Section 121(d)(2) specifies that on-site Superfund remedial actions shall attain "other Federal standards, requirements, criteria, limitations, or more stringent State requirements that are determined to be legally applicable or relevant and appropriate (ARAR) to the specified circumstances at the site." In addition, the National Contingency Plan (NCP) requires that on-site removal actions attain ARARs to the extent practicable. Off-site removal and remedial actions must comply with legally applicable requirements. This guide outlines the process used to determine whether the Resource Conservation and Recovery Act (RCRA) land disposal restrictions (LDRs) established under the Hazardous and Solid Waste Amendments (HSWA) are "applicable" to a CERCLA response action. More detailed guidance on Superfund compliance with the LDRs is being prepared by the Office of Solid Waste and Emergency Response (OSWER).

For the LDRs to be applicable to a CERCLA response, the action must constitute placement of a restricted RCRA hazardous waste. Therefore, site managers (OSCs, RPMs) must answer three separate questions to determine if the LDRs are applicable:

(1) Does the response action constitute placement?

(2) Is the CERCLA substance being placed also a RCRA hazardous waste? and if so

(3) Is the RCRA waste restricted under the LDRs?

Site managers also must determine if the CERCLA substances are California list wastes, which are a distinct category of RCRA hazardous wastes restricted under the LDRs (see Superfund LDR Guide #2).

(1) DOES THE RESPONSE CONSTITUTE PLACEMENT?

The LDRs place specific restrictions (e.g., treatment of waste to concentration levels) on RCRA hazardous wastes prior to their placement in land disposal units. Therefore, a key determination is whether the response action will constitute placement of wastes into a land disposal unit. As defined by RCRA, land disposal units include landfills, surface impoundments, waste piles, injection wells, land treatment facilities, salt dome formations, underground mines or caves, and concrete bunkers or vaults. If a CERCLA response includes disposal of wastes in any of these types of off-site land disposal units, placement will occur. However, uncontrolled hazardous waste sites often have

concept of a RCRA unit less useful for actions involving on-site disposal of wastes. Therefore, to assist in defining when "placement" does and does not occur for CERCLA actions involving on-site disposal of wastes, EPA uses the concept of "areas of contamination" (AOCs), which may be viewed as equivalent to RCRA units, for the purposes of LDR applicability determinations.

An AOC is delineated by the areal extent (or boundary) of contiguous contamination. Such contamination must be continuous, but may contain varying types and concentrations of hazardous substances. Depending on site characteristics, one or more AOCs may be delineated. Highlight 1 provides some examples of AOCs.

Highlight 1: EXAMPLES OF AREAS OF CONTAMINATION (AOCs)

- A waste source (e.g., waste pit, landfill, waste pile) and the surrounding contaminated soil.
- A waste source, and the sediments in a stream contaminated by the source, where the contamination is continuous from the source to the sediments.*
- Several lagoons separated only by dikes, where the dikes are contaminated and the lagoons share a common liner.

* The AOC does not include any contaminated surface or ground water that may be associated with the land-based waste source.

For on-site disposal, placement occurs when wastes are moved from one AOC (or unit) into another AOC (or unit). Placement does not occur when wastes are left in place, or moved within a single AOC. Highlight 2 provides scenarios of when placement does and does not occur, as defined in the proposed NCP. The Agency is current reevaluating the definition of placement prior to the promulgation of the final NCP, and therefore, these scenarios are subject to change.

Highlight 2: PLACEMENT

Placement does occur when wastes are:

- Consolidated from different AOCs into a single AOC;
- Moved outside of an AOC (for treatment or storage, for example) and returned to the same or a different AOC; or
- Excavated from an AOC, placed in a separate unit, such as an incinerator or tank that is within the AOC, and redeposited into the same AOC.

Placement does not occur when wastes are:

- Treated in situ;
- Capped in place;
- Consolidated within the AOC; or
- Processed within the AOC (but not in a separate unit, such as a tank) to improve its structural stability (e.g., for capping or to support heavy machinery).

In summary, if placement on-site or off-site does not occur, the LDRs are not applicable to the Superfund action.

(2) IS THE CERCLA SUBSTANCE A RCRA HAZARDOUS WASTE?

Because a CERCLA response must constitute placement of a restricted RCRA hazardous waste for the LDRs to be applicable, site managers must evaluate whether the contaminants at the CERCLA site are RCRA hazardous wastes. Highlight 3 briefly describes the two types of RCRA hazardous wastes --listed and characteristic wastes.

Highlight 3: RCRA HAZARDOUS WASTES

A RCRA solid waste* is hazardous if it is listed or exhibits a hazardous characteristic.

Listed RCRA Hazardous Wastes

Any waste listed in Subpart D of 40 CFR 261, including:

- F waste codes (Part 261.31)
- K waste codes (Part 261.32)
- P waste codes (Part 261.33(e))
- U waste codes (Part 261.33(f))

Characteristic RCRA Hazardous Wastes

Any waste exhibiting one of the following characteristics, as defined in 40 CFR 261:

- Ignitability
- Corrosivity
- Reactivity
- Extraction Procedure (EP) Toxicity

* A solid waste is any material that is discarded or disposed of (i.e., abandoned, recycled in certain ways, or considered inherently waste-like). The waste may be solid, semi-solid, liquid, or a contained gaseous material. Exclusions from the definition (e.g., domestic sewage sludge) appear in 40 CFR 261.4(a). Exemptions (e.g., household wastes) are found in 40 CFR 261.4(b).

Site managers are not required to presume that a CERCLA hazardous substance is a RCRA hazardous waste unless there is affirmative evidence to support such a finding. Site managers, therefore, should use "reasonable efforts" to determine whether a substance is a RCRA listed or characteristic waste. (Current data collection efforts during CERCLA removal and

APPENDIX C to EPA/540/6-91/009

OSWER DIRECTIVE 9330.2-04
DISCHARGE OF WASTEWATER FROM CERCLA SITES INTO POTWs

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

APR 15 1986

OSWER Directive 9330.2-4

MEMORANDUM

SUBJECT: Discharge of Wastewater from CERCLA Sites into POTWs

FROM: Henry L. Longest II, Director
Office of Emergency and Remedial Response

Rebecca Hanmer, Director
Office of Water Enforcement and Permits

Gene A. Lucero, Director
Office of Waste Programs Enforcement

TO: Waste Management Division Directors
Regions I - X

Water Management Division Directors
Regions I - X

A number of emergency removals and remedial cleanup actions under CERCLA will involve consideration of publicly owned treatment works (POTWs) for discharge of wastewater. The current off-site policy (issued on May 6, 1985) does not address the set of concerns and issues unique to POTWs that must be evaluated during the Remedial Investigation and Feasibility Study (RI/FS) for discharge of CERCLA wastewater to POTWs.

Recently, we have had meetings with representatives of the Association of Metropolitan Sewerage Authorities (AMSA) to discuss technical and policy concerns related to the POTW/CERCLA issue. This memorandum is to highlight some of the major points under consideration which were shared with AMSA at their recent Winter Technical Conference. The Agency intends to develop policy on the use and selection of POTWs for CERCLA wastewater. Your comments are sought on the proposed criteria set forth herein. These criteria may be useful in evaluation of POTWs for response actions (fund financed or responsible party financed) to be taken in the interim.

Our position is that no CERCLA discharges to a POTW should occur unless handled in a manner demonstrated to be protective of human health and the environment. Full compliance with all applicable requirements of the Clean Water Act (CWA), the Resource Conservation and Recovery Act (RCRA), and any other relevant or appropriate environmental statutes will be necessary.

The national pretreatment program, under the Clean Water Act, requires an analysis to determine whether the discharge of an industrial user of a POTW may pass through the POTW to cause receiving water quality problems or may interfere with POTW operations (including sludge disposal). If the analysis suggests that limits on the industrial user's discharge are needed to prevent pass through or interference, local limits or other safeguards, as necessary, must be established by the POTW and/or the NPDES permitting authority. The national pretreatment program requirements apply to the introduction of all non-domestic wastewater into any POTW, and include, among other things, the following elements:

- Prohibited discharge standards - prohibit the introduction of pollutants to the POTW which are ignitable, corrosive, excessively high in temperature, or which may cause interference or pass through at the POTW.

- Categorical discharge standards - include specific pretreatment standards which are established by EPA for the purpose of regulating industrial discharges in specific industrial categories.

- Local limits - where no categorical standards have been promulgated or where more stringent controls are necessary.

POTWs under consideration as potential receptors of CERCLA wastewaters may include those POTWs either with or without an approved pretreatment program. POTWs <u>with</u> an approved pretreatment program are required to have the mechanisms necessary to ensure compliance by industrial users with applicable pretreatment standards and requirements.* POTWs <u>without</u> an approved pretreatment program must be evaluated to determine whether sufficient mechanisms exist to allow the POTW to meet the requirements of the national pretreatment program in accepting CERCLA wastewaters. As noted above, pass through and interference are always prohibited, regardless of whether a POTW has an approved pretreatment program. POTWs without an approved pretreatment program must therefore have mechanisms which are adequate to apply the requirements of the national pretreatment program to specific situations.

---

*POTWs with approved pretreatment programs must, among other things, establish procedures to notify industrial users (IUs) of applicable pretreatment standards and requirements, receive and analyze self-monitoring reports from IUs, sample and analyze industrial effluents, investigate noncompliance, and comply with public participation requirements.

- The POTW's knowledge of and compliance with any applicable RCRA requirements or requirements of other environmental statutes (RCRA permit-by-rule requirements may be triggered if the POTW receives CERCLA wastewaters that are classified as "hazardous wastes" without prior mixing with domestic sewage, i.e., direct delivery to the POTW by truck, rail, or dedicated pipe; CERCLA wastewaters are not all necessarily considered hazardous wastes; case by case determinations have to be made).

- The various costs of managing CERCLA wastewater, including all risks, liabilities, permit fees, etc. (It may be appropriate to reflect these costs in the POTW's connection fees and user charge system).

Based upon consideration of the above elements, the discharge of CERCLA wastewater to a POTW should be deemed inappropriate if the evaluation indicates that:

- The constituents in the CERCLA discharge are not compatible with the POTW and will cause pass through, interference, toxic pollutants in toxic amounts in the POTW's receiving waters, unacceptable sludge contamination, or a hazard to employees of the POTW.

- The impact of the transport mechanism and/or discharging of CERCLA wastewater into a POTW would result in unacceptable impacts upon any environmental media.

- The POTW is determined to be an unacceptable receptor of CERCLA wastewaters based upon a review of the POTW's compliance history.

- The use of the POTW is not cost-effective.

If consideration of the various elements indicates that the discharge of CERCLA wastewater to a POTW is deemed appropriate:

- There should be early public involvement, including contact with POTW officials and users, in accordance with the CERCLA community relations plan and public participation requirements.

- The NPDES permit and fact sheet may need to be modified to reflect the conditions of acceptance of CERCLA wastewaters; permit modification may be necessitated by the need to incorporate specific pretreatment requirements, local limits, monitoring requirements and/or limitations on additional pollutants of concern in the POTW's discharge or other factors.

APPENDIX D to EPA/540/G-91/009

TCLP CONSTITUENTS

TOXICITY CHARACTERISTIC CONSTITUENTS AND REGULATORY LEVELS

Constituent	Regulatory level (mg/L)
Arsenic	5.0
Barium	100.0
Benzene	0.5
Cadmium	1.0
Carbon tetrachloride	0.5
Chlorodane	0.03
Chlorobenzene	100.0
Chloroform	6.0
Chromium	5.0
o-Cresol	200.0
m-Cresol	200.0
p-Cresol	200.0
2,4-D	10.0
1,4-Dichlorobenzene	7.5
1,2-Dichloroethane	0.5
1,1-Dichloroethylene	0.7
2,4-Dinitrotoluene	0.13
Endrin	0.02
Heptachlor (and its hydroxide)	0.008
Hexachlorobenzene	0.13
Hexachloro-1,3-butadiene	0.5
Hexachlorethane	3.0
Lead	5.0
Lindane	0.4
Mercury	0.2
Methoxychlor	10.0
Methyl ethyl ketone	200.0
Nitrobenzene	2.0

TOXICITY CHARACTERISTIC CONSTITUENTS AND REGULATORY LEVELS

Constituent	Regulatory level (mg/L)
Pentachlorophenol	100.0
Pyridine	5.0
Selenium	1.0
Silver	5.0
Tetrachloroethylene	0.7
Toxaphene	0.5
Trichlorethylene	0.5
2,4,5-Trichlorophenol	400.0
2,4,6-Trichlorophenol	2.0
2,4,5-TP (Silvex)	1.0
Vinyl chloride	2.0

GLOSSARY OF TERMS

AOC - Area of Contamination
ARARs - Applicable or Relevant and Appropriate Requirements
BDAT - Best Demonstrated Available Technology
BOA - Basic Ordering Agreement
CAA - Clean Air Act
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
CLP - Contract Laboratory Program
CWA - Clean Water Act
DE - Disposable Equipment
FIT - Field Investigation Team
HSWA - Hazardous and Solid Waste Amendments
IDW - Investigation - Derived Wastes
LDRs - Land Disposal Restrictions
NCP - National Contingency Plan
PCB - Polychlorinated Biphenyls
PPE - Personal Protective Equipment
POTW - Publicly Owned Treatment Works
PRPs - Potentially Responsible Parties
RCRA - Resource Conservation and Recovery Act
RI/FS - Remedial Investigation/Feasibility Study
RPO - Regional Project Officer
SDWA - Safe Drinking Water Act
SI - Site Inspection
SM - Site Inspection Manager
SWDA - Solid Waste Disposal Act
TSD - Treatment, Storage, and Disposal
TCLP - Toxicity Characteristic Leaching Procedure
TSCA - Toxic Substances Control Act

U.S. Government Printing Office: 1991 — 548-157/40005

Appendix B

Roy F. Weston, Inc.

Analytical Division Program Plan

ANALYTICAL LABORATORY QUALITY ASSURANCE PROGRAM PLAN (QAPP)

ROY F. WESTON, INC.
Analytics Division-L377
2417 Bond Street
University Park, IL 60466
Phone: 708-534-5200

CONTROLLED DISTRIBUTION

COPY # : D41
ISSUED TO : Ken Claypoon
EMD - Houston

Full Signature Approvals Are Kept on File with WESTON's Analytics Division QA Standard Practice Records

REVISION 05

October 1991

Approval: Date:

Raymond J. Frederici — 1 October 1991
Raymond J. Frederici
Department QA Manager-L377

Michael J. Healy — 1 October 1991
Michael J. Healy
Department Manager-L377

Raymond J. Frederici — 1 October 1991
Raymond J. Frederici
Division QA Manager

Earl M. Hansen — 30 September 1991
Earl M. Hansen, Ph.D.
Division Manager

Eff. Date: 10/01/91 Initiated By: Raymond J. Frederici Approved By: Earl M. Hansen Authorized By: A. Marie Henry SP No. 21-06-001

ANALYTICAL LABORATORY QUALITY ASSURANCE PROGRAM PLAN (QAPP)

TABLE OF CONTENTS

SECTION NUMBER	SECTION TITLE	NO. OF PAGES	PAGE NO.	REVISION DATE
1.0	QUALITY ASSURANCE POLICY	6	1-1	04/01/91
1.1	Quality Assurance/Quality Control (QA/QC)		1-1	04/01/91
1.2	Standard of Quality		1-2	04/01/91
1.3	Document Authorities		1-3	04/01/91
2.0	ORGANIZATION AND RESPONSIBILITIES	10	2-1	04/01/91
2.1	General		2-1	04/01/91
2.2	Quality Assurance Infra-Structure		2-2	04/01/91
2.3	Description of Laboratory Personnel Responsibilities		2-3	04/01/91
2.3.1	Project Director and Project Manager		2-3	04/01/91
2.3.2	Technical Director		2-4	04/01/91
2.3.3	Laboratory Manager		2-4	04/01/91
2.3.4	Section Managers/Supervisors		2-4	10/01/91
2.3.5	Quality Assurance Personnel		2-5	04/01/91
2.3.6	Report Section Manager		2-5	04/01/91
2.3.7	Chemists/Technicians		2-5	04/01/91
2.4	Training and Qualification		2-5	10/01/91
3.0	QUALITY ASSURANCE OBJECTIVES	10	3-1	04/01/91
3.1	Precision		3-1	10/01/91
3.2	Accuracy and Bias		3-3	10/01/91
3.2.1	Metals/Inorganics Analysis		3-5	04/01/91
3.2.2	Organic Analysis (GC and GC/MS)		3-6	04/01/91
3.3	Representativeness and Comparability		3-7	04/01/91
3.4	Completeness		3-7	10/01/91
3.5	References		3-8	04/01/91
4.0	SAMPLING PROCEDURES	13	4-1	04/01/91
4.1	Introduction		4-1	04/01/91
4.2	Sampling Plan		4-1	04/01/91
4.2.1	Research Background Information		4-2	04/01/91
4.2.2	Safety		4-2	04/01/91
4.2.3	Sampling Points		4-2	04/01/91
4.2.4	Volume of Samples		4-3	04/01/91
4.2.5	Sampling Equipment and Procedures		4-3	04/01/91
4.2.5.1	Groundwater Sampling		4-4	04/01/91
4.2.5.2	Surface Water Sampling		4-5	04/01/91

SECTION NUMBER	SECTION TITLE	NO. OF PAGES	PAGE NO.	REVISION DATE
	4.2.5.3 Sediment, Soil, and Sludge Sampling		4-5	04/01/91
	4.2.5.4 Wastewater Influent and Effluent Sampling		4-5	04/01/91
	4.2.5.5 Drum Sampling (Hazardous Waste)		4-6	04/01/91
	4.2.6 Training of the Field Team		4-7	04/01/91
	4.2.7 Sample Handling and Packing		4-7	04/01/91
	4.2.8 Sample Shipment		4-8	04/01/91
	4.3 Sample Containers		4-8	04/01/91
	4.4 Sample Preservation and Holding Times		4-9	04/01/91
5.0	CHAIN-OF-CUSTODY	13	5-1	04/01/91
	5.1 Field Custody		5-2	04/01/91
	5.2 Sample Receipt		5-2	04/01/91
	5.3 Sample Storage		5-4	10/01/91
	5.4 Sample Tracking		5-5	04/01/91
	5.4.1 Organic Preparation/Analysis		5-5	04/01/91
	5.4.2 Metals Preparation/Analysis		5-6	04/01/9
	5.4.3 Sample Disposition		5-6	04/01/9
	5.4.4 Record Keeping		5-7	10/01/9.
	5.4.5 Building Security		5-7	04/01/91
	5.5 Electronic Data Records		5-8	04/01/91
	5.5.1 LIMS Security System		5-8	10/01/91
	5.5.2 System Preventative Maintenance		5-9	04/01/91
	5.5.3 Software Updates and Revisions		5-10	04/01/91
6.0	CALIBRATION PROCEDURES	12	6-1	04/01/91
	6.1 Metals by Atomic Absorption (AA) Spectroscopy: Graphite Furnace (GFAA), Flame AA, Cold Vapor AA		6-1	04/01/91
	6.1.1 AA: Initial Calibration		6-2	10/01/91
	6.1.2 AA: Continuing Calibration		6-2	10/01/91
	6.2 Metals by Inductively Coupled Argon Plasma (ICP)		6-2	10/01/91
	6.2.1 ICP: Initial Calibration		6-3	10/01/91
	6.2.2 ICP: Continuing Calibration		6-4	04-01/91
	6.3 Inorganic Colorimetric Methods		6-4	04/01/91
	6.3.1 Colorimetric: Initial Calibration		6-4	04/01/91
	6.3.2 Colorimetric: Continuing Calibration		6-5	04/01/91
	6.4 Total Organic Carbon (TOC)		6-5	04/01/91
	6.4.1 TOC: Initial Calibration		6-5	04/01/91
	6.4.2 TOC: Continuing Calibration		6-6	04/01/91
	6.5 Gas Chromatography/Mass Spectrometry (GC/MS)		6-6	04/01/91
	6.5.1 Tuning and GC/MS Mass Calibration		6-6	04/01/91
	6.5.2 GC/MS: Initial Calibration		6-7	04/01/9
	6.5.3 GC/MS: Continuing Calibration		6-8	04/01/9
	6.6 Gas Chromatography (GC) and High Performance Liquid			

SECTION NUMBER	SECTION TITLE	NO. OF PAGES	PAGE NO.	REVISION DATE
	Chromatography (HPLC)		6-9	04/01/91
	6.6.1 GC & HPLC: Initial Calibration		6-9	10/01/91
	6.6.1.1 Pesticides/PCB's Initial Calibration		6-9	10/01/91
	6.6.2 GC & HPLC: Continuing Calibration		6-10	04/01/91
	6.7 Ion Chromatography (IC)		6-10	10/01/91
	6.7.1 IC: Initial Calibration		6-10	10/01/91
	6.7.2 IC: Continuing Calibration		6-11	10/01/91
	6.8 Total Organic Halogen (TOX)		6-11	10/01/91
	6.8.1 TOX: Initial Calibration		6-11	10/01/91
	6.8.2 TOX: Continuing Calibration		6-11	10/01/91
	6.9 Balances		6-12	10/01/91
	6.10 Thermometers		6-12	10/01/91
7.0	ANALYTICAL PROCEDURES	5	7-1	04/01/91
	7.1 Method References		7-1	04/01/91
	7.2 Detection Limits: Terminology and Procedures		7-2	04/01/91
	7.2.1 Method Detection Limit (MDL)		7-2	04/01/91
	7.2.2 Instrument Detection Limit (IDL)		7-2	04/01/91
	7.2.3 Reported Detection Limit (RDL)		7-3	10/01/91
	7.3 Laboratory Glassware Cleaning Procedures		7-3	10/01/91
	7.4 Sample Container Cleaning Procedure		7-4	04/01/91
	7.5 Waste Disposal		7-4	04/01/91
	7.6 Reagent Storage		7-5	04/01/91
8.0	DATA REDUCTION, VALIDATION AND REPORTING	12	8-1	04/01/91
	8.1 Introduction		8-1	04/01/91
	8.2 Data Reduction		8-1	04/01/91
	8.2.1 Significant Figures		8-2	04/01/91
	8.2.1 Rounding Off Numbers		8-2	04/01/91
	8.2.3 Gravimetric Procedures		8-3	04/01/91
	8.2.4 Colorimetric Procedures		8-3	04/01/91
	8.2.5 Titrimetric Procedures		8-4	04/01/91
	8.2.6 Direct Reading Instruments: e.g., ICP, GFAA, TOC, TOX		8-4	10/01/91
	8.2.7 Instruments with Strip Chart Output: e.g., Flame AA, Cold Vapor Hg, AutoAnalyzer Methods, etc.		8-5	04/01/91
	8.2.8 HPLC and Gas Chromatography		8-6	04/01/91
	8.2.8.1 Single Level Calibration		8-6	04/01/91
	8.2.8.2 Multi-Level Calibration		8-7	04/01/91
	8.2.9 GC/MS, Internal Standard Method		8-7	04/01/91
	8.3 Data Review/Data Validation		8-9	04/01/91
	8.4 Data Reporting		8-10	10/01/91
	8.4.1 Standard Client Report		8-11	04/01/91
	8.4.2 NJDEP CLP-II Report		8-11	04/01/91.

SECTION NUMBER	SECTION TITLE	NO. OF PAGES	PAGE NO.	REVISION DATE
	8.4.1 WESTON CLP Report		8-11	04/01/91
	8.5 Data Storage		8-12	10/01/91
9.0	INTERNAL QUALITY CONTROL CHECKS	15	9-1	04/01/91
	9.1 Quality Control Indicators and Analysis Frequency		9-1	04/01/91
	9.1.1 Method Performance QC Indicators: Preparation Batch		9-1	04/01/91
	9.1.1.1 Preparation Blanks		9-1	10/01/91
	9.1.1.2 Laboratory Control Samples and Blank Spikes		9-2	04/01/91
	9.1.1.3 Known QC Check Samples		9-3	04/01/91
	9.1.1.4 Matrix QC Indicators		9-3	04/01/91
	9.1.2 Instrument Performance QC Indicators		9-5	04/01/91
	9.1.2.1 Initial Calibration Verification (ICV)		9-5	04/01/91
	9.1.2.2 Initial Calibration Blank (ICB)		9-5	04/01/91
	9.1.2.3 ICP Interference Check Samples (ICSA/ICSAB)		9-6	10/01/91
	9.1.2.4 Detection Limit Verification Standard		9-6	04/01/91
	9.1.2.5 Continuing Calibration Verification (CCV)		9-7	04/01/91
	9.1.2.6 Continuing Calibration Blank (CCB)		9-7	04/01/91
	9.1.2.7 Linear Range Analysis Standard (LRS)		9-7	04/01/91
	9.1.2.8 Interelement Correction		9-7	10/01/91
	9.1.2.9 GC/MS Tuning and Performance		9-8	10/01/91
	9.1.2.10 GC and HPLC Instrument Performance		9-8	10/01/91
	9.1.3 Method Performance QC Indicators: Analysis Batch		9-8	04/01/91
	9.1.3.1 Serial Dilution		9-9	04/01/91
	9.1.3.2 Duplicate AA Furnace Injections		9-9	04/01/91
	9.1.3.3 Analytical Bench Spike for AA Furnace		9-9	04/01/91
	9.1.3.4 Method of Standard Additions		9-10	04/01/91
	9.1.3.5 Post-Digestion/Post Distillation Spike		9-10	04/01/91
	9.2 QC Monitoring		9-10	04/01/91
	9.2.1 Laboratory QC Charts		9-10	04/01/91
	9.2.2 Refrigerator Blanks		9-11	04/01/91
	9.2.3 Solvent/Reagent Water Approval		9-11	10/01/91
	9.2.4 Vendor-Purchased Sampling Containers		9-11	04/01/91
	9.2.5 Bottle Orders		9-12	04/01/91
	9.2.6 Balances, Refrigerators		9-12	10/01/91
	9.2.7 Instrument Time Check Verifications		9-13	04/01/91
10.0	PERFORMANCE AND SYSTEM AUDITS/SURVEILLANCES	10	10-1	04/01/91
	10.1 External Audits		10-1	04/01/91
	10.1.1 Performance Audits		10-1	04/01/91
	10.1.2 Systems Audits		10-2	04/01/91
	10.2 Internal Audits		10-2	04/01/91
	10.2.1 Performance Audits		10-2	04/01/91
	10.2.2 Systems Audits and Surveillances		10-3	04/01/9

SECTION NUMBER	SECTION TITLE	NO. OF PAGES	PAGE NO.	REVISION DATE
	10.2.3 Raw Data Audits and Surveillances		10-4	04/01/91
11.0	PREVENTATIVE MAINTENANCE	8	11-1	04/01/91
	11.1 Introduction		11-1	04/01/91
	11.2 Instrument Maintenance Log Books		11-1	04/01/91
	11.3 Instrument Maintenance and Repair		11-1	04/01/91
	11.4 Spare Parts		11-2	04/01/91
	11.5 Contingency Plans		11-2	04/01/91
12.0	PROCEDURES USED TO ASSESS DATA QUALITY	2	12-1	04/01/91
	12.1 Introduction		12-1	04/01/91
	12.2 Precision		12-1	04/01/91
	12.3 Accuracy		12-1	04/01/91
	12.4 Completeness		12-2	04/01/91
13.0	CORRECTIVE ACTION	7	13-1	04/01/91
	13.1 Responses to External On-Sites/Performance Samples		13-3	04/01/91
14.0	QUALITY ASSURANCE REPORTS TO MANAGEMENT	2	14-1	04/01/91

SECTION NUMBER	SECTION TITLE	NO. OF PAGES	PAGE NO.	REVISION DATE
TABLES				
TABLE 1-1	Correlation of WESTON's Analytics Division Quality Assurance Program Plan with EPA QAMS-005/80	1	1-4	04/01/91
TABLE 1-2	Correlation of WESTON's Analytics Division Quality Assurance Program Plan with ANSI/ASME NQA-1	1	1-5	04/01/91
TABLE 1-3	Correlation of WESTON's Analytics Division Quality Assurance Program Plan with AIHA	1	1-6	04/01/91
TABLE 3-1	QA Objectives for Accuracy for Organic Surrogate Analysis	1	3-9	04/01/91
TABLE 3-2	QA Objectives for Accuracy and Precision for Organic Target Compound Analysis	1	3-10	10/01/
TABLE 4-1	Sampling Points for Waste Receptacles	1	4-11	04/01/9
TABLE 4-2	Examples of Sampling Equipment	1	4-12	04/01/91
TABLE 4-3	Examples of Sampling Equipment for Particular Waste Types	1	4-13	04/01/91
TABLE 10-1	L372 - External Performance and Systems Audits	3	10-5	10/01/91
TABLE 10-2	L373 - External Performance and Systems Audits	1	10-8	10/01/91
TABLE 10-3	L377 - External Performance and Systems Audits	2	10-9	10/01/91
TABLE 11-1	Equipment Maintenance Summary	5	11-4	10/01/91

SECTION NUMBER	SECTION TITLE	NO. OF PAGES	PAGE NO.	REVISION DATE
FIGURES				
FIGURE 2-1	Analytics Division Organization Chart	1	2-7	04/01/91
FIGURE 2-2A	Laboratory Organization Chart: L372	1	2-8	10/01/91
FIGURE 2-2B	Laboratory Organization Chart: L373	1	2-9	10/01/91
FIGURE 2-2C	Laboratory Organization Chart: L375	1	2-10	10/01/91
FIGURE 2-2D	Laboratory Organization Chart: L377	1	2-11	10/01/91
FIGURE 5-1	Custody Transfer Record/Lab Work Request	1	5-11	04/01/91
FIGURE 5-2	Sample Extraction Record	1	5-12	04/01/91
FIGURE 5-3	Sample Digestion Record	1	5-13	04/01/91
FIGURE 9-1	Inorganic Instrument Performance Indicators	1	9-14	04/01/91
FIGURE 9-2	Inorganic Method Performance Indicators	1	9-15	10/01/91
FIGURE 13-1	Critical Path to Corrective Action	1	13-4	04/01/91
FIGURE 13-2	Sample Discrepancy Report (SDR)	2	13-5	04/01/91
FIGURE 13-3	Corrective Action Form	1	13-7	04/01/91

QUALITY ASSURANCE PROGRAM PLAN
ANALYTICS DIVISION

1.0 QUALITY ASSURANCE POLICY

It is the policy and objective of Roy F. Weston, Inc. (WESTON) to be acknowledged as an organization that provides high quality services. WESTON provides high quality services because it takes pride in its work and because providing high quality services is a sound business practice.

Quality is the most significant criteria influencing the viability and well being of WESTON. It is the criteria that distinguishes the best organization from the others.

WESTON is a professional services company and as such the quality of its services and deliverables are dependent on their reception by the client. The quality objective is mutually defined between WESTON and the client and is an inherent part of the quality assurance program.

Within relatively narrow limits, the level of excellence required may vary from project to project and from work element to work element. This is dependent on the technological and the financial risk to either the client or WESTON. There shall be a WESTON "standard of quality" established at a level of excellence to assure attaining a reputation as a quality organization.

The attainment of a reputation as a quality organization does not just happen. It results from a successful concerted effort over a long period of time. Therefore, the effort must be well planned and supported both organizationally and individually. It must be credible and rigorous, yet flexible to respond to the ever-changing needs of WESTON and the client.

1.1 Quality Assurance/Quality Control (QA/QC)

Quality, as the term is used herein, is defined as the level of excellence needed to conform to an established standard. Generally, quality will refer to the excellence of end results and/or the excellence of performance required to attain the established standard.

Quality Assurance (QA) is defined as those planned and systematic actions necessary to provide adequate confidence to WESTON and its clients that the services provided meet mutually accepted quality

standards consistent with project scope and budget. Quality assurance is attained through the implementation of a quality control program.

Quality Control (QC) is defined as the operational processes employed to ensure an objective level of excellence. Established performance criteria are defined for all areas, including

- administrative and technical methods and procedures,
- position accountability, duties and authority,
- performance monitoring, and
- peer and supervisory review, check, approval, and sign-off.

QC provides the tools to measure and evaluate the conformance of the operational procedures to criteria.

1.2 Standard of Quality

Standard of quality refers to a specific, defined, pre-established level of excellence. The phrase "standard of quality" will usually be preceded by a descriptive word or phrase such as "WESTON," "EPA," "USATHAMA," "USAFOEHL/TS," "NEESA,", "HAZWRAP," etc. which references documented descriptions of the level of excellence to be achieved.

A standard of quality shall be established for every Analytics Division project and work element. The vehicle through which this standard is documented and communicated for standard analytical services is this Quality Assurance Program Plan (QAPP) for the Analytics Division, in conjunction with a Project Technical Profile and/or Quality Assurance Project Plan (QAPjP).

The Project Technical Profile will summarize basic project requirements, such as, QC and deliverables requirements, analyte lists, certification requirements, turn-around-times, and miscellaneous project information (e.g., the project manager, work order number, subcontracting restrictions, hazard restrictions, etc.).

The QAPjP allows for customized, client-specific quality control measures that can be added to or that can supersede the basic laboratory QAPP guidance to satisfy the needs of individual programs with specialized requirements. Laboratory personnel are

available to discuss the design, advantages, and disadvantages of other quality control options, and to aid the data user in developing a project specific Quality Assurance Project Plan (QAPjP). Generally, the minimum information to be provided in these project specific plans will include:

- background and overall project objectives,
- intended use of the acquired data,
- list of measurement parameters,
- number of samples to be taken,
- kinds of samples to be taken (e.g. soil, surface water, groundwater, biological, sludge, drums, etc.), and
- dates anticipated for project start and completion.

1.3 Document Authorities

This plan has been prepared in accordance with requirements set forth in:

- QAMS-005/80, "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans", QAMS-005/80, 29 December 1980 (for format and content),
- ASME NQA-1-1989 Edition, "Quality Assurance Program Requirements for Nuclear Facilities," American Society of Mechanical Engineers, 345 East 47th Street, New York, New York 10017 (for applicable content), and
- WESTON Standard Practices Manual, Chapter 10: "Quality Assurance" (for policies and procedures).
- "Quality Assurance Manual for Industrial Hygiene Chemistry," prepared by the Analytical Chemistry Committee of the American Industrial Hygiene Association (AIHA), 1988

The ensuing tables show the correlation of sections in this QAPP to the requirements of above-referenced documents:

- Table 1-1, to QAMS-005/80
- Table 1-2, to ANSI/ASME NQA-1
- Table 1-3, to AIHA.

TABLE 1-1. CORRELATION OF WESTON'S ANALYTICS DIVISION QUALITY ASSURANCE PROGRAM PLAN WITH EPA QAMS-005/80

EPA QAMS-005/80 REQUIREMENT		ANALYTICS QAPP SECTION	
1.0	Title Page		Title Page
2.0	Table of Contents		Table of Contents
3.0	Project Description	1.0	Quality Assurance Policy
4.0	Project Organization and Responsibility	2.0	Organization and Responsibilities
5.0	QA Objectives for PARCC	3.0	Quality Assurance Objectives
6.0	Sampling Procedures	4.0	Sampling Procedures
7.0	Sample Custody	5.0	Chain of Custody
8.0	Calibration Procedures and Frequency	6.0	Calibration Procedures and Frequency
9.0	Analytical Procedures	7.0	Analytical Procedures
10.0	Data Reduction, Validation and Reporting	8.0	Data Reduction, Validation and Reporting
11.0	Internal Quality Control Checks	9.0	Internal Quality Control Checks: Laboratory
12.0	Performance and Systems Audits	10.0	Performance and Systems Audits
13.0	Preventative Maintenance Procedures	11.0	Preventative Maintenance
14.0	Specific Routine Procedures to Assess Data PARCC	12.0	Procedures Used to Assess Data Quality
15.0	Corrective Action	13.0	Corrective Action
16.0	Quality Assurance Reports to Management	14.0	Quality Assurance Reports to Management

TABLE 1-2. CORRELATION OF WESTON'S ANALYTICS DIVISION QUALITY ASSURANCE PROGRAM PLAN WITH ANSI/ASME NQA-1

ANSI/ASME NQA-1 CRITERIA		ANALYTICS QAPP SECTION	
1.0	Organization	2.0	Organization and Responsibilities
2.0	Quality Assurance Program	1.0	Quality Assurance Policy
3.0	Design Control	3.0 6.0 7.0 8.0 9.0	Quality Assurance Objectives Calibration Procedures and Frequency Analytical Procedures Data Reduction, Validation and Reporting Internal Quality Control Checks
4.0	Procurement Document Control	9.0	Internal Quality Control Checks
5.0	Instructions, Procedures, and Drawings	(see NQA-1, item 3)	
6.0	Document Control		Title Page Table of Contents
7.0	Control of Purchased Items and Services	9.0	Internal Quality Control Checks
8.0	Identification and Control of Items	9.0 12.0	Internal Quality Control Checks Procedures Used to Assess Data Quality
9.0	Control of Processes	3.0 4.0 7.0 8.0 12.0	Quality Assurance Objectives Sampling Procedures Analytical Procedures Data Reduction, Validation and Reporting Procedures Used to Assess Data Quality
10.0	Inspection	10.0	Performance and Systems Audits
11.0	Test Control	9.0	Internal Quality Control Checks
12.0	Control of Measuring and Test Equipment	6.0 11.0	Calibration Procedures and Frequency Preventative Maintenance
13.0	Handling, Storing and Shipping	5.0	Chain of Custody
14.0	Inspection, Test, and Operating Status	10.0 11.0	Performance and Systems Audits Preventative Maintenance
15.0	Control of Nonconforming Items	6.0 9.0 10.0 11.0	Calibration Procedures and Frequency Internal Quality Control Checks Performance and Systems Audits Preventative Maintenance
16.0	Corrective Action	13.0	Corrective Action
17.0	Quality Assurance Records	6.0 8.0	Calibration Procedures and Frequency Data Reduction, Validation and Reporting
18.0	Audits	10.0 14.0	Performance and Systems Audits Quality Assurance Reports to Management

TABLE 1-3. CORRELATION OF WESTON'S ANALYTICS DIVISION QUALITY ASSURANCE PROGRAM PLAN WITH AIHA

AIHA CRITERIA		ANALYTICS QAPP SECTION	
1.0	Description of QA Policies	1.0	Quality Assurance Policy
2.0	Organization Chart	2.0	Organization and Responsibilities
3.0	Personnel Qualifications	2.0	Organization and Responsibilities
4.0	Training	14.0	Quality Assurance Reports to Management
5.0	Sampling Considerations	4.0	Sampling Procedures
6.0	Chain of Custody for Samples	5.0	Chain of Custody
7.0	Sample Processing Procedures	4.0	Sampling Procedures
8.0	Reagents	9.0	Internal Quality Control Checks
9.0	Preparation and Storage of Standards and Samples	5.0 6.0	Calibration Procedures and Frequency
10.0	Analytical Methodology	7.0	Analytical Procedures
11.0	Method Validation	7.0 8.0	Analytical Procedures Data Reduction, Validation and Reporting
12.0	Data Reduction Including Statistics	3.0 8.0 12.0	Quality Assurance Objectives Data Reduction, Validation and Reporting Procedures Used to Assess Data Quality
13.0	Record Keeping	8.0	Data Reduction, Validation and Reporting
14.0	Calibration and Maintenance of Equipment	6.0 11.0	Calibration Procedures and Frequency Preventative Maintenance
15.0	Internal Quality Assurance Procedures	 10.0	Table of Contents Performance and Systems Audits
16.0	External Quality Assurance Procedures	 10.0	Table of Contents Performance and Systems Audits
17.0	Quality Assurance Audit Procedure	10.0	Performance and Systems Audits
18.0	Corrective Action Plan	13.0	Corrective Action

2.0 ORGANIZATION AND RESPONSIBILITIES

2.1 General

It is the objective of WESTON to provide an organizational structure that can enhance the attainment of Corporate goals. Quality services is a primary WESTON goal.

Organizational support for accomplishing this quality goal is derived from Policy Directives and Operating Practices. Within these documents, the development and implementation of appropriate accountabilities, duties, and authority by organizational positions are clearly delineated. Line organizations achieve and verify quality, QA organizations overview the quality achievement and verification process through reviews, audits, and surveillances. Top management leadership, support and/or pressure insures that the Corporate Policies and Practices on the subject are appropriately implemented.

Individual support for accomplishing this quality goal is derived from pride and professionalism. The individuals directing, managing, supervising, conducting, reviewing, monitoring, and approving work are individually and collectively accountable for the quality of the work. Pride in one's own effort and professionalism within the organization can assure quality.

Within the Analytics Division, the infra-structure provides maximum availability of senior, expert personnel for supervision, technical consultation, and project review for effective planning and implementation of analytical assignments. Additionally, with WESTON corporate connections, the Analytics Division is provided with enhanced capabilities to consult, trouble-shoot, and solve analytical problems. Corporate resources include engineering, design and construction, industrial hygiene, geosciences, management and computer sciences, radiological services, air quality management, asbestos monitoring, regulatory compliance, and field operations. Since each environmental situation is unique, the organizational structure for these auxiliary operations will be detailed in project specific plans, as appropriate.

The organization of WESTON's Analytics Division, including QA reporting functions outside the laboratory, is shown in Figures 2-1 and 2-2. Professional qualifications and experience for the individuals filling these positions is maintained with the laboratory's training records. The specific duties and responsibilities of the Project Director, Project Manager, Technical Director, Laboratory Manager, Quality Assurance

Personnel, Section Managers, and Analysts are described in detail in the relevant standard operating procedures (SOP's). The responsibilities and accountabilities with respect to ensuring that quality goals are met are summarized in the following sections.

2.2 Quality Assurance Infra-Structure

The chief Corporate Quality Assurance (QA) Officer is the Executive Vice President Quality Assurance/Finance. Corporate QA managerial and implementation responsibilities and authorities are held by the Vice President, Corporate Quality Assurance. The position has the authority to organize, initiate, and monitor quality assurance programs. The Corporate QA Vice President can review and approve/disapprove all Division Quality Assurance Plans; can initiate, man (e.g., teams and committees), and allocate costs of the audit process for the purpose of identifying problems and determining compliance with Corporate policies and practices; and is obligated to recommend corrective action depending upon the situation.

Within the Analytics Division, the Division QA Manager and the QA personnel in the individual laboratories are responsible for implementing and monitoring the divisional QA Program. These individuals have sufficient authority, access to work areas, and organizational freedom (including sufficient independence from cost and schedule considerations) to:

- identify problems affecting quality;
- initiate, recommend, or provide solutions to problems through designated channels;
- verify implementation of solutions; and
- assure that further work is stopped or controlled until proper resolution of a nonconformance, deficiency, or unsatisfactory condition has occurred.

The Quality Assurance Section in each laboratory reports to the Laboratory Manager, where appropriate action can be affected. However, should a situation arise where acceptable resolution of identified problems cannot be agreed upon at the laboratory level, the QA Section has direct access to Divisional and Corporate QA Management. This provides laboratory QA personnel non-laboratory management support, if needed, to ensure that QA policies an procedures are enforced.

2.3 Description of Laboratory Personnel Responsibilities

2.3.1 Project Director and Project Manager

WESTON recognizes the importance of efficient project management. In keeping with corporate guidance, the Analytics Division has established a Project Director (PD)/Project Manager (PM) group. This group is responsible for management of all analytical projects.

The laboratory PD is responsible for the overall direction of the project, and is the chief Quality Assurance Officer for the project. The PD is accountable for:

- defining the level of excellence for the project performance and/or results,
- assuring the preparation of a tailored, Project Technical Profile and/or Quality Assurance Project Plan (QAPjP),
- ensuring peer review of the adequacy of QAPjP's,
- ensuring allocation of proper quality control budgets,
- attaining concurrence with Department (e.g., Laboratory) Managers on performance and/or results objectives,
- achieving acceptable project implementation performance, and
- approving the quality of the project results (e.g., data, reports).

The PD does not have line authority over those performing the work.

The laboratory Project Managers are responsible for preparing the Project Technical Profile summarizing QA/QC requirements for the project, maintaining the laboratory schedule, ensuring that technical requirements are understood by the laboratory, and advising the Project Director and Laboratory Manager of all variances.

In general, project specific Quality Assurance Project Plans (QAPjP) are prepared by the client. The laboratory PM will provide technical guidance and the necessary laboratory related information to the preparer, and provide peer review of the final document to ensure accuracy of the laboratory information.

2.3.2 Technical Director

Technical Directors serve as the principle technical expert on assigned projects, provide technical liaison, and assist in resolving any technical issues within the area of their expertise. They are responsible for providing input and review in the development and implementation of the department QA/QC program; and for providing the critical review of department proposal and project work for programs under their technical direction. They will coordinate these activities with the Project Manager and Quality Assurance Section.

For daily technical direction of the laboratory, the role of Technical Director is filled by the Laboratory Manager, in concert with the diverse, extensive expertise of the technical staff.

2.3.3 Laboratory Manager

The ultimate responsibility for the generation of reliable laboratory data rests with the Laboratory Manager. The Laboratory Manager has the authority to effect those policies and procedures to ensure that only data of the highest attainable quality is produced. It is the Laboratory Manager's responsibility to see that all tasks performed in the laboratory are conducted according to the requirements of this Quality Assurance Program Plan (QAPP), the Project Technical Profile and/or the appropriate QAPjP's; to assure that the quality of service provided complies with the project's requirements.

The Laboratory Manager supports a QA Section which is not subordinate to or in charge of any person having direct responsibility for sampling and analysis, and that has additional reporting responsibilities to corporate QA.

2.3.4 Section Managers/Supervisors

To assist the Laboratory Manager in achieving his/her goals, the Laboratory Section Managers and Unit Leaders are responsible for the implementation of established polices and procedures. They possess the authorities commensurate with their responsibilities for the day-to-day enforcement and monitoring of laboratory activities.

Section Managers have the responsibility for ensuring that their personnel are adequately trained to perform analyses; that equipment and instrumentation under their control is calibrated and functioning properly; and that system audits are performed

regularly. These system audits will include the analysis of external check samples to determine the analyst/instrument capability to identify and quantify routine analyses.

2.3.5 Quality Assurance Personnel

The Laboratory Quality Assurance Personnel have responsibility for conducting and evaluating results from system audits. In addition, the preparation of standard operating procedures and quality assurance documentation for the laboratory shall be controlled by the QA Section. The QA Section will review program plans, as requested, for consistency with organizational and contractual requirements and will advise appropriate personnel.

2.3.6 Report Section Manager

The Laboratory Report Section Manager is responsible for coordinating receipt of all data from the various service groups within the laboratory, reviewing data for compliance to laboratory QC criteria and/or criteria in the Project Technical Profile, and ensuring that data are reported in a timely manner and in the proper format.

2.3.7 Chemists/Technicians

Any effective laboratory quality assurance/quality control program depends on the entire organization, including management and every individual on the laboratory staff. The initial review for acceptability of analytical results rests with the analysts conducting the various tests. Observations made during the performance of an analytical method may indicate that the analytical system is not in control. Analysts must use quality control indicators to assure that the method is in-control before reporting results.

2.4 Training and Qualification

Selection of qualified candidates for laboratory employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Once on board, each employee participates in a comprehensive training program coordinated by the Laboratory's QA Section. This program is designed to provide an introduction to laboratory policies and procedures, define training mechanisms, and document the processes that provide proof of an analyst's proficiency. Highlights of the program include an orientation process, initial training to attain requisite proficiency, continual monitoring of the employee's

progress, opportunity for career enhancement seminars or training courses, and documentation files to track each analysts progress.

Orientation provides the employee with a basic introduction to the laboratory. Company and laboratory goals and expectations are presented and explained, applicable QA and Health and Safety items are discussed, key laboratory staff are introduced, available resources are discussed, and the employee receives an orientation/ training manual to store introductory materials and SOP's.

Following orientation, training in the specifics of the task to be performed is the first major laboratory assignment. The trainee, under supervision of a qualified analyst, receives on-the-job instruction which culminates in sign off of a method training record to document the training. This documentation, as well as any additional internal or external training record, is maintained by the QA Section in the employee's training file. Details of this training program are in OP 21-06-009.

FIGURE 2-1.
ANALYTICS DIVISION ORGANIZATIONAL CHART

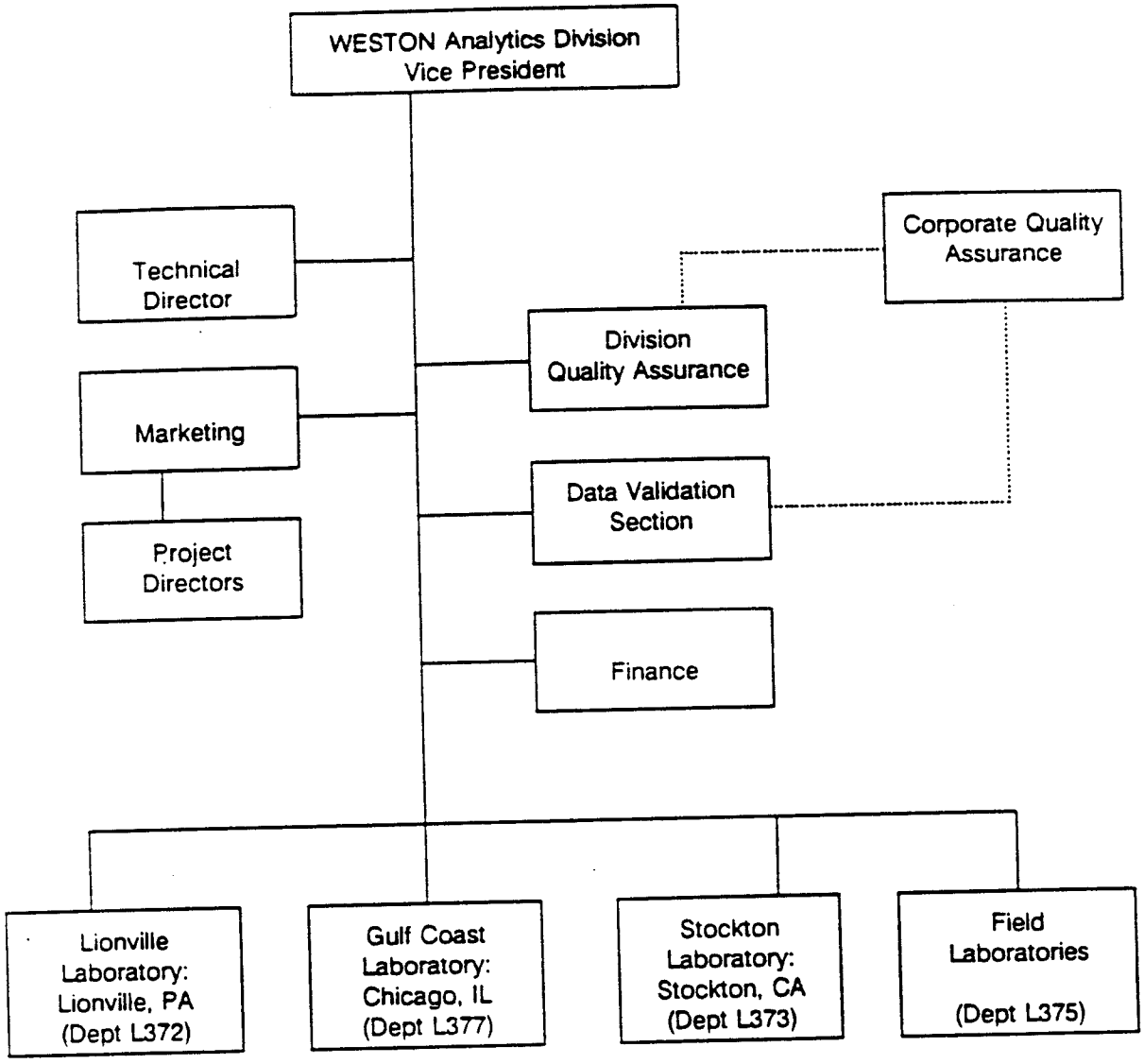


FIGURE 2-2A.
LABORATORY ORGANIZATIONAL CHART
LIONVILLE LABORATORY: L372

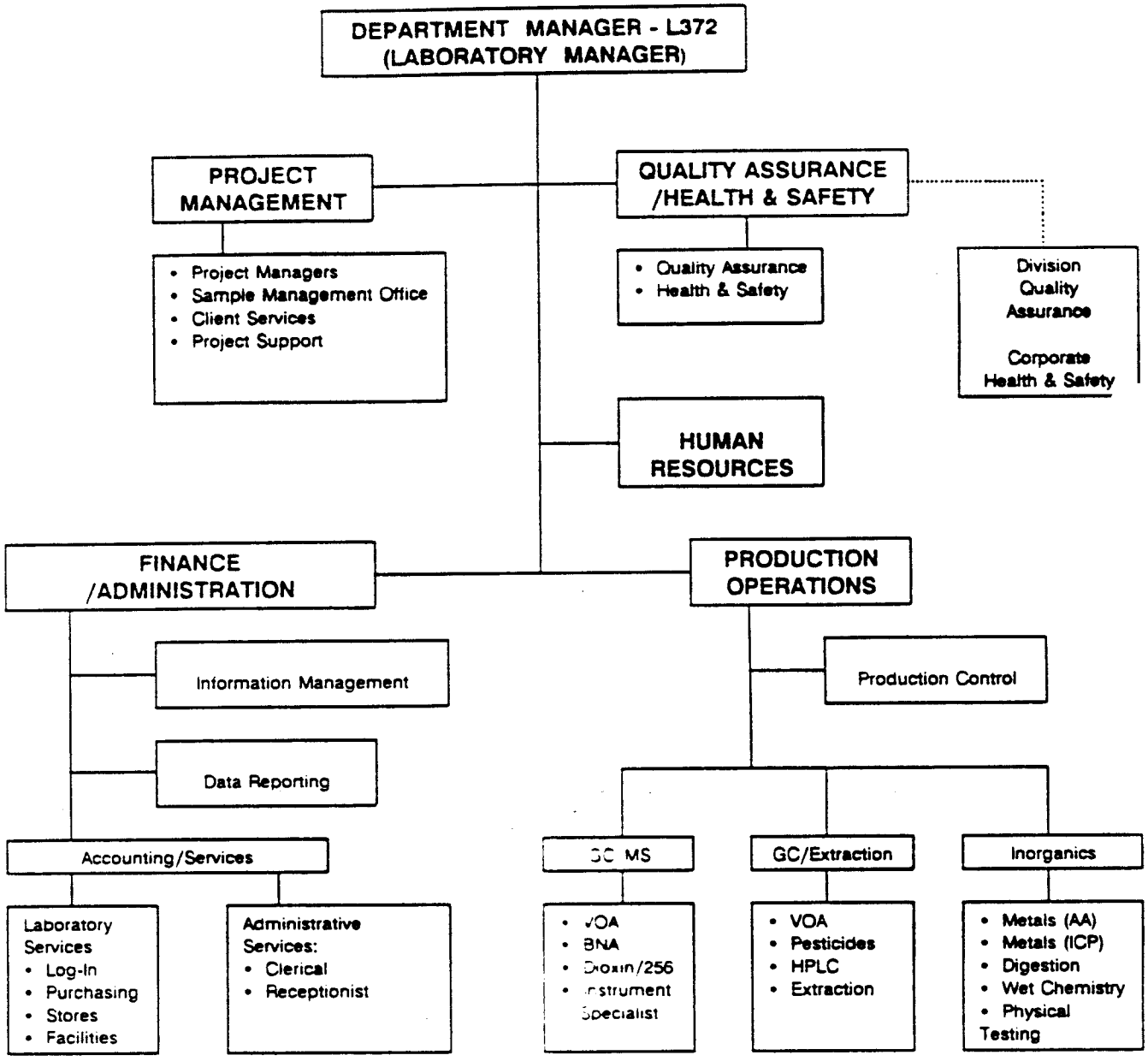


FIGURE 2-2B.
LABORATORY ORGANIZATIONAL CHART
STOCKTON LABORATORY: L373

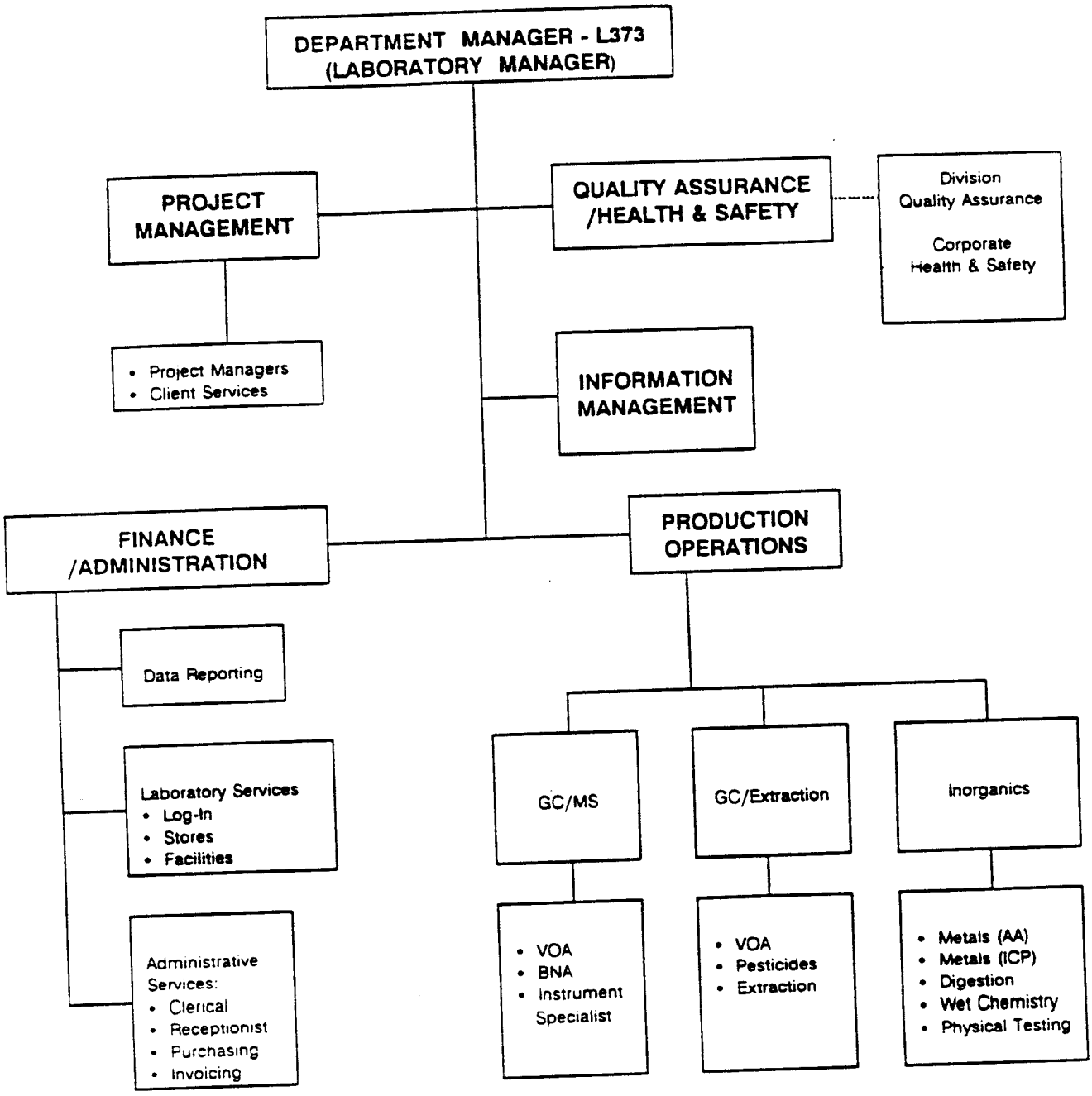


FIGURE 2-2C.
LABORATORY ORGANIZATIONAL CHART
LIONVILLE LABORATORY: L375

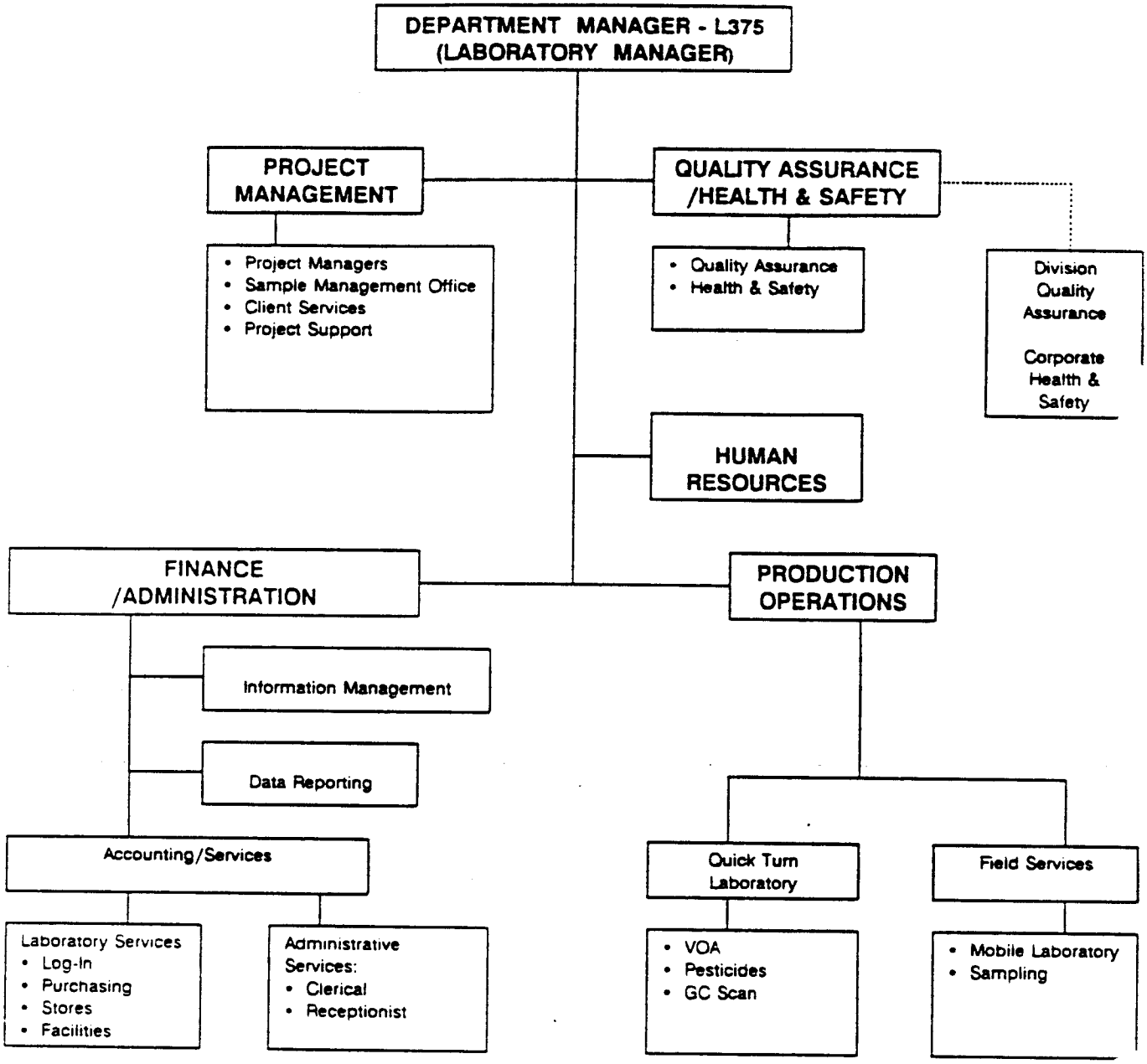
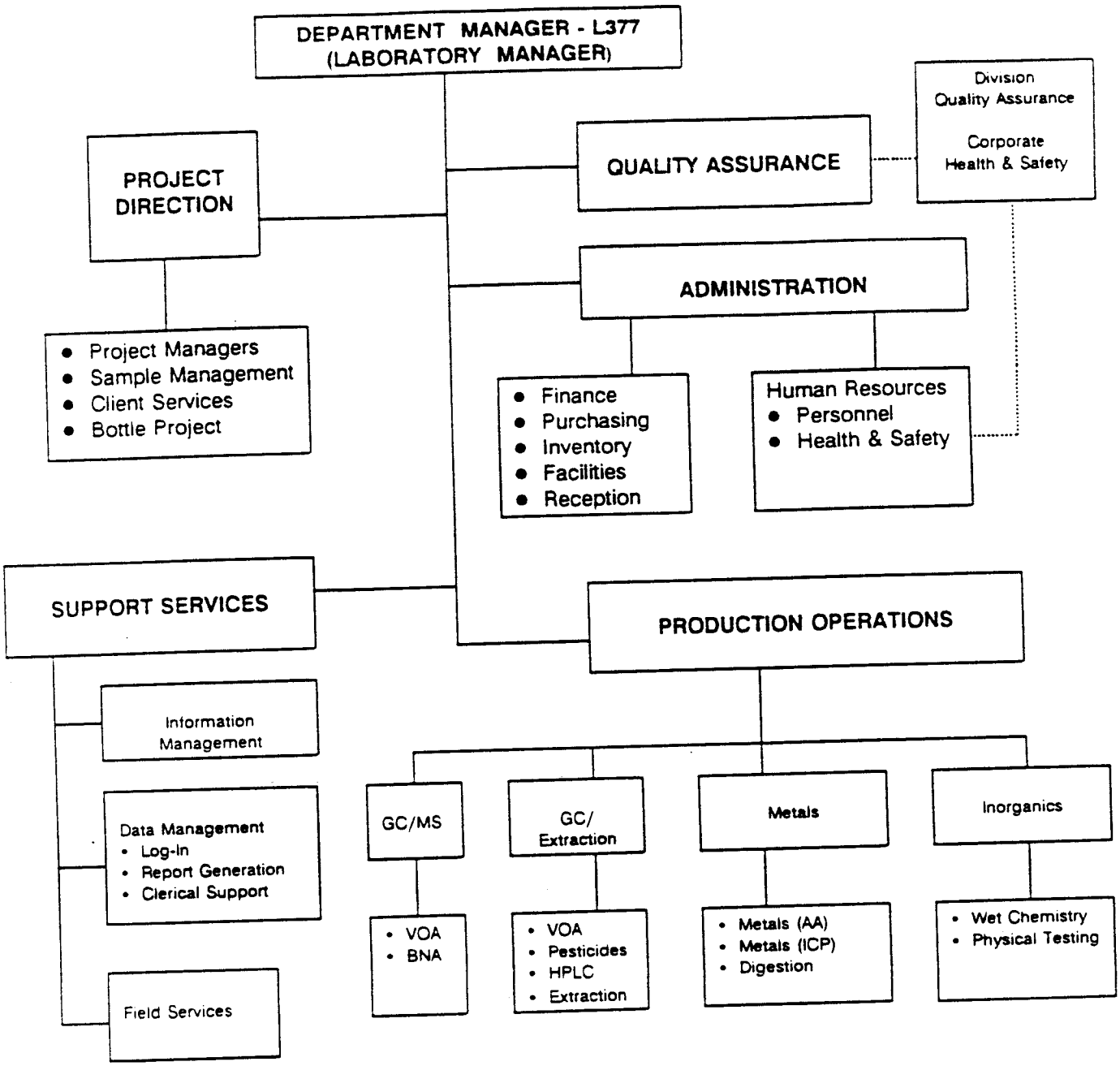


FIGURE 2-2D.
LABORATORY ORGANIZATIONAL CHART
GULF COAST LABORATORY: L377



3.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The overall objective for laboratory analysis is to provide reliable data of known and documentable quality. Qualitative and quantitative statements, referred to as data quality objectives (DQO's), are used to describe the level of quality required for a specific task. A means to measure the attainment of stated DQO's is through the use of five characteristics: precision, accuracy, representativeness, comparability, and completeness (PARCC). The PARCC parameters as generally applicable to WESTON's laboratory operations are defined in this section. Project specific QAPjP's may over-ride the stated criteria requirements of this section, and will address a broader scope (e.g., inclusion of field sampling variables) in defining project specific goals.

3.1 Precision

Precision is the level of agreement among repeated independent measurements of the same characteristic, usually under a prescribed set of conditions (e.g., under the same analytical protocols). The most commonly used estimates of precision are the relative percent difference (RPD) for when only two measurements are available, and the percent relative standard deviation (% RSD) for when three or more measurements are available. In both cases, the quantitative measure of the variability of the group of measurements is compared to their average value. This is especially useful in normalizing environmental measurements to determine acceptability ranges for precision, since it effectively corrects for the wide variability in analyte concentration indigenous to samples. Typical industrial QC techniques, such as classic Shewhart control charts, cusum charts, and related statistics are sensitive to variability in the true concentration, which precludes satisfactory application of these techniques to most of the work performed by the Analytics Division.

Precision for some Analytics Division procedures is evaluated as the degree of agreement between a new set of results and a historical database and/or a table of acceptable criteria for a given parameter. This is measured as percent difference (% D) from the reference value, and is primarily used by the Analytics Division as a means for documenting acceptability of continuing calibration or standards traceability.

The RPD is calculated by expressing as a percentage the difference between results of analysis of duplicate samples relative to the average of those results for a given analyte. This method for precision measurement can be expressed by the formula:

$$RPD = \frac{|(C_1 - C_2)|}{(C_1 + C_2)/2} \times 100\%$$

where:

RPD = relative percent difference
C_1 = concentration of analyte in sample
C_2 = concentration of analyte in replicate

The % RSD is calculated by expressing as a percentage, the standard deviation of the analytical results of the replicate determinations relative to the average of those results for a given analyte. Acceptance criteria for % RSD will be interchangeable with those established for % RPD. This method of precision measurement can be expressed by the formula:

$$\% \text{ RSD} = \frac{\sqrt{[(\Sigma C^2)n - (\Sigma C)^2]/n(n-1)}}{(C_1 + C_2 + \ldots C_n)/n} \times 100\%$$

where:

% RSD = percent relative standard deviation
C = concentration of analyte in the sample, and $(C_1 + C_2 + \ldots C_n)$ represents the sum of the concentration of each replicate
n = number of replicate analyses
Σ = "the summation of"

The % D is calculated by expressing as a percentage, the difference between the original value and new value relative to the original value. QA objectives for this precision measurement will be defined in the referring operating practice. This method for precision measurement can be expressed by the formula:

$$\text{Percent Difference (\% D)} = \frac{|\text{original value} - \text{found value}|}{\text{original value}} \times 100\%$$

Precision control limits are established and controlled by the duplicate analysis of Laboratory Control Samples (LCS). These LCS may be purchased commercially or prepared at the laboratory, and may also be identified as blank spikes (BS). For multi-analyte methods, including preparation methods such as metals digestions, the LCS may only contain a representative number of target analytes rather than the full list. For organic analyses, the LCS pair may be surrogate compounds in the blank and the blank spike and/or a select number of target analytes in duplicate fortified blanks (e.g., blank spike/blank spike duplicate: BS/BSD). The duplicate

LCS are subjected to all sample preparation steps. The RPD of the duplicate analysis is recorded and evaluated by statistically generated control limits. The maximum allowable RPD control limit is based on the average of the accumulated RPD's + 3 times the standard deviation of the accumulated RPD's of the duplicate LCS results. This empirical data is compared between the various WESTON laboratories, available method reference criteria, and available databases to establish control criteria.

When the LCS RPD exceeds the established acceptance limits, appropriate corrective action is taken (refer to the individual method operating practices (OP's) and OP 21-06-105 "Corrective Action"). After the problem has been identified, corrected and control has been re-established, sample analysis may continue. All data associated with the out-of-control situation are evaluated with respect to project DQO's for useability, sample availability for re-analysis, etc. For rejected results, the samples will be re-prepared and/or re-analyzed after control has been re-established. If data are used without re-analysis, the case narrative will address the deviation.

The % RPD for duplicate investigative sample analysis provides a tool for evaluating how well the method worked for the respective matrix. These values are used by the client to assess the validity of a reported result within the context of the project DQO's. For results outside laboratory control limits, appropriate corrective action will be taken and the deviation noted in the case narrative accompanying the sample results.

Precision control limits for inorganics and metals are <20 %RPD for water samples and <30 %RPD for soil samples. Refer to Table 3-2 for the precision control limits for organics.

3.2 Accuracy and Bias

Accuracy is the degree of agreement of the analytical measurement with the true or expected concentration. When applied to a set of observed values, accuracy will be a combination of a random component and of a systematic error (or bias) component.

Bias is a systematic error inherent in a method caused by some artifact of the measurement system or deviation from protocol. Temperature effects and extraction inefficiencies are examples of the first kind. Contamination, mechanical losses, and calibration errors are examples of the latter kinds. Bias may be both positive and negative, and several kinds can exist concurrently so that the net is all that can be evaluated, except under special conditions.

For purpose of this QAPP, and to be consistent with commonly documented methodologies and references used by the laboratory, no distinction will be made between random errors and systematic bias. All discussion of recoveries herein will be referred to collectively as accuracy measurements.

Analytical accuracy is expressed as the percent recovery (%R) of an analyte which has been used to fortify an investigative sample or a standard matrix (e.g., blank soil, analyte-free water, etc.) at a known concentration prior to analysis, and is expressed by the following formula:

$$\text{Accuracy} = \%\ \text{Recovery (\%R)} = \frac{A_T - A_0}{A_F} \times 100\%$$

where:

A_T = total amount found in fortified sample
A_0 = amount found in unfortified sample
A_F = amount added to sample

The fortified concentration will be specified by laboratory quality control requirements specified in the respective laboratory operating practice, or may be determined relative to background concentrations observed in the unfortified sample. In the latter case, the fortified concentration should be enough different (2 to 5 times higher) from the background concentration to permit a reliable recovery calculation. Fortified standard matrices prepared in the laboratory are referenced as laboratory control samples (LCS) or blank spikes (BS), while fortified field (i.e., investigative) samples are referenced as matrix spikes (MS).

Accuracy control limits are established and controlled by the analysis of Laboratory Control Samples (LCS). These LCS may be purchased commercially or prepared at the laboratory, and may also be identified as blank spikes (BS). For multi-analyte methods, including preparation methods such as metals digestions, the LCS may only contain a representative number of target analytes rather than the full list. For organic analyses, in particular for multi-analyte methods, the LCS may be surrogate compounds in the blank and/or a select number of target analytes in fortified blanks (e.g., blank spike: BS). The LCS are subjected to all sample preparation steps. The % R of the spiked analysis is recorded and evaluated by statistically generated control limits. The upper and lower control limits are based on ± 3 times the standard deviation of the mean of the accumulated LCS results. This empirical data is compared between the various WESTON laboratories, available method reference criteria, and available databases to establish control

criteria.

When the LCS % R exceeds the established acceptance limits, appropriate corrective action is taken (refer to the individual method operating practices (OP's) and OP 21-06-105 "Corrective Action"). After the problem has been identified, corrected and control has been re-established, sample analysis may continue. All data associated with the out-of control situation are evaluated with respect to project DQO's for useability, sample availability for re-analysis, etc. For rejected results, the samples will be re-prepared and/or re-analyzed after control has been re-established. If data are used without re-analysis, the case narrative will address the deviation.

The % R for fortified (spiked) investigative sample analysis provides a tool for evaluating how well the method worked for the respective matrix. These values are used by the client to assess the validity of a reported result within the context of the project DQO's. For results outside laboratory control limits, appropriate corrective action will be taken and the deviation noted in the case narrative accompanying the sample results.

Quality control (QC) samples obtained from an outside source with concentrations predetermined by the vendor are referenced as QC check samples. These QC check samples may be concentrates requiring dilution into a standard matrix per vendor supplied instructions, or fully constituted samples ready to analyze as received. Control limits are provided by the vendor, extrapolated from other in-house control data, or determined from control charts.

The quality assurance objectives for organic and inorganic analyses are tailored to the analytical technique used, and are discussed separately in the ensuing subsections.

3.2.1 Metals/Inorganics Analysis

For metals and inorganics analysis, analytical accuracy is obtained from the analyte recovery measured in a laboratory control standard, QC check sample, and/or a field sample fortified with the element of interest. Refer to the table below for the quality objectives for accuracy for routinely analyzed metals (i.e., metals included in the following lists: drinking water, priority pollutant, RCRA, Appendix IX, and EPA's Contract Laboratory Program target analyte list for hazardous waste) and inorganics. See also Section 9.1.1.4 for frequency of matrix QC indicators.

Sample Type	Recovery (%)
Laboratory Control Standard (LCS)	80-120
QC Check Sample	*
Fortified Field Sample	75-125

* Vendor supplied:
When vendor supplied control limits are not available, limits may be determined using one of the following: EPA supplied formulae to calculate limits based on statistical evaluation of EPA WS and WP performance evaluation study data, or plus/minus three times the standard deviation of replicate analysis of the sample in the laboratory, or the default windows stated above.

3.2.2 Organic Analysis (GC and GC/MS)

For organic analysis, analytical accuracy is obtained from a select number of target analytes measured in a laboratory control standard, QC check sample, and/or a field sample fortified with the compound(s) of interest. These recovery measurements comprise both target compounds and surrogate compounds, and are representative of compound lists routinely analyzed (i.e., compounds from the following lists: drinking water, priority pollutant, RCRA, Appendix IX, and EPA's Contract Laboratory Program target analyte list for hazardous waste). Refer to Tables 3-1 and 3-2 for the accuracy control data. Refer to the individual organic determinative operating practices to augment this list. Additionaly, see Section 9.1.1.4 for frequency of matrix QC indicators.

Surrogates are compounds which may be similar in structure, composition and/or physical or chemical properties to the target compounds, but are not expected in the investigative sample. Often these compounds are fluorinated versions of the chlorinated target analyte. Since chlorine and fluorine are both in the halogen family, these compounds ideally will behave similarly during preparation and analysis. For GC/MS, radiolabeled versions of the target compounds (primarily deuterium, ^{13}C, or ^{37}Cl) are also used as surrogates to mimic the target compound, as they can be distinguished during analysis from the unlabeled target compound. Since the surrogates are not expected in environmental samples, the surrogates can be added (spiked) as a marker, or recovery check, in each sample prior to extraction to help evaluate the efficiency of the extraction and analysis, thus providing a QC indicator for 100% of the samples without having to analyze a second aliquot.

Fortification of the sample with target analytes prior to extraction provides recovery data for the actual target compound,

and requires analysis of a second sample, unspiked, to allow correction for any of the compound indigenous to the sample when evaluating recoveries.

3.3 Representativeness and Comparability

For laboratory procedures, attempt will be made to ensure that all data are representative of the matrix and conditions of the sample being measured. The data will be calculated and reported in units consistent with standard reporting conventions to enable comparability to existing data, standards, and/or regulatory action limits.

Project representativeness and comparability are dependent on the sampling plan on a project specific basis, and therefore are not covered in this laboratory plan. Assessment of site and collection representativeness and comparability is performed by the field engineer.

3.4 Completeness

Completeness is a measure of the relative number of analytical data points which meet all the acceptance criteria for accuracy, precision, and any other criteria required by the specific analytical methods used. Project specific completeness goals account for all aspects of sample handling, from collection through data reporting. The level of completeness can be affected by loss or breakage of samples during transport, as well as external problems which prohibit collection of the sample. The ability to meet or exceed completeness objectives is also dependent on the nature of samples submitted for analysis. For example, if the analytical methods proposed for use (particularly for organics analyses) are intended for analysis of environmental samples of low- and medium hazard, the applicability of these methods to non-routine matrices such as drum samples, wipes, air samples, etc. may result in poor method performance and therefore adversely impact achievement of the data completeness goal.

For purpose of this QAPP, completeness will be limited to a measure of valid QC results for precision and accuracy data obtained from LCS analysis. These data will be judged by objectives in Section 3.2.1 and Tables 3-1 through 3-2 compared to the total amount of QC data collected. Completeness is calculated quarterly, with a 95% target objective for all parameters.

Completeness will be calculated as follows:

$$\text{Completeness} = \frac{\text{Number of acceptable reported QC data}}{\text{Total number of reported QC data}} \times 100\%$$

3.5 References

Laboratory control limits and detection limits are based on a combination of empirical data generated by the Analytics Division Laboratories, available method reference criteria, and available databases to establish control criteria. Method references are given in Section 7.1.

TABLE 3-2.

QA OBJECTIVES FOR ACCURACY AND PRECISION FOR ORGANIC TARGET COMPOUND ANALYSES

Fraction	Matrix Spike Compound	% Recovery Limits		% RPD Limits	
		Water	Soil/ Sediment	Water	Soil/ Sediment
VOA	1,1-Dichloroethene	61-145	59-172	14	22
VOA	Trichloroethene	71-120	62-137	14	24
VOA	Chlorobenzene	75-130	60-133	13	21
VOA	Toluene	76-125	59-139	13	21
VOA	Benzene	76-127	66-142	11	21
BN	1,2,4-Trichlorobenzene	39- 98	38-107	28	23
BN	Acenaphthene	46-118	31-137	31	19
BN	2,4-Dinitrotoluene	24- 96	28- 89	38	47
BN	Pyrene	26-127	35-142	31	36
BN	N-nitroso-di-N-propylamine	41-116	41-126	38	38
BN	1,4-Dichlorobenzene	36- 97	28-104	28	27
ACID	Pentachlorophenol	9-103	17-109	50	47
ACID	Phenol	12-110	26- 90	42	35
ACID	2-Chlorophenol	27-123	25-102	40	50
ACID	4-Chloro-3-methylphenol	23- 97	26-103	42	33
ACID	4-Nitrophenol	10- 80	11-114	50	50
PEST	Lindane	56-123	46-127	15	50
PEST	Heptachlor	40-131	35-130	20	31
PEST	Aldrin	40-120	34-132	22	43
PEST	Dieldrin	52-126	31-134	18	38
PEST	Endrin	56-121	42-139	21	45
PEST	4,4-DDT	38-127	23-134	27	50
PCB	Aroclor 1254	50-150	50-150	30	50

% RPD = Relative Percent Difference

This list includes selected compounds used for QA/QC accuracy and precision control in the groups (fractions) of analytes shown. Selected compounds are consistent with guidance presented in U.S.EPA SW-846, 3rd edition and/or the U.S. EPA Contract Laboratory Program (CLP) Statement of Work (SOW 2/88). Stated control limits are performance based and have been adopted from the referenced SOW, with the exception of PCB. PCB limits are based on laboratory performance data.

TABLE 3-1.

QUALITY ASSURANCE OBJECTIVES FOR ACCURACY
FOR ORGANIC SURROGATE ANALYSES

Fraction	Surrogate Compound	Percent Recovery	
		Low/Medium Water	Low/Medium Soil/Sediment
VOA	Toluene-d_8	88-110	81-117
VOA	4-Bromofluorobenzene	86-115	74-121
VOA	1,2-Dichloroethane-d_4	76-114	70-121
BNA	Nitrobenzene-d_5	35-114	23-120
BNA	2-Fluorobiphenyl	43-116	30-115
BNA	p-Terphenyl-d_{14}	33-141	18-137
BNA	Phenol-d_5	10- 94	24-113
BNA	2-Fluorophenol	21-100	25-121
BNA	2,4,6-Tribromophenol	10-123	19-122
PEST	Dibutylchlorendate	24-154	20-150

This list includes selected compounds used for QA/QC accuracy and precision control in the groups (fractions) of analytes shown. Selected compounds are consistent with guidance presented in U.S.EPA SW-846, 3rd edition and/or the U.S. EPA Contract Laboratory Program (CLP) Statement of Work (SOW 2/88). Stated control limits are performance based and have been adopted from the referenced SOW.

4.0 SAMPLING PROCEDURES

4.1 Introduction

While samples submitted to the laboratory for analysis are generally collected by non-laboratory personnel, WESTON's Analytics Division fully recognizes the importance of the sample collection program in the overall assessment of data quality and usability. Sampling procedures must ensure the integrity of the samples collected, provide representative samples of the media being evaluated, and be compatible with planned laboratory analysis. To address these items, field sampling plans are developed on a project specific basis in accordance with regional government regulations, program requirements (e.g., drinking water, wastewater, hazardous waste, etc.), and scientific objectives. Additionally, the sampling plan will include the details of the applicable techniques to be used. This section provides an overview of the elements of a sampling program.

4.2 Sampling Plan

The objective of sampling is to obtain information that provides a qualitative and quantitative measure of site conditions, so that appropriate action can be taken relative to project goals. These goals encompass areas such as:

- preliminary site investigation,
- emergency cleanup operations,
- remedial response operations,
- backup for litigation purposes,
- monitoring, and
- research or technology transfer.

It is important, therefore, that the sampling effort be preceded by a well-planned, custom-tailored sampling plan for each project. This will help ensure that goals are met, that sampling is completed in a timely, cost effective manner, safety of sampling personnel is maximized, samples are representative of the site, sampling errors are reduced, and integrity of the sample is preserved during and after sampling.

The sampling plan should address the definition of project objectives, selection of representative sampling sites, collection of sufficient volumes of material, selection and preparation of proper sample containers, preservation of sample integrity, identification of samples, proper sample holding times, safe handling and transportation procedures, and standard chain-of-

custody procedures.

The following subsections list steps which are essential in preparation of the sampling plan.

4.2.1 Research Background Information

A preliminary fact-finding investigation is conducted to: evaluate the site history, review any data available from prior sampling excursions, review available geotechnical data, consider the materials to be sampled (composition, form, expected concentration, etc.), determine what analyses will best address the issues at the site. This information is used to define project objectives.

4.2.2 Safety

Safety requirements and arrangement for equipment and procedural needs for safe sampling must be determined. The sampling plan will delineate the safety procedures for sample collection, such as respiratory protection required while sampling concentrated sources, procedures for entering buildings or enclosed structures, length of time personnel are to remain in protective clothing while sampling, and identification of the person handling the field samples. Proper procedures must be used when opening drums, tanks, or other vessels, and all personnel must be notified of potential hazards when closed containers will be opened.

The sampling plan will also list telephone numbers, addresses, and directions to the nearest medical facility, ambulance service, fire department, police department, and the client contact. The fire department should be alerted to possible incidents during a very hazardous inspection.

4.2.3 Sampling Points

A representative sample is crucial to decision-making and to enforcement proceedings and is dependent on proper selection of sampling points. Special consideration will be required for hazardous wastes, which are usually multi-phase mixtures and are stored in receptacles of different sizes and shapes. No single series of sampling points can be specified for all types of waste receptacles. Table 4-1 lists most types of receptacles used for hazardous waste and the corresponding recommended sampling points.

In some cases, it may be appropriate to conduct a preliminary survey of the facility prior to sampling. This would consist of a brief site visit and survey, during which time safety requirements

for the site would be ascertained and a sampling plan established by the inspector.

4.2.4 Volume of Samples

Sufficient volume of a sample, representative of the main body of the water or waste, must be collected. This sample must be adequate in size for all needs, including laboratory analysis, field measurements such as pH, dissolved oxygen (DO), conductivity, and residual chlorine, splitting with other organizations involved, etc. In all cases, the laboratory should be consulted for guidance prior to sampling. As general guidance, the sample containers provided by the laboratory should be filled. This will provide adequate volumes to perform analysis once. Choose at least one sample per twenty (20) for each matrix and collect triple volumes for all analytes to allow sufficient sample for laboratory duplicate and spike analysis.

Determine the sample volume required for each location, with special considerations given to the type of sample container and preservative needed for each analyte. Analytes with the same container/preservative requirement may be able to be combined into one larger container (i.e., 1 L rather than three 250 mL bottles). Allow sufficient volume for field and laboratory QC samples.

4.2.5 Sampling Equipment and Procedures

Determine the sampling equipment needed and arrange to have the necessary facilities and supplies for proper decontamination between samples. The time between sampling and testing should be kept to an absolute minimum in order to keep changes to the physical and chemical integrity of the sample to a minimum.

Sample sites exhibit wide variability, thus sampling procedures will vary depending on the medium sampled (liquid, solid, or gas) and the type of structure the waste is contained in order to adequately characterize the site. Sampling procedures to be used should be standardized. Examples of guidance available for sampling include:

- "NPDES Compliance Sampling Manual," U.S. EPA, Office of Water Enforcement (October, 1979),
- "Samplers and Sampling Procedures for Hazardous Waste Streams," U.S. EPA, Municipal Environmental Research Laboratory (January, 1980),

- SW-846, Test Methods for Evaluating Solid Waste, 3rd Edition, November 1986,
- New Jersey Department of Environmental Protection "Field Sampling Procedures Manual", February 1988,
- USEPA Region II "CERCLA Quality Assurance Manual", Revision I, October 1989, and
- USEPA Region IV "Standard Operating Procedures and Quality Assurance Manual", April 1986.

In general, two basic types of sampling measurements are used: samples collected and subsequently analyzed in the laboratory, and samples which are analyzed in-situ. Samples sent to the laboratory may be either grab or composite samples. Highlights of some common types of sampling events to collect samples for laboratory analysis follow in this section. A more detailed discussion of sampling protocols is given in the above sampling references and in WESTON OP 21-06-002.

Sampling personnel frequently are required to split samples collected with facility personnel or EPA laboratories. It is essential that a true duplicate split be made, otherwise analytical results will not be comparable.

To obtain a true duplicate, a large quantity of sampled material will be collected, thoroughly mixed, and equally proportioned into similar containers. If preservation is necessary, both are preserved with an appropriate chemical from a common dispenser at the same time. Both duplicates are labeled with the same sample location description and marked as splits and logged into a field notebook.

4.2.5.1 Groundwater Sampling

Pumps (e.g., submersible, bladder, inertial lift, peristaltic, or bailer) are used for groundwater sampling. Prior to pumping, the static water level and total depth measurements are obtained, and used to calculate the casing volume. Monitoring wells should be purged of stagnant water prior to sampling, in order to ensure that representative groundwater has entered the well. A minimum of three casing volumes should be purged whenever possible.

Once the well has been purged (usually 3 well volumes), a sufficient volume of water is collected to fill all required sample containers, as well as to perform all field measurements such as

pH, dissolved oxygen (DO), conductivity, and residual chlorine. Preservation is performed in the field, and samples are prepared for transport back to the laboratory. All observations are recorded in the field log. Used bailers are placed in bags for transport back to the laboratory for decontamination, unless the bailer is to remain dedicated to that particular well for future sampling or if it is to be cleaned in the field for additional well sampling.

4.2.5.2 Surface Water Sampling

The sampler (e.g., Kemmerer, Nansen, or DO dunker) is lowered into the surface water (e.g., lake, pond, lagoon, stream, etc.) to the required depth, and then retrieved after a suitable amount of time to fill the sampler. A sufficient volume of water is collected to fill all required sample containers, as well as to perform all field measurements such as pH, DO, conductivity, and residual chlorine. All observations are recorded in the field log. Preservation is performed in the field, and the samples are prepared for transport back to the laboratory. The used samplers are placed in bags for transport back to the laboratory for decontamination, unless the sampler is to be cleaned for additional surface water sampling.

4.2.5.3 Sediment, Soil, and Sludge Sampling

The choice of which sampling device to use will be dependent on the type of sample being taken and the depth from which the sample is to be taken. Care must be taken to preserve the integrity of the sample both physically and chemically.

A stainless steel trowel, auger, corer, etc. is used to retrieve the soil, sediment, or sludge from the required depth. A stainless steel mixing pan or tray may be used to mix a sample prior to filling individual samples, to composite, or to split samples for duplicate analysis. Soil, sediment, and sludge samples are not chemically preserved in the field. Samples are temperature preserved with ice in the transport coolers. Field measurements are taken (e.g., pH and conductivity), and all observations are recorded in the field log.

4.2.5.4 Wastewater Influent and Effluent Sampling

Wastewater influent and effluent sampling may be performed either by using an automatic sampler or by manual sampling with a Teflon® or stainless steel collection vessel. Sample location is usually dictated by the site's NPDES permit. If a sample location is not

designated, the sampler must take the sample from a location where the wastewater is well mixed. Influent samples should be taken from a location upstream from the wastewater treatment plant (untreated wastewater). Effluent samples should be taken downstream from the wastewater treatment plant before it reaches its primary receiving water (treated wastewater).

If an automatic sampler is used to collect sample aliquots over a given time period, flow meter measurements are necessary. A minimum of 100 mL of sample should be collected every time the sampler is activated.

Manual sampling may be performed using a Teflon® or stainless steel collection vessel to obtain a grab sample. It may be necessary to attach a pole or rope to the collection vessel in order to reach the sampling site.

Manual sampling may also be performed by using the actual sample container as the sampling device. This is recommended for oil and grease and bacteriological samples.

A sufficient volume of wastewater should be collected to fill all required sample containers, as well as to perform possible field measurements such as pH, DO and conductivity. Samples are preserved in the field and prepared for transport back to the laboratory. All observations are recorded in field log.

4.2.5.5 Drum Sampling (Hazardous Waste)

Receptacles (i.e., drums, tanks, etc.), should only be sampled when necessary to meet enforcement or cleanup requirements. Opening of drums or other sealed receptacles may be hazardous to sampling personnel unless proper safety procedures are followed.

Samples of waste materials, water, soil, or sediments will be collected through the use of peristaltic, mechanical or automatic pumps, soil augers, sediment dredges, hand scoops, and other equipment (see Table 4-2) as required. All samples should be collected in a manner that assures no contamination between samples. When possible, dedicated equipment should be used for each site to avoid the need for field cleaning of utensils.

Samples from drums, bags, reservoirs, or other small vessels are generally obtained by a dip or insertion tube (coliwasa sampler). After agitation of the vessel or container, if possible, the tube is inserted diagonally, sealed, and removed. Thus, the sample obtained is a cross-sectional representative sample, avoiding bias

due to stratification of material in the container. Sometimes it is difficult to obtain a representative sample of large containers, such as bulk liquid storage tanks. In these cases, often the only sampling location is a bottom valve, and the sample obtained is from the bottom layer within the tank. Many times this may be a "worst case" sample, especially for PCB's and other dense substances. Whenever possible, surface, middle, and bottom samples are collected from large bulk liquid storage tanks in order to avoid possible stratification bias. Using this tiered sampling technique helps to accurately characterize the overall concentration of the parameter of interest. A general list of usage of sampling equipment is given in Table 4-3.

4.2.6 Training of the Field Team

Provisions will be made to review procedures for sample collection through training or refresher courses for samplers. This training will include review of procedures for containing and handling samples, proper chain-of-custody procedures, and other specific procedures outlined in the sampling plan.

4.2.7 Sample Handling and Packing

The sampling plan will identify necessary packaging, labeling, and shipping requirements. Guidance for proper sample handling and packing procedures are in the User's Guide to the U.S. EPA Contract Laboratory Program. The collected sample and its container represent one of the major avenues of personnel and environmental exposure. Precautions will be taken to ensure that all the samples removed from the site are within the sample container and that no residue remains on the outside of the container.

A unique code number is assigned to each sample. All sample bottles will be differentiated by use of a sample label. All information pertinent to the field activities will be recorded in bound field notebooks. The notebooks must contain the following information:

- source of sample (including plant name, location, and sample point description),
- analysis required and preservative type (where applicable),
- name of collector, date and time of collection, physical/environmental conditions during field activity,
- matrix sampled, sample collection method, number and volume of

samples taken,

- sample identification number(s), custody seal numbers,
- any field measurements, and
- documentation of shipping dates and methods.

Samples will be packed and shipped following U.S. EPA recommended procedures and in accordance with applicable DOT regulations. Chain-of-custody is initiated in the field and will travel with the samples. Custody seals will be affixed to the shipping container. A detailed discussion of chain-of-custody procedures is found in Section 5.

4.2.8 Sample Shipment

Delivery of samples to the laboratory for analysis must also be addressed in the sampling plan. Consider analyte holding times when determining shipping frequency. Many laboratory contractual agreements measure holding times from the date of receipt at the laboratory, while regulatory holding times are measured from the date of sample collection.

4.3 Sample Containers

Sample containers must be matched with the requested analysis to ensure compatibility. For example, organic extractables must be sampled in glass jars with Teflon®-lined caps, as plastics can contaminate the sample; VOA's must be sampled in glass vials with Teflon®-lined septum caps, etc. At least three (3) working days advance notice is needed for the Analytics Division to process the required number and type of sample containers for most specific sampling episodes. Shorter preparation time can be provided with a surcharge for bottles, supplies, and shipping costs.

Sample containers used at WESTON's Analytics Division are primarily purchased from approved vendors, such as I-CHEM Research, Inc. and EAGLE-PICHER. These bottles are cleaned and are quality control checked by the vendor prior to shipment to WESTON. The vendor's standard operating procedures are on file with the bottle preparation OP's (Chapter 21-08) in the QA Section.

In the event that bottles are not pre-cleaned, the client (e.g., USATHAMA) has special cleaning procedures, or special containers such as charcoal tubes for air sampling are required, the Container Preparation SOP (RFW OP 21-08-006) should be followed.

All sample containers provided by WESTON will be shipped with chain-of-custody sheets (see Section 5). These chain-of-custody sheets will be completed by the field sampling personnel and returned with the samples.

4.4 Sample Preservation and Holding Times

The preservatives required for all analyses will be provided by WESTON with the sample containers. The required preservation methods will be in accordance with those given in the Manual for Certification of Laboratories Analyzing Drinking Water, Third Edition, April 1980, for drinking water, 40 CFR Part 136, revised as of 1 July 1988, for wastewater and in SW-846, Test Methods for Evaluating Solid Waste, Third Edition, November 1986, for soils and wastes.

Holding time is the maximum time that may elapse before sample analysis or preparation for analysis is begun. It is measured either from the time of collection of the sample in the field or from the verified time of sample receipt (VTSR) in the laboratory, depending on project requirements. It is the responsibility of the laboratory Project Manager to determine from the client which holding times are applicable, and to provide this information to appropriate laboratory personnel.

Generally, drinking water (potable) and wastewater type analyses require holding times measured from sample collection. These holding times are given in the Manual for Certification of Laboratories Analyzing Drinking Water, Third Edition, April 1980, for drinking water, 40 CFR Part 136, revised as of 1 July 1988, for wastewater and in SW-846, Test Methods for Evaluating Solid Waste, Third Edition, November 1986, for soils and wastes.

Some programs, e.g. the U.S. EPA Contract Laboratory Program (CLP) and CLP-type agency or client programs, measure holding times from verified time of sample receipt (VTSR) at the laboratory. This is particularly useful for contract laboratory services when sampling and analysis responsibilities are shared by two firms. Data useability considerations are most often based on holding times from sample collection. VTSR holding times are generally two days shorter than holding times from collection of samples, and are given in the US EPA-CLP Statement of Work, or the project specific contract or work plan. Field sampling crews are responsible for delivery of samples to the laboratory within two days. The laboratory is responsible for initiating analysis within the time specified from VTSR. This gives both parties planning and working time, while allowing maximum useability for the data user with

respect to analysis of samples within the specified days from collection. Samples designated as CLP must specify in the project plan that holding times from sample collection are superseded by holding times from VTSR.

Holding times are tracked in the laboratory with the aid of the Laboratory Information Management System (LIMS). All sample collection dates and receipt dates are recorded on the chain-of-custody. This information is transferred into LIMS by sample Log-In personnel. Additionally, Log-In enters holding time information (i.e., from collection or from receipt) into LIMS based on information provided on the chain-of-custody and in the project records forwarded by the laboratory Project Manager. LIMS calculates the appropriate holding time for each parameter. This information is then available to laboratory project and analytical personnel for tracking and scheduling purposes. Due dates shown for the analysis (or extraction) of each parameter on the LIMS backlog reports are based on the required reporting date, or on the holding time if it falls sooner than the required reporting date for analyses.

All analyses which have holding times of 48 hours or less are identified by the sample custodian, and the appropriate production unit is notified that samples are in house.

TABLE 4-1. SAMPLING POINTS FOR WASTE RECEPTACLES

RECEPTACLES	SAMPLING POINT
Drum, bung on one end	Withdraw sample through the bung opening.
Drum, bung on side	Sample drums only if they are laying on side with bung up. Withdraw sample through the bung opening.
Barrel, fiberdrum, buckets, sacks, bags	Withdraw samples through the top of barrels, fiberdrum, buckets, and similar receptacles. Withdraw samples through fill openings of bags and sacks. Withdraw samples through the center of the receptacles and to different points diagonally opposite the point of entry.
Vacuum truck and similar containers	Withdraw sample through open hatch. Sample all other hatches.
Pond, pit, lagoons	Divide surface area into an imaginary grid.* Take three samples, if possible; one sample near the surface, one sample at mid-depth or at center, and one sample at the bottom. Repeat the sampling at each grid section over the entire pond or site.
Waste pile	Withdraw samples through at least three different points near the top of pile to points diagonally opposite the point of entry.
Storage tank	Sample from the top through the sampling hole.
Soil	Divide the surface area into an imaginary grid.* Sample each grid section.

* The number of grid sections is determined by the desired number of samples to be collected which, when combined, should give a representative sample of the wastes.

TABLE 4-2. EXAMPLES OF SAMPLING EQUIPMENT

- Sampling plan
- Sample containers (plastic and glass), caps, liners
- Shovels
- Soil Samplers (auger, scoop, steel spoon, etc.)
- Stainless steel buckets
- Remote barrel opener equipment, non-sparking bung wrench
- Thermometer
- Draeger tubes
- Tenax columns and power packs
- Ambient air monitor
- Surveyor's ribbon
- Glass pipets and glass tubing
- Wooden paddles (tongue depressors)
- Monitoring well sampling equipment: e.g., pumps (submersible, bladder, inertial lift, peristaltic, bailer)
- Well sounder, slope indicator
- Surface water sampling equipment (e.g., Kemmerer, Nansen, DO dunker)
- ISCO samplers
- Radiation detector (beta, gamma)
- Explosimeter
- Conductivity meter
- pH paper, pH meter, spare probes
- DO meter

TABLE 4-3. EXAMPLES OF SAMPLING EQUIPMENT FOR PARTICULAR WASTE TYPES

TYPE OF WASTE	SAMPLING POINT: DRUM	SACKS AND BAGS	OPEN BED TRUCK	CLOSED BED TRUCK	STORAGE TANKS OR BINS	WASTE PILES	PONDS, LAGOONS & PITS	CONVEYOR BELT	PIPE
Free Flowing Liquids and Slurries	Coliwasa	N/A	N/A	Coliwasa	Weighted Bottle	N/A	Dipper	N/A	Dipper
Sludge	Scoop	N/A	Scoop	Scoop	Scoop	N/A		N/A	N/A
Moist Powders or Granules	Scoop	Scoop	Scoop	Scoop	Scoop	Scoop	Scoop	Shovel	
Dry Powders or Granules	Thief	Thief	Thief	Thief	Thief	Thief	Thief	Shovel	
Sand or Packed Powders	Auger	Auger	Auger	Auger				N/A	
Large Grained Solids	Large Scoop	Large Scoop	Large Scoop	Large Scoop	Large Scoop	Large Scoop	Large Scoop	Large Scoop	

5.0 CHAIN-OF-CUSTODY

The purpose of chain-of-custody procedures is to document the history of sample containers and samples, including sample extracts or digestates. The associated records should provide traceability from the time of preparation of sample containers, through collection, shipment, analysis and disposal of the sample. Items under custody will be:

- maintained in the physical possession or view of the responsible party, or
- placed and/or stored in a designated secure area to prevent tampering. This secure area must be accessible only to authorized personnel.

A majority of the data generated by the Analytics Division is potential litigation evidence. A primary step in the evidentiary trail is to provide proof that the sample collected in the field is the sample that was actually analyzed. The Chain of Custody (COC) forms for Field and Laboratory, when properly completed, provide the necessary documentation.

In addition to providing accountability for the physical location of the sample, sample integrity is dependent on proper collection and storage of the sample. Description of chain-of-custody procedures associated with sample collection, receipt, storage, preparation, analysis and general security procedures are described in subsequent sections of this chapter.

The area Supervisors are responsible for the records received or generated by their respective areas at the laboratory. Laboratory documentation used to establish chain of custody and sample identification may include the following:

- Field Chain of Custody Forms or other paperwork which arrives with the sample (these may be WESTON's forms, or the client's own forms).
- Custody Transfer Record/Lab Work Request (Figure 5-1), also referred to as the laboratory Chain of Custody (COC).
- Sample labels or tags (Figure 5-2) are attached to each sample container and may contain the following information: sample date; time (2400 clock); sample description; sample matrix; filtration, preservation and known hazards information; sample management (disposal); RFW number; and parameter group. These

labels/tags are verified for accuracy against the paperwork received with the samples. The signed Chain of Custody form will serve as documentation of this verification, rather than attempt to peel or remove tags/labels to place in the written documentation file.

- Sample custody seals may be attached to sample containers and/or the transport coolers. Sample containers are sealed in such a way as to prevent the sample tag from being removed. Sample seals will also prevent the container or cooler from being opened without authorization.

- Sample preparation logs, i.e., extraction and digestion information recorded in hard-bound laboratory books that are filled out in legible hand-writing, and signed and dated by the chemist.

- Sample analysis logs, e.g., metals, GC/MS, etc. information recorded in hard-bound laboratory books that are filled out in legible hand-writing, and signed and dated by the chemist.

- Sample storage log (same as the laboratory COC).

- Sample disposition log which documents sample disposal by a contracted waste disposal company.

5.1 Field Custody

When sample containers are provided by WESTON, chain-of-custody documentation (see Figure 5-1) will be shipped with the sample containers. These forms will be completed by field personnel, noting time and date of transfer of samples to the shipping containers and placed in the shipping container in the plastic Ziploc container provided. Additional field documentation is discussed briefly in Section 4.0 and WESTON OP 21-06-002. On a project specific basis, applicable procedures will be described in detail in the respective QAPjP. The field personnel are responsible for the records in the field. Responsibility for transportation of the samples to the laboratory will be defined for each project.

5.2 Sample Receipt

A designated sample custodian is responsible for samples received at WESTON. In addition to receiving samples, the sample custodian is also responsible for documentation of sample receipt, storage before and after sample analysis, and documentation of eventual

proper disposal of samples.

5.2.1 Upon receipt, the sample custodian will inspect the sample container for integrity. The presence of leaking or broken containers will be noted on the chain-of-custody form (see Figure 5-1). The sample custodian will sign (with date and time of receipt) the chain-of-custody form, thus assuming custody of the samples. If chain-of-custody forms are not included, the sample custodian will initiate these forms.

5.2.2 The sample custodian will coordinate sample bottle information (e.g., sample tag/label, etc.), log book information, chain of custody records, and all pertinent information associated with the sample to verify sample identity and to assure that all information is correct. Any inconsistencies will be resolved with the field sampling representative and corrective action specified before sample analysis proceeds.

5.2.3 The sample custodian will assign a unique number (RFW #) to each sample received. This will be an eleven digit number in the following format: YYMMLBBB-XXX,

where YYMMLBBB is the RFW batch #, and

YYMM = year/month, e.g., 9104.

L = Laboratory identifier: L = Lionville, S = Stockton, G = Gulf Coast, M = Mobile, D = Denver, A = Auburn

BBB = a computer assigned consecutive batch number which rolls over after 999 to 001.

XXX = a consecutively assigned sample number unique to a specified field sampling point. Because of preservation and volume requirements for requested analytes, a sample from one field sampling point may arrive in more than one bottle. In this case, each bottle from the same sampling point will be assigned the same number.

The RFW batch # will be recorded on the COC and on the bottles using a permanent marker. The RFW tracking number is the primary means of tracking a sample through

the laboratory. Samples are logged into a hard bound sample log book by documenting appropriate information.

5.2.4 Samples will be moved to one of the locked sample storage refrigerators (maintained at 4° ± 2°C) for storage prior to analysis. The storage location will be recorded on the chain-of-custody form.

5.2.5 The sample custodian will maintain the original of the chain-of-custody form in the sample log-in area. Copies of the chain-of-custody are provided to the laboratory Report Manager, to each laboratory Section Manager, to the respective Unit Leaders, to the Project Manager, and to the QA Section.

5.2.6 The sample custodian will alert appropriate production unit of any analyses requiring immediate attention due to short holding times.

5.2.7 The sample custodian will log the sample information into the Laboratory Information Management System (LIMS). These data include laboratory number, field sample number, dates collected and received, project or client identification, and parameters to be analyzed.

5.3 Sample Storage

Samples will be maintained in storage in one of the secured storage refrigerators prior to sample preparation and analysis. The standard operating procedures for sample storage are described in detail in WESTON SOP's; a summary of these procedures follows.

Storage refrigerators are maintained at 4° ± 2°C. The temperature is monitored by the laboratory security system and is additionally recorded daily in a bound log by the QA Section. During working hours, if equipment failure (compressor failure, door left open, etc.) results in the temperature of the storage refrigerator exceeding the upper or lower control limits, an audible alarm will sound and the samples will be moved to suitably controlled storage until the problem has been corrected. During off working hours, the alarm is automatically transferred to the security agency who alerts (via beeper call) laboratory and maintenance personnel so that prompt corrective action can be taken.

Refrigerator storage is designed to segregate samples to prevent cross-contamination and to prevent sample mix-up. This includes storage of volatiles samples separate from semivolatiles and

inorganics samples. Within the refrigerators, samples are stored by RFW batch # for easy retrieval.

Access to laboratory facilities is restricted to laboratory personnel or escorted guests, as described in Section 5.4.5. Therefore, once custody transfer to the laboratory has been completed, the sample is considered placed and stored in a designated secure area accessible only to authorized personnel (i.e., the laboratory facility). At this point, no further custody transfer documentation is required until sample disposal.

Stricter custody procedures which account for sample transfers from storage to analyst and vise versa within the laboratory are required for some projects. Generally, data for these projects will be used for litigation purposes. The samples are stored in a locked walk-in refrigerator, and the key is securely kept by the sample custodian. When the samples are relinquished to an analyst, both the analyst and the sample custodian are required to sign and date the appropriate lines on the laboratory chain of custody form (also described as the Custody Transfer Record/Lab Work Request Form). When the samples are returned to the appropriate cooler, both parties must again sign the original chain of custody form. All samples at the Lionville facility will be maintained at this level of custody.

5.4 Sample Tracking

The standard operating procedures for sample tracking are described in detail in WESTON SOP's. These procedures are summarized in this section.

5.4.1 Organic Preparation/Analysis

Samples are received by the Organic Sample Preparation Section for extraction prior to analysis by gas chromatography, GC/MS, or liquid chromatography. All pertinent data are recorded in a bound laboratory notebook, and assigned a preparation batch number. The first four characters of the extraction/preparation batch number must be the last two digits of the current year followed by the laboratory identifier. For example, 91LE0010 would represent the 10th preparation batch extracted by the Lionville laboratory in 1991. The following laboratory identifiers are used:

E = Extraction	S = Stockton Lab
L = Lionville Lab	M = Mobile Lab
G = Gulf Coast Lab	D = Denver Lab

This extraction information is transferred to the Laboratory Information Management System (LIMS) and a hard-copy Sample Extraction Record is generated. A copy of this form is shown in Figure 5-2. The original is placed on the facing page of the laboratory notebook where extraction data have been entered and is used for custody transfer documentation to the analyst. Copies are provided to the analyst to inform them that extracts are ready for analysis.

Extracts are maintained by the Organic Sample Preparation Section in refrigerated storage until transferred to the analysts.

5.4.2 Metals Preparation/Analysis

Samples are received by the Metals Sample Preparation Section for digestion prior to analysis for metals by Atomic Absorption Spectroscopy or Inductively Coupled Plasma Spectroscopy. When samples are prepared for digestion, the preparation technician records the pertinent information in a laboratory digestion notebook and assigns a preparation batch number. The first three characters of the digestion batch number must be the last two digits of the current year followed by the laboratory identifier. The final four characters are a four digit batch counter which is reset to '0001' at the beginning of each year. For example, 91L0012 would represent the 12th batch digested by the Lionville laboratory in 1991. The following laboratory identifiers are used:

L = Lionville Lab	M = Mobile Lab
G = Gulf Coast Lab	D = Denver Lab
S = Stockton Lab	

This digestion information is then transferred to LIMS and a hard-copy Sample Digestion Record is generated. A copy of this form is shown in Figure 5-3. The digestion record is maintained to acknowledge custody transfer of digestates to the Metals Analysis Section. A copy of the Sample Digestion Record is provided to the Metals Analysis Section to alert them that digestates are ready for analysis.

The original copy of the Sample Digestion Record is retained by the Metals Sample Preparation Section.

5.4.3 Sample Disposition

All samples will be held a minimum of 30 days after the data report is submitted to the client. Samples may be held longer due to special requests or specific contract requirements. All hazardous

samples will be disposed of commercially or returned to the client.

When samples are transferred from the lab to any other destination chain of custody protocols are followed.

5.4.4 Record Keeping

Data related to sample manipulation/preparation/analysis procedures and observations will be documented by the analyst/technician in the sample extraction log, sample digestion log, sample distillation log, analysis log or the technician's personal log book. These are hard-bound notebooks which are issued by the Laboratory Quality Assurance Section. Laboratory notebook pages are signed and dated daily by laboratory analysts. Corrections to notebook entries are made by drawing a single line through the erroneous entry and writing the correct entry next to the one crossed out. A reason for the correction will be noted, as appropriate. All corrections are initialed and dated by the analyst.

5.4.5 Building Security

The WESTON Laboratory maintains controlled building access at all times. All non-WESTON laboratory personnel are required to sign in at the receptionist's desk and are escorted by laboratory personnel while in the building.

The laboratory is locked at all times, unless a receptionist is present to monitor building access (e.g., between the hours of 8:00 a.m. and 5 p.m. Monday through Friday at designated facilities). The locked building is accessed by laboratory employees by using a key or card key. Additionally, a passcode for the Building Security System may be required if no other employees are in the building.

At the Lionville and Stockton facilities, security is additionally monitored by a Security System. This security system not only monitors building access, but also monitors the temperature in the computer room and, in Lionville, in the walk-in sample storage refrigerators. If the control temperature range is exceeded during working hours, an alarm sounds. During non-working hours, an alarm alerts the Security Agency, and response is as follows. The local law enforcement agency is alerted by the Security Agency (for breached security only), and one of three laboratory personnel are notified by the Security Agency. Police response to security alarms takes place within 5 minutes and laboratory personnel are on-site within 20 minutes.

5.5 Electronic Data Records

WESTON's Analytics Division utilizes a Laboratory Information Management System, or LIMS, for the management of sample tracking, data storage, data reduction, and data reporting functions. The LIMS acronym actually refers to the WESTON-customized programs or software that are running on the computer. These programs run on a Concurrent Computer Corporation super-mini computer, utilizing Concurrent's OS/32 operating system. A WESTON-customized version of Perkin-Elmer Corporation's LIMS 2000 software, coupled with their Chromatography Laboratory Automation System (CLAS), is currently used. CLAS is used by the Organics group for data acquisition from various gas chromatographs (GC's), including high pressure liquid chromatograghs (HPLC's).

Personal computers (PC's) are utilized to access the data from LIMS, transfer data to LIMS, and utilize the various LIMS features for data management. File transfers comprise the predominant analyst use of LIMS. This is accomplished utilizing modem communication software, generally Crosstalk using a KERMIT file transfer protocol to transfer files between the PC (the remote system) and LIMS (the host system).

5.5.1 LIMS Security System

All users log onto the system via the Multi-Terminal Monitor, or MTM. Security is controlled through individual user passwords which allow or deny access into specific accounts (e.g., Metals, Wetlab, Reports, etc.). Each account may further allow or deny access to specific programs or tasks.

While entry or modification of information in the data base is controlled by these security measures, the data base itself has some built in safeguards. When a sample is logged in for specific analyses, the analysis for that sample is assigned a status code by LIMS. The following is a list of status codes used by LIMS:

Status	Meaning
1	Sample and Test are logged into LIMS
2	Sample is on hold
3	Sample extraction is in process
4	Sample has been subbed out
5	Extraction/Digestion/Prep is complete
6	Analyzed but not yet reviewed
7	Completed (results reviewed by analyst)
8	Reported (results/deliverables in data reporting)
88	Released (reviewed/reported to client)

9 Canceled

Programs used by analysts to report their data to LIMS update these codes automatically. When an analytical result has been entered into the data base and the status set to 8 (released), the result cannot be accidentally overwritten if a new result is submitted again. The result can only be changed by having a person with the proper security clearance change the status to a lower level. The status of a result does not go to 8 (Released) until the result and its related Quality Control (QC) has been reviewed and approved by the Unit Leader (or designee) of the section generating the result. A data summary report can be used by the supervisor to review results and associated QC. If the supervisor approves the data, the status code is then set to 8.

After the status is set to 8, only a Unit Leader, the head of the Report Generation Department, certain individuals in the QA Department, or the LIMS System Operator has access to programs that will allow the re-setting of the status below 8. Changing the status of an analysis from 8 requires the request from a Unit Leader and full written documentation of the change via a Corrective Action Report (CAR). Once the status has been reset, the results for that analysis can be updated.

5.5.2 System Preventative Maintenance

The System Operator makes daily, weekly, and monthly checks on the system performance. A daily check is made of the computers system log which records all activity regarding the computers OS/32 operating system. This log will reveal problems with the basic system tasks that keep the basic system going. Some programs, aside from the Operating System, create their own logs which are also checked to verify they are performing properly.

A weekly online backup is made of the entire database, "online" meaning the system does not have to be stopped in order to backup all of the data base records to tape. In addition to backing up the database, all data files submitted by instruments or analysts used to upload analytical data into the database are also backed up to tape weekly.

A monthly Preventative Maintenance check from the computer manufacturer assures the hardware is in good operating condition. This check requires that the system be brought down for about four hours while the technician runs various diagnostic checks.

All system maintenance and problems are recorded in a bound system

log which is kept in the LIMS room next to the computer.

5.5.3 Software Updates and Revisions

Software used on the WESTON LIMS system comes in the form of OS/32 Operating System software from Concurrent, LIMS 2000 database software from Perkin-Elmer, and customized LIMS software written by employees of WESTON's Analytics Division. WESTON has three laboratories, each with similar, though not exactly the same, LIMS hardware and software. Every attempt is made to keep the three systems similar so that data may be shared among the systems, for example, when samples are split among the laboratories from the same client. Updates in WESTON software are done monthly by distributing an update tape to each lab with the revised software. A list of the programs and the changes made accompany each tape. This document is kept on file in the LIMS office along with the date the new software was loaded and implemented. New software is tested with dummy data before being sent out to all systems. After implementation, all users are advised of the changes and requested to report any problems with the software to the System Operator.

When updates in software are received from manufacturers, this is noted in the bound LIMS logbook.

FIGURE 5-1
CUSTODY TRANSFER RECORD/LAB WORK REQUEST

WESTON Analytics Use Only

Custody Transfer Record/Lab Work Request

Page ___ of ___

Client
Est. Final Proj. Sampling Date
Work Order #
Project Contact/Phone #
AD Project Manager
QC ___ Del ___ TAT
Date Rec'd ___ Date Due
Account #

Refrigerator #
#/Type Container — Liquid / Solid
Volume — Liquid / Solid
Preservatives

ANALYSES REQUESTED → ORGANIC: VOA, BNA, Pest/PCB, Herb; INORG: Metal, CN

WESTON Analytics Use Only

MATRIX CODES: S - Soil; SE - Sediment; SO - Solid; SL - Sludge; W - Water; O - Oil; A - Air; DS - Drum Solids; DL - Drum Liquids; L - EP/TCLP Leachate; WI - Wipe; X - Other; F - Fish	Lab ID	Client ID/Description	Matrix QC Chosen (✓) MS	MSD	Matrix	Date Collected	Time Collected

FIELD PERSONNEL: COMPLETE ONLY SHADED AREAS

Special Instructions:

DATE/REVISIONS:
1 ___
2 ___
3 ___
4 ___
5 ___
6 ___

WESTON Analytics Use Only

Samples were: 1) Shipped ___ or Hand Delivered ___ Airbill # ___; 2) Ambient or Chilled; 3) Received in Good Condition Y or N; 4) Labels Indicate Properly Preserved Y or N; 5) Received Within Holding Times Y or N

COC Tape was: 1) Present on Outer Package Y or N; 2) Untorn on Outer Package Y or N; 3) Present on Sample Y or N; 4) Untorn on Sample Y or N

COC Record Present Upon Sample Rec'l Y or N

Discrepancies Between Samples Labels and COC Record? Y or N
NOTES

Relinquished by	Received by	Date	Time	Relinquished by	Received by	Date	Time

RFW 21-21-001/A-7/91 ___ L372 ___ L373 ___ L375 ___ L377 ___ L378 Ref# ___ Cooler# ___ 381-596a

FIGURE 5-2
SAMPLE EXTRACTION RECORD

SAMPLE EXTRACTION RECORD

Sheet no.: 1

Extract. Date: 03/20/91 Extraction Batch No: 91LE0560 Analyst: JS Method: CONT

Test: 0625 Cleanup Date: Analyst: Client: AAA COMPANY, INC

LIMS Report Date: 04/01/91 Solvent: DCM Adsorbent:

Sample No:	Client Name / Client ID	pH	Initial WT/VOL	Surr. Mult.	Spike Mult.	Final VOL BASE	Final VOL ACID	Split Mult.	GPC Y/N	% Solids	C/D FACTOR
9103L344-	AAA COMPANY, INC										
005	ES-1	7	100	1.0		1	1	1.0	N		10.0
005 R	ES-1	7	100	1.0		1	1	1.0	N		10.0
005 S	ES-1	7	100	1.0	1.0	1	1	1.0	N		10.0
006	ES-2	7	100	1.0		1	1	1.0	N		10.0
007	ES-3	7	100	1.0		1	1	1.0	N		10.0
008	ES-4	7	100	1.0		1	1	1.0	N		10.0
9103L353-	CANTWAIT ENVIRONMENTAL										
004	8013	7	100	1.0		1	1	1.0	N		10.0
004 R	8013	7	100	1.0		1	1	1.0	N		10.0
004 S	8013	7	100	1.0	1.0	1	1	1.0	N		10.0
91LE0560-MB1		7	1000	1.0		1	1	1.0	N		1.0
91LE0560-MB1 S		7	1000	1.0	1.0	1	1	1.0	N		1.0
91LT0038-LB1		7	100	1.0		1	1	1.0	N		10.0

Comments:
Surrogate: 500 UL ESU 27K @ 100/200 UG/ML
Spike: 500 UL TCLP SPIKE @ 100/200 UG/ML

Extracts Transferred	Relinquished By	Date Time	Received By	Date Time	Reason for Transfer

FIGURE 5-3
SAMPLE DIGESTION RECORD

SAMPLE DIGESTION RECORD

Sheet No:1 OF 1

Digestion Date: 04/01/91 Digestion Batch No: 91L0867 Analyst: RWS Client: QUICKTAT, INC.

Completion Date: 04/01/91 Type of Prep.: ICP Method: CLP Matrix: WATER

Parameters: IN,PT,ZR
Type of Analysis: TOTAL

Sample No:	Initial WT/VOL	Final VOL	Spike Mult.	pH <2>	% Solids	C/D FACTOR	Parameters
9104L447							
001	100	100		<		1.0000	
001 R	100	100		<		1.0000	
001 S	100	100	1	<		1.0000	
003	100	100		<		1.0000	
005	100	100		<		1.0000	
007	100	100		<		1.0000	
009	100	100		<		1.0000	
011	100	100		<		1.0000	
014	100	100		<		1.0000	
017	100	100		<		1.0000	
019	100	100		<		1.0000	
021	100	100		<		1.0000	
023	100	100		<		1.0000	
025	100	100		<		1.0000	
028	100	100		<		1.0000	
91L0867-MB1	100	100		<		1.0000	
91L0867-LC1 L	100	100	1	<		1.0000	
91L0867-LC2 L	100	100	1	<		1.0000	

EXTRACTS TRANSFERRED	RELINQUISHED BY	DATE / TIME	REC'D BY	DATE/ TIME	REASON FOR TRANSFER

6.0 CALIBRATION PROCEDURES

All instruments must be calibrated prior to use as a measurement device to establish the instrumental response to known reference materials. The manner in which various instruments are calibrated is dependent on the particular type of instrument and its intended use. All sample measurements are made within the calibrated range of the instrument. Preparation of all reference materials used for calibration will be documented in a standards preparation notebook.

Instrument calibration typically consists of two types: initial calibration and continuing calibration. Initial calibration procedures establish the calibration range of the instrument and determine instrument response over that range. Typically, three to five analyte concentrations are used to establish instrument response over a concentration range. The instrument response over the range is generally absorbance, peak height, etc., which can be expressed as a linear model with a correlation coefficient (e.g., for Atomic Absorption, Inductively Coupled Plasma, UV-Visible-Infrared Spectrophotometry) or as a response factor or amount vs. response plot (e.g., for Ion Chromatography, Gas Chromatography, Gas Chromatography/Mass Spectrometry, High Performance Liquid Chromatography).

Continuing calibration usually includes measurement of the instrument response to fewer calibration standards and requires instrument response to compare with certain limits (e.g. $\pm$ 10%) of the initial measured instrument response. Continuing calibration may be used within an analytical sequence to verify stable calibration throughout the sequence, and/or to demonstrate that instrument response did not drift during a period of non-use of the instrument.

Specific instrument calibration procedures for various instruments are summarized further in this section, and detailed in the respective analytical methods.

6.1 Metals by Atomic Absorption (AA) Spectroscopy: Graphite Furnace (GFAA), Flame AA, and Cold Vapor AA

Atomic absorption spectrophotometers will be calibrated prior to each day of use. Calibration standards will be from appropriate reference materials, and working calibration standards will be prepared fresh daily. Calibration data are recorded and archived with the respective sample data. Lamps and flame/furnace conditions are optimized for maximum response prior to any analytical measurements.

6.1.1 AA: Initial Calibration

Initial calibration will include analysis of a calibration blank and a minimum of four (4) calibration standards covering the anticipated range of measurement. Duplicate injections are made for each concentration. Absorbance readings are recorded and the resultant standard calibration curve must show a correlation coefficient of ≥ 0.995 and a slope consistent with previous curves. If the correlation coefficient criteria are not met, the instrument is recalibrated prior to analysis of samples.

An initial calibration verification (ICV) standard will be analyzed immediately after standardization. The ICV must be within ten percent (10%) of the true value (mercury must be within twenty percent (20%) of the true value), or the initial calibration must be repeated. The ICV must be from a source other than that used for initial calibration.

An initial calibration blank (ICB) will be analyzed after the ICV. The ICB must be free of target analytes at and above the reporting limit, or the initial calibration must be repeated.

A standard at the reported detection limit (CRA) will be analyzed after the ICB to verify linearity near the reporting limit for AA analysis. The CRA must indicate a positive recovery for the metal of interest. The CRA is not applicable to mercury.

6.1.2 AA: Continuing Calibration

The initial calibration is verified during the analysis sequence by evaluation of a continuing calibration verification (CCV) standard and a continuing calibration verification blank (CCB) after every ten (10) samples are analyzed. The CCV value must be within ± ten percent (10%) recovery of the true value (mercury must be within ± twenty percent (20%) recovery of the true value). The CCB must be free of target analytes at and above the reported detection limit.

If any initial/continuing calibration verifications or blanks exceed their acceptance criteria, analysis is terminated, and the instrument is recalibrated. All samples since the last valid calibration verification are reanalyzed. During auto-sampler runs, sample results must be bracketed by acceptable calibration QC.

6.2 Metals by Inductively Coupled Argon Plasma (ICP)

Following a period of time sufficient to warm up the instrument, the ICP will be calibrated prior to each analytical run or

minimally every 24 hours. Calibration standards will be prepared from reliable reference materials and contain all metals for which analyses are being conducted. Triplicate readings will be made for each QC and investigative sample, and the average value used. If the standard deviation of the three readings is greater than 20%, and one of the three burns appears to be in error (e.g., from poor sample injection), duplicate readings may be used. All reported results are based on at least two readings. If the standard deviation criteria still do not meet, the analysis must be repeated. Working calibration standards are prepared fresh daily. Calibration data is recorded and archived with the respective sample data.

6.2.1 ICP: Initial Calibration

Quarterly, multi-concentration calibration is performed as described in Section 9.1.2.7 to document linearity. On a day-to-day basis, a single standard is analyzed for initial calibration as described below.

Prior to an analytical run, the instrument is calibrated using a standard near the high end of the calibration range and a blank. An initial calibration verification (ICV) standard will be analyzed immediately after standardization, followed by an initial calibration blank (ICB). The ICV must be from a source other than that used for initial calibration. The ICV must be within ± ten percent (10%) recovery of the true value and the ICB must be free of target analytes at and above the reporting limit, or the initial calibration must be repeated.

A standard at two times the reported detection limit (CRI) will be analyzed after the ICB to verify linearity near the reporting limit for ICP analysis. The CRI will be analyzed again at the end of the eight hour analytical sequence, prior to analysis of the final CCV/CCB. The CRI is not required for Al, Ba, Ca, Fe, Mg, Na, and K, but must indicate a positive recovery for all other metals.

ICP Interference Check Samples (ICSA/ICSAB) will be analyzed consecutively at the beginning of each eight (8) hour analytical sequence, after the ICV/ICB, and again at the end of each eight (8) hour analytical sequence, prior to the final CCV/CCB. The ICSA/ICSAB verify the absence of spectral interferences.

6.2.2 ICP: Continuing Calibration

The initial calibration is verified during the analysis sequence by analysis of a continuing calibration blank (CCB) and a continuing

calibration verification standard (CCV) after every ten (10) samples are analyzed. The response of the continuing calibration verification standard must be within ± ten percent (10%) recovery of the true value. The continuing calibration blank must be free of target analytes at and above the reported detection limit.

If any initial/continuing calibration verifications or blanks exceed their acceptance criteria, analysis is terminated, and the instrument is recalibrated. All samples since the last valid calibration verification are reanalyzed.

6.3 Inorganic Colorimetric Methods

6.3.1 Colorimetric: Initial Calibration

A full initial standard calibration curve will be prepared for all colorimetric analyses whenever new reagents are used, or when changes in the procedure are introduced. Working standards to define this curve will include a minimum of five (5) concentrations which cover the anticipated range of measurement, plus a calibration blank. At least one of the calibration standards is at the desired reporting limit. The requirement for an acceptable initial calibration will be a correlation coefficient equal to or greater than 0.995 in order to consider the response linear over the measured range. If the correlation coefficient criteria of 0.995 is not met, the instrument is recalibrated prior to analysis of samples. Calibration data, to include the correlation coefficient, is entered into the laboratory notebook with the sample data to maintain a permanent record of instrument calibrations.

On a daily basis, verification of the full initial curve can be accomplished by analysis of a mid-range and high range standard. Results must be within 10% of the original curve. If not within 10% of the original curve, reanalysis of the standards may be done once to verify the readings; otherwise, a new curve will be developed.

For procedures that require pretreatment steps, a minimum of one standard shall be prepared with the pretreatment. If the pre-treated standard is within ±10% of the standard curve, the curve will be used. If the pre-treated sample is not within ±10% of the curve, the reason will be determined. If it is determined that the difference between the curves is inherent in the procedure, the curve will be based on the standards prepared and carried through the pretreatment.

An initial calibration verification (ICV) standard will be analyzed immediately after the standardization, followed by an initial calibration blank (ICB). The ICV must be from a source other than that used for initial calibration. The ICV must be within ± ten percent (10%) recovery of the true value and the ICB must be free of target analytes at and above the reporting limit, or the initial calibration must be repeated.

6.3.2 Colorimetric: Continuing Calibration

The initial calibration is verified during the analysis sequence by analysis of a continuing calibration blank (CCB) and a continuing calibration verification standard (CCV) after every ten (10) samples are analyzed. The response of the continuing calibration verification standard must be within ± ten percent (10%) recovery of the true value. The continuing calibration blank must be free of target analytes at and above the reported detection limit.

If any initial/continuing calibration verifications or blanks exceed their acceptance criteria, analysis is terminated, and the instrument is recalibrated. All samples since the last valid calibration verification are reanalyzed.

6.4 Total Organic Carbon (TOC)

6.4.1 TOC: Initial Calibration

The total organic carbon analyzer will be calibrated prior to each day of use. Calibration standards are prepared from potassium hydrogen phthalate, and working calibration standards are prepared fresh daily. The working standards will include a blank and a minimum of five (5) concentrations to cover the anticipated range of measurement.

At least one of the calibration standards will be at the desired reporting detection limit. The correlation coefficient of the plot of known versus found concentrations must be at least 0.995 in order to consider the responses linear over a range. If a correlation coefficient of 0.995 cannot be achieved, the instrument is recalibrated prior to analysis of samples. Calibration data, to include the correlation coefficient, is entered into laboratory notebooks to maintain a permanent record of instrument calibrations.

An initial calibration verification (ICV) standard is analyzed immediately after standardization, followed by an initial calibration blank (ICB). The ICV must be from a source other than

that used for initial calibration. The ICV must be within ten percent (±10%) of the true value, or the initial calibration must be repeated. The ICB must be free of target analytes at and above the reporting limit, or the initial calibration must be repeated.

6.4.2 TOC: Continuing Calibration

The initial calibration is verified during the analysis sequence by analysis of a continuing calibration blank (CCB) and a continuing calibration verification standard (CCV) after every ten (10) samples are analyzed. The response of the continuing calibration verification standard must be within ± ten percent (10%) recovery of the true value. The continuing calibration blank must be free of target analytes at and above the reported detection limit.

If any initial/continuing calibration verifications or blanks exceed their acceptance criteria, analysis is terminated, and the instrument is recalibrated. All samples since the last valid calibration verification are reanalyzed.

6.5 Gas Chromatography/Mass Spectrometry (GC/MS)

All GC/MS instrumentation is calibrated to set specifications prior to sample analysis. These specifications vary depending on the requirements of the analytical program and the designated analytical method.

6.5.1 Tuning and GC/MS Mass Calibration

Mass spectrometers are calibrated with perfluorotributylamine (FC-43) or perfluorophenanthrene (FC 5311) as required to ensure correct mass assignment. In addition, at the beginning of the daily work shift, the GC/MS system must be tuned with decafluorotriphenylphosphine (DFTPP) for semivolatiles analysis and 4-bromofluorobenzene (BFB) for volatiles analysis.

The majority of WESTON's work utilizes EPA-CLP or SW-846 protocols, which define the work shift as a 12-hour period initiated by the injection of DFTPP, BFB, or the dioxin/furan window mix. For drinking water programs (500 series methods), an 8-hour work shift is specified in the method for calibration frequency. For wastewater programs (600 series methods), the tune expires when the day's analytical sequence is complete; however, no time limit is given for the length of the daily GC/MS work shift. Ion abundances will be within the windows dictated by the specific program requirements.

6.5.2 GC/MS: Initial Calibration

After an instrument has been tuned, initial calibration curves for analytes appropriate to the analyses to be performed are generated for at least five solutions containing known concentrations of authentic standards of compounds of concern. These solutions are generally cocktails of the method target analytes. The calibration curves will bracket the anticipated working range of analyses. For some compounds in the calibration standard cocktail, such as:

benzoic acid, 2,4-dinitrophenol, 4-nitrophenol, 2-nitroaniline, 3-nitroaniline, 4-nitroaniline, 4,6-dinitro-2-methylphenol, 2,4,5-trichlorophenol, and pentachlorophenol,

the detection is difficult at the lowest calibration appropriate for the majority of the compounds in the mix. In these instances, a four-point initial calibration will be acceptable. Linearity is verified by evaluating the response factors (RF) for the initial calibration standards: Calibration Check Compounds (CCC's) must have a percent relative standard deviation (% RSD) of ≤30 percent. System Performance Check Compounds (SPCC's) must have a minimum average RF of 0.300 for VOA (except bromoform at 0.250) and 0.050 for semivolatiles. These specified CCC's and SPCC's follow:

VOLATILES	SEMIVOLATILES
# chloromethane	* phenol
* vinyl chloride	* 1,4-dichlorobenzene
* 1,1-dichloroethene	# n-nitroso-di-n-propylamine
# 1,1-dichloroethane	* 2-nitrophenol
* chloroform	* 2,4-dichlorophenol
* 1,2-dichloropropane	# hexachlorobutadiene
# bromoform	* 4-chloro-3-methylphenol
# 1,1,2,2-tetrachloroethane	# hexachlorocyclopentadiene
* toluene	* 2,4,6-trichlorophenol
# chlorobenzene	* acenaphthene
* ethylbenzene	# 2,4-dinitrophenol
	# 4-nitrophenol
	* n-nitrosodiphenylamine
	* pentachlorophenol
	* fluoranthene
	* di-n-octylphthalate
	* benzo-a-pyrene

* = Calibration Check Compounds (CCC)
(for di-n-octylphthalate, exceeded criteria to ≤40% will be accepted and addressed in the case narrative)

\# = System Performance Check Compounds (SPCC)

For drinking water and wastewater methods (500 and 600 series), a minimum of three concentrations levels may be used to define the initial calibration curve. Additionally, CCC's and SPCC's are not applicable. Options are specified in the respective methods for using RF criteria to demonstrate linearity or to use a non-linear calibration curve.

Once an acceptable calibration is obtained, samples may be analyzed up until the expiration of the tune. At that time, the instrument must be re-tuned prior to further analysis. After acceptable tuning, a continuing calibration standard (see Subsection 6.5.3) may be analyzed in lieu of a full five-point calibration if the specified criteria are met. Otherwise, a five-point curve must be re-established.

The majority of compounds analyzed for GC/MS comprise EPA's Target Compound List (TCL) or Priority Pollutant List (PP). For add-on compounds not on the current TCL or PP lists, initial calibration is performed using a single point calibration of the additional compound(s), unless prior arrangements are made for a full three-to-five point calibration.

Calibration data, to include linearity verification, will be maintained in the laboratory's permanent records of instrument calibrations.

6.5.3 GC/MS: Continuing Calibration

During each operating shift, a single calibration standard may be analyzed to verify that the instrument responses are still within the initial calibration determinations. The response factor for each target compound in the daily standard is calculated and recorded, then compared to the average RF from the initial calibration.

For EPA-CLP or SW-846 protocols, if significant (>25 %D) RF drift is observed for the CCC's, appropriate corrective actions will be taken to restore confidence in the instrumental measurements. In addition, a minimum RF of 0.300 for VOA (except bromoform at 0.250) and 0.050 for semivolatiles must be reported for SPCC's. If criteria cannot be met, an acceptable five-point initial calibration must be re-established.

For drinking water and wastewater methods (EPA 500 and 600 series methods), the above-referenced CCC's and SPCC's are not applicable. The respective acceptance criteria for the continuing calibration are specified in the analytical methods. If criteria cannot be

met, an acceptable three-point initial calibration must be re-established.

6.6 Gas Chromatography (GC) and High Performance Liquid Chromatography (HPLC)

Gas chromatographs and high performance liquid chromatographs will be calibrated prior to each day of use. Calibration standard mixtures will be prepared from appropriate reference materials and will contain analytes appropriate for the method of analysis.

6.6.1 GC & HPLC: Initial Calibration

Working calibration standards for initial calibration will be prepared fresh weekly. The working standards will include a calibration blank and at least five (5) calibration standards covering the anticipated range of measurement. The low level standard must be at near a concentration which is equivalent to the quantitation limits for the method. The other standards must extend through the linear working range of the detector. The parameters requiring quantitation must have a correlation coefficient of ≥ 0.995 or have an average calibration factor of ≤ 20 %RSD in order for results to be calculated from a linear regression curve, otherwise, a non-linear curve can be used. Any extracts containing parameters of interest which exceed the concentration of the high level standard, must be diluted to bring the parameters within the range of the standards.

6.6.1.1 Pesticides/PCB Initial Calibration

The calibration typically employed for pesticide and/or PCB analysis is a single level calibration, based on the procedure outlined in the EPA Contract Laboratory Program SOW 2/88. Instrument/detector linearity is first demonstrated for a select group of pesticides (e.g., aldrin, endrin, DDT,& DBC) in the Evaluation Mixes. Once a linear response is demonstrated for these four pesticides a linear response is assumed for the remaining pesticides/PCB's.

Several pesticide/PCB methods (e.g., EPA Methods 8080 and 608 and Standard Methods 509A, 16th and earlier editions or Method 6630, 17th edition, 1989) require a multi-level calibration for the quantitative determination of pesticide/PCB extract concentrations. When a multi-level calibration is requested, either through a specific method or as a specific requirement by a given client, it must be performed for all target compounds requiring quantitation.

Multi-level calibration must be performed at a minimum of five (5) levels for pesticides and at a minimum of three (3) levels for PCB's. The low level standard must be at or below a concentration which is equivalent to the quantitation limit. The other standards must extend through the linear working range of the detector. The parameters requiring quantitation must have a correlation coefficient of ≥ 0.995 or have an average calibration factor of ≤ 20 %RSD in order for results to be calculated from a linear regression curve, otherwise, a non-linear curve will be used. Any extracts containing parameters of interest which exceed the concentration of the high level standard, must be diluted to bring the parameters within the range of the standards.

The single point calibration may be used to determine that no target compounds are present in samples at or below the quantitation limit. The single point calibration may also be used to determine matrix spike and surrogate recoveries.

6.6.2 GC & HPLC: Continuing Calibration

The response of the instrument will be verified for each analysis sequence by evaluation of a mid-range calibration check standard. In order to demonstrate that the initial calibration curve is still valid, the calibration check standard must be within ± fifteen percent (15%) recovery of the initial calibration for the compounds of interest or the instrument must be recalibrated. For multi-analyte methods, this check standard may contain a representative number of target analytes rather than the full list of target compounds. Optionally, initial calibration (i.e., the full range of concentration levels) can be performed at the beginning of the analysis sequence.

Within the analysis sequence, instrument drift will be monitored by analysis of a mid-range calibration standard every ten (10) samples. The % difference (% D) in calibration factors (CF's) for the continuing calibration standard compared to the average CF from the initial calibration will be calculated and recorded. If significant (> 15 %D) calibration factor drift is observed for the compounds of interest, appropriate corrective actions will be taken to restore confidence in the instrumental measurements.

6.7 Ion Chromatography (IC)

6.7.1 IC Initial Calibration

The ion chromatograph will be calibrated prior to each day of use. Calibration standards will be prepared from appropriate reference

materials, and working calibration standards for the ions of interest will be prepared fresh daily. The working standards will include a blank and a minimum of three (3) concentrations to cover the anticipated range of measurements. At least one of the calibration standards will be at or below the desired instrument detection limit. The correlation coefficient of the plot of known versus found concentrations will be at least 0.995 in order to consider the instrument acceptably calibrated over a range. If a correlation coefficient of 0.995 cannot be achieved, the instrument will be recalibrated prior to analysis of samples.

Calibration data, to include the correlation coefficient, will be archived with sample raw data to maintain a permanent record of instrument calibrations.

6.7.2 IC: Continuing Calibration

A continuing calibration standard and blank will be analyzed at a frequency of ten percent (10%) and at the end of the analysis shift. The response calculated as a percent recovery of the standard must be ± ten percent (10%) of the true value. The response of the blank must be less than the detection limit.

6.8 Total Organic Halogen (TOX)

6.8.1 TOX: Initial Calibration

Working calibration standards for initial calibration will be prepared fresh daily. The working standards will include a calibration blank and at least five (5) calibration standards covering the anticipated range of measurement. The low level standard must be at near a concentration which is equivalent to the quantitation limits for the method. The other standards must extend through the linear working range of the detector. The parameters requiring quantitation must have a correlation coefficient of ≥ 0.995 or have an average calibration factor of ≤20 %RSD in order for results to be calculated from a linear regression curve, otherwise, a non-linear curve can be used. Any extracts containing parameters of interest which exceed the concentration of the high level standard, must be diluted to bring the parameters within the range of the standards.

6.8.2 TOX: Continuing Calibration

The response of the instrument will be verified for each analysis sequence by evaluation of two calibration check standards, one near the detection limit and one near mid-range. In order to

demonstrate that the initial calibration curve is still valid, the calibration check standard must be within ± fifteen percent (15%) recovery of the initial calibration for the compounds of interest or the instrument must be recalibrated. Since this is a multi-analyte methods, this check standard may contain a representative number of target analytes rather than the full list of target compounds. Optionally, initial calibration (i.e., the full range of concentration levels) can be performed at the beginning of the analysis sequence.

Within the analysis sequence, instrument drift will be monitored by analysis of a mid-range calibration standard every ten (10) samples. The % difference (%D) in calibration factors (CF's) for the continuing calibration standard compared to the average CF from the initial calibration will be calculated and recorded. If significant (> 15 %D) calibration factor drift is observed for the compounds of interest, appropriate corrective actions will be taken to restore confidence in the instrumental measurements.

6.9 Balances

Laboratory balances will be calibrated and serviced annually by a factory representative. In addition, the balances will be checked daily (regular work hours) with a miniumum of two masses: both in the gram range for top loading balances, and one each in the gram and milligram range for analytical balances. A record of calibrations and daily checks will be kept in the balance log.

Weights used by the analysts for daily balance checks will be calibrated monthly against a set of certified Class S weights.

6.10 Thermometers

Oven and refrigerator thermometers will be calibrated annually against a National Institute of Standards and Technology (NIST) certified thermometer in the range of interest. Results for these quarterly calibrations will be recorded in a calibration notebook. Daily (regular business hours or when used) readings will be recorded with the respective refrigerator or method records. Details of daily temperature checks are described in WESTON OP 21-06-100.

7.0 ANALYTICAL PROCEDURES

Routine analytical services are performed using standard EPA-approved methodology. In some cases, modification of standard methods may be necessary to provide accurate analyses of particularly complex matrices. When modifications to standard analytical methods are performed, the specific alterations, as well as the reason for the change, will be reported with the results of analysis. Choice of method is determined by the type of samples and the client/agency program represented. These programs include, but are not limited to the following:

- o Drinking Water,
- o Wastewater,
- o Hazardous Waste, and
- o Air.

For non-routine analytical services (e.g. special matrices, research projects, non-routine compound lists, etc.), the method of choice is selected based on client needs and available technology.

Since numerous methods and analytical techniques are available, continued communication between the client and laboratory is imperative to assure the correct methods are utilized. Once client methodology requirements are established, this and other pertinent information is summarized by the laboratory Project Manager in a Technical Profile Sheet for the project. The Technical Profile Sheet is distributed to appropriate laboratory management, such as the Laboratory Director, Section Managers, Unit Leaders, and QA Manager, to ensure that the proper analytical methods are applied when the samples arrive.

7.1 Method References

The most commonly used method references for the analytical procedures used in the laboratory are listed below. These references are applicable to the analytical test methods used on a daily basis in the laboratory.

ASTM = Annual Book of ASTM Standards, American Society for Testing and Materials, updated yearly

CLP-O = EPA Contract Laboratory Program (CLP) Statement of Work (SOW) for Organics Analysis, Multi-Media, Multi-Concentration: 2/88 updated through 5/89; and EPA-CLP SOW OLM01.0 (3/90) and as updated

CLP-I = EPA Contract Laboratory Program (CLP) Statement of Work (SOW) for Inorganics Analysis, Multi-Media, Multi-Concentration: 7/88 updated through 2/89; and EPA-CLP SOW ILM01.0 (3/90) and as updated

E = EPA 600/4-79-020, Methods for Chemical Analysis of Water and Wastes, March 1989

NIOSH = NIOSH Manual of Analytical Methods, 3rd Edition, February 1984, updated through Supplement 4, August 1990

SW = EPA SW-846, Test Methods for Evaluating Solid Waste, 3rd Edition, November 1986

SM = Standard Methods for the Examination of Water and Wastewater: 15th Edition, 1980, 16th Edition, 1985 and 17th Edition, 1989 (Note method numbers changed format with 17th Edition)

THAMA = USATHAMA PAM 11-41, United States Army Toxic and Hazardous Materials Agency (USATHAMA) Quality Assurance Program, Revision 0, January 1990. Methods certified per requirements set forth in Section 5.

7.2 Detection Limits: Terminology and Procedures

7.2.1 Method Detection Limit (MDL)

The method detection limit is the lowest concentration that can be seen for a given analytical method and sample matrix with a 99% confidence level. The MDL is determined according to Appendix B of 40CFR Chapter 1, Part 136 - Guidelines Establishing Test Procedures for the Analysis of Pollutants. A standard deviation and calculated 99 percent confidence level are determined through analysis of a minimum of seven predetermined low standards of a given matrix which have gone through the same preparation and analysis as a sample of the same matrix. MDL's reflect a calculated value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices.

7.2.2 Instrument Detection Limit (IDL)

The instrument detection limit is the lowest concentration above background noise that an instrument can reliably detect. IDL's for organics are determined through triplicate analysis of target analytes at a concentration near the expected IDL (e.g., based on

instrument manufacturer's suggested value) or reporting limit. Three times the standard deviation of these analyses define the instrument detection limit (IDL).

IDL's for metals are determined by evaluation of seven consecutive measurements of the target analytes at a concentration three to five times the expected IDL (e.g., IDL based on the instrument manufacturer's suggested value) repeated on three nonconsecutive days. Three times the average of the standard deviation obtained from the three days' analyses define the IDL.

7.2.3 Reported Detection Limit (RDL)/Quantitation Limit (QL)

The reported detection limit (RDL) is a laboratory-established limit of detection that will be confidently reported by the laboratory, and is also referenced as a quantitation limit (QL). It is based on program requirements, sample matrix, sample composition, and in-house instrument capabilities. These reporting limits will often be higher than the method detection limits (MDL's) in the associated published analytical procedure or determined experimentally in the laboratory as described in Section 7.2.1. However, MDL's are generally determined using clean matrices which are free of interferences, such as deionized water, and which are analyzed under optimal laboratory conditions. For actual sample analysis, these MDL's may not be routinely achievable.

MDL's and/or IDL's demonstrate minimum detection limits which can be achieved using the method and equipment specified. All reporting limits (i.e., quantitation limits) should be greater than or equal to the MDL/IDL values.

Individual sample detection limits may vary from the laboratory's routinely reported detection limits. This may be due to dilution requirements, variability in sample weight or volume used to perform the analysis, dry weight adjustment for solid samples, the presence of analytical background contaminants, or other sample-related or analysis-related conditions.

7.3 Laboratory Glassware Cleaning Procedures

All glassware must be thoroughly cleaned prior to use to ensure that sample integrity is not affected from artifacts caused by contaminated glassware. Specific cleaning procedures for glassware are described in OP 21-15-0001 for inorganics and OP 21-16-0001 for organics. In summary:

- general laboratory glassware is cleaned with a low- or no-phosphate detergent, followed by thorough rinsing with tap water and deionized water,
- volumetric flasks and pipettes used for inorganics, test tubes and caps used for micro-COD procedures, phosphate glassware, and metals-related glassware include an acid-washing step,
- BOD glassware cleaning includes a NOCHROMIX-washing step,
- microbiological containers must be sterilized prior to use,
- organic glassware includes a solvent-wash, and
- non-volumetric organic glassware may optionally be kiln dried at 450°C.

For difficult to clean glassware, supervisory assistance is recommended. An attempt will be made to determine the composition of material so that appropriate cleaning procedures and safety measures can be taken. The following may be tried with proper precautions: NOCHROMIX, chloroform, acetone, strong base (50% NaOH), hot phosphorus, or other acids. Safety must be a primary concern.

7.4 Sample Container Cleaning Procedure

Sample containers used at WESTON's Analytics Division are primarily purchased from approved vendors, such as I-CHEM Research, Inc. and EAGLE-PICHER. These bottles are cleaned and are quality control checked by the vendor prior to shipment to WESTON. The vendor's standard operating procedures are on file with the bottle preparation OP's (Chapter 21-08) in the QA Section. WESTON's QC procedures associated with purchased bottles are summarized in Section 9.2.4 and 9.2.5.

In the event that bottles are not pre-cleaned, the client (e.g., USATHAMA) has special cleaning procedures, or special containers such as charcoal tubes for air sampling are required, the Container Preparation SOP (RFW OP 21-08-006) should be followed.

7.5 Waste Disposal

The laboratory is registered with the EPA as a Hazardous Waste Generator. Laboratory waste consists of not only the waste generated during analyses of the samples, but also the samples themselves. After the sample storage date for a group of samples

has expired, the samples are ready for disposal. Preferentially, samples are sent back to the client. Those not returned to the client are considered hazardous and are disposed of in conformance to regulatory requirements. Likewise, standards or reagent solutions used in the analyses of the samples must be disposed of properly. Waste disposal is contracted to a licensed waste disposal company. General guidelines for segregating and storing wastes until they are removed are provided by the disposal company. Each WESTON laboratory may use different categories for waste segregation and storage as approved by their disposal company. Details of waste disposal procedures are given in Chapter 21-12 of the WESTON's Standard Practices Manual.

7.6 Reagent Storage

All laboratory chemicals are segregated according to group. For example, strong acids are never stored with strong bases. Prudent safety practices are followed for possible accidental spills of laboratory reagents (e.g., sodium bicarbonate solutions for acid/base spills, Slick Wick or corn cob shavings for solvent spills, Oil-Dry for oils spills, etc.). The ensuing table summarizes the general storage protocols for reagents.

REAGENT	METHOD OF STORAGE
Acids	Vented acid storage lockers, segregated according to acid type
Bases	Base storage cabinet
Solvents	Vented solvent storage lockers, segregated by group: extractions, VOA, Semi-VOA and pesticide/herbicide
Dry Granular or Powder Reagents	Reagent store room, segregated into 3 groups: general, reactive, corrosive
GC/MS Neat Compounds	GC/MS freezer
Metals Stock Standards	Metals storage cabinet

8.0 DATA REDUCTION, VALIDATION AND REPORTING

8.1 Introduction

Analytical data are recorded into bound laboratory notebooks issued by the QA Section. These notebooks may be pre-formatted bench sheets or analysis run logs which are made into bound notebooks by the QA Section (per OP 21-06-118), or hardbound scientific notebooks which must be formatted by the analyst. Data are recorded and associated with a unique WESTON sample identification number (RFW #) for internal tracking and reporting. Notebook pages contain the following information, as applicable: name of the laboratory (WESTON), analytical method, analyst, date, logbook number, sequential page number, associated RFW sample numbers, reagent concentrations, instrument settings, and raw data. Entries for instrument logs will be in chronological order and maintained so as to enable reconstruction of the run sequence of individual instruments. Notebooks will be maintained in accordance with OP 21-06-107.

The laboratory analysts sign and date all notebook entries daily. The notebook pages are reviewed periodically by the Section Manager or designee. Copies of instrument outputs (chromatograms, strip charts, etc.) are maintained on file.

8.2 Data Reduction

Data reduction is performed by the individual analysts and consists of calculating concentrations in samples from the raw data obtained from the measuring instruments. The complexity of the data reduction will be dependent on the specific analytical method and the number of discrete operations (e.g., extractions, dilutions, and concentrations) involved in obtaining a sample that can be measured. The analyst will reduce or calculate all raw data into the final reportable values or enter all necessary raw data into LIMS in order for the data base system to calculate the final reportable values. Copies of all raw data and the calculations used to generate the final results, such as hard-bound laboratory notebooks, strip-charts, chromatograms, LOTUS spreadsheets, and LIMS record files, will be retained on file to allow reconstruction of the data reduction process at a later date.

For data reporting, rounding will not be performed until after the final result is obtained to minimize rounding errors, and results will not normally be expressed in more than two (2) or three (3) significant figures. All results will be reported with the proper measurement units (e.g., mg/L, µg/kg, etc.).

8.2.1 Significant Figures

All reported analytical values should contain only figures (or digits) which are known to be reasonably reliable, i.e., only significant figures. Significant figures consist of all digits that are definitely known and one last digit which is estimated.

For example, if a value is reported as 18.8 mg/L, the 18 must be firm while the 0.8 is somewhat uncertain, but presumably a better estimate than a value of 0.7 or 0.9. The number zero (0) may or may not be a significant figure depending on the situation. If it represents a measured quantity, it is a significant figure. If it merely locates the decimal point, it is not a significant figure.

- Zero within a number. A zero between two non-zero digits is always significant.

- Zero at the beginning of a number. With no preceding non-zero digits, a zero before the decimal point is not significant. If there are no non-zero digits preceding a decimal point, the zeros after the decimal point, but preceding other non-zero digits are not significant. These zeros only indicate the position of the decimal point.

- Zero at the end of a number. Final zeros to the right a decimal point, at the end of a number, are always meant to be significant figures. Final zeros in a whole number may or may not be significant.

Significant figures reflect the limits in accuracy (reliability) of the particular method of analysis and measuring instruments. At the project planning stage, a consideration for choosing the right analysis method should include an evaluation of whether the number of significant digits of the resulting values obtainable for the analysis technique is sufficient for interpretation purposes. If not, there is little that can be done within the limits of the given laboratory operations to improve these values. If more significant figures are needed, a further improvement in method or selection of another method will be required.

Once the number of significant figures obtainable from a type of analysis is established, data resulting from such analyses are reduced, and reported according to scientific rounding rules.

8.2.2 Rounding Off Numbers

Rounding off numbers is a necessary operation in all analytical

areas to account for the limits of measurements of every instrument and all glassware. Results are rounded by dropping digits that are not significant, using scientific rounding rules:

- If the figures following those to be retained is less than 5, the figure is dropped and the retained figures are kept unchanged.
- If the figure following those to be retained is greater than 5, the figure is dropped and the last retained figure is raised by 1.
- If the figures following those to be retained is 5 and if there are no figures other than zeros beyond the 5, the figure 5 is dropped and the last place figure retained is increased by 1 if it is an odd number, and it is kept unchanged if it is an even number.
- When an arithmetic operation with a series of numbers is performed, the result should be rounded off to the same number of decimal places as the figure with the smallest number of places after the operation is completed with all decimal places intact.

8.2.3 Gravimetric Procedures

Data reduction procedures for gravimetric analyses are detailed in the respective analytical methods. These methods include solids determination, oil and grease, etc. In general, the following calculation is used.

$$\frac{A\ (mg) - B\ (mg)}{C\ (mg\ or\ mL)} * 1000\ mg/kg\ or\ mL/L = R\ (mg/kg\ or\ mg/L)$$

A = Gross weight of sample with container weight
B = Tare weight of container
C = Size of sample being analyzed
R = Result

8.2.4 Colorimetric Procedures

Data reduction procedures for colorimetric analyses are detailed in the respective analytical methods. In general, a standard calibration curve is prepared which compares concentration vs. absorbance readings of known standards. The calibration curve is developed by calculating a Least Squares Fit (i.e., linear regression) to evaluate the correlation coefficient, slope, and y-

intercept of the curve. Sample response (absorbance reading) is applied to the linear regression line to obtain an initial raw result which is then factored into equations to obtain the estimate of the concentration in the original sample. Standards are generally expressed as weight per volume of the parameter of interest. The final calculation is as follows:

$$\frac{A * B * D}{C} = R \text{ (mg/kg or mg/L)}$$

A = Concentration obtained from the absorbance reading calculated by least squares program of a computer or calculator.
B = Final volume of sample preparation
C = Initial weight or volume of sample
D = Dilution (equals 1 if no dilution)
R = Result

8.2.5 Titrimetric Procedures

Data reduction procedures for titrimetric analyses are detailed in the respective analytical methods. In general, the following calculation is used.

$$\frac{\text{mL Titrant} * \text{Normality of Titrant} * \text{Factor}}{\text{Sample Size (mL or g)}} = R$$

R = Result in mg/kg or mg/L

Factor is dependent upon the type of analysis. Refer directly to referenced procedures for specific factors. The following are example factors typical to titrimetric procedures:

Alkalinity	50,000
Total Kjeldahl Nitrogen	14,010
Nitrogen Ammonia	14,010
Chlorine	40,000
Chloride	40,000
Sulfite	40,000

8.2.6 Direct Reading Instruments: e.g., ICP, GFAA, TOC, TOX

ICP and GFAA results are results obtained from a direct instrument reading. Standards of a known concentration are analyzed and the instrument sets up a calibration curve. Both instruments allow any dilution factor to be entered into the instruments program prior to analysis.

If sample preparation was required prior to analysis, (e.g., digestion), the reading is then related to the original sample matrix using the following calculation:

$$\frac{A * B}{C} = R \text{ (mg/L or mg/kg)}$$

A = Direct instrument reading (includes dilution factor)
B = Final volume of sample being analyzed
C = Initial weight or volume of samples
R = Result

8.2.7 Instruments with Strip Chart Output: e.g., Flame AA, Cold Vapor Hg, AutoAnalyzer Methods, etc.

A standard calibration curve is set up for each analysis, and strip chart measurements by peak height are recorded. The peak heights of the samples are compared to the standard curve and a value is calculated utilizing a Least Squares Fit.

The sample results must then be corrected for dilution. Standards may be expressed on a weight basis (e.g., µg), or may be expressed on a weight/volume basis (e.g., mg/L). Therefore, strip chart measurements by peak height are calculated by one of two methods:

8.2.7.1 Method used when standards are expressed on a weight basis (e.g., µg):

$$\frac{A * D}{\text{Sample Size (g or mL)}} = R \text{ (mg/L or mg/kg)}$$

A = Value in µg obtained from Least Squares Fit calculation from computer/calculator.
D = Dilution Factor
R = Result

8.2.7.2 Method used when standards are expressed on a weight/volume basis (mg/L):

$$(A * B * D)/C = R \text{ (mg/L or mg/kg)}$$

A = Value in mg/L obtained from the Least Squares Fit calculation from computer/calculator.
B = Final volume of sample preparation.
C = Initial weight or volume of sample
D = Dilution Factor
R = Result

8.2.8 HPLC and Gas Chromatography

Chromatography protocols utilized in the laboratory specify data reduction using either a single-level calibration procedure, or a multi-level calibration procedure. The method chosen will be dictated by client analytical requirements.

8.2.8.1 Single-Level Calibration

For protocols such as CLP requiring a single-level calibration procedure, instrument/detector linearity is first demonstrated for a select group of analytes, e.g., pesticides (aldrin, endrin, DDT,& DBC) in the Evaluation Mixes. Once linear response is demonstrated for these four pesticides a linear response is assumed for the remaining pesticides/PCB's. The concentration in the sample is calculated using the following equation for external standards. Response can be measure by the manual peak height technique or by automated peak height of peak area measurements from an integrator.

Water Samples

$$\text{Concentration } (\mu g/L) = \frac{(A_x)(I_s)(V_t)(F)}{(A_s)(V_i)(V_s)(1\ L/1000\ mL)}$$

A_x = Response for the parameter to be measured.
A_s = Response for the external standard.
V_t = Volume of total extract (mL)
I_s = Amount of standard injected in nanograms (ng)
V_i = Volume of extract injected (mL)
V_s = Volume of water extracted (mL)
F = Dilution Factor

Sediment/Soil Samples

$$\text{Concentration } (\mu g/kg) \text{ (Dry weight basis)} = \frac{(A_x)(I_s)(V_t)(F)(S)}{(A_s)(V_i)(W_s)(D)(1\ kg/1000\ g)}$$

A_x, I_s, A_s, V_i, V = same as given above for water

V_t = Volume of total extract (mL)
W_s = Weight of sample extracted (g)

S = Split multiplier (S=1 if no GPC cleanup, S=2 if GPC cleanup employed).

$$D = \frac{100 - \%\ \text{moisture}}{100}$$

8.2.8.2 Multi-Level Calibration

Several chromatography methods (e.g., EPA 8000 Series and 600 Series Methods for volatiles and extractables) require a multi-level calibration for the quantitative determination of sample or extract concentrations. When a multi-level calibration is requested, either through a specific method or as a specific requirement by a given client, it must be performed for all target compounds requiring quantitation.

The calculation of the final concentration of positively identified parameters is performed using the following equations:

Water Samples

$$\text{Concentration } (\mu g/L) = \frac{(C_x)(V_t)(F)}{(V_s)(1\ L/1000\ mL)}$$

C_x = Extract concentration of parameter x ($\mu g/mL$) determined by linear regression calculation from the 5-point calibration curve.

V_t = Volume of total extract (mL)
F = Dilution factor
V_s = Volume of water extracted (mL)

Sediment/Soil Samples

$$\text{Concentration } (\mu g/kg) = \frac{(C_x)(V_t)(F)(S)}{(W_s)(D)(1\ kg/1000\ g)}$$

C_x, V_t, F = Same as given above for water

S = Split multiplier (S = 1 if no GPC cleanup, S = 2 if GPC cleanup is employed)

W_s = Weight of sample extracted (g)

D = 100 - (% moisture content of sample)/100

8.2.9 GC/MS, Internal Standard Method

The GC/MS data system and the LIMS data system perform quantitation of target compounds as well as tentatively identified compounds (TIC's) for water and soils. In general, up to as many as 20 TIC's are identified for semivolatiles, and up to as many as 10 TIC's are identified for volatiles. However, for routine analysis up to 5

TIC's per fraction are searched.

GC/MS data reduction and review also involves operator professional judgements concerning the correctness of the identification of the target compounds and tentatively identified compounds. The final report will reflect these judgements.

8.2.9.1 Target Compounds for Water

$$\frac{(A_x)(C_{is})(V_t)}{(A_{is})(RF)(V_o)(V_i)} = R\ (\mu g/L)$$

A_x = Area of characteristic ion for compound of interest
C_{is} = Amount of internal standard injected (ng)
V_t = Volume of total extract (uL). This includes a measured final volume.
A_{is} = Area of characteristic ion of internal standard
RF = Response Factor* for compound being measured
V_o = Volume of water extracted (mL)
V_i = Volume of extract injected (uL)

$$*RF = \frac{(Area_x)}{(Area_{is})} \times \frac{(C_{is}\ injected)}{(C_x)}$$ where: C = ng

8.2.9.2 Target Compounds for Soil

$$\frac{(A_x)(C_{is})(V_t)}{(A_{is})(RF)(V_o)(V_i)(W_s)(D)} = R\ (\mu g/kg)$$

All terms are the same as water calculation except:

W_s = Weight of sample extracted or diluted (g)
D^* = 100 - (% moisture content of sample)/100

8.2.9.3 TIC's for Water and Soils

Quantitation of TIC's (Tentatively Identified Compounds) is performed by the instrument data system, the operator, and the LIMS data system. The formulas above for waters and soils can be used with the following exceptions:

A_x and A_{is} should be taken from the total ion integration listing accompanying the TIC report. The nearest non-interfered internal standard should be used. The RF is assumed to be 1. The concentration is therefore estimated and is flagged with a "J" when reported. The total ng of the TIC is calculated as follows:

$$\frac{(\text{Area of TIC}^{**})\ (C_{is})}{\text{Area}_{is}} = \text{ng of TIC}$$

This number is entered into a LIMS spreadsheet that will calculate the final concentration of the TIC.

**The operator visually confirms that the integration is correct. If not, the peak should be integrated manually with a user program.

8.3 Data Review/Data Validation

System reviews are performed at all levels. The individual analyst constantly reviews the quality of data through calibration checks, quality control sample results, and performance evaluation samples. These reviews are performed prior to submission to the Section Manager or the Laboratory Project Manager.

The Section Manager and/or the Laboratory Project Manager review data to ensure consistency with laboratory QC requirements, to verify reasonableness with other generated data, and to determine if program requirements have been satisfied. Selected hard copy output of data (chromatograms, spectra, etc.) will be reviewed to ensure that results are interpreted correctly. Unusual or unexpected results will be reviewed, and a resolution will be made as to whether the analysis should be repeated. In addition, the Laboratory Project Manager or Section Manager will recalculate selected results to verify the calculation procedure.

Prior to final review/sign off by the Laboratory Manager, the Data Reporting Section will verify that the report deliverable is complete and in proper format, screen the report for compliance to laboratory and client QA/QC requirements, and ensure that the case narrative covers any noted deficiencies. The Laboratory Manager will be the final laboratory review prior to reporting the results to the client's Project Manager (PM). The PM will do a final completeness check before submitting the data report to the client.

The Quality Assurance Section independently conducts a complete review of selected reports to determine if laboratory and client quality assurance/quality control requirements have been met. Discrepancies will be reported to the appropriate Section Manager and/or Laboratory Project Manager for resolution.

Data audits are also performed by regulatory agencies, client representatives, or third party data validators. The frequency, level of detail, and the areas of concern during these reviews are dependent on the specific program requirements. Third party data

validation done by or at the request of the regulatory agency or client will generally be conducted according to specific technical review protocols, such as EPA's Laboratory Data Validation Functional Guidelines. This level of review is outside the purview of the laboratory, and should not be confused with the data review/data validation procedures described in this Section 8.3.

Third party validation services offered by WESTON are contracted separately from analytical services and are provided by WESTON's Data Validation group. This group provides data validation to agencies and clients outside the laboratory. Although data validated by this group has included independent review, validation, and usability assessment of Analytics Division data, their primary focus is data package assessment for non-WESTON data.

8.4 Data Reporting

Reports will contain final results (uncorrected for blanks and recoveries), methods of analysis, levels of detection, surrogate recovery data, and method blank data. In addition, special analytical problems, and/or any modifications of referenced methods will be noted. The number of significant figures reported will be consistent with the limits of uncertainty inherent in the analytical method. Consequently, most analytical results will be reported to no more than two (2) or three (3) significant figures. Data are normally reported in units commonly used for the analyses performed. Concentrations in liquids are expressed in terms of weight per unit volume (e.g., milligrams per liter, mg/L). Concentrations in solid or semi-solid matrices are expressed in terms of weight per unit weight of sample (e.g., micrograms per gram, µg/g).

Reported detection limits will account for all appropriate concentration, dilution, and/or extraction factors, unless otherwise specified by program requirements (e.g., USATHAMA IRDMS reports).

The final data report provided by WESTON Analytics conforms to one of three basic types, with an option for a separately contracted electronic data deliverable (EDD):

- WESTON Standard Client Report,
- NJDEP CLP-II Report, and
- WESTON CLP Report.

Reported QC results minimally include a method blank. Other QC will be specified per client and analysis protocols. Re-analyses

will not be required for organics for surrogate or internal standard area outliers unless exceeded criteria are determined to be due to laboratory error, or unless the client has specifically contracted for this matrix effect confirmation.

8.4.1 Standard Client Report

The standard client report contains a transmittal letter and the following:

- case narrative describing: data qualifiers, sample collection, sample preparation (e.g., extraction or digestion) and analysis dates, and a description of any technical problems encountered with the analysis,
- sample data summaries to include appropriate QC result summaries, and
- five-peak library search report for GC-MS volatiles and semivolatiles.

8.4.2 NJDEP CLP-II Report

The New Jersey Department of Environmental Protection requires a CLP-II report for some projects. Deliverables requirements for this report are as specified by NJDEP. In briefly summary, it will contain a transmittal letter and the following:

- cover page/laboratory chronicle,
- chain of custody-sample request form,
- case narrative,
- all CLP report forms (including QC results forms),
- sample data results,
- chromatograms for organic samples, and
- appropriate sample spectra for GC/MS.

8.4.3 WESTON CLP Report

This is a data documentation package assembled according to EPA Contract Laboratory (CLP) requirements, as described in WESTON OP's 21-20-019 and 21-20-020. This report can apply to CLP as well as non-CLP parameters. In brief summary, included are:

- cover page/laboratory chronicle,
- chain of custody-sample request form,
- case narrative,
- all CLP report forms (including QC results forms),

- sample data results,
- all associated raw data for standards and samples, and
- when separately contracted, a CLP diskette deliverable.

8.5 Data Storage

All raw data, such as hard-bound laboratory notebooks and logbooks, strip charts and instrument printouts, LOTUS spreadsheets, and magnetic tapes, as well as final reports, are retained for a minimum period of 5 years. These raw data and reports are documented and stored in a manner which are easily retrievable. Prior to transfer to WESTON's secure archives area, interim storage of raw data records are maintained in the Laboratory:

- LOTUS spreadsheets and instrument print-outs for conventional inorganic parameters are filed by parameter group and batch number. Generally, current year and previous year documents are kept on file in the laboratory.

- Instrument print-outs and strip charts for the Metals, GC, HPLC, and GC/MS groups are stored in file cabinets in each specific laboratory area.

- Final sample reports are filed alphabetically by client for future reference, and maintained in the laboratory for approximately one year. When full data documentation packages are part of the final report, these client files generally include only an abbreviated copy of the package.

- Due to the bulk of full data documentation packages, they are generally filed separately from the client files by RFW batch for future reference.

All hard-bound laboratory notebooks and logbooks are assigned a book number by the QA Section. A new book will be assigned for each instrument or parameter as the most current book is completed.

9.0 INTERNAL QUALITY CONTROL CHECKS: LABORATORY

The daily quality of analytical data generated in the WESTON laboratories is controlled by the implementation of this Analytical Laboratory Quality Assurance Program Plan. The types of internal quality control checks used in the analytical chemistry laboratory are described in this section. Control checks used for field operations are described in OP 21-06-002. Control checks used for microbiological procedures are described in Chapter 21-14 of the WESTON Standard Practices Manual.

9.1 Quality Control Indicators and Analysis Frequency

In order to assess the validity of a reported result, QC indicators are placed in the measurement system to provide a tool for evaluating how well the method worked. There are QC indicators to evaluate method performance at both the preparation and the measurement steps, and QC indicators to evaluate matrix effects.

9.1.1 Method Performance QC Indicators: Preparation Batch

Most samples to be analyzed in the laboratory require some pre-treatment before a measurement can be made. This may include extraction, digestion, distillation, etc. During the pre-treatment step, samples are arranged into discreet, manageable groups, called preparation (prep) batches, to facilitate and control uniform treatment for all samples. Each prep batch will have a maximum of 20 investigative samples of the same matrix (e.g., soil or water). In addition, QC indicators such as blanks, spikes, and duplicates are added to each prep batch to monitor the performance of the system. All QC associated with a preparation batch will be carried through the entire analytical procedure, from prep to final analysis.

9.1.1.1 Preparation Blanks

The preparation blank (PB), also referenced as a method blank (MB) or reagent blank, is used to monitor potential contamination from the sample preparation process. Preparation (prep) blanks will be prepared by processing a volume of deionized laboratory water for water samples, or a purified solid matrix for soil/sediment samples (when available), through the entire analytical scheme. The reagent blank volume or weight must be approximately equal to the sample volumes or sample weights being processed. In the absence of a suitable solid matrix for soil blanks, reagents will be added to an empty flask and carried through the entire analytical scheme. Results will be calculated based on starting with a "blank" soil

approximately equal to the weight of the samples.

For semivolatiles analyses, ACS reagent grade anhydrous sodium sulfate in glass is purchased for use as a solid standard matrix. Prior to use, it is heated in the kiln at 400°C overnight.

For VOA analyses, a commercially available concrete sand equivalent to "Ottawa sand" was purchased from a local hardware store, kiln dried at 700°C for 4 hours, and found to serve as an acceptable solid standard matrix. Other sources of solid matrix may be used if demonstrated to be analyte-free. However, unless a specific client request is made to use a solid matrix, water only will be purged and the results calculated and reported as soil.

For metals, the prep blank will be prepared by processing a volume of deionized laboratory water for both water (PBW) and soil or sediment (PBS) samples through the entire analysis scheme. A 100 mL aliquot is digested with all water samples, while a 3-5 mL aliquot is digested with all soil samples. Final results will be calculated as µg/L for the PBW, based on a 100 mL sample size. To facilitate comparison to the actual field samples, final results for the PBS will be calculated as mg/kg, assuming 100 % solids and a weight equivalent to the aliquot used for the corresponding investigative samples.

9.1.1.2 Laboratory Control Samples and Blank Spikes

Laboratory control samples and blank spikes are by our definition the same. Laboratory control sample (LCS) is the terminology used by the inorganics group, while blank spike (BS) is the terminology used by the organics group. The LCS or BS solution must be from an alternate source than the standards used for calibration. If a calibration verification standard is analyzed, which by definition will be from a source other than the initial calibration, the LCS/BS solution may the same as one of these solutions.

The laboratory control sample is a water (LCSW) or solid (LCSS) sample of known concentration (e.g., a sample of laboratory reagent grade water fortified (spiked) with the analytes of interest) which is processed through the entire preparation and analysis procedures concurrently to the investigative samples to demonstrate acceptable method performance, independent of the investigative sample matrix. If solid LCS is not available, the water LCS will be processed through the soil preparation (e.g., digestion for metals or distillation for cyanide). To facilitate comparison to the actual field samples, final results for the LCSS will be calculated as mg/kg or µg/kg, assuming 100 % solids and a weight equivalent to

the aliquot used for the corresponding investigative samples.

For organics, in particular for multi-analyte methods, the LCS (or BS) may be surrogate compounds in the blank and/or a select number of target analytes in fortified method blanks.

LCS's and blank spikes are performed in duplicate for each preparation batch of 20 or fewer samples. Duplicate analysis allows precision and accuracy data to be generated.

9.1.1.3 Known QC Check Samples

Quality control (QC) samples obtained from an outside source with concentrations predetermined by the vendor are referenced as QC check samples. Outside vendor sources may include U.S. EPA, the National Institute of Standards and Technology (NIST), or a commercial source. These QC check samples may be concentrates requiring dilution into a standard matrix per vendor supplied instructions, or fully constituted samples ready to analyze as received. Control limits are provided by the vendor, extrapolated from other in-house control data, or determined from control charts.

The QC check sample may be used to check the accuracy of an analytical procedure. It is particularly applicable when a minor revision or adjustment has been made to an analytical procedure or instrument. It may also be used for an LCS.

9.1.1.4 Matrix QC Indicators

Matrix QC indicators include field sample duplicates (DUP) and spikes (MS). Over the last several years, spiked duplicates (MSD) have become popular replacements for laboratory DUP's, as the MSD provides measurement data for precision assessment when no target compounds are indigenous to the sample selected for duplicate analysis.

A matrix spike (MS) is an aliquot of an investigative sample which is fortified (spiked) with the analytes of interest and analyzed with an associated sample batch to monitor the effects of the investigative sample matrix (matrix effects) on the analytical method. A field blank should never be chosen as the sample for matrix spike analysis.

Laboratory duplicate samples are obtained by splitting a field sample into two separate aliquots and performing two separate analyses on the aliquots. The analysis of laboratory duplicates

monitors sample precision; however, it may be affected by sample inhomogeneity, particularly in the case of nonaqueous samples, as well as reproducibility of laboratory preparation and measurement techniques.

Matrix spikes (MS), matrix spike duplicates (MSD), and duplicates (DUP) are performed only in association with selected protocols. Frequency of these matrix QC indicators will be specified in the project-specific Quality Assurance Project Plan. Generally inorganics protocols specify an MS/DUP and organics protocols specify an MS/MSD.

For Safe Drinking Water Act (SDWA) methods, MS/MSD or MS/DUP is performed at a rate of 10% (1 per 10 samples), or one set per preparation batch, whichever is greater, with the added caution that the frequency may be different for different monitoring programs.

For EPA SW-846 methods, MS/MSD or MS/DUP is performed at a rate of 5% (1 per 20 samples), or one set per preparation batch, whichever is greater, with the added caution that the frequency may be different for different monitoring programs.

Under USEPA CLP protocols, i.e., the Statement of Work (SOW) for analytical services, a minimum QC indicator frequency of 5% for matrix spike/matrix spike duplicate (MS/MSD) has been determined to provide an adequate confidence level for evaluating matrix effects in hazardous waste samples which will most likely be used for litigation purposes. This equates to one MS/MSD for each group of 20 samples of a similar matrix and concentration level (e.g., per low level soil, medium level soil, or water) for each project.

In addition to analytical protocols and QC requirements, the SOW also provides contractual information specific to EPA, which provides EPA with the framework for implementation of the analytical protocols on a timely, project specific basis. This includes delivery schedules, distribution of results to appropriate EPA personnel, definition of terms such as "Case" and "Sample Delivery Group" (SDG), etc. Contractual items specific to EPA are only applicable to EPA's Contract Laboratory Program, and do not apply to clients adopting the SOW for analysis outside this contract.

One of the contractual requirements initiated with the 2/88 SOW is the concept of sample delivery group (SDG). A number of factors influenced this concept, including:

- Contractually, the contractor laboratory was not required to submit a data deliverable until 40 days after receipt of the last sample in the case. Occasionally, the same Case # would be used by the sampling crew for an extended period of time, e.g., for a project that carried through the whole summer. This allowed one project/one case. However, because the "due date" was contractually extended every time a new sample was submitted for analysis, EPA was unable to obtain the sample results from some laboratories in a timely fashion.

- For large sampling events, a single case could contain data for 40 or more samples. The resulting data packages comprised thousands of pages, and was unwieldy in both assembly by the laboratory and review by the data user.

To address these problems, cases were subdivided into one or more SDG's with no more than 20 samples each, and with each SDG covering a maximum time span of 14 calendar days. This time limiting factor was added as consideration in determining the contractual 5% QC frequency, i.e., 5% MS/MSD per matrix, per concentration, per 14 days, whichever is more frequent. Note this does not mean every SDG will have an MS/MSD; however, there will be at least one MS/MSD for each 14 day period. This time limitation for SDG's is an EPA CLP contractual issue, and will not automatically apply to non-EPA CLP contract work.

For non-EPA contracts, SOW contract issues must be re-defined for the individual client, as noted in the above discussion. This includes client assignment of case numbers and SDG's, if these are to be applicable to the project.

9.1.2 Instrument Performance QC Indicators

Instrument performance is monitored each day of use to ensure and document operating conditions conducive to proper target compound identification. The instrument QC indicators appropriate to each analytical technique are identified in the respective method. A brief description of these checks is included in this section. Refer to the respective method for applicability.

9.1.2.1 Initial Calibration Verification (ICV)

A calibration standard of known concentration prepared from an alternate source than the standard used for the initial calibration curve. The ICV is analyzed immediately after the standard curve to confirm calibration.

9.1.2.2 Initial Calibration Blank (ICB)

A blank water or solvent that is run immediately after the standard curve to confirm the calibration and to confirm that a blank is reading less than the reporting limit.

9.1.2.3 ICP Interference Check Samples (ICSA/ICSAB)

ICP Interference Check Samples (ICSA/ICSAB) will be analyzed consecutively at the beginning of each eight (8) hour analytical sequence, after the ICV/ICB, and again at the end of each eight (8) hour analytical sequence, prior to the final CCV/CCB. The ICSA/ICSAB is analyzed to verify the absence of spectral interferences.

Results for the ICP Interference Check Samples shall be within limits of 80 - 120% of the established mean value. If results for the ICSA/ICSAB do not fall within the control limit, action will be to terminate the analysis, correct the problem, recalibrate, and reanalyze the samples.

The ICSA and ICSAB shall be prepared with interferent and analyte concentrations at the following levels:

Interferents (Solution A)	(mg/L)	Analytes (Solution B)	(mg/L)
Al, Ca, Mg	500	Ag, Cd, Ni, Pb, Zn	1.0
Fe	200	Ba, Be, Co, Cr, Cu,	0.5

Interferent elements for spectral interferences other than Al, Ca, Fe, and Mg will be made as needed, and documented with the ICP instrument records. The mean concentration will be established by initially analyzing each lot of ICS Solution at least five times for the analytes of concern. The mean determination must be made during an analytical run that meets all ICP QC specifications.

Alternately, the ICSA/ICSB may be obtained from EPA or a commercial vendor with established mean values provided with the solution.

9.1.2.4 Detection Limit Verification Standard

For AA furnace analysis, a standard at the reported detection limit (CRA) will be analyzed after the ICB to verify linearity near the reporting limit for AA analysis. The CRA must indicate a positive recovery for the metal of interest.

For ICP analysis, a standard at two times the reported detection limit (CRI) will be analyzed after the ICB to verify linearity near the reporting limit for ICP analysis. The CRI will be analyzed again at the end of the eight hour analytical sequence, prior to analysis of the final CCV/CCB. The CRI is not required for Al, Ba, Ca, Fe, Mg, Na, and K, but must indicate a positive recovery for all other ICP metals .

9.1.2.5 Continuing Calibration Verification (CCV)

A continuing calibration standard (CCV) is a standard of known concentration made from an alternate source than the standard curve. The CCV is analyzed for wet chemistry, metals, HPLC, and GC analyses to confirm that the calibration has not drifted . The CCV will be analyzed at a rate of 10% (1 per 10 samples) for inorganics wet chemistry, HPLC, and GC analyses. For metals, the CCV is analyzed at 10% or for AA furnace every two (2) hours or for ICP every eight (8) hours, whichever is more frequent.

9.1.2.6 Continuing Calibration Blank (CCB)

The continuing calibration blank (CCB) is a reagent water blank that is analyzed at a rate of 10% (1 per 10 samples) for inorganics and metals analyses. The CCB is used to confirm that the baseline has not drifted, and to confirm that the blank is still reading less than the reporting limit.

9.1.2.7 Linear Range Analysis Standard (LRS)

For ICP analysis, calibration will be performed quarterly with a blank and a minimum of five (5) standard concentrations to cover the anticipated range of measurement. This will verify linearity and document the upper limit of the linear range for each element. At least one of the calibration standards will be at or near the reporting limit. The calibration curve generated must have a correlation coefficient equal to or greater than 0.995 in order to consider the responses linear over a range. All samples found to be above the ICP linear range will be diluted and reanalyzed.

9.1.2.8 Interelement Correction (IEC)

For ICP analysis, correction factors for spectral interference due to Al, Ca, Fe, and Mg will be determined at least annually for all wavelengths used for each analyte reported by ICP, or any time the ICP is adjusted in any way that may affect the IEC's. Correction factors for spectral interferences other than Al, Ca, Fe, and Mg are highly recommended and will be made as needed, and documented

with the ICP instrument records.

9.1.2.9 GC/MS Tuning and Performance

For GC/MS analysis, mass spectrometers are calibrated with perfluorotributylamine (FC-43) or perfluorophenanthrene (FC 5311) as required to ensure correct mass assignment. In addition, at the beginning of the daily work shift, the GC/MS system must be tuned with decafluorotriphenylphosphine (DFTPP) for semivolatiles analysis, 4-bromofluorobenzene (BFB) for volatiles analysis, or the dioxin/furan window mix for dioxin/furan analysis to the method specified criteria.

Performance is further monitored through response to target compounds during initial and continuing calibration, with minimum response criteria for specified system performance check compounds (SPCC's) and linearity verification by evaluating the response factors (RF) for calibration check compounds (CCC's).

Throughout the analysis shift, blanks, internal standard areas, surrogates, shifts in chromatographic baseline, resolution of peaks, and overall quality of the chromatography are used collectively to monitor instrument performance.

9.1.2.10 GC and HPLC Instrument Performance

Instrument performance for chromatographic methods is monitored through retention time shift evaluation (e.g., for aldrin or DDT), linearity checks, and degradation checks of selected target compounds. Throughout the analysis shift, blanks, shifts in chromatographic baseline, shifts in retention times, resolution of peaks, and overall quality of the chromatography are used collectively to monitor instrument performance.

9.1.3 Method Performance QC Indicators: Analysis Batch

Matrix specific QC indicators can be used at the instrument to verify how dependable the measurement is for the respective sample matrix. These indicators provide information on sample matrix effects which is independent of the efficiency of the preparatory technique. The method performance QC indicators appropriate to each analytical technique are identified in the respective method. A brief description of these checks is included in this section.

These QC checks are performed to provide a tool for evaluating how well the method worked for the respective matrix. These values are used by the client to assess the validity of a reported result

within the context of the project DQO's. For results outside laboratory control limits, appropriate corrective action will be taken and the deviation noted in the case narrative accompanying the sample results.

9.1.3.1 Serial Dilution

For metals, a five-fold (CLP) or four-fold (SW-846) dilution of an investigative sample is performed at the instrument to check for possible physical and/or chemical interferences. This sample is referenced as a serial dilution. If the analyte concentration is minimally a factor of ten above the IDL after dilution, the diluted value should agree within 10% of the original determination to demonstrate no interferences.

For SW-846 protocols, serial dilution is recommended whenever a new or unusual matrix is encountered for both ICP and AA analyses. For CLP protocols, one serial dilution per batch of twenty (20) samples per matrix is specified (see Section 9.1.1.4 for a discussion on determining a batch of 20 samples) for ICP analyses. Field blanks may not be used for serial dilution analysis.

9.1.3.2 Duplicate AA Furnace Injections

Except when performing method of standard additions (MSA), CLP protocols require duplicate injections for all analyses. The results of these two readings must agree within 20% RSD, or one rerun is required (rerun will be duplicate injections of the sample which did not meet criteria).

Although multiple injections is recommended for increased accuracy and as an aid to help detect furnace pipetting errors, multiple injections is not required per SW-846 7000 methods. Since all AA furnace injections are reliably reproduced using autosamplers, WESTON does not routinely analyze double injections for non-CLP methods.

9.1.3.3 Analytical Bench Spike for AA Furnace

Analytical bench spikes are prepared at the instrument by fortifying the digestate with a known quantity of the analyte of interest. A bench spike is performed on each sample immediately following the unspiked analysis. Specifics on preparation and acceptance criteria are provided in the respective CLP and SW-846 protocols. Bench spikes are not required on matrix spikes, except as described in Section 9.1.3.5.

9.1.3.4 Method of Standard Additions

Method of standard additions (MSA) is performed routinely on Extraction Procedure (EP) Toxicity Characteristic extracts, or other samples found to contain matrix interferences when analyzed for metals. The correlation coefficient of the MSA curve should be >0.995, and the sample concentration is defined as the Y-intercept.

9.1.3.5 Post-Digestion/Post-Distillation Spike

For CLP protocols, when the matrix spike recovery falls outside QC limits and the unspiked sample does not exceed four times the amount spiked, an analytical bench spike at 2X the reporting limit or 2X the indigenous level, whichever is greater, will be performed on the corresponding unspiked sample. This will apply to cyanide and all metals, except mercury.

9.2 QC Monitoring

9.2.1 Laboratory QC Charts

The analyses of quality control samples are entered chronologically onto quality control charts specifically maintained for each analytical procedure. These control charts are labeled with upper and lower warning limits corresponding to ± two times the standard deviation of the mean of the accumulated results, and upper and lower control limits corresponding to ± three times the standard deviation of the mean of the accumulated results, the analysis which is being charted, and the value (e.g., % recovery, % RPD, etc.) which is being monitored.

A custom LIMS QC charting system has been developed for the laboratory to automate the QC charting process. This unique system blends the use of database and graphics functions.

Laboratory control charts on LIMS are produced by four major application programs which are built around two databases. The two databases that hold the information needed for the lab control charts are: LM (Lab Method), and LQ (Lab QC Data). Each method makes a record in the LM database which will lead to generation of one chart. The QC data points are extracted from the Analysis and Result data sets and are loaded into the LQ data set. This is done so that each record in LQ is associated with a certain method in LM. Both the LQ and LM data sets are then used by the various control chart programs. The details of producing QC charts using this LIMS system is detailed in WESTON OP 21-11-108 for routine laboratory charts and OP 21-11-112 for specialized USATHAMA QC

charts.

QC charts and associated control limits are updated quarterly, and are used to demonstrate method performance and help identify system errors. More frequent QC charts can be generated monthly or even daily based on the most recent 40 data points in order to track any potential out of control QC trends for a given parameter.

9.2.2 Refrigerator Blanks

Refrigerator storage blanks are placed in VOA sample storage refrigerators at two week intervals, after which time they are analyzed for full VOA TCL analytes by either GC or GC/MS. These blanks monitor VOA refrigerators for contamination.

9.2.3 Solvent/Reagent Water Approval

Pre-purchase approval of solvents, including bottled water purchased for field sampling projects, is performed for all solvents purchased in large quantities. This may include, but is not limited to, acetone, acetonitrile, ethyl ether, freon, hexane, isooctane, methanol, methylene chloride, toluene, bottled deionized water, and bottled HPLC water. Prior to purchase, a candidate lot of solvent is put in reserve at the vendor's warehouse. A sample case of the lot of solvent is provided by the vendor to the laboratory for testing. If the solvent passes acceptance criteria, the vendor is notified and holds the sample in reserve for laboratory use. The approved lot of solvent is shipped to the laboratory in increments until the entire lot has been received. Prior to exhaustion of the reserve lot, the process will be repeated with a new lot to ensure a constant supply of approved solvent.

The laboratory's on-tap deionized water supply is similarly tested on a monthly basis for selected parameters. Samples are collected and submitted for analysis by laboratory personnel.

9.2.4 Vendor-Purchased Sampling Containers

Pre-cleaned sample containers may be purchased from laboratory approved vendors, such as I-CHEM Research, Inc. and EAGLE-PICHER. All cases of bottles have an identifying code which indicates to the vendor the date on which they were cleaned. These sampling containers are available with two levels of documentation. The highest level of documentation includes a certificate of analysis from the vendor and traceability information on each container. Use of these bottles is contracted separately by the client to

provide an extra measure of credibility to the sampling/analysis effort, particularly for litigation cases. This level of container is used with no further QC testing by the laboratory.

For most routine work performed at the laboratory, supplemental QC checks in place, e.g., field blanks, and historical sample data indicate bottle contamination is not a problem; and the extra costs to the project for per-bottle certification are not warranted. For these projects, the bottles purchased are pre-cleaned under the vendor's internal QA/QC procedures, in the same manner as those which are purchased as certified. However, the vendor does not specially segregate these containers after cleaning for analysis and subsequent certification of the lot. Documentation received for these containers just indicates that the samples have been cleaned prior to shipment. For these bottles, WESTON randomly pulls a set of containers from each vendor in stock on a monthly basis, and provides an in-house analysis for target analytes of concern.

9.2.5 Bottle Orders

All requests for field sampling containers are processed according to WESTON OP 21-08-001, Bottle Orders: Preparation/Shipment. Documentation prepared for each bottle order includes QC lot numbers for all associated solvents, reagent blank water, and sampling containers. A tracking number is assigned to each processed order, and this number is printed on the associated sample container labels. This QC monitoring enables WESTON to provide traceability information for chemicals and bottles provided for each job, should it be needed at a later date.

The volatiles trip blanks which accompany bottle orders are prepared in the WESTON laboratory. The source of this water will be the laboratory's on-tap deionized water which is boiled prior to use, unless otherwise specified by the client. This is the same water used for daily GC/MS VOA method blanks. The QA Section performs random checks of these trip blank water samples to ensure that they are free of air bubbles.

9.2.6 Balances, Refrigerators

All analytical balances and sample/standards storage refrigerators and freezers are monitored daily. Refrigerators are monitored twice daily, and include the walk-in coolers in the sample receipt areas as well as those located within the individual laboratories. All daily checks are recorded in the respective balance, refrigerator, or freezer log.

9.2.7 Instrument Time Check Verifications

An independent check of GC and GC/MS instrument time clocks is performed randomly and at a minimum prescribed frequency by the QA Section.

FIGURE 9-1
INORGANIC INSTRUMENT PERFORMANCE INDICATORS

Performance Indicator and Analysis Frequency	Criteria				
	AA	ICP	CVAA	Cyanide	Other
Initial Calibration Verification (ICV): analyze immediately after initial calibration	90-110 %R	90-110 %R	80-120 %R	85-115 %R	90-110 %R
Initial Calibration Blank (ICB): analyze immediately after ICV	|CRDL|	|CRDL|	|CRDL|	|CRDL|	|CRDL|
Interference Check Samples (ICSA and ICSAB): analyze after ICV, before samples	NA	80-120 %R (ICSAB)	NA	NA	NA
CRDL Standard (CRA and CRI): CRA: analyze after ICV/ICB, but before samples CRI: analyze after ICV/ICB, but before samples and at the end of the run or minimum of two times per 8 hour shift	CRA[3]	CRI[4]	NA	note 2	NA
Continuing Calibration Verification (CCV): analyze at 10% interval or AA: every 2 hours or ICP: every 8 hours	90-110 %R	90-110 %R	80-120 %R	85-115 %R	90-110 %R
Continuing Calibration Blank (CCB): analyze immediately after CCV	|CRDL|	|CRDL|	|CRDL|	|CRDL|	|CRDL|
Linear Range Standard (LRS): quarterly	NA	95-105 %R	NA	NA	NA
Interelement Corrections For ICP: annually or as needed after service	NA	minimally Al, Ca, Fe, Mg	NA	NA	NA

NOTES:

1. The ICV must be prepared from different stock sources than those used for the initial calibration standards.
2. One of the initial calibration standards for cyanide must be at the CRDL.
3. The CRA must be at the CRDL or the IDL, whichever is greater.
4. The CRI must be at 2X the CRDL or 2X the IDL, whichever is greater. Required for every wavelength used for analysis, except those for Al, Ba, Ca, Fe, Mg, Na, K, and elements not on the TCL.

FIGURE 9-2
INORGANIC METHOD PERFORMANCE INDICATORS

Performance Indicator and Analysis Frequency	Criteria				
	AA	ICP	CVAA	Cyanide	Other
Preparation Blank (PB) one per digestion batch of ≤20 samples per matrix	|CRDL|	|CRDL|	|CRDL|	|CRDL|	|CRDL|
Laboratory Control Sample (LCSW): one per digestion batch of ≤20 samples per water matrix	80-120 %R except Ag, Sb	80-120 %R except Ag, Sb	80-120 %R	80-120 %R	80-120 %R
LCSS (solid): same as water	for actual soil LCSS, limits established case by case basis: refer to the "certified" results accompanying the soil				
Matrix Spike (S): one per digestion batch of ≤20 samples per matrix	75-125 %R	75-125 %R	75-125 %R	75-125 %R	75-125 %R
Duplicate Sample (D) one per digestion batch of ≤20 samples per matrix	≤20 %RPD	≤20 %RPD	≤20 %RPD	≤20 %RPD	≤20 %RPD
ICP Serial Dilution (L): one per RFW batch of ≤20 samples per matrix (performed at instrument)	NA	90-110 %R	NA	NA	NA
Duplicate AA Furnace Injections: every sample, except during MSA (i.e., maximum 20 injections between ICV/ICB)	if >20 %RSD, requires one rerun (i.e., two burns)	NA	NA	NA	NA
Analytical Spike at Instrument (A): all furnace analyses, @2X CRDL (except Pb spiked at 20 µg/L for CLP, 10-20 µg/L other protocols), immediately following the sample	85-115 %R except MSA and Matrix Spike	NA	NA	NA	NA
Method of Standard Additions (MSA): when sample absorbance or conc is not <50% of analytical bench spike absorbance or conc, and single analytical bench spike at the instrument is <85% or >115%, then requires full MSA, i.e., 3 concentration levels plus a blank (see also SOW)	correlation coefficient (R) >0.995 if R <0.995, reanalyze once, report result with best R	NA	NA	NA	NA
Post-digestion/Post-Distillation Spike (A): matrix spike outside 75-125% and sample result ≤4X spike amount, spike @2X CRDL or 2X sample concentration, whichever is greater.	NA	analyze /report (except for Ag)	NA	analyze /report	NA

10.0 PERFORMANCE AND SYSTEM AUDITS/SURVEILLANCES

Quality assurance audits and surveillances are conducted to verify conformance with the laboratory's quality assurance program, to determine the effectiveness of the QA program, and to continually improve the quality effort.

Performance audits test the laboratory's ability to correctly assay an unknown sample. They may be single blind or double blind. In a single blind study, the analyst is not provided with the acceptable result for the unknown sample until after the experimental result is reported; however, it is known that the sample is a performance test. In a double blind performance test, the analyst not only has no knowledge of the acceptable result, but the sample is disguised in such a manner as to maintain anonymity as a performance test sample.

Systems audits and surveillances evaluate the operational details of the QA program. An audit consists of a systematic procedure to ascertain the implementation of a specific QA requirement, such as sample tracking or chain of custody procedures. Audits will be conducted by persons other than those who performed or directly supervised the work being inspected. A surveillance consists of inspection or monitoring of a specific targeted area for compliance to requirements, such as an evaluation of a single analytical method to ensure conformance with the written OP.

10.1 External Audits

Performance audits, as well as on-site systems audits, by non-Analytics Division agencies and clients are an on-going, continual occurrence. Whether scheduled or a surprise arrival, full cooperation with the audit team will be provided by laboratory staff during the on-site visit. A full response to any deficiencies cited as a result of a performance audit or on-site visit will be addressed within a timely manner, as determined by the client. The QA Manager is responsible for scheduling and coordinating all external audits.

A representation of the number, type, and auditing agency are summarized in Table 10-1. This Table 10-1 does not include non-government audits.

10.1.1 Performance Audits

Single blind performance audits (i.e., Performance Evaluation Studies: PES) are routinely analyzed at least four times a year:

twice as U.S. EPA WS and WP studies, and twice as New York State DOH Potable, Non-Potable, Solid and Hazardous Waste, and Air and Emissions. Additionally, air matrix NIOSH PAT samples are analyzed quarterly, and NO_x and SO_x are analyzed annually. Other water/wastewater PES are received annually from Illinois EPA and NC DNR&CD, quarterly from confidential clients for full TCL/TAL plus selected wastewater parameters, and semi-annually from the Oklahoma Water Resources Board (OWRB).

PES samples are additionally analyzed as double and single blinds on a project specific basis for selected clients, including the Corps of Engineers, Federal and State Agencies, as well as non-government clients.

10.1.2 Systems Audits

On-site evaluation by agencies, clients, or designated third party auditors (both government and non-government) are routinely conducted to assure program compliance. These audits are preferentially pre-scheduled with the client to ensure appropriate personnel are available to answer questions. However, audits may also be unannounced. In either instance, full cooperation with audit team the laboratory staff during the on-site visit will be provided.

Program compliance may be defined as adherence to requirements for a specific certification or licensing program, as for state certifications, or adherence to specific project requirements. Government program clients include State Regulatory Agencies, U.S. EPA, the Nuclear Regulatory Commission (NRC), the Department of Defense, and the Department of Energy. Non-government clients include industrial clients and engineering firms utilizing our laboratory services for drinking water, groundwater, wastewater, hazardous waste, and mixed waste water, soil, air, tissue, and miscellaneous waste matrices.

10.2 Internal Audits

The laboratory QA Manager has overall responsibility for monitoring the internal Quality Assurance/Quality Control program. The QA Section Manager has a staff to provide in-house audits, and to review and validate analytical data packages.

10.2.1 Performance Audits

Internal performance audits conducted at the bench level provide the analyst with a tool to self-evaluate the acceptability of a

specific data set. This is accomplished through analysis of laboratory control samples or spiked blanks of known concentration to the analyst which must meet minimum performance standards. When these QC checks are performed in duplicate, method accuracy and precision information can be generated to demonstrate the proper functioning of the total measurement system.

As an additional feature of the laboratory's internal QA Program, double blind performance evaluation samples are periodically submitted to the laboratory for analysis. These samples originate both internally and externally, and are scheduled through the laboratory's project management system to ensure anonymity. Over the course of a year, samples are submitted to cover all routinely analyzed methods.

Externally originated double blinds are analyzed quarterly by the Lionville Laboratory for full organic and inorganic target compound list parameters in both soil and water. Externally originated samples are purchased from a commercial vendor (currently ERA) in a constituted form. WESTON initiates these external double-blind samples using the same procedures utilized for routine clients through a designated project manager, to include, for example, assigning of work order numbers, forward scheduling the analyses (using a "fake" client name, which changes quarterly), generation of bottles orders so that samples arrive in standard containers, etc. This system effectively gets samples into the laboratory for unbiased analysis. Results are compiled by the project manager and submitted to the QA Section for review and evaluation. Any noted deficiencies are addressed with the appropriate laboratory service group and a corrective action plan is implemented, as needed.

Internally originated samples are handled in the same manner as the externally purchased double blinds, except that they are prepared by the laboratory, unknown to the analysts, using EPA, NIST, or commercially available reference materials.

10.2.2 Systems Audits and Surveillances

Internal laboratory systems audits and surveillances will be conducted and documented on a quarterly basis, at minimum. Each quarter's audit will target a limited section of the laboratory, and be coordinated such that the entire laboratory is planned for QA audit at least once annually. Unique client audit procedures and data requirements will be complied with as contractually specified. The internal audit consists of a review of laboratory systems, procedures and documentation. Any deficiencies and/or deviations are documented and a summary report is prepared.

Items which may be included for focus in routine laboratory audits and surveillances include, but are not limited to:

- life of reagents
- holding times
- interferences (if any)
- maintenance logs
- standards traceability
- preparation of glassware
- sample preservation
- equipment/instrumentation
- computer spreadsheets
- calculations
- standard deliverables
- lab book documentation
- safety
- method detection limits
- current standard operating practice (SOP)

A system audit report is prepared and distributed to the responsible party, including the appropriate supervisor. A maximum of two weeks is given to address any recommended corrective actions. The original copy of the completed responses is kept on file in the QA Section.

10.2.3 Raw Data Audits and Surveillances

All laboratory notebooks are routinely reviewed by the analyst and a second reviewer to assure correctness of sample and quality control calculations. In addition, all active laboratory data books and QC files are subject to periodic audits/surveillances by QA personnel and/or Unit Leaders.

Raw data evaluations will be based on the following completed information, as applicable:

- parameter and method,
- instrument ID and settings,
- date and full signature of analyst,
- valid standard curve,
- frequency of QC,
- QC calculations and recoveries,
- sample calculations, and
- neatness and ease of data interpretation.

Reviewed data will be documented as "reviewed by" and signed (initials or full signature) and dated by the reviewer.

TABLE 10-1
WESTON, ANALYTICS DIVISION-L372/L375 (LIONVILLE LABORATORY)
EXTERNAL AGENCY PERFORMANCE AND SYSTEMS AUDITS

Last Update: 30 September 1991

AGENCY	PARAMETERS	AUDIT TYPE/FREQUENCY	DATE*	REQUIRED FOR
California State Dept. of Health	Water Supply, Water Pollution	Performance/Semiannually; and System/Biennially	06/90	Water/Wastewater Certification
Florida Dept. of Health and Rehab Services	Water Supply, Water Pollution	Performance/Semiannually; and System/Biennially	06/90	Water/Wastewater Certification
Illinois EPA	Water Supply, Water Pollution	Performance/Semiannually; and System/Biennially	09/88	Water/Wastewater Certification
Louisiana Dept. of Health and Hospitals	Water Supply	Performance/Semiannually; and System/Biennially	10/90	Drinking Water Certification
New Hampshire Department of Environmental Services	Water Supply, Water Pollution	Performance/Semiannually; and System/Triennially	05/91	Water/Wastewater Certification
New Jersey Department of Environmental Protection	Water Supply, Water Pollution	Performance/Annually; System/Biennially	05/91	Water/Wastewater Certification
	Hazardous Waste	Performance and System/ Per Project Requirements	05/91	Hazardous Waste Approval, RI/FS
New York State Dept. of Health	Water Supply, Water Pollution	Performance/Quarterly; System/Annually	01/90	Water/Wastewater Certification
New York State Department of Environmental Conservation	Water Supply, Water Pollution, Hazardous Waste	Performance (CLP-type)/ Per Contract Requirement	02/90	State Analytical Contract
		System (CLP-type audits)/ Per Contract Requirement	06/90	
North Carolina Division of Health Services	Water Supply	Performance/Semiannually; System/Biennially	07/90	Drinking Water Certification
North Carolina Dept of Natural Resources and Community Development	Water Pollution	Performance/Semiannually; System/Biennially	12/88	Wastewater Certification

TABLE 10-1
WESTON, ANALYTICS DIVISION-L372/L375 (LIONVILLE LABORATORY)
EXTERNAL AGENCY PERFORMANCE AND SYSTEMS AUDITS

Last Update: 30 September 1991

AGENCY	PARAMETERS	AUDIT TYPE/FREQUENCY	DATE*	REQUIRED FOR
Oklahoma Water Resources Board	Water Supply, Water Pollution	Performance/Semiannually; System/Biennially		Water/Wastewater Certification
Pennsylvania Department of Environmental Resources	Water Supply	Performance/Annually; System/Biennially	09/89* 09/90**	Drinking Water Certification (*Chemistry and (**Microbiology)
	Hazardous Waste		01/90	State Analytical Contract
U.S. EPA (Regional Reps, Techlaw, NEIC)	Water Supply, Water Pollution, Hazardous Waste	Performance and system CLP-type audits/ Per Contract Requirement	04/90	Superfund Related Analytical Work
U.S. Air Force/ MITRE Corporation	Water Supply, Water Pollution, Hazardous Waste	Performance and system CLP-type audits/ Per Contract Requirement	06/90	Water/Wastewater, Superfund Related Analytical Work
U.S. Army Corps of Engineers	Water Supply, Water Pollution, Hazardous Waste	Performance and system CLP-type audits/ Per Contract Requirement	02/91	Water/Wastewater, Superfund Related Analytical Work (L372)
U.S. Army Corps of Engineers	Hazardous Waste	Performance and system CLP-type audits/ Per Contract Requirement	02/91	Validation of the Mobile on-Site Laboratory (L375) for Hazardous Waste Related Analytical Work
U.S. Army Toxic and Hazardous Materials Agency	Water Supply, Water Pollution, Hazardous Waste	System CLP-type audits/ Per Contract Requirement	08/91	USATHAMA Tasks for Installation Restoration (IR) Analytical Work (Contracts)
U.S. Department of Energy	Mixed Waste	System Per Contract Requirement	08/91	D.O.E. Mixed Waste Contracts

TABLE 10-1
WESTON, ANALYTICS DIVISION-L372/L375 (LIONVILLE LABORATORY)
EXTERNAL AGENCY PERFORMANCE AND SYSTEMS AUDITS

Last Update: 30 September 1991

AGENCY	PARAMETERS	AUDIT TYPE/FREQUENCY	DATE*	REQUIRED FOR
U.S. Navy/ Martin Marietta	Water Supply, Water Pollution, Hazardous Waste	Performance and system CLP-type audits/ Per Contract Requirement	07/89	Water/Wastewater, Superfund Related Analytical Work
U.S. Nuclear Regulatory Commission	Mixed Waste and Radiolabeled Isotopes	System Per NRC License Requirement	01/91	NRC License Maintenance
Utah State Health Laboratory	Water Supply/ Water Pollution	Performance/Semiannually; System/Biennially	11/89	Water/Wastewater Certification
Washington State Dept. of Ecology	Water Pollution	Performance/Biennially; System/Triennially	02/90	Wastewater Certification
Wisconsin Dept. of Natural Resources	Water Supply, Water Pollution	Performance/Semiannually; System/Triennially	06/89	Water/Wastewater Certification

* Date of Last On-Site
Water Supply = Drinking Water
Water Pollution = Wastewater
Hazardous Waste = "Target Compound List" Superfund Analyses
CLP = U.S. EPA and/or State-Lead Contract Laboratory Program

TABLE 10-2
WESTON, ANALYTICS DIVISION-L373 (STOCKTON LABORATORY)
EXTERNAL AGENCY PERFORMANCE AND SYSTEMS AUDITS

Last Update: 30 September 1991

AGENCY	PARAMETERS	AUDIT TYPE/FREQUENCY	DATE*	REQUIRED FOR
California State Dept. of Health	Water Supply, Water Pollution	Performance/Semiannually; System/Biennially	08/90	Water/Wastewater /Hazardous Waste Certification
New Hampshire Department of Environmental Services	Water Supply, Water Pollution, Hazardous Waste	Performance/Semiannually	07/91	Certification
New Jersey Department of Environmental Protection	Water Supply, Water Pollution	Performance/Annually; System/Biennially	06/91	Water/Wastewater Certification
New York State Dept. of Health	Water Supply, Water Pollution	Performace/Quarterly; System/Annually	03/90	Water/Wastewater Certification
South Carolina	Water Supply, Water Pollution, Hazardous Waste	Performance/Semiannually	07/91	Certification
U.S. Air Force/ MITRE Corporation	Water Supply, Water Pollution, Hazardous Waste	Performance and System	05/91	Water/Wastewater /Solid Waste
U.S. Navy/ Martin Marietta	Water Supply, Water Pollution, Hazardous Waste	Performance and System	09/91	Water/Wastewater Analytical Work
Washington State Dept. of Ecology	Water Pollution	Performance/Semiannually; System/Triennially	08/91	Wastewater Certification

* Date of Last On-Site
Water Supply = Drinking Water
Water Pollution = Wastewater
Hazardous Waste = "Target Compound List" Superfund Analyses
CLP = U.S. EPA and/or State-Lead Contract Laboratory Program

TABLE 10-3
WESTON, ANALYTICS DIVISION-L377 (GULF COAST LABORATORY)
EXTERNAL AGENCY PERFORMANCE AND SYSTEMS AUDITS

Last Update: May 1991

AGENCY	PARAMETERS	AUDIT TYPE/FREQUENCY	DATE	REQUIRED FOR
California State Dept. of Health	Water Supply, Water Pollution, Hazardous Waste	Performance/Semiannually; and System/Biennially	05/90	Water/Wastewater /Hazardous Waste Certification
Colorado Dept. of Health	Water Supply, Water Pollution, Hazardous Waste	Performance/Semiannually; and System/Biennially	09/89	Water/Wastewater Certification
Florida Health and Rehabilitative Services	Water Supply, Water Pollution	Performance/Semiannually; System/Biennially	05/91	Drinking Water Certification
Illinois EPA	Water Supply	Performance/Annually; and System/Biennially	03/90	Drinking Water Certification
	Hazardous Waste and Remediation	Performance/Annually; System/Annually	09/91	State Contract Laboratory Program
Louisiana Dept. of Health	Water Supply	Performance/Semiannually; System/Biennially	12/90	Drinking Water Certification
New Jersey Department of Environmental Protection	Water Supply, Waste Pollution	Performance/Semiannually; System/Biennially	02/91	Water/Wastewater Certification
	Water Pollution, Hazardous Waste	Performance and System/ Per Project Requirements	05/90	Superfund Related Analytical Work Contract X-408
New York State Dept. of Environ. Conservation	Water Supply, Water Pollution, Hazardous Waste	Performance and System (CLP-type) per Project Requirements	09/89	Water/Wastewater and Superfund Related Work
New York State Dept. of Health	Water Supply, Water Pollution, Hazardous Waste	Performance/Semiannually; and System/Biennially	04/90	Water/Wastewater /Solid Waste Certification
North Carolina Division of Health Services	Water Supply	Performance/Semiannually; and System/Biennially	06/90	Drinking Water Certification

TABLE 10-3
WESTON, ANALYTICS DIVISION-L377 (GULF COAST LABORATORY)
EXTERNAL AGENCY PERFORMANCE AND SYSTEMS AUDITS

Last Update: May 1991

U.S. Air Force MITRE Corporation	Water Supply, Water Pollution, Hazardous Waste	Performance and System CLP-type Audits/ Per Contract	07/89	Water/Wastewater and Superfund Related Work
U.S. Army Corps of Engineers	Water Supply, Water Pollution, Hazardous Waste	Performance and System CLP-type Audits/ Per Contract	07/88	Water/Wastewater and Superfund Related Work
U.S. EPA Region V (Project Specific)	Water Pollution, Hazardous Waste	Performance and System CLP-type Audits/ Per Contract	09/90	Water/Wastewater and Superfund Related Work
U.S. FDA Inspector	Food and Drug	System/Annually unannounced	02/91	FDA approval
Utah State Health Laboratory	Water Supply, Water Pollution, Hazardous Waste	Performance/Semiannually; and System/Biennially	12/89	Water/Wastewater and Hazardous Waste Certification
Washington State Dept. of Ecology	Waste Pollution	Performance/Semiannually; System/Triennially	10/90	Wastewater Certification
Wisconsin Dept. of Natural Resources	Water Supply, Water Pollution	Performance/Semiannually; System/Biennially	09/91	Drinking Water/ Wastewater Certification

* Date of Last On-Site
Water Supply = Drinking Water
Water Pollution = Wastewater
Hazardous Waste = "Target Compound List" Superfund Analyses
CLP = U.S. EPA and/or State-Lead Contract Laboratory Program

11.0 PREVENTATIVE MAINTENANCE

11.1 Introduction

The ability to generate valid analytical data requires that all analytical instrumentation be properly and regularly maintained. The responsibility of routine care lies with the analysts using the instruments. Guidance on required routine maintenance, as well as troubleshooting information, is provided in the respective instrument manuals and laboratory OP's. For more extensive preventative maintenance or emergency repair service, the analytical laboratory maintains full service contracts on all major instruments. The elements of the maintenance program are discussed in the following sections.

11.2 Instrument Maintenance Log Books

Each analytical instrument is assigned an instrument log book. All maintenance activities are recorded in the instrument log. The information entered in the instrument log includes:

- date of service or maintenance,
- person performing service or maintenance,
- type of service performed and reason for service,
- replacement parts installed (if appropriate),
- documentation of the re-establishment of working order,
- miscellaneous information.

If service is performed by the manufacturer, a copy of the service record (when available) is affixed to the notebook page, or cross-referenced in the notebook to a separate maintenance file. The service record should include sufficient detail to describe the service performed (e.g., not just "service call," but "replaced pump motor gear"). If the service record does not spell out this information, it must be written separately into the maintenance log.

11.3 Instrument Maintenance and Repair

Preventative maintenance and repairs that cannot be performed by laboratory staff are contracted to the manufacturer's service department, or to an authorized maintenance vendor. WESTON service agreements provide for preventative maintenance, emergency service, and emergency shipping of spare parts. Annual service of the laboratory balances is an example of contracted preventative maintenance. For emergency response, service contracts on the Gas

Chromatographs, GC/MS instruments and AA-ICP require on-site response within 48-72 hours. (Typically, service representatives are on site within 24 hours of a service call.) The service contracts also provide for 24-hour delivery of critical spare parts in response to a service request.

The maintenance procedures and frequencies for major analytical instrumentation are summarized in Table 11-1. Additional information is provided in the respective instrument manuals, and in the following laboratory OP's:

- 21-15-0002.1 Instrument Maintenance: AA/ICP
- 21-15-0002.2 Instrument Maintenance: Wet Chemistry
- 21-16-0002.1 Instrument Maintenance: GC
- 21-16-0002.2 Instrument Maintenance: GC/MS

11.4 Spare Parts

WESTON Laboratory maintains an inventory of routinely required spare parts (for example, spare sources, vacuum pumps and filaments for GC/MS, spare torches, burner heads for AA-ICP).

The instrument operators have the responsibility, with the appropriate Section Manager, to ensure that an acceptable inventory of spare parts is maintained.

11.5 Contingency Plans

Properly maintained equipment will provide dependable service; however, emergencies cannot be totally avoided. Major equipment, such as the LIMS and GC/MS instrumentation, are backed up with an uninterrupted power supply (UPS) to provide continuous operation through electrical power outages and "brown outs". If a power failure occurs during non-working hours (defined here as other than the normal 8:00 a.m. to 5:00 p.m. work week), the same security system which controls building access will activate an alarm to the security agency. Supervisory and building maintenance personnel are notified via beeper call, and can be on site within 20 minutes or remain on stand-by alert until the emergency is passed or further action is necessary. Additionally, some laboratory personnel from night shift will often already be on site. Service is generally restored within an hour, and the UPS coverage is sufficient to carry operations through until electric service is restored. For prolonged power outages, laboratory personnel on stand-by alert will prepare for an organized, systematic shut-down of major equipment. A decision on the need for auxiliary back-up generators to run storage refrigerators will be made.

With respect to instrument-related downtime, an attempt is made to maintain adequate redundancy in instrumentation to cover short term losses due to repairs. For long-term downtime, arrangements can be made to rent appropriate equipment until necessary repairs can be completed. In either case, with client approval, arrangements may be made to off-load work to another laboratory to enable analysis within prescribed holding times.

TABLE 11-1: EQUIPMENT MAINTENANCE SUMMARY

INSTRUMENT	PROCEDURE	FREQUENCY
AA (Graphite Furnace)	Clean optics and windows	Daily
	Replace windows	As required
	Check or change cuvette	Daily
	Check & drain compressor drain	Daily
	Clean atomizer cell	Daily
	Nebulizer cleaned/dried	Weekly or as required
	Check/change marble stones	Weekly
	Clean filters	Weekly
AA (Flame)	Check gas pressure	Daily
	Check water level in drain receptacle	Daily
	Check nebulizer and tubing	Daily
	Check/clean lamps and windows	Daily
	Clean burner head in sonic bath	Weekly
	Clean mixing chamber, flow spoiler, and impact bead	Weekly
	Check/replace O-rings in mixing chamber	Monthly
	Check drainage hose	Monthly
AA (Cold Vapor Hg)	Clean scrubber tube/replace H_2SO_4 or $MgClO_4$	Daily
	Clean aerator	Daily
	Check tubing for moisture	Daily
	Change activated carbon/glass wool	Weekly
	Check/clean sample cell	Weekly
	Change tubing	Monthly or as required
AA (Hydride)	Check pump tubes	Daily
	Check absorption cell	Daily
	Check vapor/liquid separator	Daily
	Check acetylene gas pressure	Daily
	Check inert gas pressure	Daily
	Empty waste container	Daily or as required
	Check/oil pump roller	Weekly
	Check pump tube flow rates	Weekly
ICP	Check pump tubing	Daily
	Check liquid argon supply	Daily
	Check fluid level in waste container	Daily
	Check filters	Weekly
	Clean or replace filters	As required
	Check/clean torch and carbon ignition tip	Weekly
	Check sample spray chamber for debris	Monthly
	Clean and align nebulizer	Monthly
	Check entrance slit for debris	Monthly
	Change printer ribbon	As required

TABLE 11-1: EQUIPMENT MAINTENANCE SUMMARY

INSTRUMENT	PROCEDURE	FREQUENCY
ICP (Hydride)	Check pump tubing	Daily
	Check liquid argon supply	Daily
	Check fluid level in waste container	Daily
	Check filters	Weekly
	Clean or replace filters	As required
	Check/clean torch and carbon ignition tip	Weekly
	Check sample spray chamber for debris	Monthly
	Clean and align high solids nebulizer	Monthly
	Check entrance slit for debris	Monthly
	Change printer ribbon	As required
	Check vapor/liquid separator	Daily
	Check inert gas (argon) pressure	Daily
	Empty waste container	Daily or as required
	Check/oil 2-channel peristaltic pump	Weekly
	Check pump tube flow rates	Weekly
UV-Vis Spectrophotometer	Check tubing	Daily
	Clean ambient flow cell	Quarterly
	Precision check/alignment of flow cell	Quarterly
	Clean printer head	When changing paper or if print too light
	Wavelength verification check	Semi-annually
Technicon & AlpChem AutoAnalyzers	Clean sampler	Daily
	Check all tubing	Daily
	Clean inside of colorimeter	Daily
	Record manifold temperature	Daily
	Clean pump well and pump rollers	Weekly
	Clean wash fluid receptacle	Weekly
	Oil rollers/chains/side rails	Weekly
IR Spectrophotometer	Clean cell	Daily
	Check/adjust cell alignment	As required
TOC	Check scrubbers, reactor cell	Daily
	Check infrared zero	Daily
	Check carrier gas	Daily
	Check all tubing	Daily
	Check/clean injector valve	Daily
	Check infrared span	Quarterly
	Check printer head	Quarterly
	Check battery charge	Yearly
	Check permeation dryer	Yearly

TABLE 11-1: EQUIPMENT MAINTENANCE SUMMARY

INSTRUMENT	PROCEDURE	FREQUENCY
TOX	Clean sample boat/titration cell/electrodes	Daily
	Check baseline and furnace temperature	Daily
	Clean inlet/exit tubes	Weekly
	Check or replace O-rings	Weekly
	Check 3 gases	Weekly
	Check absorption rate	Monthly
	Check electrode septa	Monthly
	Recondition cell	Semi-annually
	Re-coat electrodes	Semi-annually
	Clean pyrolysis tube	Semi-annually
Finnigan GC/MS	Clean ionizer source	Quarterly or as needed
	Change filament	Quarterly or as needed
	Clean quadrupole rods	Quarterly or as needed
	Change electron multiplier	As needed
	CARD CAGE MAINTENANCE:	
	o Change air filter	Monthly/Quarterly
	o Clean cooling fans	Monthly/Quarterly
	o All PCBA's: reseat boards connectors and check all voltages on PCBA's to see if within specifications. Adjust if necessary.	Monthly/Quarterly
	POWER CONTROLLER MAINTENANCE:	
	o Clean cooling fans	Quarterly
	o All PCBA's: reseat all connections.	Quarterly
	VACUUM SYSTEM	
	o Mechanical pumps: change oil	Quarterly or as needed
	o Diffusion pump: change oil	Annually or as needed
	o Turbo pump: change oil, cooling fan, check water level in recirculator, change 50/50 mixture water/ethylene glycol.	Quarterly or as needed
	COMPUTER SYSTEM:	
	o Clean or replace cooling fans	Monthly/quarterly
	o All PCBA's: reseat boards, cables	Monthly/quarterly
	o Disk drive (CDC):	
	change filter	Quarterly
	change pre-filter	Monthly
	o Disk drive (Priam/Winchester): clean cooling fans	Quarterly
	o Tape streamer: clean tape head, clean capstan surface	Monthly or as needed
	o Printronix printers (MVP, P300): check print quality	Quarterly

TABLE 11-1: EQUIPMENT MAINTENANCE SUMMARY

INSTRUMENT	PROCEDURE	FREQUENCY
Hewlett Packard GC/MS	Ion gauge tube degassing	As required
	Pump oil-level check	Monthly
	Pump oil changing	Semi-annually
	Analyzer bake-out	As required
	Analyzer cleaning	As required
	Resolution adjustment	As required
	COMPUTER SYSTEM AND PRINTER:	
	Air filter cleaning	As required
	Change data system air filter	As required
	Printer head carriage lubrication	As required
	Paper sprocket cleaning	As required
	Drive belt lubrication	As required
Gas Chromatograph	Compare standard response to previous day or since last initial calibration	Daily
	Check recorder zero and noise level	Daily
	Check carrier gas flow rate in column	Daily via use of known compound retention
	Check temp. of detector, inlet, column oven	Daily
	Septum replacement	As required
	Glass wool replacement	As required
	Check system for gas leaks with SNOOP	Monthly or w/cylinder change
	Check for loose/fray wires and insulation	Monthly
	Column temperature verification	Daily
	Visually check for shifting of column packing material resulting in forward movement beyond the bottom of the column exit or settling in excess of 1/2" from the glass wool plug at the column inlet	Weekly or as needed
Electron Capture Detector (ECD)	Detector wipe test (Ni-63)	Semi-annually
	Detector cleaning	As required
Flame Ionization Detector (FID)	Detector cleaning	As required
Hall 700A Detector Hall 1000 Detector	Electrolyte change	As required by noise
	Reactor tube/teflon connecting tube change	Semi-annually or as required
	Clean detector cell	As required
Photoionization Detector (PID)	Change O-rings	Yearly
	Clean lamp window	As required
HPLC	Change guard columns	As required
	Change lamps	As required
	Change pump seals	Semi-annually or as required
	Replace tubing	As required
	Change fuses in power supply	As required
	Filter all samples and solvents	Daily
	Change autosampler rotor/stator	As required

TABLE 11-1: EQUIPMENT MAINTENANCE SUMMARY

INSTRUMENT	PROCEDURE	FREQUENCY
Balances	Class "S" traceable weight check Clean pan and check if level Field service	Daily, when used Daily Annually
Conductivity Meter	0.01 M KCl calibration Conductivity cell cleaning	Daily As required
Deionized/Distilled Water	Check conductivity Check deionizer light Monitor for VOA's System cleaning Replace cartridge & large mixed bed resins	Daily Daily Daily As required As required
Drying Ovens	Temperature monitoring Temperature adjustments	Daily As required
Refrigerators /Freezers	Temperature monitoring Warning system checked Temperature adjustment Defrosting/cleaning	Daily Monthly As required As required
Vacuum Pumps /Air Compressor	Drained Belts checked Lubricated	Weekly Monthly Semi-annually
pH/Specific Ion Meter	Calibration/check slope Clean electrode	Daily As required
BOD incubator	Temperature monitoring Coil and incubator cleaning	Daily Monthly
Centrifuge	Check brushes and bearings	Every 6 months or as needed
Water baths	Temperature monitoring Water replaced	Daily Monthly or as needed

12.0 PROCEDURES USED TO ASSESS DATA QUALITY

12.1 Introduction

The QA objectives for precision, accuracy, and completeness were given and discussed in Section 3, including the necessary formulas for calculations. All analytical data are reviewed relative to these criteria and specific project requirements to assess the quality of the analytical data. Where all criteria are met, data are deemed acceptable without qualification. Where precision and accuracy goals are not met, the sample set is re-analyzed or reported with qualification in the case narrative. Some of the factors affecting this final sample disposition include:

- o project-specific QA/QC requirements,
- o availability of sufficient sample for re-analysis,
- o holding time considerations, and
- o regulatory action limits.

12.2 Precision

Precision is measured through analyses of replicate QC controls and field samples. Results from these measurements are calculated as relative percent difference (% RPD) or percent relative standard deviation (% RSD) and evaluated according to the criteria set forth in Sections 3.1. Laboratory QC control samples are used to demonstrate acceptable method performance, and are used to trigger corrective action when control limits are exceeded.

Precision measurements from field samples primarily give an indication of sample homogeneity, although laboratory sample preparation and measurement reproducibility will be an additive variable. Problems with sample homogeneity are more likely to occur with soil and sediment samples, water samples containing a noticeable amount of solids, and non-standard matrices.

12.3 Accuracy

Accuracy is measured through the analysis of fortified reagent free matrices and fortified field samples. Results from these measurements are calculated as percent recovery and evaluated according to the criteria set forth in Section 3.2. Laboratory control samples are used to demonstrate acceptable method performance, and are used to trigger corrective action when control limits are exceeded.

Accuracy measurements from field samples give an indication of

physical or chemical interferences present which can either enhance or mask the actual presence of target analytes, although laboratory sample preparation and measurement efficiencies will be an additive variable. Determination of percent recovery (% R) requires analysis of a fortified sample and a non-fortified sample, so that any background analyte already present in the sample can be accounted for in the recovery determination. Thus, sample homogeneity also becomes a factor in recovery determinations, as variable background can affect the apparent analyte recovery. Problems with sample recovery are more likely to occur with soil and sediment samples, water samples containing a noticeable amount of solids, and non-standard matrices.

12.4 Completeness

Completeness has been defined in Subsection 3.4 as a measure of the amount of analytical data reported for an analytical method or system meeting all accuracy and precision criteria. As stated, the minimum laboratory goal for completeness is 95% and the ability to exceed this goal (especially for organic TCL analyses) is dependent on the applicability of the analytical methods to the sample matrices analyzed. However, even if data have not met this laboratory definition of data able to be reported without qualification, project completion goals may still be met if the qualified data, i.e., data of know quality even if not perfect, is suitable for specified project goals.

13.0 CORRECTIVE ACTION

Monitoring systems in the laboratory are designed to help ensure not only that reported data are of known and documentable quality, but that the quality reflects the degree of excellence expected and demanded by WESTON management and our clients. Quality indicators for the effectiveness of these monitoring systems include both internal and external audits and/or surveillances to measure performance against established criteria for good laboratory practices. When evaluation of these quality indicators shows an unsatisfactory condition affecting the quality of services provided, a corrective action must be initiated. The procedures for corrective action are given WESTON OP 21-06-105, and summarized in this section. Corrective action may be immediate or long term.

Immediate corrective action to correct or repair non-conforming equipment and systems is generally initiated as the result of quality control (QC) procedures. The individual has relatively quick feedback that a problem exists, e.g., calibration does not meet or QC check samples exceed allowable criteria, and can take immediate action to repair the system.

Long term corrective action is generally initiated due to quality assurance (QA) issues. These are most often identified during audits. This involves a deeper investigation into the root-cause of the nonconformance, and may take much longer to identify and resolve. Staff training, method revision, replacement of equipment, LIMS reprogramming, et cetera, may be indicated by long term corrective action.

All corrective actions, whether immediate or long term, will comprise the following steps to ensure a closed-loop corrective action system:

- Define the problem;
- Assign responsibility for investigating the problem;
- Determine a corrective action to eliminate the problem;
- Assign and accept responsibility for implementing the corrective action;
- Establish effectiveness of the corrective action and implement the correction; and
- Verify that the corrective action has eliminated the problem.

The initial responsibility to monitor the quality of a function or analytical system lies with the individual performing the task or procedure. Quality indicators are evaluated against laboratory established or client specified QA/QC requirements. If the assessment reveals that any of the QC acceptance criteria are not met, the analyst must immediately assess the analytical system to correct the problem. When an acceptable resolution cannot be met and/or data quality is negatively impacted, the analyst will notify the appropriate supervisor and initiate a Sample Discrepancy Form (SDR) (see Figure 13-2).

When the appropriate corrective action measures have been defined and the analytical system is determined to be "in control" or the measures required to put the system "in control" have been identified and scheduled, the problem and resolution or planned action is documented in the appropriate notebook. If an SDR was required, the SDR will be routed for proper authorizations and signatures.

If a large number of SDR's are received by the QA Section or further action is required, a Corrective Action (CA) Form (Figure 13-3) is initiated. This CA Form may also be initiated by any laboratory employee for problems not suited to, or broader in scope than, the SDR's .

Data generated concurrently with an out-of-control system will be evaluated for usability in light of the nature of the deficiency. If the deficiency does not impair the usability of the results, data will be reported and the deficiency noted in the case narrative. Where sample results are impaired, the Laboratory Project Manager is notified by a written SDR and appropriate corrective action (e.g., reanalysis) is taken and documented.

The Quality Assurance (QA) Section has the authority to stop the analysis and to hold all analyses of samples affected by an out-of-control situation. The method cannot be restarted without the above documentation leading to the QA Section's approval to restart the method. For cases where suspension of the method was imposed by QA, QA sign-off is required prior to reinstatement of the affected method.

The Section Manager, with the respective Unit Leaders and Supervisors, are responsible for correcting out-of-control situations, placing highest priority on this endeavor.

Any out-of-control situations that are not acceptably addressed at the laboratory level may be reported to Corporate Quality Assurance

Management by the Quality Assurance Manager, indicating the nature of the out-of-control situation and problems encountered in solving the situation. This provides laboratory QA personnel non-laboratory management support, if needed, to ensure QA policies and procedures are enforced.

The critical path for assessing the correctness and acceptability of analytical data is shown in Figure A.

13.1 Responses to External On-Sites/Performance Samples

When the results from an external on-site audit or performance evaluation study are received by the laboratory, a summary of the results is distributed to appropriate laboratory personnel.

If deficiencies exist, the person responsible for the response will issue a memo addressing the findings and resultant steps to correct the deficiency. Upon receipt of all corrective action responses, the QA Section will forward the information to the respective outside client or agency.

FIGURE 13-1. CRITICAL PATH FOR CORRECTIVE ACTION

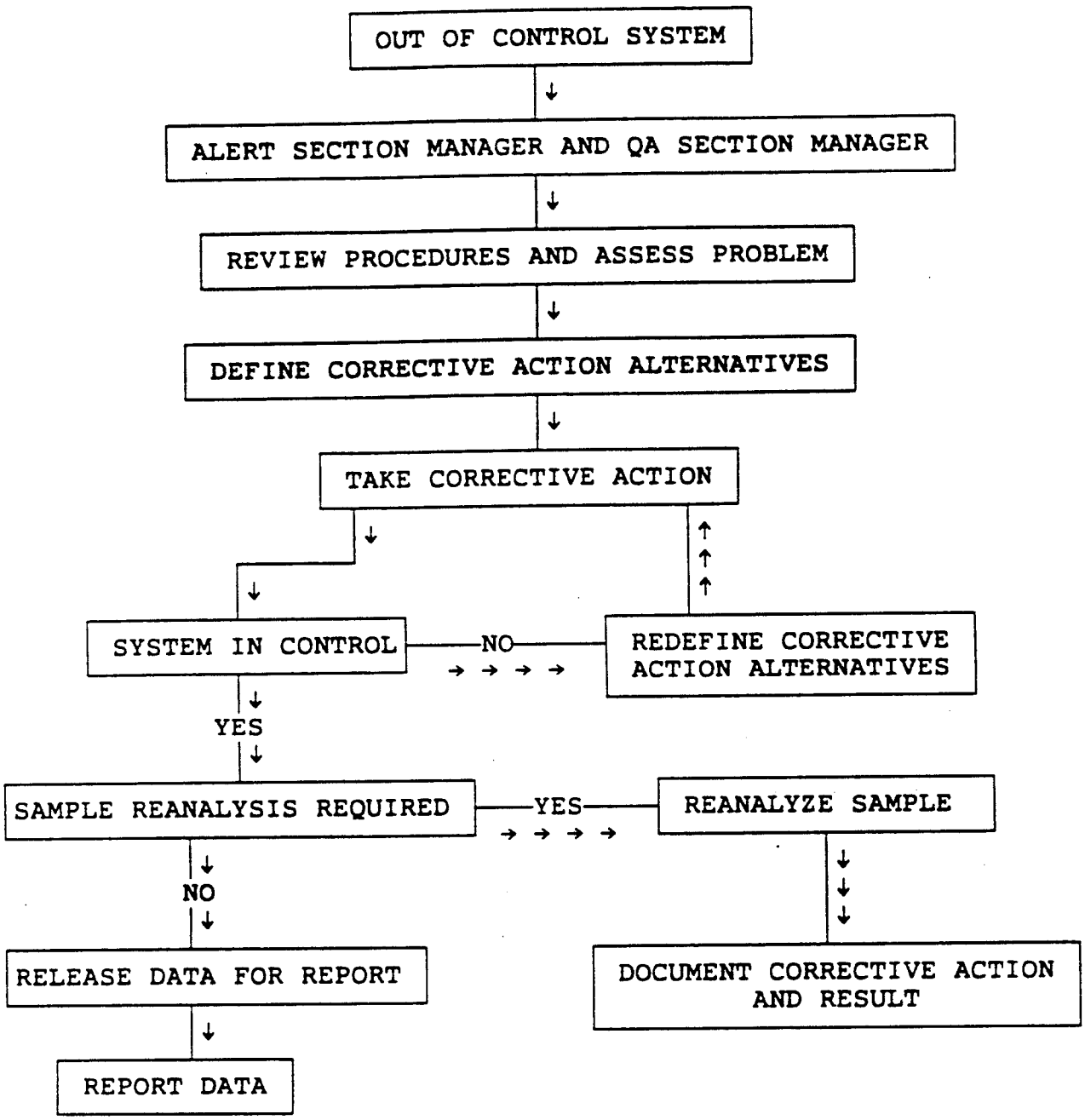


Figure 13-2. (Side 1 of 2)

WESTON SAMPLE DISCREPANCY REPORT (SDR)

SDR IN-PROGRESS ROUTING: (see other side)

Initiator _____
Date _____
Client _____
RFW Lot # _____
Samples _____

Parameter: _____
Matrix: _____
Prep Batch: _____
Urgency:
___ Immediate ___ Other

Category for Discrepancy:
___ Log-In
___ LIMS
___ Analysis/Sample
___ Project Revision
___ Other:

A. Reason for SDR:

A1a.
Requires Verification By (circle):
Log-in or Prep Group

___ Missing Sample/Extract
___ Wrong Sample Pulled
___ Improper Bottle Type
___ Container Broken
___ Preservation Wrong
___ Received Past Hold
___ Insufficient Sample
___ Label ID's Illegible

A2.
Verified By (circle):
Log-in or Prep Group
(signature) (date)

_____ _____
_____ _____
_____ _____
_____ _____
_____ _____
_____ _____
_____ _____
_____ _____

A1b.

___ Re-Log: Tech Profile Error..Client Changed Request..
Sampler Error on C-O-C..Transcription Error..
Wrong Test Code, Re-Log As _____
___ Re-Leach: Metals/Inorg/VOA/BNA/Pest/Herb/____
___ Re-Digest: AA/ICP/HG/_____
___ Re-Extract: BNA/PEST/_____
___ QC Out: SURR/MS...High/Low/<10%/Missing/2X
___ QC Out: B/BS/BSD/LCS/LCS-D...High/Low
___ Hold Time Exceeded: Prep/Analysis/Report
___ Not Amenable to Analysis
___ Other (describe)

B. PM Instructions For Disposition (signature/date): _____

___ Cancel ___ Add ___ Subout Analysis
___ Place On Hold ___ Take Off Hold
___ Change W.O. # to: _____
___ MS/MSD on Sample ____,if enough sample: ORG/INORG
___ MS/DUP on Sample ____,if enough sample: ORG/INORG
___ Change Client name to: _____
___ Wrong Test Code, Re-Log As _____
___ Include in Narrative

__ Other, explain:

C. FINAL ACTION: a clear description of what was done for resolution, when it was done, and by whom it was done

Action Taken:
___ Revision To Chain-of-Custody Completed
___ LIMS Corrections Completed
___ Other, explain

Action By (name/date): _____
Forward to Pat Feldman, QA for distribution →→→

D. Distribution of Completed SDR

X Initiator: _____
X Lab Manager: J.R. Tuschall
X QA (original): D.S. Therry
___ Data Reporting: _____
___ _____

Distributed By:
(signature/date)

RFW 21-21-006/E-10/90 (SDR Revision 5.0)

Figure 13-2. SAMPLE DISCREPANCY REPORT (Side 2 of 2)

SDR CIRCULATION

Forward To:			Received:	
(√)	Name	Date	Initials	Date
LAST: Over for Final Copy and Distribution				

SUMMARY INSTRUCTIONS:

1. Initiator complete the top header section, and Section "A" Reason for SDR:

   If "A1a": route the YELLOW copy to "A2" Log-In/Sample Prep (circle one) for Verification.

   If "A1b": check/circle/fill in the applicable spaces,
   route the YELLOW copy to "B" PM Instructions for Disposition,
   or complete "C" Final Action.

2. After "A2" Verification: route the YELLOW copy to "B" PM Instructions for Disposition (if necessary), or complete "C" Final Action

3. After "B" PM Action: route YELLOW copy to the person responsible for taking the Final Action "C" to resolve the SDR.

4. Final Action: Describe the action taken for final resolution of the SDR in the lower left hand box "C" of the YELLOW copy.

5. Forward the completed YELLOW copy of the SDR to QA for distribution "D".

Figure 13-3. CORRECTIVE ACTION FORM

WESTON CORRECTIVE ACTION DOCUMENTATION

AUDIT REPORT #

INSTRUCTIONS: 1) **ORIGINATOR** completes **PERSON RESPONSIBLE FOR RESPONSE** and **DESCRIPTION OF PROBLEM** blocks.
2) Originator forward form to **PERSON RESPONSIBLE FOR RESPONSE**.
3) Develop/plan a **SEQUENCE OF CORRECTIVE ACTION** and obtain **INITIAL CA APPROVAL** sign-off from supervisor.
4) Forward original form to QA for sign-off and **FOLLOW-UP ACTION**. This allows all pertinent action to be documented on the original form. On completion of the corrective action, the form is signed off by QA, distributed, and the original archived with the QA records.

DATE/ORIGINATOR

PAGE ___OF ___

PERSON RESPONSIBLE FOR RESPONSE (corrective action plan and implementation of corrective action plan):

DISTRIBUTION:
___ LABORATORY MANAGER
___ INORGANIC MANAGER
___ GC/MS MANAGER
___ GC/EXTR MANAGER
___ QA MANAGER
___ QA REPORT FILE
___

DESCRIPTION OF PROBLEM and when identified:

CAUSE OF PROBLEM if known or suspected:

SEQUENCE OF CORRECTIVE ACTION (CA) planned (signature/date): _____

INITIAL CA APPROVAL: Supervisor signature/date:
QA signature/date:

DESCRIPTION OF QA FOLLOW-UP ACTION (include signature/date):

FINAL CA APPROVED (QA signature/date):

RFW 21-21-006/C-03/91

14.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

The Laboratory QA Manager provides monthly reports to the Laboratory Manager and Division QA Manager, summarizing QA activities for the reporting period. The Division QA Manager incorporates all Analytics Division Laboratory QA reports into a summary report to Laboratory, Division, and Corporate Management on a quarterly basis.

For day-to-day reporting, a Sample Discrepancy Report (SDR) and/or Corrective Action Documentation is initiated for laboratory QA situations requiring immediate attention (see Corrective Action OP 21-06-105). Distribution of these corrective action documents includes the appropriate Laboratory Project Manager, who must acknowledge and approve corrective action to remedy project-related out of control situations. Additionally, the Laboratory Manager and QA Manager are copied on all SDR's and Correction Action Documentation.

QA reports to laboratory management summarize a wide range of QA activities. These activities may include, but are not limited to:

- Performance Evaluation Studies (PES)

  Results of both external and internal performance audits are distributed to laboratory line management for review and action, as appropriate. Any required response to deficiencies must be submitted to QA for review. After acceptable corrective action responses are received for all noted deficiencies, a summary of the results with attached responses is distributed.

- Agency and Client On-Site Audits

  On-site evaluations of laboratory facilities and procedures are conducted by external auditors to ensure conformance to the requirements of their respective programs. These are scheduled and coordinated through the QA Section. The summary evaluation received from the client reporting findings and/or recommendations and observations are distributed through the QA Section to laboratory line management for review and action, as appropriate. Any required response to deficiencies must be submitted to QA for review. After acceptable corrective action responses are received for all noted deficiencies, a summary of the results with attached responses is distributed.

- Technical Systems Audits

  An assessment of the laboratory data quality objective for completeness is performed and reported quarterly based on reported deliverables for data precision, data accuracy, and completeness.

- Management Systems Reviews

  Thorough and efficient, documented laboratory operational procedures and systems facilitate generation of a quality analytical product. Audits and surveillances of established procedures are conducted on a continuing basis to verify conformance. Based on these procedural reviews, a report is issued summarizing any findings and recommendations for revision in laboratory procedures to improve the analytical systems.

- Zero Defects Plan Monitoring

  To enhance the quality and timeliness of the analytical services provided by the Lionville Laboratory, a plan aimed at "zero defects" has been implemented. Quality objectives with measurable goals are developed for each service group in the laboratory to help identify and control situations which impact the quality of services produced by each laboratory service group. The QA Section assists in monitoring and evaluating each group's quality goals, and generates a summary report for the respective service group and the Laboratory Manager.

- Employee Orientation and Training Activities

  Orientation to WESTON policies and procedures, in-house method training, and employee attendance at outside training courses and conferences all contribute toward employee proficiency. Documentation of these activities is kept on file with the QA Section. A summary is provided to laboratory management in the monthly QA report.

007204

Appendix C

Typical Monitoring Well Construction Summary

And

Geologic Log

WESTON Analytics

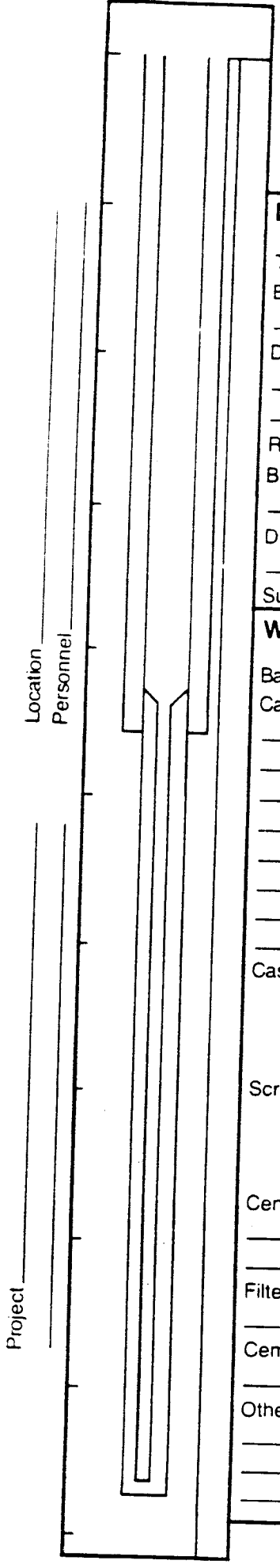
Custody Transfer Record/Lab Work Request Form

Well _____

Well Construction Summary 007205

Location or Coords: _____ Elevation: Ground Level _____

Top of Casing _____



Location _____

Personnel _____

Project _____

Drilling Summary:

Total Depth _____

Borehole Diameter _____

Driller _____

Rig _____

Bit(s) _____

Drilling Fluid _____

Surface Casing _____

Well Design:

Basis: Geologic Log ____ Geophysical Log ____

Casing String(s): C = Casing S = Screen

____	–	____	____	____	–	____	____
____	–	____	____	____	–	____	____
____	–	____	____	____	–	____	____
____	–	____	____	____	–	____	____
____	–	____	____	____	–	____	____
____	–	____	____	____	–	____	____
____	–	____	____	____	–	____	____
____	–	____	____	____	–	____	____
____	–	____	____	____	–	____	____

Casing: C1 _____

C2 _____

Screen: S1 _____

S2 _____

Centralizers _____

Filter Material _____

Cement _____

Other _____

Construction Time Log:

Task	Start		Finish	
	Date	Time	Date	Time
Drilling:				
Geophys. Logging:				
Casing:				
Filter Placement:				
Cementing:				
Development:				
Other:				

Well Development:

Comments:

WESTON DESIGNERS CONSULTANTS

007206

GEOLOGIC DRILL LOG

PROJECT NAME/LOCATION				PAGE NO. 1 of	WELL NO.
DATE STARTED	DATE FINISHED	DRILLER	DRILL METHOD	BOREHOLE DIAMETER (in)	TOTAL DEPTH (ft)
GEOLOGIST		GROUND ELEVATION (ft. MSL)	COORDINATES (ft)		

DEPTH	SAMPLE INTERVAL	RECOVERY(%)	SAMPLE TYPE	SAMPLE ID	BLOW COUNT	OVA	USCS	WELL CONSTRUCTION	DEPTH	GRAPHICS LOG	VISUAL DESCRIPTION
5									5		
10									10		
15									15		
20									20		

A = ANALYTICAL SAMPLE
G = GEOTECHNICAL SAMPLE
L = LITHOLOGIC SAMPLE ONLY
R = ARCHIVED SAMPLE

WESTON

PAGE NO. 1 of | WELL NO.

WESTON Analytics Use Only

Custody Transfer Record/Lab Work Request

WESTON

Page ___ of ___

Client _____

Est. Final Proj. Sampling Date _____

Work Order # _____

Project Contact/Phone # _____

AD Project Manager _____

QC _____ Del _____ TAT _____

Date Rec'd _____ Date Due _____

Account # _____

Refrigerator #

#/Type Container	Liquid / Solid
Volume	Liquid / Solid
Preservatives	

ANALYSES REQUESTED →

ORGANIC: VOA | BNA | Pest/PCB | Herb

INORG: Metal | CN

MATRIX CODES:

- S - Soil
- SE - Sediment
- SO - Solid
- SL - Sludge
- W - Water
- O - Oil
- A - Air
- DS - Drum Solids
- DL - Drum Liquids
- L - EP/TCLP Leachate
- WI - Wipe
- X - Other
- F - Fish

Lab ID	Client ID/Description	Matrix QC Chosen (✓)	Matrix	Date Collected

Special Instructions:

DATE/REVISIONS:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

WESTON Analytics Use Only

Samples were:
1) Shipped ___ or Hand Delivered ___
Airbill # _____

2) Ambient or Chilled

3) Received in Good Condition Y or N

4) Properly Preserved Y or N

5) Received Within Holding Times Y or N

COC Tape was:
1) Present on Outer Package Y or N

2) Unbroken on Outer Package Y or N

3) Present on Sample Y or N

4) Unbroken on Sample Y or N

COC Record Present Upon Sample Rec't Y or N

10200

Relinquished by	Received by	Date	Time

Relinquished by	Received by	Date	Time

Discrepancies Between Samples Labels and COC Record? Y or N
NOTES:

REW 21-21 001/A-8/90

___ L372 ___ L373 ___ L375 ___ L377 L378 Ref# Cooler# 381 596a

007208

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

REMEDIAL INVESTIGATION/FEASIBILITY STUDY
WORK PLAN ADDENDUM
FOR AREA LHAAP-1A

Prepared for:

U.S. Army Corps of Engineers
Tulsa District
Contract DACA56-93-D-0008

Submitted by:

Roy F. Weston, Inc.
5599 San Felipe, Suite 700
Houston, Texas 77056
713-621-1620

September 1993

NOTICE

The information in this document has been funded by the U.S. Army Corps of Engineers (USACE) under Contract No. DACA-56-93-D-0008 to Roy F. Weston, Inc. (WESTON). This document has not been formally released either by WESTON or the USACE. This document should not be cited or quoted.

LONGHORN ARMY AMMUNITION PLANT

REMEDIAL INVESTIGATION/FEASIBILITY STUDY
WORK PLAN ADDENDUM
FOR AREA LHAAP-1A

TABLE OF CONTENTS

SECTION	TITLE	PAGE
EXECUTIVE SUMMARY		ES-1
1.0	INTRODUCTION	1-1
2.0	FACILITY BACKGROUND	2-1
3.0	SITE NATURE AND EXTENT OF CONTAMINATION	3-1
3.1	LHAAP-1A - INERT BURNING GROUNDS ADDITIONAL AREA	3-1
3.1.1	Site History	3-1
3.1.2	Site Description	3-1
3.1.3	Previous Investigations	3-4
3.1.4	Assessment of Existing Data and Historic Records	3-5
3.1.5	Potential Contaminants and Migration Pathways	3-5
3.1.6	Identification of Potential Receptors	3-5
3.1.7	Initial Remedial Action	3-7
4.0	PLAN OF INVESTIGATION LHAAP 1A - INERT BURNING GROUNDS ADDITIONAL AREA	4-1
4.1	Data Requirements for Site Characterization	4-3
4.2	General Plan for Site Investigation - RI Phase I	4-5
4.2.1	Soil Borings	4-6
4.2.2	Surface Water and Sediment Samples	4-7
4.2.3	Monitoring Wells and Groundwater Samples	4-7
4.3	General Plan for Site Investigation - RI Phase II	4-10
5.0	FEASIBILITY STUDY ACTIVITIES	5-1
6.0	RISK ASSESSMENT	6-1
7.0	PRELIMINARY IDENTIFICATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REGULATIONS (ARARs)	7-1

LONGHORN ARMY AMMUNITION PLANT

REMEDIAL INVESTIGATION/FEASIBILITY STUDY
WORK PLAN ADDENDUM
FOR AREA LHAAP-1A

TABLE OF CONTENTS
(Continued)

SECTION	TITLE	PAGE
8.0	BUDGET AND SCHEDULE	8-1

APPENDICES

A INVESTIGATION DERIVED WASTE

LONGHORN ARMY AMMUNITION PLANT

REMEDIAL INVESTIGATION/FEASIBILITY STUDY
WORK PLAN ADDENDUM
FOR AREA LHAAP-1A

LIST OF TABLES

TABLE	TITLE	PAGE
4-1	Summary Of Sampling, Analytical Parameters, Storage, Holding Time And Preservation Requirements Ri Phase I Field Investigation	4-2
8-1	Schedule For Delivery Of Work Items Remedial Investigation For Area LHAAP-1A	8-2

LONGHORN ARMY AMMUNITION PLANT

REMEDIAL INVESTIGATION/FEASIBILITY STUDY
WORK PLAN ADDENDUM
FOR AREA LHAAP-1A

LIST OF FIGURES

FIGURE	TITLE	PAGE
3-1-1	Location Map For LHAAP-1 and LHAAP-1A	3-2
3-1-2	Site Map	3-3
4-1-1	Proposed Sample Locations	4-8

EXECUTIVE SUMMARY

This Work Plan Addendum has been prepared by Roy F. Weston, Inc. (WESTON®) for the U.S. Army Corps of Engineers (USACE), Tulsa District and funded under Contract No. DACA56-93-D-0008, Delivery Order No. 1. It is intended as an addendum to the Longhorn Army Ammunition Plant (LHAAP) Remedial Investigation/Feasibility Study (RI/FS) Work Plan (June 1992), which describes remedial investigation activities at 13 Solid Waste Management Units (SWMUs) at LHAAP. This Work Plan Addendum describes the investigation activities to be conducted at an area adjacent to SWMU No. LHAAP-1, the Inert Burning Grounds, and designated as LHAAP-1A.

The description of activities at LHAAP-1A is presented in the same format as in the final RI/FS Work Plan, Volume I - General, with additional information added as necessary. Pertinent sections from the RI/FS Work Plan have been included by reference where possible to avoid unnecessary duplication. The area of LHAAP-1A, which covers approximately 4.8 acres, was surveyed and a detailed topographic map with one-foot contours is provided. Proposed sampling locations were selected based on site history, physical characteristics, and field reconnaissance. A total of four soil borings, four groundwater grab samples, five monitoring wells, five groundwater samples, three surface water/sediment samples, and three construction debris samples are proposed for the RI Phase I investigation. Soil samples for chemical analyses include 27 samples to be collected from the soil and monitoring well borings. The additional amount of investigation-derived waste anticipated to be generated as a result of the field activities

is approximately 2.0 cubic yards of soil cuttings, 500 gallons of decontamination water, 1000 gallons of purge and development water, and twenty 20-gallon plastic bags of used personal protective equipment.

SECTION 1.0

INTRODUCTION

Under a Federal Facilities Agreement (FFA) between the U.S. Environmental Protection Agency (EPA), the Texas Water Commission (now known as the Texas Natural Resources Conservation Commission) and the Department of the Army, a Remedial Investigation/Feasibility Study (RI/FS) is underway at the Longhorn Army Ammunition Plant (LHAAP) in Marshall, Texas. The FFA requires a RI/FS under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) to characterize the nature and extent of contamination at 13 Solid Waste Management Units (SWMUs) at LHAAP and to develop a remedy for remediation of each area. The U.S. Army Corps of Engineers (USACE) prepared a comprehensive RI/FS Work Plan to address remedial activities required at the 13 SWMUs following CERCLA guidelines. During the RI Work Plan development for the Inert Burning Grounds, SWMU No. LHAAP-1, an additional area to be investigated was identified northwest of this site. Roy F. Weston, Inc. (WESTON®) has been contracted by the USACE, Tulsa District under Contract No. DACA56-93-D-0008, Delivery Order No. 1, to prepare a RI/FS Work Plan Addendum to describe investigation activities to be conducted at this additional area, identified as LHAAP-1A.

This Work Plan Addendum is intended as a supplement to the final Longhorn Army Ammunition Plant RI/FS Work Plan, Volume I - General, dated June 1992, which contains detailed information about the facility background and history; each area to be investigated; previous investigations; potential contaminants; migration pathways; potential receptors; sampling

rationale; number and type of samples; analytical parameters; feasibility study and risk assessment activities. This Work Plan Addendum has been adapted from the Work Plan Addendum for LHAAP-1A prepared by Ebasco Services Incorporated (Ebasco) under Contract No. DACA56-90-D-0017 with the USACE Tulsa District. The purpose of this Work Plan Addendum is to present a description of the investigations to be conducted, a map showing proposed sample locations, a topographic map of the additional area, and an estimate of the volume of investigation-derived waste to be generated. This document follows the same format as the final RI/FS Work Plan Volume I - General, with additional information added as needed to describe investigations to be conducted at LHAAP-1A. Pertinent sections from the RI/FS Work Plan have been included by reference where applicable. Since the overall RI/FS investigation-derived waste will increase with the additional field work at LHAAP-1A, the waste descriptions and quantity estimates are provided as Appendix A.

All procedures described in the final RI/FS Work Plan Volume II - Chemical Data Acquisition Plan (CDAP) will remain applicable for the investigation at LHAAP-1A. The CDAP discusses the data quality procedures and techniques used to insure that all data obtained are of acceptable quality. WESTON has prepared an Addendum to the CDAP to address changes to the USACE CDAP for Area LHAAP-1A. Also, a Site Health and Safety Plan (HASP) has been prepared by WESTON to establish procedures to protect personnel during the field activities at LHAAP-1A.

SECTION 2.0

FACILITY BACKGROUND

General information about LHAAP including location, boundary features, facility background, and environmental conditions is described in Section 2.0, Facility Background, of the final RI/FS Work Plan, Volume I - General.

SECTION 3.0

SITE NATURE AND EXTENT OF CONTAMINATION

3.1 LHAAP-1A - INERT BURNING GROUNDS ADDITIONAL AREA

3.1.1 Site History

Historical use of this additional area of the Inert Burning Grounds is assumed to be the same as that described for the Inert Burning Grounds in Section 3.10 of the final RI/FS Work Plan, Volume I - General.

3.1.2 Site Description

The site is situated in the extreme northwestern portion of LHAAP, as shown on Figure 3-1-1. The site is located directly adjacent to the northwest boundary of LHAAP-1. A detailed map of the southernmost portion of the Inert Burning Grounds and surrounding area is shown on Figure 3-1-2. It depicts detailed topography and surface drainage patterns, estimated groundwater flow direction, location of previous sampling points, and the suspected limit of the site. Also shown are roads, fences, and limited vegetation information with heavily timbered areas differentiated from lightly or nontimbered areas. The limits of this area of the site were established on the basis of field observations, detailed topographic information, and vegetation patterns. Current vegetation patterns serve as a rough indicator of past disposal areas because there has been considerable regrowth of trees during the 25 or more years that have elapsed

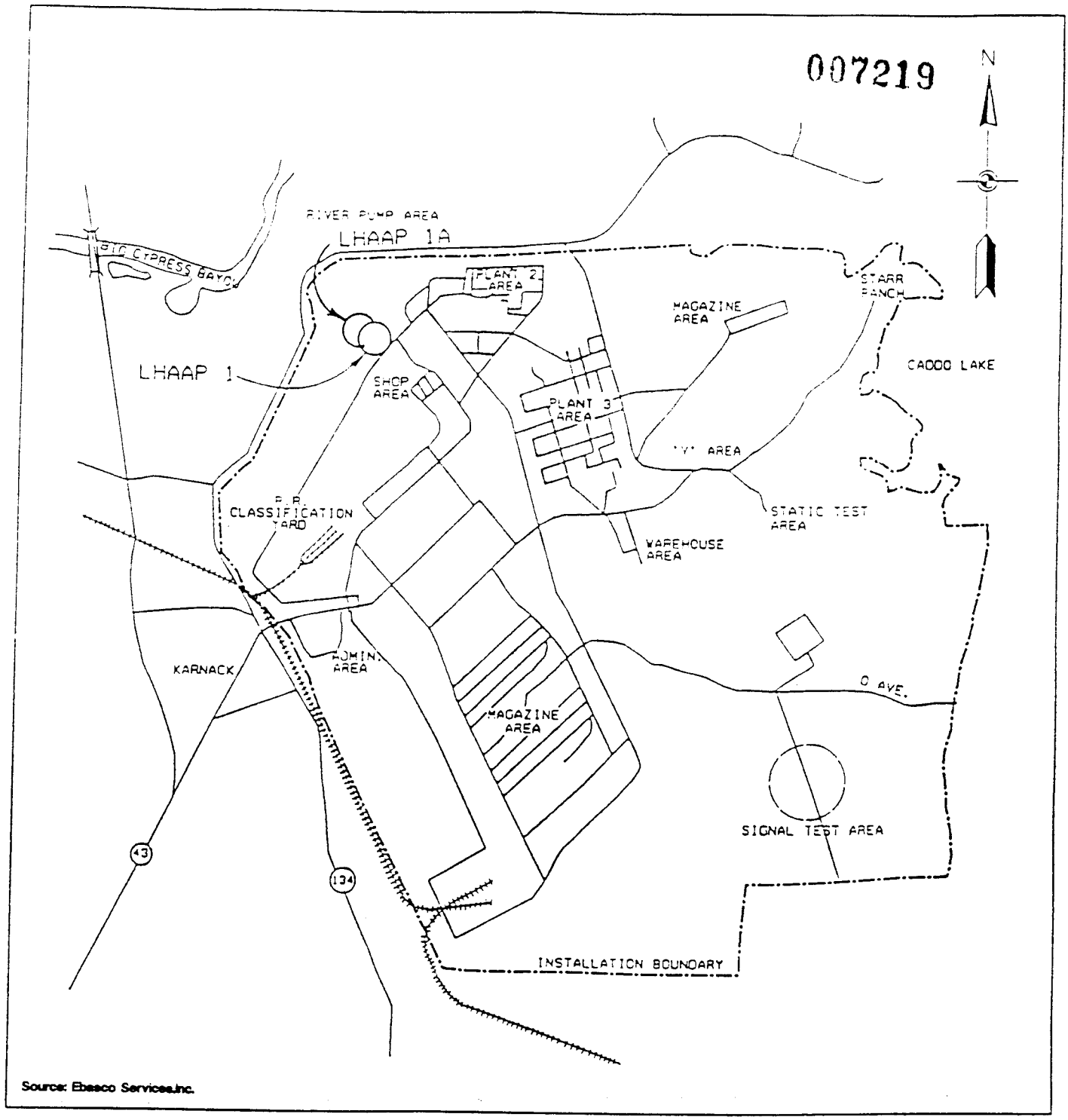


FIGURE 3-1-1 LOCATION MAP FOR LHAAP AREA 1 & 1A

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

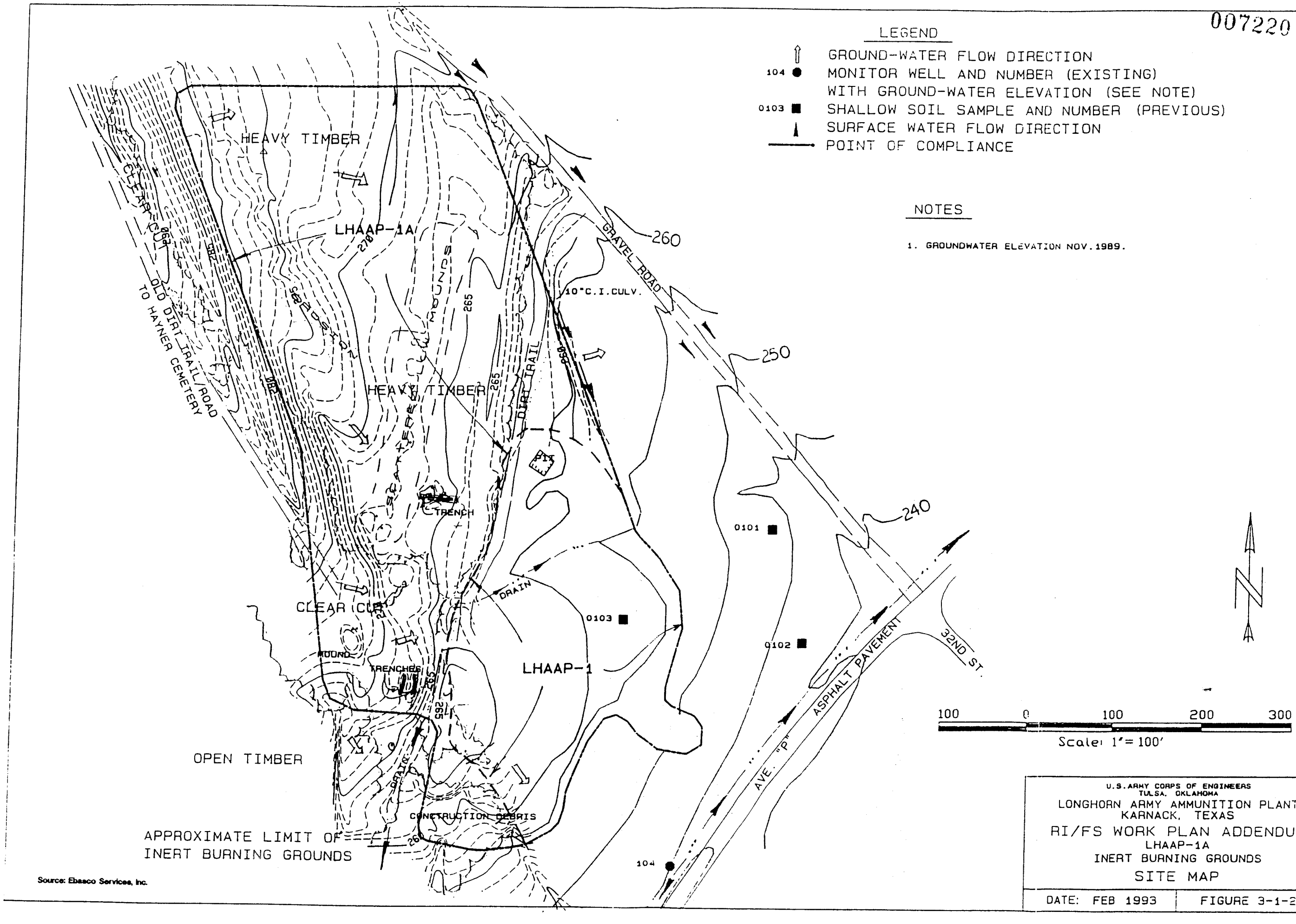
007220

LEGEND

- GROUND-WATER FLOW DIRECTION
- 104 ● MONITOR WELL AND NUMBER (EXISTING) WITH GROUND-WATER ELEVATION (SEE NOTE)
- 0103 ■ SHALLOW SOIL SAMPLE AND NUMBER (PREVIOUS)
- SURFACE WATER FLOW DIRECTION
- POINT OF COMPLIANCE

NOTES

1. GROUNDWATER ELEVATION NOV. 1989.



Source: Ebasco Services, Inc.

U.S. ARMY CORPS OF ENGINEERS
TULSA, OKLAHOMA
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RI/FS WORK PLAN ADDENDUM
LHAAP-1A
INERT BURNING GROUNDS
SITE MAP

DATE: FEB 1993 | FIGURE 3-1-2

since the site was used for waste disposal. The LHAAP-1A area of the Inert Burning Grounds covers an area of approximately 4.8 acres.

General soil and geologic maps and the boring data for nearby Well 104 indicate the site is located within the outcrop of the Wilcox Group of sediments that typically consist of interbedded sands, silts, and clays. At this site, these sediments appear to be overlain by a few feet of residually-derived soils and/or fill materials. Depth to groundwater probably averages about five feet with some seasonal fluctuation. The groundwater hydraulic gradient is expected to be topographically controlled, with the general flow directions as indicated on Figure 3-1-2. The general flow direction across the site is assumed to be toward the southeast.

As shown on Figure 3-1-2, surface drainage from the site collects in ditches alongside Avenue P and 32nd Street, then passes through either the concrete culvert across 32nd Street at its intersection with Avenue P or the concrete culvert across Avenue P near Well 104. The site's surface drainage eventually enters Goose Prairie Creek, which flows into Caddo Lake. The total flow distance from the site to Caddo Lake is approximately three miles.

3.1.3 Previous Investigations

Previous investigations in the area have been described for the Inert Burning Grounds in Section 3.10.3 of the final RI/FS Work Plan, Volume I - General.

3.1.4 Assessment of Existing Data and Historic Records

The assessment of existing data in the area has been described for the Inert Burning Grounds in Section 3.10.4 of the final RI/FS Work Plan, Volume I - General.

3.1.5 Potential Contaminants and Migration Pathways

Since the LHAAP-1A area is immediately adjacent to LHAAP-1, the potential contaminants and migration pathways will be the same as those described in Section 3.10.5 of the final RI/FS Work Plan, Volume I - General.

3.1.6 Identification of Potential Receptors

The general public does not have ready access to the site because it is located within the confines of LHAAP. Also, installation personnel and authorized visitors do not have ready access to the site because the site and adjoining areas are enclosed by a security fence with a locked access gate. The site is seldom visited because it is not currently used for anything except occasional hunting.

There are no water supply wells located in the direction of expected groundwater flow from the site and none are expected to be installed. The groundwater flow direction across the site is probably to the southeast, while the more regional direction is to the east toward Caddo Lake. The nearest public water supply well, Well 502, is about 1.0 mile west-southwest of and

hydraulically upgradient from the site. A potential threat to public health and the environment posed by contaminated groundwater originating at this site appears to be its possible emergence into the surface water flow regime.

There is no accelerated soil erosion on the site, however some tree clearing was observed at the southern end of the site extending to the old dirt trail/road to Hagner Cemetery that would increase future soil erosion and sediment yield. There are no water bodies or major watercourses on the site; however, there is a small ditch bisecting the southern end of the site and several small depressions in nearby downstream ditches that retain water for varying lengths of time following excessive rainfall. The site is not expected to be developed as a drainage way or for surface water use. There are no obvious signs of groundwater emerging into the drainage ditches that collect surface runoff from the site.

Surface water runoff and water-borne sediment derived from the site eventually enter Caddo Lake which is used as a water supply for approximately 16,600 Louisiana residents. The flow distance from the site to Caddo Lake is about three miles. Caddo Lake is not known to have been affected by contaminants originating at this site.

The site is a relatively natural area with no obvious signs of plant stress. The site area is mostly overgrown with woodland except for the trail on the eastern side of the site, the dirt trail/road to Hagner Cemetery on the western side of the site, and the broader clearing located along the trails. The trail on the eastern side of the site is vegetated with grass and shrubs while the dirt trail/road appears to have been cleared by a bulldozer and is barren. Along woodland edges of

the trail and clearing are greenbriar and muscadine vines. On the east side of the site, there are a man-made pits and a dirt piles under the tree canopy, but there is no evidence of vegetative stress. The predominant tree types in the site area are pine and sweet gum. The understory growth is generally limited to poison ivy and an occasional oak seedling. The area has generally good cover and browse for deer.

3.1.7 Initial Remedial Action

Based upon what is known about the site and the nature and extent of its contaminants, quick remedial action is not deemed necessary. The elevated levels of constituents found in the surface soils found downgradient of the site and the low levels of explosive compounds found in the groundwater pose no imminent threat to potential receptors at this time.

SECTION 4.0

PLAN OF INVESTIGATION
LHAAP-1A INERT BURNING GROUNDS ADDITIONAL AREA

The plan of investigation described below is designed to obtain site-specific data about both the physical and chemical characteristics of the site. Since use of the additional area of the Inert Burning Grounds (LHAAP-1A) is assumed to be the same as that described for the LHAAP-1 Inert Burning Grounds of the final RI/FS Work Plan, Volume 1 - General, the compounds to be analyzed for are consistent with those compounds analyzed for the Inert Burning Grounds and other sites with similar contamination. Unless otherwise stated, all soil, sediment, surface water, and groundwater samples from monitoring wells will be analyzed for pH, specific conductance, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), high explosives, antimony, arsenic, barium, cadmium, chromium, lead, mercury, nickel, selenium, silver, thallium, nitrate, sulfate, and chloride. All physical analyses for soil boring samples will include, at a minimum, visual classification, moisture content, gradation, plastic limit, and liquid limit tests. Groundwater samples from soil borings will be analyzed for the following indicator parameters: total organic halides (TOX); total organic carbon (TOC); explosives; nitrate; sulfate; chloride; and total phenols. Additionally, up to three samples of construction material debris will be obtained from area LHAAP-1 and analyzed for asbestos. All sampling and analyses will be performed in accordance with the procedures outlined in Volume II - Chemical Data Acquisition Plan (CDAP) and the Addendum to the CDAP prepared by WESTON. Procedures to protect personnel during field activities are outlined in the Site Health and Safety Plan (HASP).

Field investigation activities for the site will consist of two phases. The first phase of activities, RI Phase I, will be performed to obtain the data requirements to complete the site characterization. The estimated number and types of samples to be taken during the RI Phase I investigation are shown on Table 4-1. Table 4-1 also presents the type of analysis to be performed, the analytical methods to be used, sample containers and preservative type. After completing the first phase field efforts, a second phase of investigations, RI Phase II, will be performed in which additional groundwater monitoring wells may be installed to more fully assess the groundwater impact at the site and soil borings may be drilled to determine the full extent of soil contamination, if necessary. Depending on the information obtained during RI Phase I, additional wells and borings will be installed either within the waste unit to characterize the nature of the groundwater contaminants or along the point of compliance to help characterize the extent of groundwater and soil contamination.

4.1 DATA REQUIREMENTS FOR SITE CHARACTERIZATION

Groundwater in Well 104, located near LHAAP-1, has shown explosive compounds and possibly elevated concentrations of metals and nitrates which may have migrated from the Inert Burning Grounds area. However, current soil and groundwater data are insufficient to make this determination. Therefore, additional data are required to fully characterize the soils, geology, and hydrogeology at the site and at adjoining areas which may be affected by migration of site contaminants. Additional data are also required to firmly establish the nature and extent of contamination in the fill materials, soils, Wilcox Group materials, surface water, sediment, and

TABLE 4-1
SUMMARY OF SAMPLING, ANALYTICAL PARAMETERS, STORAGE, HOLDING TIME AND PRESERVATION REQUIREMENTS
AERA LHAAP-1A RI PHASE I FIELD INVESTIGATION

Media	No. of Samples	QA	QC	No. of Travel Blanks*	No. of Equipment Blanks	Total No. of Samples	Field Test (1)	Metals (2)	VOC's (3)	SVOC's (4)	Explosives (5)	Anions (6)	Total Organic Carbon (7)	Total Organic Halogen (8)	Total Phenols (9)	Geotech. Samples (10)	Asbestos (11)
SOIL**	27	3	3	3	2	38[12]	-	35[12]	38[12]	35[12]	35[12]	35[12]	-	-	-	27	-
WATER																	
Well	5	1	1	1	-	8	6	7	8	7	7	7	-	-	-	-	-
Ground	4	1	1	1	-	7	5	-	1	-	6	6	6	6	6	-	-
Surface	3	1	1	1	-	6	4	5	6	5	5	5	-	-	-	-	-
SEDIMENT***	3	1	1	****	-	5	-	5	5	5	5	5	-	-	-	-	-
CONSTRUCTION MATERIAL	3	1	1	-	0	5	-	-	-	-	-	-	-	-	-	-	5

* To include volatile organic compounds only

** For the proposed analyses 5-250 ml. straight side glass jars are required, Cool 4°C

*** For the proposed analyses a 5 liter wide mouth glass jar is required, Cool 4°C

**** Sampling performed in conjunction with surface water sampling

(1) Field tests to include Ph, conductivity and temperature, 1/2 pint glass. Any Ph and conductivity tests required for soil samples will be performed by the subcontract laboratory.

(2) Metals Analysis for Sb, As, Ba, Cd, Cr, Pb, Hg, Ni, Se, Ag, & Ti; EPA 6010 or SW-846 Methodologies as specified in Appendix B Table B-2 of CDAP, HNO_3 to Ph < 2 (liquids), Cool 4°C, 1 liter plastic

(3) Volatiles; EPA SW-846 8240, 4 drops HCL (liquid), Cool 4°C, 3-40 ml glass vial

(4) Semi Voletiles; EPA SW-846 8270, Cool 4°C, 2-1 liter amber glass

(5) Explosives; EPA SW-846 8330, Cool 4°C, 2-1 liter amber glass

(6) Anions to include nitrate, chloride & sulfate; EPA-600 (2) 300.0, Cool 4°C, 1-liter amber glass

(7) Total organic carbon; EPA SW-846 9060, H_2SO_4 to Ph < 2 (liquid), Cool 4°C, 1-liter amber glass

(8) Total organic halogen; EPA SW-846 9020, H_2SO_4 to Ph < 2 (liquid), Cool 4°C, 1-liter amber glass

(9) Total phenols; EPA SW-846 9066, H_2SO_4 to Ph < 2 (liquid), Cool 4°C, 1-liter amber glass

(10) Moisture Content; ASTM D2216, No preservative
Sieve Analysis; ASTM D 422, No preservative
Atterberg Limits (3 point); ASTM D 4318, No preservative

(11) Asbestos

(12) Three additional samples taken as duplicates and sent to USACE of Dallas, Texas as QA samples.

Source: "RI/FS Work Plan Addendum for Arcs LHAAP-1A". Ebasco 1993.

007221

groundwater. The additional data will serve as a basis for the determination of contaminant persistence and migration, including migration rates.

Borings are required on and near the site to establish the thickness and nature of fill materials, to characterize the natural soils and underlying Wilcox materials, and to determine the depth to groundwater. The borings will permit sampling of these media for chemical analyses and for limited physical tests and analyses. One boring is needed upstream and hydraulically upgradient from but near the site to establish local background conditions unaffected by past waste disposal activities. Grab sampling of groundwater in soil borings will provide additional data on the extent of groundwater contamination at the site.

Monitoring wells installed at the site will provide more representative data on groundwater depth and flow direction. The wells will be used to collect groundwater samples for chemical analyses to characterize the nature of any contaminants entering the groundwater at this site. The wells will also be used for performance of "slug" tests to determine the aquifers hydrogeologic characteristics for developing fate and transport models to address remediation measures, should they be necessary.

Surface water and sediment sampling for chemical analyses is necessary in the drainage ditch that exits the southern end of the site and the drainage ditches along Avenue P and 32nd Street that initially collect the surface water runoff and water-borne sediment derived from the site. One surface water and sediment sampling location needs to be near the site in a ditch upstream and hydraulically upgradient from and near the site to establish local background conditions.

4.2 General Plan for Site Investigation - RI Phase I

The overall objectives in performing the first phase of field investigations for the RI at the Inert Burning Grounds including areas LHAAP-1 and LHAAP-1A are to identify the presence of any explosive contaminants in the soils, to determine whether groundwater has been impacted by leaching of these constituents, to determine the depth to groundwater and the direction of groundwater flow, to determine if surface water and sediments have been impacted by contaminants migrating from the site, and to assess the soil and geological conditions at the site. To accomplish these objectives, a field investigation plan for area LHAAP-1 has been developed and approved in Section 4.10 of the final RI/FS Work Plan, Volume I - General. Following implementation of the plan, an additional area to be investigated (LHAAP-1A) was identified. An investigation of area LHAAP-1A is necessary to meet the objectives stated above.

The proposed field investigation for area LHAAP-1A includes the following:

Four - 7-foot soil borings[1]

Four - Groundwater grab samples from soil borings

Five - 25-foot monitoring wells to be installed[1]

Five - Monitoring wells to be sampled

Five - Slug tests of the new monitoring wells

Three - Surface water/sediment sample locations[2]

[1] Soil samples will be collected for physical and chemical analyses.

[2] Includes one background location.

Boring depths are estimated based on an anticipated depth to groundwater of five feet, with borings continuing at least two feet past the depth where groundwater is encountered. Actual depths may vary depending on the subsurface conditions encountered during the investigation. These proposed sample locations for the additional area of the Inert Burning Grounds are shown on Figure 4-1-1. All sampling and monitoring well installation activities will be in accordance with the Volume II - Chemical Data Acquisition Plan (CDAP), (USACE, June 1992), and the addendum to the CDAP prepared by WESTON (September 1993).

4.2.1 Soil Borings

Four soil borings will be drilled at LHAAP-1A at the locations shown on Figure 4-1-1. Each boring will be drilled two feet past where groundwater is first encountered. The depth to the water table is expected to be about 5 feet, but seasonal fluctuation is possible. The proposed borings are located within the suspected limit of LHAAP-1A and are expected to penetrate a few feet of fill before reaching undisturbed materials. A background boring located north of the site in an area that does not appear to have been affected by solid waste disposal activities will be drilled as part of the RI Phase I for area LHAAP-1.

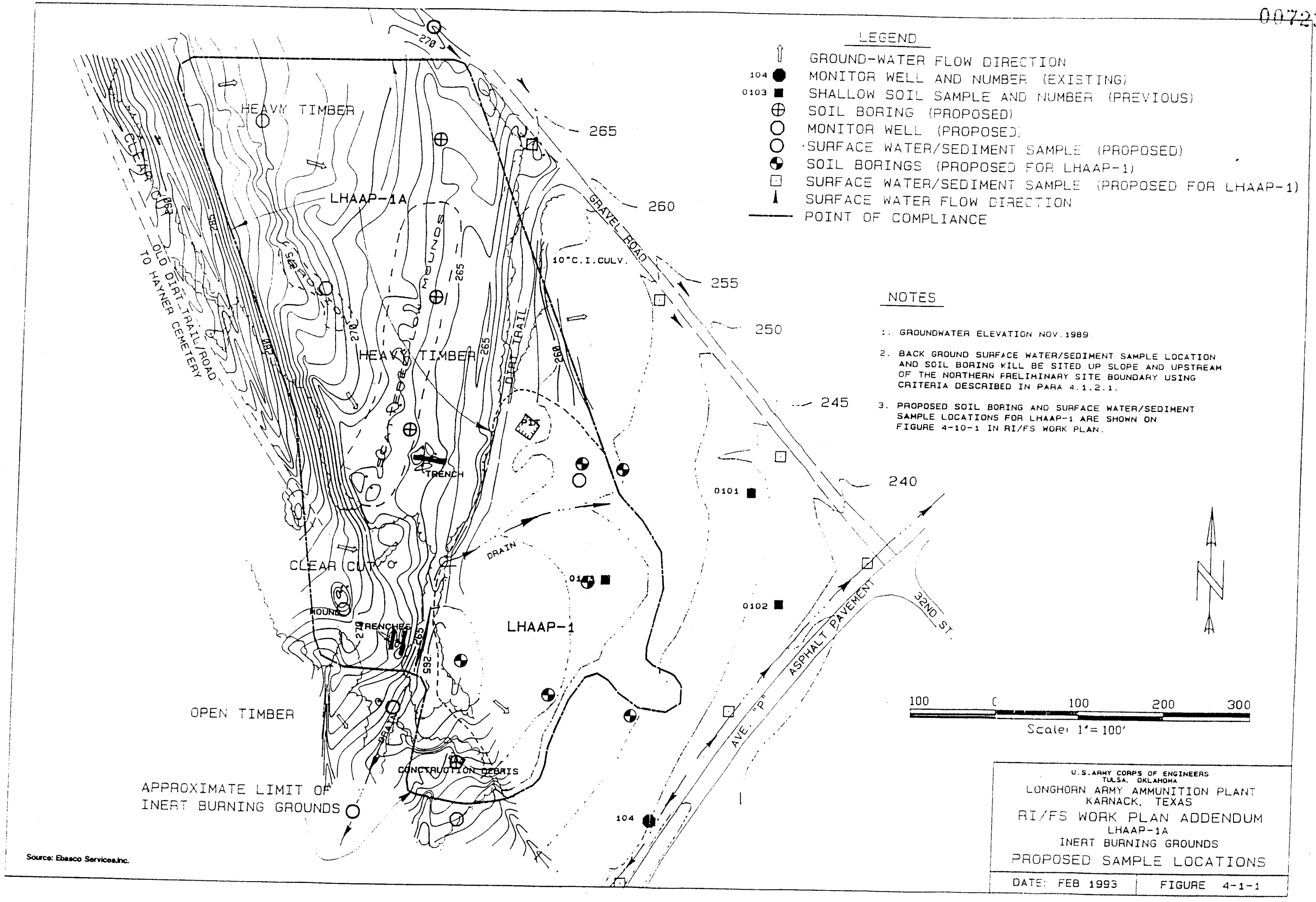
Soil samples for physical analyses will be taken beginning at the ground surface then once every 5 feet or change in soil type, whichever occurs more frequently. Soil samples for chemical analyses will be taken at least every 2.5 feet of boring depth, beginning at the ground surface. The soil sampling procedures outlined in Section 4.5.3 of the CDAP will be followed.

4.2.2 Surface Water and Sediment Samples

Three additional surface water and sediment samples each will be taken in the drainage ditch that exits the southern end of the site and the ditch alongside 32nd Street at the locations shown on Figure 4-1-1. One sampling location will serve as a background location alongside 32nd Street north of the site in an area that does not appear to have been affected by solid waste disposal activities Two samples located at the centerline of the drainage ditch that exits the southern end of the site will serve as downgradient locations for surface water and sediment samples from the site.

4.2.3 Monitoring Wells and Groundwater Samples

Five groundwater monitoring wells will be installed at the site to provide groundwater depth and flow direction information, and provide more representative data on groundwater quality data at the site. Sampling of these wells will characterize the nature of contaminants entering the groundwater from these suspected areas. Grab samples of the groundwater from the four soil borings will also be taken to better delineate the impact of any groundwater contamination at the site. Existing Well 104 will be sampled as part of the RI Phase I for area LHAAP-1.



Source: Ebasco Services,Inc.

U.S.ARMY CORPS OF ENGINEERS
TULSA, OKLAHOMA
LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS
RI/FS WORK PLAN ADDENDUM
LHAAP-1A
INERT BURNING GROUNDS
PROPOSED SAMPLE LOCATIONS

DATE: FEB 1993 | FIGURE 4-1-1

Monitoring Well Installation

The proposed well locations for the site are shown on Figure 4-1-1 and are as follows:

Three monitoring wells will be located near the western edge of the point of compliance,

One monitoring well will be located at the south end, outside the point of compliance,

One monitoring well will be located at the previously proposed borehole location for LHAAP-1 that is just southeast of the "pit".

The wells will be installed to a maximum depth of 20 feet into groundwater or to a depth where a lower confining material at least 2 feet thick occurs, whichever is shallower, and will screen the entire saturated zone above the confining material. Monitoring well installation procedures described in Section 4.2 of the CDAP will be followed.

Soil sampling from the monitoring well borings for both physical and chemical analyses will be performed following the same procedures described for sampling the soil borings to be drilled at the site, with the exception that soil samples for chemical analyses will be collected only from the unsaturated zone. Analytical parameters will be the same.

The newly installed monitoring wells will be slug tested and sampled. Slug tests will be performed in accordance with the procedures outlined in Section 4.4.12 of the addendum to the CDAP. Grab samples of the groundwater from the four soil borings will also be taken. Groundwater sampling will be in accordance with the procedures outlined in Section 4.5.1 of the CDAP.

4.3 General Plan for Site Investigation - RI Phase II

WESTON recommends that areas LHAAP-1 and LHAAP-1A be combined and treated as one site for the RI Phase II investigation. The RI Phase II investigation is described in Section 4.10.3 for the final RI/FS Work Plan, Volume I - General. Following implementation of the plan, an additional area to be investigated (LHAAP-1A) was identified. An investigation of area LHAAP-1A is necessary to meet the objectives stated above.

SECTION 5.0

FEASIBILITY STUDY ACTIVITIES

WESTON recommends that areas LHAAP-1 and LHAAP-1A be combined and treated as one site for the feasibility study. The feasibility study activities are described in Section 5.0 of the final RI/FS Work Plan, Volume I - General.

SECTION 6.0

RISK ASSESSMENT

The Baseline Risk Assessment will consist of two basic assessments - a Health Risk Assessment and an Ecological Risk Assessment. It is WESTON's recommendation that areas LHAAP-1 and LHAAP-1A be combined and treated as one site in the risk assessments. The Health Risk Assessment for LHAAP-1 is described in Section 6.2.10 of the final RI/FS Work Plan, Volume I - General and the Ecological Risk Assessment is described in Section 6.4 of the final RI/FS Work Plan, Volume I - General.

SECTION 7.0

PRELIMINARY IDENTIFICATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REGULATIONS (ARARs)

The identification of ARARs is described in Section 7.0 of the final RI/FS Work Plan, Volume I - General.

SECTION 8.0

BUDGET AND SCHEDULE

8.1 BUDGET

All remedial activities at LHAAP will be funded by the Defense Environmental Restoration Account (DERA) through the United States Army. Funding to the DERA is appropriated by Congress annually. The Army will seek sufficient funding for execution of all remedial activities at LHAAP in a timely manner.

Funding for remedial activities at Army installations is done on a priority basis. Because of the number of Army installations requiring environmental restoration work and the limited amount of funding, not all work is funded immediately. Funding for Phase I Investigation activities for LHAAP-1A was approved in September 1993.

8.2 SCHEDULE

The schedule for delivery of work items to the USACE Contracting Officer is presented in Table 8-1. The schedule is in calendar days. Calendar days for each work requirement extend from the award date of the delivery order (September 11, 1993), unless otherwise noted.

TABLE 8-1

SCHEDULE FOR DELIVERY OF WORK ITEMS

REMEDIAL INVESTIGATION FOR AREA LHAAP-1A

Delivery Order Items of Work	Completion Schedule
1. WESTON Chemical Data Acquisition Plan (CDAP) (Draft)	14 days
2. WESTON Site Safety and Health Plan (SSHP) (Draft)	14 days
3. WESTON Field Work Plan (Draft)	14 days
4. WESTON Chemical Data Acquisition Plan (CDAP) (Final)	7 days after receipt of comments
5. WESTON Site Safety Health Plan (SSHP) (Final)	7 days after receipt of comments
6. WESTON Field Work Plan (Final)	7 days after receipt of comments

TABLE 8-1
SCHEDULE FOR DELIVERY OF WORK ITEMS
REMEDIAL INVESTIGATION FOR AREA LHAAP-1A

(Continued)

7. RI Field Work	30 days after WESTON CDAP, SSHP, and Field Work Plan are approved by CO
8. Sampling and Data Results Report with Validation Report (Draft)	90 days after completion of field work
9. Sampling and Data Results Report with Validation Report (Final)	14 days after receipt of approved comments on Draft
10. Response to Regulatory Comments Sampling and Data Results Report	14 days after receipt of regulatory comments
11. Site Characterization Summary (SCS) Report (Draft)	14 days after receipt of comments on Sampling and Data Results Report (Final)
12. Site Characterization Summary Report (Final)	14 days after receipt of approved comments on SCS (Draft)

TABLE 8-1
SCHEDULE FOR DELIVERY OF WORK ITEMS
REMEDIAL INVESTIGATION FOR AREA LHAAP-1A

(Continued)

13. Response to Regulatory Comments on SCS Report	14 days after receipt of approved regulatory comments
14. Review Conference	To be scheduled by CO
Delivery Order Items of Work	Completion Schedule
15. Monthly Progress Report	Monthly, following award of contract
16. Remedial Investigation (RI) Report (Preliminary Draft)	14 days after receipt of approved regulatory comments on SCS (Final)
17. Remedial Investigation Report (Draft)	14 days after receipt of approved comments on RI Report (Preliminary Draft)
18. Remedial Investigation Report (Draft Final)	14 days after receipt of approved regulatory comments on RI (Draft)

TABLE 8-1
SCHEDULE FOR DELIVERY OF WORK ITEMS
REMEDIAL INVESTIGATION FOR AREA LHAAP-1A

(Continued)

19. Remedial Investigation Report (Final)	14 days after receipt of approved RI draft final comments.

APPENDIX A

INVESTIGATION-DERIVED WASTE

MANAGEMENT PLAN

1.1 Types and Estimated Quantities of Investigation Derived Waste (IDW).

The estimated waste quantities for LHAAP-1A and the description and total amount for each type are provided in the following paragraphs.

1.1.1 Drill Cuttings

The drill cuttings will consist of soil removed from soil borings. All of the bore holes will be drilled at least two feet into the saturated groundwater zone. To prevent spread of contamination the bore holes will be grouted after soil and bore hole water sampling. All borings will be drilled in the area of concern (AOC). No borings are planned for outside the AOC. A total of 2 cubic yards of drill cuttings are expected to be generated.

1.1.2 Purge and Development Water

The new monitoring wells will be purged of at least five volumes of water during development and an additional five volumes of water prior to sampling new and existing monitoring wells as described in the Chemical Data Acquisition Plan (CDSAP), Volume II of the RI/FS Work Plan. The soil borings will not be purged for water sampling. All purge water will be taken directly from the saturated groundwater zone. An estimated volume of 1,000 gallons of purge and development water is expected to be generated.

1.1.3 Decontamination Fluids

The drilling equipment will be decontaminated between each boring as described on page 23 of the CDAP, Volume II of the RI/FS Work Plan. Sampling equipment will be washed with a non-phosphate detergent, tap water rinse, distilled water rinse, and hexane rinse, in that order, allowed to air dry, and sealed in clean containers prior to use.

Personnel equipment decontamination will be minimal with the use of disposable suits, gloves, and boot covers. A boot wash will be utilized, if chemically resistant boots (rather than covers) are used. If personnel protective equipment (PPE) Level C or higher is implemented, additional decontamination washes will be utilized.

Approximately 500 gallons of decontamination fluids is expected to be generated.

1.1.4 Personnel Protective Equipment (PPE)

A modified Level D PPE will initially apply for all intrusive investigations. This is described in detail in the Site Safety and Health Plan in Volume III of the final RI/FS Work Plan. Disposable items will include the following items:

- Tyvek full body coveralls
- Chemically resistant surgical type gloves (inner)
- Cotton work gloves (outer)
- Chemical resistant boot covers
- Respiratory dual cartridge filters for air purifying and a combination organic

vapor/HEPA filter (respirators will be added if needed based upon the air monitoring action levels).

Twenty 20-gallon plastic bags are expected to be generated.

1.2 IDW APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

A comprehensive list of ARARs is presented in Section 7, Volume I of the final RI/FS Work Plan.

1.3 METHODS FOR CHARACTERIZING RCRA HAZARDOUS/NON-HAZARDOUS IDW

The primary method for characterizing the IDW has been a review of historical use of the Inert Burning Grounds and past investigation results. For LHAAP-1A, the assumption was made that the waste would be similar to LHAAP-1. Past experience and professional judgment will be used to determine if any wastes should be tested for TCLP parameters to determine if it is characteristically hazardous.

007247

SEP 09 1993

CERTIFIED MAIL: RETURN RECEIPT REQUESTED P104 195 178

Lynn Muckelrath, Project Manager
Longhorn Army Ammunition Plant
ATTN: SMCLO-EN
Marshall, Texas 75671-1059

Dear Lynn,

Pursuant to the Federal Facility Agreement (FFA) for the Longhorn Army Ammunition Plant (AAP), EPA is conveying with this letter the approval of the Remedial Investigation/Feasibility Study (RI/FS) Work Plan Addendum Phase I for Site LHAAP-18&24 (Burning Ground 3 & The Unlined Evaporation Pond), dated August 1993.

If you have any questions this or any other matter, please contact me at (214) 655-6735.

Sincerely,

Lisa Marie Price
Remedial Project Manager
Texas Enforcement Section

cc: Cyril O. Onewokae
HQ, AMCCOM
AMSMC-EQE
Rock Island, IL 61299-6000

Texas Water Commission
Mike Moore, Superfund
Pollution Cleanup Division
P.O. Box 13087
Capital Station
Austin, Texas 78711-3087

Tulsa District Corps of Engineers
P.O. Box 61
Attn: Hunter Davidson
SWT-EC-DR
Tulsa, OK 74121-0061

John Hall, *Chairman*
Pam Reed, *Commissioner*
Peggy Garner, *Commissioner*
Anthony Grigsby, *Executive Director*

007248

RECEIVED
EPA REGION VI
1993 SEP 20 AM 8:34
SUPERFUND BRANCH

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

September 13, 1993

CERTIFIED MAIL

RETURN RECEIPT REQUESTED

Lynn Muckelrath, Project Manager
Longhorn Army Ammunition Plant
Attn: SMCLO-EN
Marshall, Texas 75671-1059

Re: Longhorn Army Ammunition Plant
Remedial Investigation/Feasibility Study (RI/FS) Work Plan
Addendum Phase I for Site LHAAP-18 & 24

Dear Mr. Muckelrath:

The Texas Natural Resource Conservation Commission (TNRCC) approves the referenced plan, subject to the Army's responses to and/or modifications required by the enclosed comments.

If you have any additional questions or comments, please contact me at (512) 908-2483.

Sincerely yours,

Michael A. Moore
RI/FS II Unit
Superfund Investigation Section
Pollution Cleanup Division

MM:

cc: Hunter Davidson, COE Tulsa District
Lisa Price (6H-ET), EPA Region VI
Michael Brashear, LEGAL/FO - Region 5/Tyler
Mark Weegar, WASTE/IHW - Corrective Action

TNRCC Comments
on
Longhorn Army Ammunition Plant Remedial Investigation/Feasibility Study Work Plan Addendum Phase I For Site LHAAP-18 & 24 Burning Ground 3 & The Unlined Evaporation Pond

Section	Page	Comment
4.0	5	Will both soil and water samples be analyzed for all of the parameters listed (*e.g.* will soil samples be analyzed for pH and specific conductance)? If not, I suggest that this list be presented in a table for clarification.
Table 4.1	6	If you have not already done so, it is recommended that you review EPA's VISITT database to determine whether any additional remediation technologies should be added to this list. I am enclosing a copy of a VISITT registration note for your information. Additional technologies which appear to have merit may be added to the proposed list during the investigation.
Table 4.2	8	Well depths and screened intervals should be determined in the field. In order to prevent vertical cross-contamination, the screened interval in a well should not connect multiple transmissive zones; and in order to ensure capture of DNAPL's, the bottom of the screen should be placed into a confining zone.
4.1.2.3.1	10	Well construction materials, as well as sample extraction equipment, must be compatible with the contaminants which are likely to be encountered. TNRCC does not recommend the use of PVC materials when organic solvents are present in ground water.

007250

NOTE TO USER:

The second release of the VISITT system and database (Version 2.0) contains information collected from vendors by the EPA through fall and winter 1992-93. VISITT database updates will be released annually so that VISITT will remain a dynamic tool in linking remediation professionals with the evolving innovative technology field. EPA strongly encourages you to register as a VISITT user. As a registered user, you will receive announcements of new software and data releases and other relevant innovative technology information from EPA's Technology Innovation Office.

To register as a VISITT user, please fax the following information to (513) 891-6685:

- Name
- Organization
- Address
- Phone number
- Diskette size (3-1/2" or 5-1/4")
- Indication that this request is to order the VISITT software or to register as a VISITT user only

Or mail this information to:

U.S. EPA/NCEPI
P.O. Box 42419
Cincinnati, OH 45242-0419

DISCLAIMER

Inclusion in the U.S. Environmental Protection Agency's Vendor Information System for Innovative Treatment Technologies (VISITT) does not mean that the EPA approves, recommends, licenses, certifies, or authorizes the use of any of the technologies. Nor does the EPA certify the accuracy of the data. Listing in this database means only that the vendor has provided information on a technology that EPA considers to be eligible.

COMMISSION
JUN 10 1993
RECEIVED

LONGHORN ARMY AMMUNITION PLANT MEETING AGENDA

MEETING: TECHNICAL REVIEW COMMITTEE (TRC) & PROGRAM MANAGERS

LOCATION: LONGHORN ARMY AMMUNITION PLANT MARSHALL , TEXAS BLDG. 703

DATE / TIME: SEPTEMBER 14, 1993 9:00 A.M.

SIGN IN: AT ENTRANCE OF LHAAP THERE IS A GATE HOUSE WHERE YOU SIGN IN. THE GUARD WILL ISSUE A TEMPORARY BADGE. IF YOU BRING A CAMERA PLEASE REQUEST A CAMERA PERMIT.

AGENDA

I. COMMENTS & STATUS.- R. I. /PHASE I

A. EBASCO-SITES LHAAP - 1,11,13,14,XX,27
B. SVERDRUP -SITES LHAAP - 12,16,17,18,24,29,32
C. SUMPS- COE -SITE LHAAP - 35
D. WESTON - ADDENDUM - SITE LHAAP-1
E. WORK PLANS - ADDENDUM LHAAP- 18 @ 24

II. INTERIM REMEDIAL ACTION - STATUS

007252

TRC Meeting
LHAAP - 14 Sept 93

Lynn Muckleath	LHAAP	903-679-2980
Wendy D. Lanier	Tulsa Dist. USACE	918-669-7045
CPT Ross C. Nguyen	Tulsa Distuct, COE.	918-669-7551
Beenice Perez	Tulsa District, COE	918-669-7170
Hunter Davidson	Tulsa District, COE	918-669-7553
Jim Carter	Ft Worth Dist, COE.	318-676-3365
DUDLEY BEENE	"	"
Scott Weber	Southwestern Division, Corps, Dallas	214/767-2406
Lisa Price	EPA	214 655 6744
Michael Moore	TNRCC	(512) 908-2483
William R. Corrigan	Thiokol	(903) 679-2219
Bill Sniffen	Thiokol	(318) 459-5633
Cyril Onewokae	HQ, Amccom, Amsmc-EQE	(309) 782-1350
Steve Flowers	Thiokol	318/459-5633
LTC Lawrence J. Sowa	LHAAP (Commander)	

SUMMARY OF EVENTS DURING PHASE I SUMPS INVESTIGATION

August 29,1993 - Phase I Field Investigations of 125 Waste Process Sumps and 20 waste Rack Sumps were completed. The field investigations included:

-collecting soil samples from borings located adjacent to the sumps or waste racks;

-and collecting water/sludge samples from 20 sumps.

A total of 656 soil samples have been collected.

A total of 23 equipment blanks were sent.

Lab Data

Of the 145 sumps investigated, results for 46 sumps have been received.
A list is provided for some frequent compounds detected.

No results have been received on the sludge/water sampling.

Sumps on List Not Sampled

Samples were not collected for the following sumps:

Sump 800 - Concerns of safety - because we had been hitting obstacles during drilling even after they were cleared by telephone & utility personnel, I was uncomfortable drilling in this area because of the absence of personnel to investigate in the event something was hit or a pipe broken.

Sump 36 - Unable to locate

Sump 46 - Unable to locate

Sump 106 - by Bldg 401 - sump inside of bldg

WRS-20 - Unable to locate, however, waste rack nearby Bldg 42-H was sampled and labeled as WRS-21. WRS-21 was not tested for cyanide as requested for WRS-20.

007254

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

REPLY TO ATTENTION OF

October 6, 1993

SMCLO-EN

RECEIVED
EPA REGION VI
1993 OCT -8 PM 2:45
SUPERFUND BRANCH

Ms. Lisa Price
Superfund Enforcement
U. S. Environmental Protection Agency
1445 Ross Avenue
Dallas, TX 21010-5401

Dear Ms. Price:

Enclosed is a copy of the Final Remedial Investigation/Feasibility Study (RI/FS) Work Plan Addendum Phase I for the Burning Ground #3 and the Unlined Evaporation Pond (Site LHAAP 18 & 24) at Longhorn Army Ammunition Plant.

If there are any questions, please contact Mr. Lynn Muckelrath at 903-679-2980.

Sincerely,

Lawrence J. Sowa
Lieutenant Colonel, U. S. Army
Commanding Officer

Enclosure

007255

LONGHORN ARMY AMMUNITION PLANT
KARNACK, TEXAS

REMEDIAL INVESTIGATION/FEASIBILITY STUDY

FINAL
WORK PLAN ADDENDUM PHASE I

FOR SITE LHAAP-18 & 24
BURNING GROUND 3 &
THE UNLINED EVAPORATION POND

September 1993

Prepared by

TULSA DISTRICT
U.S. ARMY CORPS OF ENGINEERS

FIGURES

Figure — Page

Figure 4-1-1
PROPOSED SOIL BORING LOCATIONS FOR THE PHASE I SITE INVESTIGATIONS 10
Figure 4-1-2
PROPOSED WELL LOCATIONS FOR THE PHASE I SITE INVESTIGATIONS 12

TABLES

TABLE 4.0
SAMPLING PARAMETERS FOR
BURNING GROUND 3 & UEP
PHASE I ADDITIONAL INVESTIGATION 5
Table 4.1.
PRELIMINARY LIST OF TREATMENT ALTERNATIVES 7
TABLE 4.2.
PROPOSED INVESTIGATIONS FOR PHASE 1 ADDITIONAL INVESTIGATIONS FOR
IRA OF SOURCE MATERIAL 9

APPENDICES

Appendix A - Investigation Derived Waste Management Plan

EXECUTIVE SUMMARY

This Work Plan Addendum has been prepared by the U.S. Army Corps of Engineers, Tulsa District for Longhorn Army Ammunition Plant (LHAAP). It is intended as an addendum to the Longhorn Army Ammunition Plant (LHAAP) Remedial Investigation/Feasibility (RI/FS) Work Plan (June 1992), which describes remedial investigations at 13 Solid Waste Management Units (SWMUs) at LHAAP. This Work Plan Addendum describes additional investigations to be conducted at site No. LHAAP-18 & 24, the Active Burning Grounds (Burning Ground 3) and the Unlined Evaporation Pond (UEP). The description of investigations presented in this addendum is given in the same format as in the final RI/FS Work Plan, Volume I - General, with additional information added as necessary. Pertinent sections from the RI/FS Work Plan have been included by reference where possible to avoid unnecessary duplication. Proposed sampling locations were selected based on site history, physical characteristics, and field reconnaissance. A total of 8 soil borings with soil sampling, installation of 4 monitoring wells, collection and testing of 50 groundwater samples, and a small scale trench into the contaminated buried soil/debris with a small bucket backhoe for collection of samples for bench scale tests are proposed for the RI/FS Addendum Phase I Investigations.

SECTION 1.0
INTRODUCTION

Under a Federal Facilities Agreement (FFA) between the U.S. Environmental Protection Agency (EPA), the Texas Water Commission (TWC) and the Department of the Army, a Remedial Investigation/Feasibility Study (RI/FS) is underway at Longhorn Army Ammunition Plant (LHAAP) in Marshall, Texas. The FFA requires an RI/FS under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) to characterize the nature and extent of contamination at 13 Solid Waste Management Units (SWMUs) at LHAAP and to develop a remedy for remediation of each area. The U.S. Army Corps of Engineers (USACE) prepared a comprehensive RI/FS Work Plan to address remedial activities required at the 13 SWMUs following CERCLA guidelines. During the RI Work Plan development for the Active Burning Grounds #3, SWMU No. LHAAP-18 & 24, additional investigations were identified as required to evaluate the Interim Remedial Action (IRA) at the site for source control.

This Work Plan Addendum is intended as a supplement to the final Longhorn Army Ammunition Plant RI/FS Work Plan, Volume I - General, dated June 1992, which contains detailed information about the facility background and history; each area to be investigated; previous investigations; potential contaminants; migration pathways; potential receptors; sampling rationale; number and type of samples; analytical parameters; feasibility study and risk assessment activities. The purpose of this Work Plan Addendum is to present a description of the additional investigations to be conducted, a map showing proposed sample locations, and an estimate of the volume of investigation-derived waste to be generated. This document follows the same format as the final RI/FS Work Plan Volume I - General, with additional information added as needed to describe investigations to be conducted at the site. Pertinent sections from the RI/FS Work Plan have been included by reference where possible to avoid unnecessary duplication. Since the investigation-derived waste will increase with the additional field work at LHAAP-18 & 24, the waste descriptions and quantity estimates are provided as Appendix A.

All procedures described in the final RI/FS Work Plan Volume II - Chemical Data Acquisition Plan (CDAP), and Volume III - Site Safety and Health Plan (SSHP) will remain

applicable for the investigation at LHAAP-18 & 24. The CDAP discusses the data quality procedures and techniques used to insure that all data obtained are of acceptable quality and the Investigation-Derived Waste (IDW) Management Plan. The SSHP establishes procedures to protect personnel during the field activities at LHAAP-18 & 24.

SECTION 2.0
FACILITY BACKGROUND

General information about Longhorn Army Ammunition Plant including location, boundary features, facility background, and environmental conditions is described in Section 2.0, Facility Background, of the final RI/FS Work Plan, Volume I - General.

SECTION 3.0

SITE NATURE AND EXTENT OF CONTAMINATION

3.1 LHAAP-18 & 24 - BURNING GROUNDS 3 AND UNLINED EVAPORATION POND.

3.1.1 Site History. Historical use of this site is assumed to be the same as that described in Section 3.6.1 of the final RI/FS Work Plan, Volume I - General.

3.1.2 Site Description. The site description is the same as that described in Section 3.6.1 of the final RI/FS Work Plan, Volume I - General.

3.1.3 Previous Investigations. Previous investigations in the area have been described for this site in Section 3.6.3 of the final RI/FS Work Plan, Volume I - General.

3.1.4 Assessment of Existing Data and Historic Records. Assessment of existing data in the area have been described for this site in Section 3.6.4 of the final RI/FS Work Plan, Volume I - General.

3.1.5 Potential Contaminants and Migration Pathways. The potential contaminants and migration pathways will be the same as those described in Section 3.6.5 of the final RI/FS Work Plan, Volume I - General.

3.1.6 Identification of Potential Receptors. The identification of potential receptors will be the same as those described in Section 3.6.6 of the final RI/FS Work Plan, Volume I - General.

3.1.7 Initial Remedial Action. The initial remedial action will be the same as described in Section 3.6.7 of the final RI/FS Work Plan, Volume I - General.

The interim remedial action (IRA) will include source material and groundwater removal and treatment. The need for an IRA is shown by the increase in concentrations of volatile organics detected in the groundwater. In the shallow aquifer zone, monitoring well (MW) 2 went from a methylene chloride (MEC) concentration of 2,900,000 ug/l in June 1988 to 9,080,000 ug/l in November 1992 and a trichloroethylene (TCE) concentration of 60,000 ug/l in June 1988 to 199,000 ug/l in November of 1992, several other wells in this zone had concentrations over DNAPL indicator limits. In the deeper zone at the site, MW-15 went from a MEC concentration of 37 ug/l in June 1988 to 68,000 ug/l in November 1992 and a TCE concentration of 54 ug/l in June 1988 to 9,390 ug/l in November of 1992, this is particarly alarming since it indicates an increased vertical migration rate.

SECTION 4.0
PLAN OF INVESTIGATION

The plan of investigation described below is designed to obtain site-specific data about both the physical and chemical characteristics of the Burning Ground 3 & UEP site. Table 4.0 presents the parameters will be analyzed for all soil and groundwater samples. Additionally, six bench scale test will be performed on samples from the trench soil/debris and six bench scale test will be performed on samples of groundwater that will be obtained from the most heavily known contaminated areas, the planned bench scale test are also listed in Table 4.0.

TABLE 4.0
SAMPLING PARAMETERS FOR
BURNING GROUND 3 & UEP
PHASE I ADDITIONAL INVESTIGATION

Sampling Matrix	Chemical Parameters	Physical Parameters
SOIL from borings & monitoring wells	pH; volatile organic compounds (VOCs); semi-volatile organic compounds (SVOCs); explosives; antimony; arsenic; barium; cadmium; chromium; lead; mercury; nickel; selenium; silver; thallium; nitrate; sulfate; and chloride	visual classification, moisture content, gradation, plastic limit, and liquid limit tests
GROUND WATER	pH; specific conductance; volatile organic compounds (VOCs); semi-volatile organic compounds (SVOCs); explosives; antimony; arsenic; barium; cadmium; chromium; lead; mercury; nickel; selenium; silver; thallium; nitrate; sulfate; and chloride	
Soil Bench Scale Test (BST)	Incineration, Thermal Desorption, Aeration, Bio-remediation, Stabilization, Chemical Extraction (samples will also be tested before and after BST for the chemical parameters to show effectiveness of the procedure)	
Water Bench Scale Test (BST)	Air stripping, Activated Carbon, Ultraviolet Photolysis, Ion exchange, Reverse Osmosis, Precipitation (samples will also be tested before and after BST for the chemical parameters to show effectiveness of the procedure)	

Note: For more detail see the CDAP in the RI/FS Work Plan.

All sampling and analyses will be performed in accordance with the procedures outlined in Volume II - Chemical Data Acquisition Plan (CDAP) and Volume III - Site Safety and Health Plan (SSHP) of the final RI/FS Work Plan. A preliminary list of alternatives to be

evaluated for the IRA at Burning Ground 3 & the UEP site is given on Table 4.1. Field investigations for the site will consist of multiple phases. The first phase of investigations, RI Phase I, will be performed to obtain the data requirements to complete the site characterization to proceed with the IRA on the near surface source material. The estimated number and types of samples to be taken during the RI Phase I Additional investigations are shown on Table 4.2. After completing the first phase field efforts, starting the IRA, and evaluating the existing data needs, the total site RI will continue to more fully assess the deeper groundwater at the site. Additional groundwater monitoring wells and soil borings may be drilled to determine the full extent of soil and groundwater contamination, if necessary.

Table 4.1.
PRELIMINARY LIST OF TREATMENT ALTERNATIVES
FOR THE IRA

Matrix	IN-SITU/ EX-SITU	CONTAMINANT/ PROCEDURE TYPE	TECHNOLOGY
GROUNDWATER	IN-SITU	VOC	Bioremediation Vapor Extraction Note:(Low permeability of soils limits effectiveness of in-situ treatment.)
		METALS	
	EX-SITU	VOC	Air stripping Activated Carbon Ultraviolet Photolysis
		METALS	Ion exchange Reverse Osmosis Precipitation
		COLLECTION	Well-point System Interceptor/Collection Trenches I/C Trenches with Vacuum Enhanced Extraction
SOIL/WASTE	IN-SITU	VOC	stabilization Vitrification Soil Vapor Extraction Note:(Low permeability of soils limits effectiveness of in-situ treatment.)
		METALS	stabilization Vitrification
	EX-SITU	VOC	Incineration Thermal Desorption Aeration Bio-remediation
		METALS	Stabilization Chemical Extraction
		EXCAVATION/ PRETREATMENT	Staging area Dewatering unit Soil shredding Soil screening
AIR/ VAPOR EMISSIONS		VOC	Activated Carbon Flaring
		DUST	Water Spray Baghouse Scrubber

4.1 LHAAP 18 & 24 - Burning Grounds 3 and UEP.

4.1.1 Data Requirements for Site Characterization. Additional data is needed to more fully characterize the site before proceeding with the IRA. A list of additional investigations for this phase with a description, specific purpose, and type of sampling to be performed are provided in Table 4.2.

4.1.2 General Plan for Site Investigation - RI Phase I. The overall A field investigation plan for area LHAAP-18 & 24 was developed and approved in Section 4.6 of the final RI/FS Work Plan, Volume I - General. The field investigation (listed in Section 4.6.2 of the final RI/FS Work Plan, Volume I - General) for area LHAAP-18 & 24 includes the following:

8 - surface water/sediment sampling
41 - monitoring well sampling
7 - monitoring wells to be plugged

The changes from this plan are to include installation and sampling of 8 borings, install 4 wells, sample all wells at the site that can yield a water sample, collect soil/waste & water samples for bench scale tests. Well abandonmnet scheduled under the RI/FS Work Plan will take place as part of the IRA.

The objectives in performing the first phase of additional field investigations for the RI at the Burning Ground 3, LHAAP-18 & 24 are to determine if low density compounds are floating on the near surface groundwater, delineate the TCE plume north of the UEP, investigate areas of suspected contamination (including the UEP) that have not previously been samples, and to collect samples for bench scale tests.

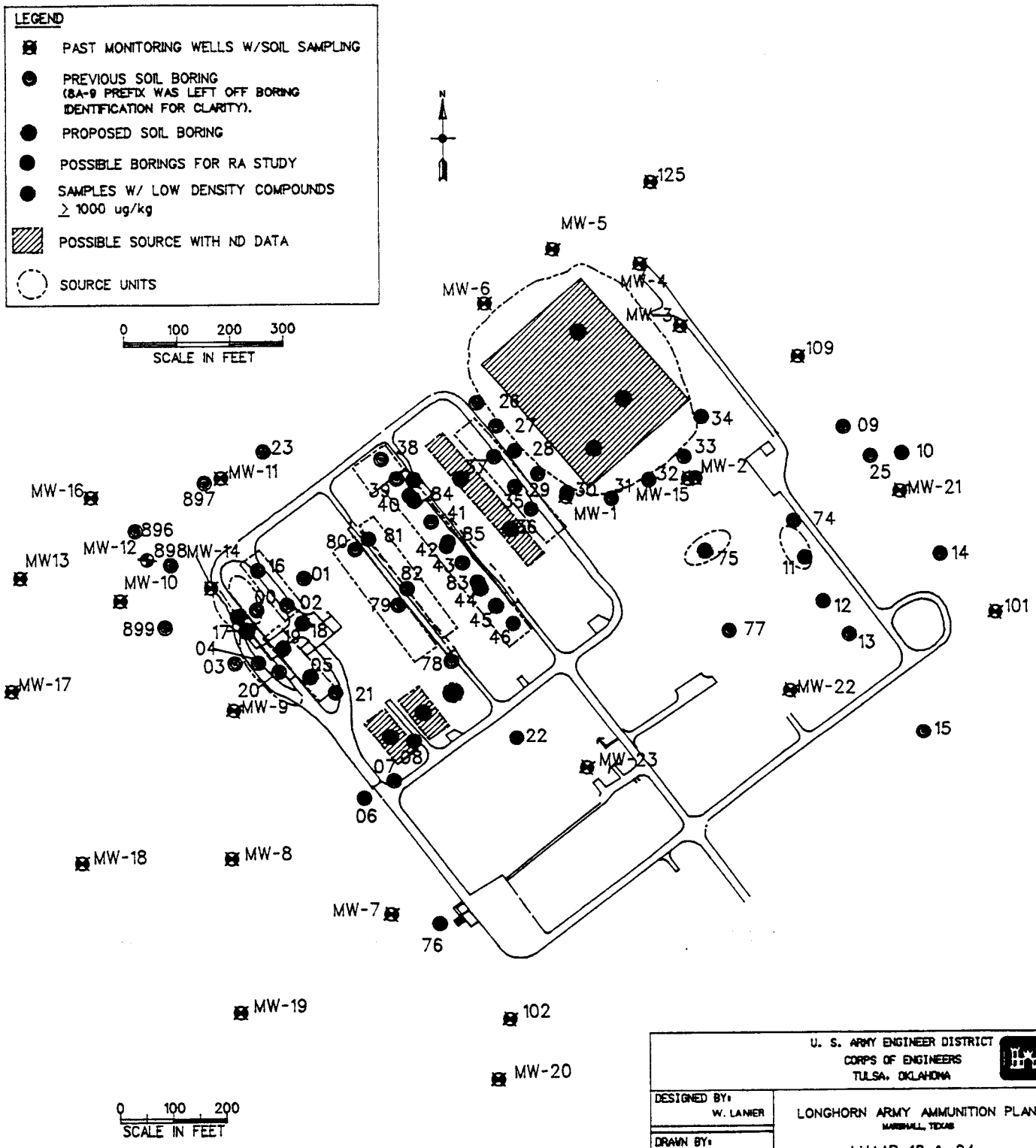
4.1.2.1 Soil Borings Eight additional soil borings will be drilled at the locations shown on Figure 4-1-1. The objective of the additional soil borings is to gather analytical and stratigraphic data from the suspected source areas. Two of the borings are located in the center of the suspected burn trench next to borings 935-937. Three of the borings are in the UEP, one near the truck ramp in the southern corner, one in the north corner near the rocket motor washout, and one near the east corner near the well MW-2. The last three are in 3 separate suspect areas that have never been investigated near 908 and operating burn cages.

Boring depths are estimated based on an anticipated depth of contamination. Actual depths may vary depending on the subsurface conditions encountered during investigations.

TABLE 4.2.
PROPOSED INVESTIGATIONS FOR PHASE 1 ADDITIONAL INVESTIGATIONS FOR IRA OF SOURCE MATERIAL
AT BURNING GROUND 3 & UEP

WORK ITEM	NUMBER/LOCATION	PURPOSE	DEPTH	SAMPLING
1. Install shallow wells	3 down gradient from areas where soil samples had low density compounds at concentration over 1,000 ug/l (near ACD and burn pits see map of past soil investigations with proposed borings)	To detect LNAPL plume and collect hydrogeologic characteristics for developing fate and transport models to address remediation measures, should they be necessary.	Fifteen feet below water table with a 20 foot screen 5 feet above the water table .	Sample all 3 wells for LNAPL and full range of sampling.
2. Perform soil borings and collect soil samples	3 - in UEP 2 - in suspected burn trench next to borings 935-937 3 - in 3 separate areas near 908 (see map of past soil investigations with proposed borings)	To confirm suspect source areas of presence of buried waste	At least 15 feet, or till no indication of disturbed material is encountered whichever comes first	Sample every 5 feet and collect sample at noticeably high contamination in the field.
3. Install monitoring well	1 - downgradient (northwest) of MW-5 & MW-6	To close tce plume north west of mw-5 & mw-6	Twenty foot screen at approximately 15 to 35 feet below land surface	Sample with the other monitoring wells for voc's. Semi-vo's, explosives, and metals.
4. Sample all existing monitoring wells including 123, 125, BH-11, and BH-22	50 - wells	To provide a "snap shot" of contaminant plume before interim remedial action and monitor the migration since november 1992	NA	Sample for voc's. Semi-vo's, explosives, and metals
5. Trenching with a small back hoe to collect soil samples for bench scale test	Approximately 6 samples from two "hot areas" near acd and north end of middle burn pit	To test effectiveness of remedial technology and to gather site condition information for implementation of the ira (such as inflow seepage & side slope stability in waste material)	Approximately 10 feet deep	Samples for bench scale test
6. Collect water samples from most contaminated wells for water treatment bench scale test	As needed to perform test	To test effectiveness of remedial technology	NA	Samples for bench scale test

FIGURE 4-1-1
PROPOSED SOIL BORING FOR PHASE I SITE INVESTIGATIONS



NOTE: LOCATIONS OF SITE FEATURES AND SAMPLING LOCATIONS HAVE BEEN ASSEMBLED FROM REFERENCED DOCUMENTS PREPARED BY VARIOUS AGENCIES.

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

DESIGNED BY: W. LANIER	LONGHORN ARMY AMMUNITION PLANT MARSHALL, TEXAS
DRAWN BY: C. STAUDENMAIER	LHAAP 18 & 24 INTERIM REMEDIAL ACTION PAST SOIL INVESTIGATIONS WITH PROPOSED SOIL BORINGS
CHECKED BY:	
SUBMITTED BY:	SCALE: AS SHOWN
CHIEF, ENVIRO. DESIGN C. WORD	DATE: AUGUST 1993
	DWG CODE:
	FIGURE 4-1-1
DIGITAL FILE: PPINSOIL.DGN	

4.1.2.2 Monitoring Wells and Groundwater Samples Four groundwater monitoring wells will be installed at the site to determine the presence of a Low density non-aqueous phase liquid (LNAPL) plume and define TCE migration northwest of the UEP in the upper saturated zone. The wells will also provide groundwater depth and flow direction. Sampling of all of the wells will monitor the migration and changes in concentration of contamination present in the groundwater and variations of the groundwater elevation at the site .

4.1.2.2.1 Monitoring Well Installation The proposed well locations for the site are shown on Figure 4-1-2 and are as follows:

- TO DETECT A POSSIBLE LNAPL PLUME

  Three monitoring wells are to be installed hydraulically down gradient from areas with the highest concentration of low density volatile organic compounds in the soil samples

- TO DETERMINE THE TCE CONCENTRATION DOWNGRADIENT OF MW-5 AND MW-6 WELLS

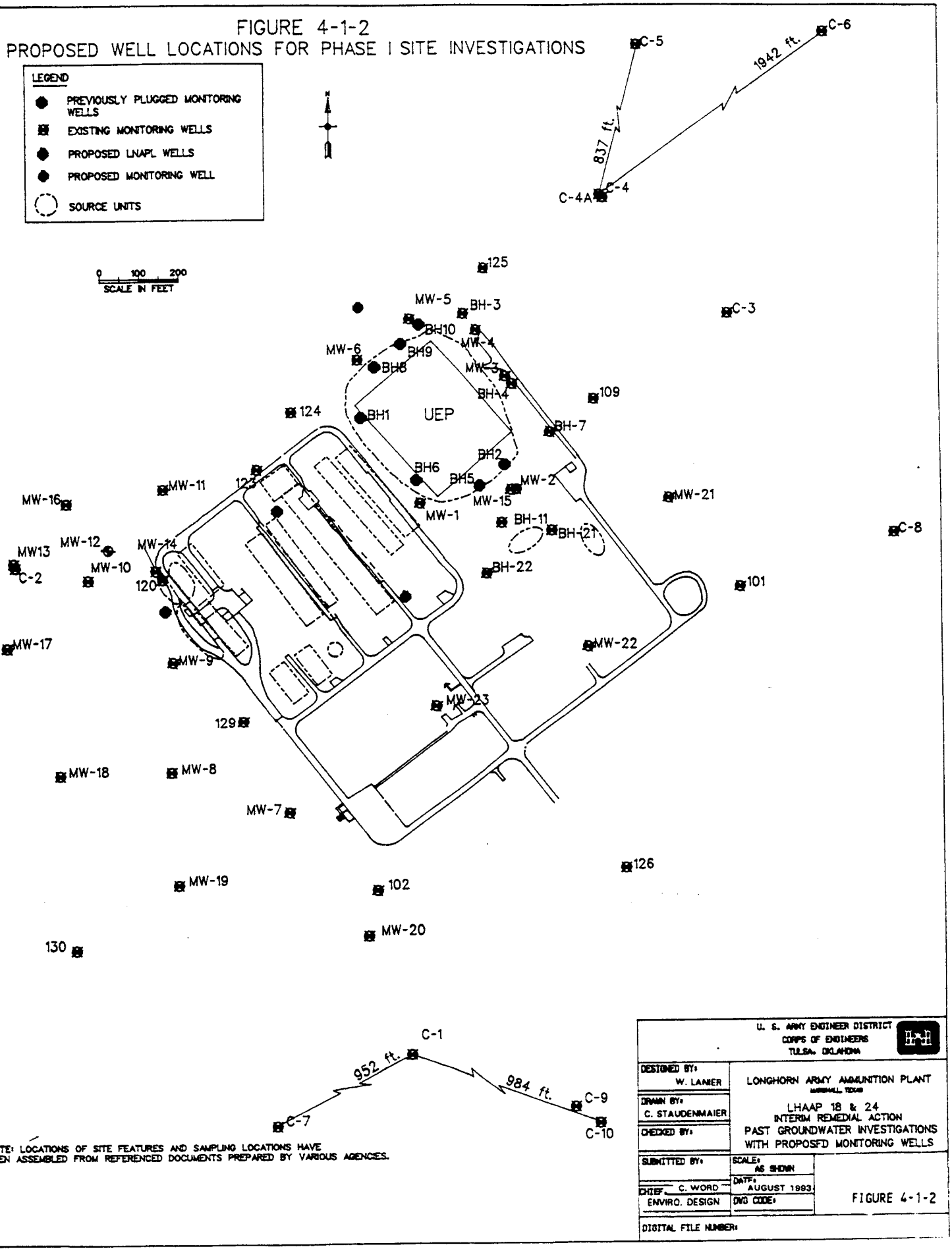
  One monitoring well will be located northwest of the UEP to determine

The wells will be installed based on observation in the field, the approximate depth of the well screens are shown on Table 4.2.

All sampling and analyses will be performed in accordance with the procedures outlined in Volume II - Chemical Data Acquisition Plan (CDAP) and Volume III - Site Safety and Health Plan (SSHP) of the final RI/FS Work Plan. Soil sampling for both physical and chemical analyses will be performed following the same procedures described for sampling the soil borings to be drilled at the site, with the exception that soil samples for chemical analyses will be taken only from the unsaturated zone. Analytical parameters will be the same as listed in Table 4.0 and the RI/FS Work Plan.

4.1.2.2.2 Groundwater Sampling The newly installed monitoring wells will be slug tested and sampled for analytical and physical parameters listed in Table 4.0 of this document and section 4.6.2 of the final RI/FS Work Plan, Volume I - General.

FIGURE 4-1-2
PROPOSED WELL LOCATIONS FOR PHASE I SITE INVESTIGATIONS



NOTE: LOCATIONS OF SITE FEATURES AND SAMPLING LOCATIONS HAVE BEEN ASSEMBLED FROM REFERENCED DOCUMENTS PREPARED BY VARIOUS AGENCIES.

	U. S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS TULSA, OKLAHOMA
DESIGNED BY: W. LANIER	LONGHORN ARMY AMMUNITION PLANT MARSHALL, TEXAS
DRAWN BY: C. STAUDENMAIER	LHAAP 18 & 24 INTERIM REMEDIAL ACTION
CHECKED BY:	PAST GROUNDWATER INVESTIGATIONS WITH PROPOSED MONITORING WELLS
SUBMITTED BY:	SCALE: AS SHOWN
CHIEF, ENVIRO. DESIGN C. WORD	DATE: AUGUST 1993
	DWG CODE:
DIGITAL FILE NUMBER:	FIGURE 4-1-2

007270

SECTION 5.0
FEASIBILITY STUDY ACTIVITIES

The feasibility study activities are described in Section 5.0 of the final RI/FS Work Plan, Volume I - General. The preliminary list of alternatives as provided in Table 4.1 will be evaluated for the IRA.

SECTION 6.0
RISK ASSESSMENT

The Baseline Risk Assessment will consist of two basic assessments - a Health Risk Assessment and an Ecological Risk Assessment.

The Health Risk Assessment for LHAAP-1 is described in Section 6.2.10 of the final RI/FS Work Plan, Volume I - General and the Ecological Risk Assessment is described in Section 6.4 of the final RI/FS Work Plan, Volume I - General.

SECTION 7.0
PRELIMINARY IDENTIFICATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

The identification of ARARs is described in Section 7.0 of the final RI/FS Work Plan, Volume I - General.

SECTION 8.0
BUDGET AND SCHEDULE

8.1 BUDGET. All remedial activities at LHAAP will be funded with the Defense Environmental Restoration Account (DERA) whicnh is managed by the U.S. Army Environmental Center (AEC). DERA funds are appropriated by Congress annually. Funding requiremnt for this effort shall be identified in a timely manner through the chain of command to AEC.

Funding for installation restoration program projects at Army installations is done on a priority basis. Because of the number of Army installations requiring environmental restoration work and the limited amount of funding, not all work is funded immediately. Funding for Phase I Investigations for LHAAP-18 & 24 has been received in fiscal year 1993.

8.2 SCHEDULE. A schedule of 87 months was proposed for remedial activities at LHAAP as outlined in Section 8.0, Budget and Schedule, of the final RI/FS Work Plan, Volume I - General. The schedule includes all activities from project planning through the completion of the remedial design.

APPENDIX A
INVESTIGATION DERIVED WASTE MANAGEMENT PLAN

WASTE DESCRIPTION

WASTE DESCRIPTION

1.1 Types and Estimated Quantities of Investigation Derived Waste (IDW). The estimated waste quantities for LHAAP-18 & 24 and the description and total amount for each type are provided in the following table. Please refer to Appendix C of the RI/FS Work Plan, Volume II -Chemical Data Acquisition Plan, Investigation-Derived Waste Management Plan for additional detail.

IDW ESTIMATED QUANTITIES AND TYPE										
INVESTIGATIONS							ESTIMATED WASTE QUANTITIES			
PHASE	MONITORING WELLS (depth)	BORINGS (depth)	SAMPLES				SOIL CUTTINGS (cf)	PURGE WATER (gal)	DECON. FLUIDS (gal)	PPE & DISP. EQUIPMENT (20 gal bags)
			SEDIMENT	SOIL	GROUNDWATER	Surface water				
Original	0	0	8	0	39	8	0	16,365.	219	28
New	3 @ 25' 1 @ 35'	8 @ 15' 2 trenches @ 10'	0	32 6 FOR TREATABILITY TESTING	11 6+ FOR TREATABILITY TESTING	0	102	5,220.	100	10
Total	4	8 borings 2 trenches	8	38	55	8	102	21,585.	319	38

007276

PUBLIC NOTICE

FINDING OF NO SIGNIFICANT IMPACT

ENVIRONMENTAL ASSESSMENT

LONGHORN ARMY AMMUNITION PLANT (LHAAP)
KARNACK, TEXAS

Pursuant to the regulations implementing the provisions of the National Environmental Policy Act (NEPA) (40CFR, Part 1500 et al), the Department of the Army (DA) gives notice that it has prepared the required environmental documentation for construction of a treatment area near Burning Ground 3 (BG-3) at LHAAP. The documentation is on file and may be reviewed by interested parties at the Public Affairs Office, LHAAP, P. O. Box 1029, Marshall, Texas 75671, (903) 679-2228.

The proposed action is for the construction of a treatment area near BG-3. The soils and ground water at BG-3 have been contaminated from past activities and need to be remediated. The construction of the treatment area is necessary for the proper storage and eventual treatment of the soil and water. It will consist of a curbed concrete pad with a sump for handling soil and a gravel parking area. There will be space for treatment facilities in the future.

The proposed action is not expected to have a significant environmental impact on air, water, soils, plants, animals or humans. The program is also not expected to conflict with existing or proposed federal, state or local land use plans, policies, laws and controls, including the Clean Air Act, Federal Water Pollution Control Act Amendments, and Resource Conservation and Recovery Act. It does not constitute a significant change relevant to environmental concerns associated with the no-action alternative.

The Department of the Army will receive comments on this proposed action for a thirty-day period from the date this Finding of No Significant Impact (FNSI) is published. Address comments to Commander, Longhorn Army Ammunition Plant, ATTN: Public Affairs Office, P. O. Box 1029, Marshall, Texas 75671.

12/93

ENVIRONMENTAL ASSESSMENT (EA)
for the
PROPOSED TREATMENT AREA
FOR
BURNING GROUND NO. 3

LONGHORN ARMY AMMUNITION PLANT

DECEMBER 1993

I. Purpose and Need for the Proposed Action:

A. GENERAL: The Longhorn Army Ammunition Plant (LHAAP) is located in northeastern Texas, in Harrison County, about 15 miles east of Marshall, Texas. The plant is bounded on the west by State Highway 134 and on the east by Caddo Lake. At the present time, the plant consists of 8,523 acres, extending approximately 4 miles in the north-south direction and 4 miles in the east-west direction.

B. PURPOSE AND NEED: There is a need for the construction of a treatment area near Burning Ground No. 3 (BG-3). The soil and ground water in BG-3 have been contaminated from past activities that are no longer practiced. In order to clean or remediate the site, an area needs to be constructed to properly store and eventually treat the soil and ground water. This area will be designed to contain the contaminants and prevent their release.

II. Description of the Proposed Action: The Remedial investigation for Longhorn Army Ammunition Plant (LHAAP) identified BG-3 as a significantly contaminated site. High levels of TCE and methylene chloride in the ground water raised concern that an interim response maybe necessary to prevent the contaminants from further spreading and becoming a risk to humans and the environment. In order to remediate the site a nearby treatment area is needed to handle, test, store, and eventually treat the soil and water.

A site was selected that met safety and environmental requirements. Figure No. 1 shows the location of the site on LHAAP and Figure No. 2 shows the site in relation to BG-3. These figures and most of the data used in this environmental assessment are from a draft report dated October 1993 by the U. S. Army Corps of Engineers.

The site dimensions are shown in Figure No. 3. For the first phase, only the 100 foot by 100 foot concrete pad is necessary. It is designed to contain all contaminants by having a curb on the edges and the whole pad drains to a sump that collects any contaminated water. All contaminated soil and water will be stored in closed containers. The project is being reviewed by the Environmental Protection Agency (EPA) and the Texas Natural Resource Conservation Commission (TNRCC) to ensure compliance.

All activities will be carried out in accordance with applicable local, state, and federal regulatory requirements.

III. Alternatives Considered:

A. NO ACTION:

(1) Reason for Selection - This would not change current activities or disturb the contaminated soils and ground water and risk a significant release to the environment by excavating or moving the contaminants.

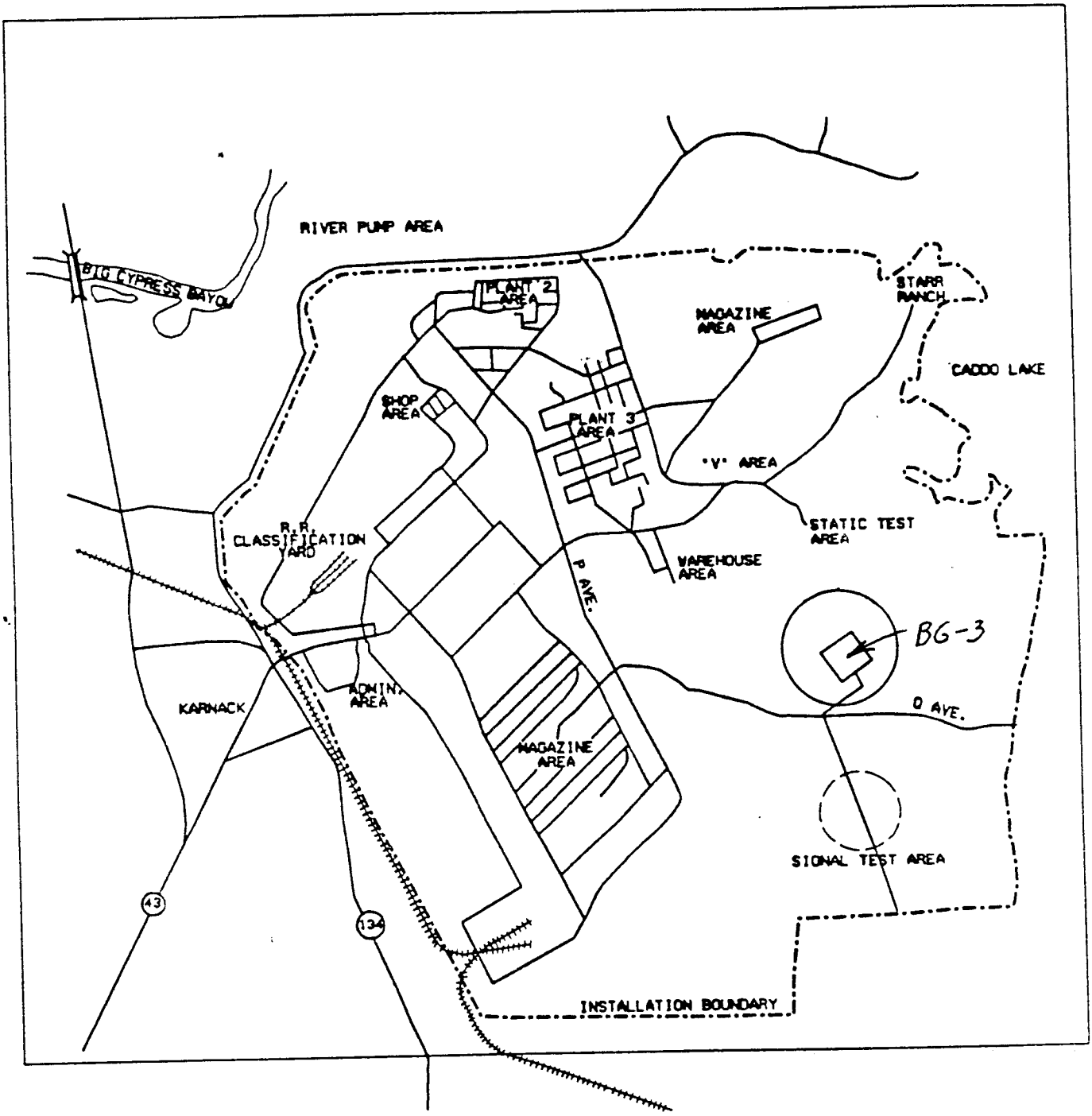
(2) Reason for Rejection - The contaminants would remain in the ground and could eventually find their way to the surface and they are already in the shallow ground water.

B. CONSTRUCTION OF TREATMENT AREA

(1) Reason for Selection - The treatment area is needed to have a site where the contaminated soils and water can be handled in an environmentally safe manner.

(2) Reason for Rejection - Without the treatment area the contaminated soil and water cannot be handled without an increased risk of release.

007279



LOCATION MAP FOR LHAAP's BG-3

FIGURE 1

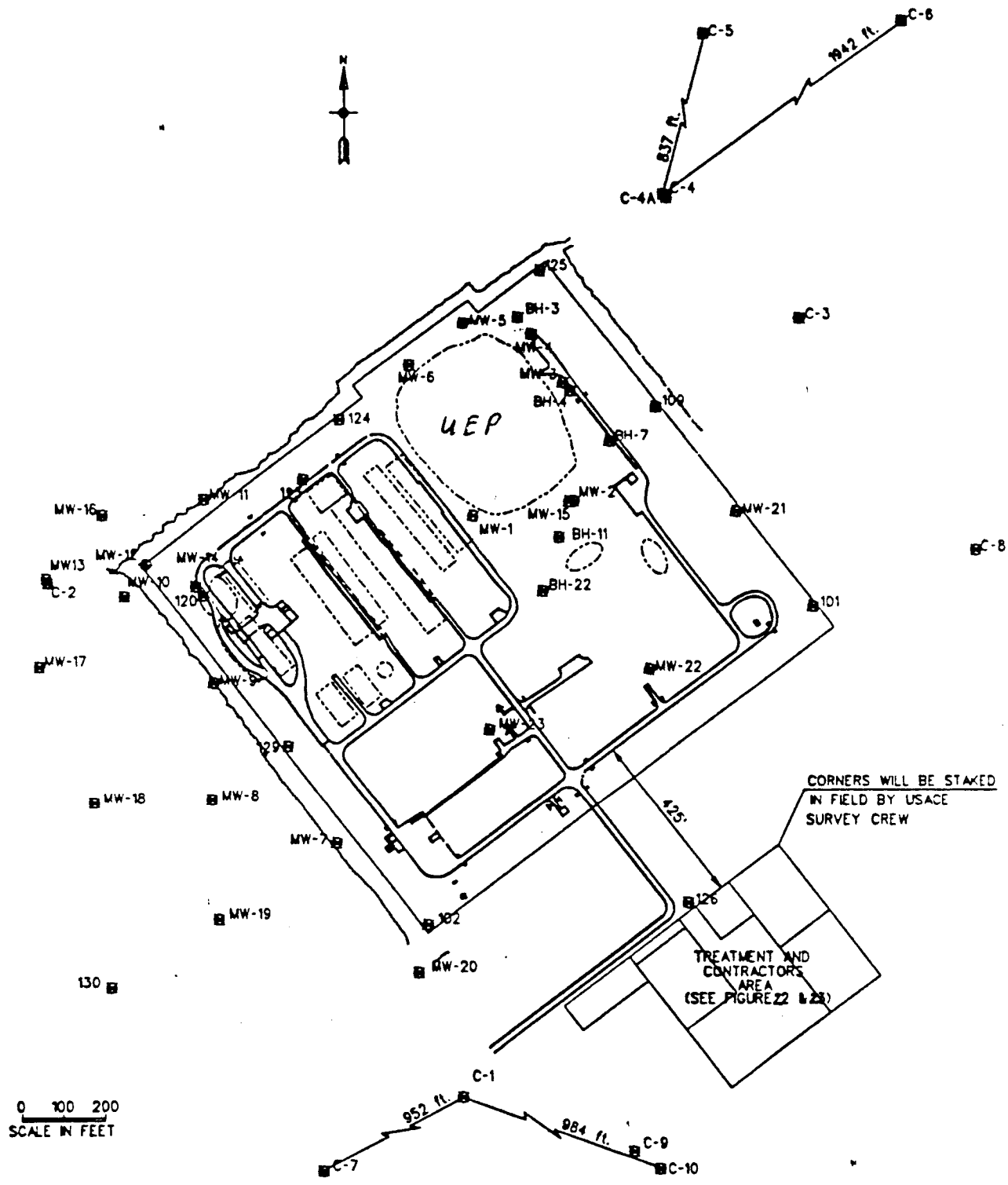
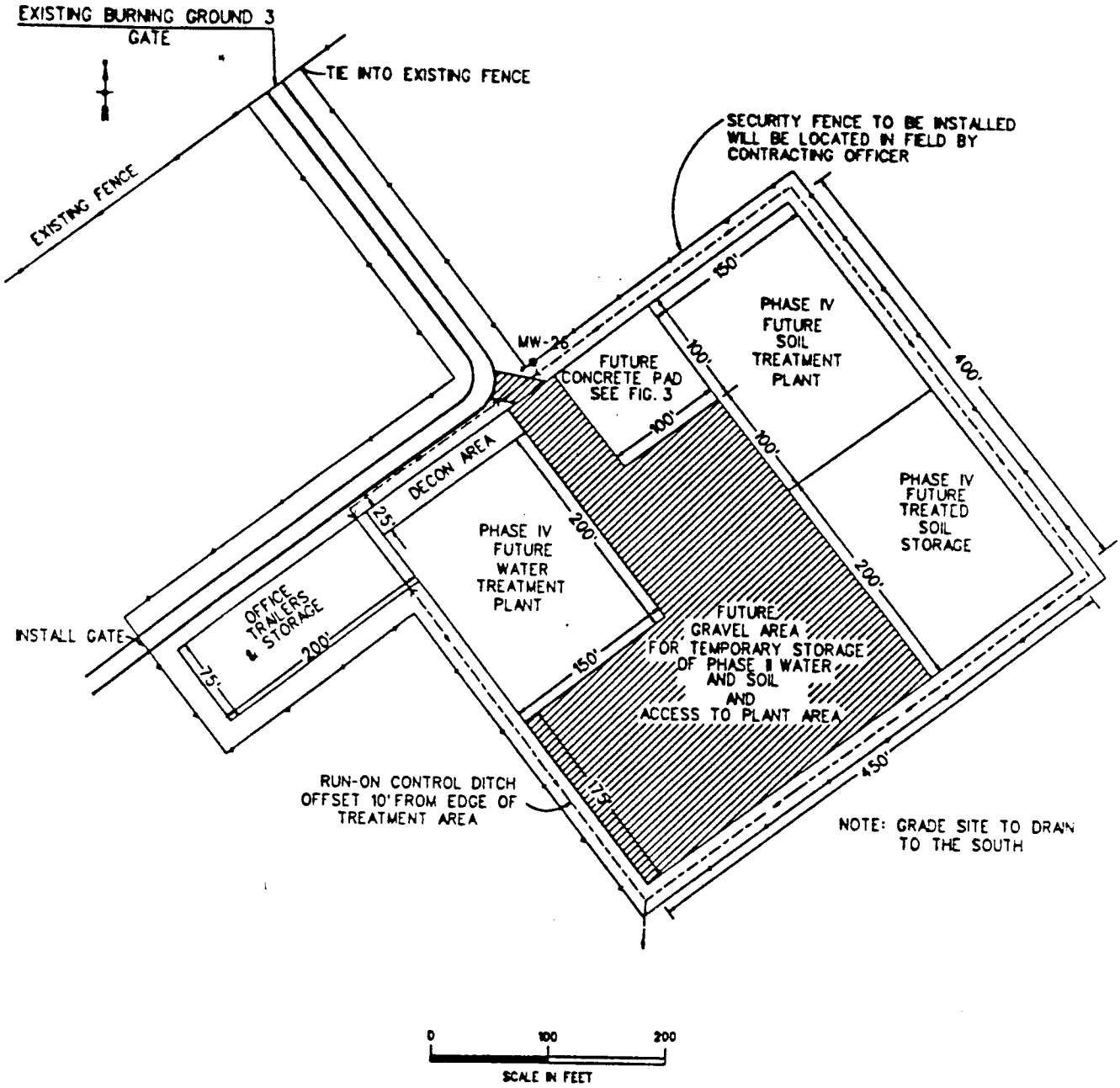


FIGURE 2
BURNING GROUND 3 & UEP SITE
WITH PROPOSED IRA TREATMENT AREA & MONITORING WELLS
LONGHORN ARMY AMMUNITION PLANT



PROPOSED TREATMENT AREA

FOR INTERIM REMEDIAL ACTION (IRA)
BURNING GROUND 3 & UNLINED EVAPORATION POND
LONGHORN ARMY AMMUNITION PLANT

FIGURE 3

IV. Affected Environment (Baseline Conditions)

A. ENVIRONMENTAL SETTING: LHAAP is located in the Western Gulf Coastal Plain physiographic province which is dominated by pine forests. The area around LHAAP is characterized by rolling hills with elevations ranging from 170 to 338 feet (52 to 103 m) above mean sea level (MSL). The northeastern boundary is on Caddo Lake which is the lowest elevation. The geologic formations found at LHAAP are Quaternary and Tertiary in age. The Quaternary which is composed of clay, silt, and sand. It is found in the flood plains of streams. The Tertiary Wilcox outcrops on the remainder of the plant. It dips gently to the northwest and contains clays, silts, lignite, ironstone, and some water producing sands. These formations weather into soils consisting of clays, silts, and sands. The soils in this area can be grouped into three broad categories: upland soils, frequently flooded soils, and submerged soils.

The major upland soils include Scottsville, Eastwood and Metcalf series. Scottsville and Eastwood series consist of deep, moderately well-drained, very slowly permeable soils formed on unconsolidated loamy and clayey sediments of the Wilcox formation.

The major soils in the frequently flooded category include Socagee and Sardis. Socagee series consists of deep, poorly-drained, moderately permeable soils on bottom lands. These soils are developed from acid, loamy, alluvium in flood plains. Socagee and Sardis soils are subject to frequent flooding. The duration of flooding is from a few hours to a few days. Flooding is mainly from January through May. A perched water table is at the surface to 1.5 feet below the surface during most years from December through May. Some spots will be ponded with 2 to 10 inches of water for 1 to 4 weeks after heavy rains during the same period.

Cypress series consists of soils on perennially submerged areas. These soils are formed in acid, clayey alluvium in lake beds, old ox bows, and areas bordering stream channels. Cypress soils are very poorly drained. Permeability is very slow. An apparent water table is present from about four feet to one foot above the soil surface during most of the year and from two feet above the soil surface to a depth of about one foot below the soil surface during dry periods. These soils are used mainly for wildlife and recreation due to the high water table and perennial submersion of the soil. Native vegetation consists mainly of Bald Cypress.

Approximately 70% of the total installation acreage is wooded. The Loblolly Pine is the main tree species with some Shortleaf Pine and also some mixed hardwoods. The hardwoods include Cherry Bark Oak, Southern Red Oak, White Oak, Water Oak, and Sweet Gum. For lists of plant species see the Wildlife Management Plan, November 1987 and the Installation EIA for LHAAP (August 1978), Appendix G.

About 16 species of mammals are known from the area in which the plant is located. The EIA provided a comprehensive list of over 73 species of birds likely or actually found within the same area. For a list of these mammals and birds see Appendix H of the EIA of LHAAP, (August (1978).

No endangered flora or fauna have been identified at LHAAP.

The flora and fauna at the Longhorn Army Ammunition Plant are described in greater detail in the Installation Environmental Impact Assessment (EIA) for LHAAP dated August, 1978.

V. Environmental Consequences of the Proposed Action:

A. AIR QUALITY: Contaminated soils and water will be held in enclosed containers to keep air emissions to an absolute minimum.

B. WATER QUALITY: The treatment area is designed to prevent releases to surface and ground water.

C. NOISE LEVEL: Noise levels will remain the same as currently experienced in the BG-3 area.

D. NATURAL RESOURCES:

(1) Wildlife - No significant impact will result from the proposed action. Approximately five acres will be cleared for the treatment area.

(2) Vegetation - No impact will result from the proposed action other than clearing the treatment site. No unusual or endangered vegetation has been identified at the site.

(3) Energy - No unusual energy requirements are expected.

(4) No historical or cultural features will be affected by this action. The site has been surveyed for significant cultural or historical locations and none were found.

E. SOLID AND HAZARDOUS WASTE MANAGEMENT: All waste derived from this action will be regulated as a Corrective Action Management Unit (CAMU) which is set up under Comprehensive Environmental, Response, Compensation and Liability Act (CERCLA). This system is set up to expedite remediation at CERCLA sites. In addition all waste handling and disposal methods will be reviewed by EPA and the Texas Natural Resource Conservation Commission (TNRCC).

F. URBAN QUALITY: The proposed action is situated in a rural location and within the boundaries of LHAAP and will not have a adverse impact on local communities. Noise will not increase above current levels for residences outside the plant. The proposed action could disrupt local or regional socioeconomic conditions by closing BG-3 for the remediation which could impact plant operation and employment. Efforts are being made by the involved parties to coordinate on going activities with the investigation and remediation of BG-3.

G. INTERGOVERNMENTAL CONFLICTS: There was a compromise on the site chosen for the treatment facility. Since BG-3 is still an active burning ground and safety regulations restrict how close other operations can be located. To prevent needless spread of contamination, the treatment facility should be as close to BG-3 as possible. The site

chosen will require an exemption form the standard rules for distance.

No unresolvable problems are anticipated in this category. The proposed action does not conflict with any federal, state, or local land use plans or environmental statutes. There will be no significant regional or national/international environmental effects due to the proposed action.

H. IMPACT ON REUSE OR CONSERVATION POTENTIAL: The treatment facility site can be used for other purposes or it can be removed and reforested.

I. RELATIONSHIP OF SHORT-TERM USES OF THE ENVIRONMENT AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY: The remediation will enhance the long term use of the BG-3 area.

J. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES: None are expected to occur with this action.

VI. Listing of Agencies and Persons Consulted:

A. Mr. Tom Brantley, Forester, Thiokol Corporation, Karnack, Texas.

B. Mr. David Burroughs, Manager Environmental Quality, Thiokol Corporation, Karnack, Texas.

C. Mr. Steve Flowers, Senior Environmental Engineer, Thiokol Corporation, Karnack, Texas.

D. Mr. Lynn Muckelrath, U. S. Army, Longhorn Army Ammunition Plant, Karnack, Texas.

E. Mr. Lonnie Spunaugle, Senior Engineer, Thiokol Corporation, Karnack, Texas.

VII. Preparer of this Document: Mr. William A. Sniffen, Thiokol Corporation.

VIII. Conclusion: As a result of this Environmental Assessment, it is concluded that with established waste management techniques, no significant adverse impact will result from the proposed action, and that the action will not be environmentally controversial. Therefore, an Environmental Impact Statement is not required.

007287

ENVIRONMENTAL ASSESSMENT
for the
PROPOSED TREATMENT AREA
for
BURNING GROUND 3

LONGHORN ARMY AMMUNITION PLANT

DECEMBER 1993

Prepared by:

William A. Sniffen
Environmental Engineer
Thiokol Corporation

Date: 12-2-93

Reviewed by:

Lynn Muckelrath
Environmental Coordinator
LHAAP

Date: 6 Dec 93

Reviewed by:

David Burroughs
Manager Environmental Quality
Thiokol Corporation

Date: 12-2-93

Reviewed by:

Robert E. Mills
OPSEC
LHAAP/LAAP

Date: 2 Dec 93

Approved by:

Lawrence J. Sowa
LTC, OD
Commanding
LHAAP/LAAP

Date: 6 Dec 93

007288

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

REPLY TO
ATTENTION OF

December 1,1993

SMCLO-EN-EV

SUBJECT: Meeting, Longhorn Army Ammunition Plant, for Technical Review Committee (TRC) - December 8, 1993.

Environmental Protection Agency
ATTN: Lisa M. Price (6H-ET)
1445 Ross Avenue
Dallas, Texas 75202

Dear Ms. Price:

Enclosed is a tentative agenda for the TRC Meeting. This will be the eighth meeting for the TRC, and we hope that you will be able to attend.

If you have any questions or suggestions regarding the meeting or agenda, contact Mr. Lynn Muckelrath (903) 679-2980.

Sincerely,

Lawrence J. Sowa
Lieutenant Colonel , U. S. Army
Commanding Officer

Enclosure

LONGHORN ARMY AMMUNITION PLANT MEETING AGENDA

MEETING: TECHNICAL REVIEW COMMITTEE (TRC) & PROGRAM MANAGERS

LOCATION: LONGHORN ARMY AMMUNITION PLANT MARSHALL , TEXAS BLDG. 703

DATE / TIME: DECEMBER 8, 1993 9:00 A.M. THRU DECEMBER 9, AS REQUIRED

SIGN IN: AT ENTRANCE OF LHAAP THERE IS A GATE HOUSE WHERE YOU SIGN IN. THE GUARD WILL ISSUE A TEMPORARY BADGE. IF YOU BRING A CAMERA PLEASE REQUEST A CAMERA PERMIT.

AGENDA -TRC

I. COMMENTS & STATUS.- R. I. /PHASE I

A. EBASCO-SITES LHAAP - 1,11,13,14,XX,27
B. SVERDRUP -SITES LHAAP - 12,16,17,18,24,29,32
C. SUMPS- COE -SITE LHAAP - 35
D. WESTON - ADDENDUM - SITE LHAAP-1 -IN PROCESS
E. AWD - PHASE I IRA SITES 18 & 24

II. SCHEDULES

III. INVESTIGATION DERIVED WASTES

IV. SCOPING POTENTIAL SITE CLOSURES

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

007290

REPLY TO
ATTENTION OF

December 2, 1993

Environmental Protection Agency
ATTN: Lisa M. Price (6-ET)
1445 Ross Avenue
Dallas, TX 75202

Dear Ms. Price:

Enclosed is an update Deadlines for Primary and Secondary documents of Longhorn Army Ammunition Plant in regard to the Federal Facility Agreement.

If you have any questions please contact Mr. Lynn Muckelrath at 903-679-2980.

Sincerely,

Lawrence J. Sowa
Lieutenant Colonel, U. S. Army
Commanding Officer

Enclosure

LONGHORN ARMY AMMUNITION PLANT

DEADLINES FOR PRIMARY AND SECONDARY DOCUMENTS

007291

TASK NAME	GROUP #1 (1,11, 13,14,XX,27)	GROUP #2 (12,16 17,18,24,29,32)	145 SUMPS	IRA at 18 & 24
Phase I Field Summary Report (S)				
Army	16 Oct 93	13 Dec 93	7 Jan 94	
Regulators	28 Nov 93	27 Jan 93	21 Feb 94	
Phase II Work Plan (S)				
Army	2 Jun 94	5 Aug 94	22 Apr 94	6 Nov 93
Regulators	17 Jul 94	19 Sep 94	6 Jun 94	14 Dec 93
Phase II Field Investigations (S)				
Mobilize	31 Aug 94	3 Nov 94	11 Jul 94	20 Feb 94
Data Results	23 Apr 95	26 Jun 95	2 May 95	4 Aug 94
Site Characterization Summary (S)				
Army	25 May 95	28 Jul 95	3 Jul 95	
Regulators	9 Jul 95	11 Sep 95	17 Aug 95	
RI Report (P)				
Army	23 Oct 95	25 Dec 95	30 Jan 96	
Regulators	23 Dec 95	24 Feb 96	31 Mar 96	
Final	21 Feb 96	24 Apr 96	30 May 96	

(as o Dec 93)

LONGHORN ARMY AMMUNITION PLANT

DEADLINES FOR PRIMARY AND SECONDARY DOCUMENTS

00729?

TASK NAME	GROUP #1 (1,11, 13,14,XX,27)	GROUP #2 (12,16 17,18,24,29,32)	145 SUMPS	IRA at 18 & 24
Initial Screening of Alternatives (P)				
Army	23 Mar 94	23 Mar 94	23 Mar 94	23 Mar 94
Regulators	23 May 94	23 May 94	23 May 94	23 May 94
Final	22 Jul 94	22 Jul 94	22 Jul 94	22 Jul 94
Risk Assessment (P)				
Army	24 May 95	27 Jul 95	1 Aug 95	17 Nov 93
Regulators	24 Jul 95	23 Aug 95	1 Oct 95	17 Jan 94
Final	22 Sep 95	22 Oct 95	30 Nov 95	18 Mar 94
Pilot Study (S)				
Army	23 Jul 95	26 Sep 95	2 Aug 95	20 Aug 94
Regulators	6 Sep 95	10 Nov 95	16 Sep 95	27 Sep 94
Treatability Study Report (S)				
Army	20 Jan 96	25 Mar 96	17 Jan 96	
Regulators	5 Mar 96	9 May 96	2 Mar 96	

(as of Dec 93)

LONGHORN ARMY AMMUNITION PLANT

DEADLINES FOR PRIMARY AND SECONDARY DOCUMENTS

007293

TASK NAME	GROUP #1 (1,11, 13,14,XX,27)	GROUP #2 (12,16 17,18,24,29,32)	145 SUMPS	IRA at 18 & 24
Detailed Analysis of Alternatives (S)				
Army	19 Jul 96	22 Sep 96	16 Jul 96	
Regulators	2 Sep 96	6 Nov 96	30 Aug 96	
Feasibility Study Report (P)				
Army	16 Jan 97	22 Mar 97	13 Jan 97	
Regulators	18 Mar 97	22 May 97	15 Mar 97	
Final	17 May 97	21 Jul 97	14 May 97	
Proposed Plan (P)				
Army	18 Jul 97	20 Sep 97	15 Jul 97	1 Apr 94
Regulators	17 Sep 97	20 Nov 97	14 Sep 97	1 Jun 94
Final	16 Nov 97	19 Jan 98	13 Nov 97	31 Jul 94
Responsiveness Summary (P)				
Army	20 Jan 98	25 Mar 98	17 Jan 98	25 Sep 94
Regulators	22 Mar 98	25 May 98	19 Mar 98	25 Nov 94
Final	21 May 98	24 Jul 98	17 May 98	24 Jan 95

(as of Dec 93)

LONGHORN ARMY AMMUNITION PLANT

DEADLINES FOR PRIMARY AND SECONDARY DOCUMENTS

007294

TASK NAME	GROUP #1 (1,11, 13,14,XX,27)	GROUP #2 (12,16 17,18,24,29,32)	145 SUMPS	IRA at 18 & 24
Record of Decision (P)				
Army	20 Feb 98	25 Apr 98	16 Feb 98	19 Oct 94
Regulators	22 Apr 98	25 Jun 98	18 Apr 98	19 Dec 94
Final	21 Jun 98	24 Aug 98	17 Jun 98	17 Feb 95
Remedial Design Work Plan (P)				
Army	6 Mar 98	10 May 98	3 Mar 98	
Regulators	5 May 98	10 Jul 98	3 May 98	
Final	4 Jul 98	8 Sep 98	2 Jul 98	
30% Remedial Design (S)				
Army	5 Aug 98	10 Oct 98	2 Aug 98	
Regulators	4 Sep 98	9 Nov 98	1 Sep 98	
60% Remedial Design (S)				
Army	4 Nov 98	9 Jan 99	1 Nov 98	
Regulators	4 Dec 98	8 Feb 98	1 Dec 98	

(as of 1 Dec 93)

LONGHORN ARMY AMMUNITION PLANT

DEADLINES FOR PRIMARY AND SECONDARY DOCUMENTS

007295

TASK NAME	GROUP #1 (1,11, 13,14,XX,27)	GROUP #2 (12,16 17,18,24,29,32)	145 SUMPS	IRA at 18 & 24
90% Remedial Design (S)				
Army	3 Feb 99	9 Apr 99	31 Jan 99	
Regulators	4 Mar 99	9 May 99	1 Mar 99	
Remedial Design (P)				
Army	4 May 99	7 Jul 99	1 May 99	
Regulators	18 Jun 99	23 Aug 99	15 Jun 99	
Final	1 Aug 99	6 Oct 99	29 Jul 99	
Remedial Action Work Plan (P)				
Army	2 Oct 99	7 Dec 99	29 Sep 99	3 Nov 94
Regulators	2 Dec 99	4 Feb 00	29 Nov 99	3 Jan 95
Final	31 Jan 00	4 Apr 00	28 Jan 00	3 Mar 95
Remedial Action				
Mobilize	25 May 00	4 Aug 00	25 May 00	19 Mar 95

(as of Dec 93)

WORK BREAKDOWN SCHEDULE
ASSUMPTIONS
(as of 1 Dec 93)

1. Funding is available and remedial activities will not be delayed because of lack of funding.

2. Additional field work will not be required beyond RI Phase 1 and 2.

3. For Secondary Document, the turn around time (from the time Draft document is sent to Army to review to the time Draft Final is sent to regulators to review) is **6** weeks.

4. For Primary Document, the turn around time is **8** weeks.

5. A "Scope Meeting" for the next phase of work will be schedule **2** weeks after the regulators received the Draft Final.

6. We will start to develop a scope **1 week** after the "Scope Meeting". It will take **30 days** to develop this scope.

7. For work done by A-E contractors, the procurement time for an A-E contract is:
   * **49 days** if <$500,000
   * **90 days** if >$500,000

8. This schedule is based on ideal situation that is we can resolve all comments within **14 days** and produce the next document within **14 days.**

9. The turn around time for field sample analysis (w/validation) is **75 days.** And **30 days** for review/summarize field data. Total is **105 days.**

10. Phase II Field Investigations (actual Field Work) is **120 days** or less for Group #1 and 2. **180 days** or less for the sumps.

11. RI Phase II Field Investigations for Area 1A will be conducted with RI Phase II Field Investigations of Group #2.

12. No significant delays due to active burning.

13. No significant weather delays (possible 20+ days on Phase II field work).

14. No significant changed site conditions (such as large buried debris, or munitions).

WORK BREAKDOWN SCHEDULE

for 1,11,13,14,XX,27

(as of 30 Nov 93)

TASK NAME	START DATE	DUR	END DATE
INVESTIGATION & ANALYSIS	**02/02/93**		**04/23/95**
Phase I Field Work	02/02/93		04/02/93
Phase I Sample Analysis	completed in Oct 93		
Review/Summarize Phase I Data	completed in Oct 93		
Prepare Phase I Field Summary Report (FSR)	completed in Oct 93		
Army review Draft FSR	10/16/93	14	10/30/93
Comment Resolution	11/01/93	14	11/15/93
Prepare Draft Final FSR	11/16/93	14	11/27/93
Regulators review Draft Final FSR	11/28/93	14	12/12/93
Comment Resolution	12/13/93	7	12/20/93
Final Phase I FSR Approval	12/21/93	14	01/04/94
Prepare scope for Phase II	12/16/93	30	01/15/94
Procure A-E Contractor	01/16/94	90	04/16/94
Prepare Draft Phase II Work Plan Addm	04/17/94	45	06/01/94
Army review Draft Phase II WP Addm	06/02/94	14	06/16/94
Comment Resolution	06/17/94	14	07/01/94
Prepare Draft Final Phase II WP Addm	07/02/94	14	07/16/94
Regulators review Draft Final WP Addm	07/17/94	14	07/31/94
Comment Resolution	08/01/94	14	08/15/94
Final Phase II Work Plan Approval	08/16/94	14	08/30/94
Negotiation for Phase II Field Work	07/17/94	42	08/30/94
Mobilize for Phase II Field Work	08/31/94	7	09/07/94
Perform Phase II Field Work	09/08/94	120	01/06/95
Phase II Sample Analysis	01/07/95	75	03/23/95
Review/Summarize Phase II Data	03/24/95	30	04/23/95
SITE CHARACTERIZATION SUMMARY	**03/24/95**	**144**	**08/22/95**
Negotiation for SCS Report	03/24/95	30	04/23/95
Prepare Draft SCS Report	04/24/95	30	05/24/95
Army review Draft SCS Report	05/25/95	14	06/08/95
Comment Resolution	06/09/95	14	06/23/95
Prepare Draft Final SCS Report	06/24/95	14	07/08/95
Regulators review Draft Final SCS Report	07/09/95	14	07/23/95
Comment Resolution	07/24/95	14	08/07/95
Final SCS Report Approval	08/08/95	14	08/22/95

INITIAL: _____ _____

TASK NAME	START DATE	DUR	END DATE
RI REPORT	**07/24/95**	**204**	**02/21/96**
Negotiation for RI Report	07/24/95	28	08/22/95
Prepare Draft RI Report	08/23/95	60	10/22/95
Army review Draft RI Report	10/23/95	30	11/22/95
Comment Resolution	11/23/95	14	12/07/95
Prepare Draft Final RI Report	12/08/95	14	12/22/95
Regulators review Draft Final RI Report	12/23/95	30	01/22/96
Comment Resolution	01/23/96	14	02/06/96
Final RI Report Approval	02/07/96	14	02/21/96
RISK ASSESSMENT	**03/24/95**	**176**	**09/22/95**
Prepare Draft Risk Assessment Report	03/24/95	60	05/23/95
Army review Draft Risk Assessment Report	05/24/95	30	06/23/95
Comment Resolution	06/24/95	14	07/08/95
Prepare Draft Final RA Report	07/09/95	14	07/23/95
Regulators review Draft Final RA Report	07/24/95	30	08/23/95
Comment Resolution	08/24/95	14	09/07/95
Final Risk Assessment Report Approval	09/08/95	14	09/22/95
INITIAL SCREENING OF ALTERNATIVES	**11/16/93**	**237**	**07/22/94**
Prepare a list of Media of Concern	11/16/93	21	12/07/93
Army review list of Media of Concern	12/08/93	14	12/22/93
Comment Resolution	12/23/93	14	01/06/94
Regulators review list of Media of Concern	01/07/94	14	01/21/94
Comment Resolution	01/22/94	14	02/05/94
Final list of Media of Concern	02/05/94	14	02/19/94
Prepare Draft ISA Report	02/20/94	30	03/22/94
Army review Draft ISA Report	03/23/94	30	04/22/94
Comment Resolution	04/23/94	14	05/07/94
Prepare Draft Final ISA Report	05/08/94	14	05/22/94
Regulator review Draft Final ISA Report	05/23/94	30	06/22/94
Comment Resolution	06/23/94	14	07/07/94
Final ISA Report Approval	07/08/94	14	07/22/94
TREATABILITY STUDY/PILOT TESTING	**04/23/95**	**348**	**04/18/96**
Prepare Draft Pilot Study FI Report	04/23/95	90	07/22/95
Army review Draft Pilot Study	07/23/95	14	08/06/95
Comment Resolution	08/07/95	14	08/21/95
Prepare Draft Final Pilot Study	08/22/95	14	09/05/95
Regulators review Draft Final Pilot Study	09/06/95	14	09/20/95
Comment Resolution	09/21/95	14	10/05/95
Final Pilot Study Approval	10/06/95	14	10/20/95

INITIAL: _____ _____

TASK NAME	START DATE	DUR	END DATE
TREATABILITY STUDY/PILOT TESTING (cont'd)			
Prepare Draft Treatability Study	10/21/95	90	01/19/96
Army review Draft TS	01/20/96	14	02/03/96
Comment Resolution	02/04/96	14	02/18/96
Prepare Draft Final TS	02/19/96	14	03/04/96
Regulators review Draft Final TS	03/05/96	14	03/19/96
Comment Resolution	03/20/96	14	04/03/96
Final TS Approval	04/04/96	14	04/18/96
DETAILED ANALYSIS OF ALTERNATIVES	**04/19/96**	**174**	**10/16/96**
Prepare Draft DAOA	04/19/96	90	07/18/96
Army review Draft DAOA	07/19/96	14	08/02/96
Comment Resolution	08/03/96	14	08/17/96
Prepare Draft Final DAOA	08/18/96	14	09/01/96
Regulators review Draft Final DAOA	09/02/96	14	09/16/96
Comment Resolution	09/17/96	14	10/01/96
Final DAOA Approval	10/02/96	14	10/16/96
FEASIBILITY STUDY REPORT	**10/17/96**	**206**	**05/17/97**
Prepare Draft FS Report	10/17/96	90	01/15/97
Army review Draft FS Report	01/16/97	30	02/15/97
Comment Resolution	02/16/97	14	03/02/97
Prepare Draft Final FS Report	03/03/97	14	03/17/97
Regulators review Draft Final FS Report	03/18/97	30	04/17/97
Comment Resolution	04/18/97	14	05/02/97
Final FS Report Approval	05/03/97	14	05/17/97
PROPOSED PLAN	**05/18/97**	**207**	**12/19/97**
Prepare Draft Proposed Plan	05/18/97	60	07/17/97
Army review Draft Proposed Plan	07/18/97	30	08/17/97
Comment Resolution	08/18/97	14	09/01/97
Prepare Draft Final Proposed Plan	09/02/97	14	09/16/97
Regulators review Draft Final PP	09/17/97	30	10/17/97
Comment Resolution	10/18/97	14	11/01/97
Final Proposed Plan Approval	11/02/97	14	11/16/97
Public Meeting	11/17/97	1	11/18/97
Public Comment Period	11/19/97	30	12/19/97
RESPONSIVENESS SUMMARY	**12/20/97**	**146**	**05/21/98**
Prepare Draft Responsiveness Summary	12/20/97	30	01/19/98
Army review Draft RS	01/20/98	30	02/19/98
Comment Resolution	02/20/98	14	03/06/98
Prepare Draft Final RS	03/07/98	14	03/21/98
Regulators review Draft Final RS	03/22/98	30	04/21/98
Comment Resolution	04/22/98	14	05/06/98
Final RS Approval	05/07/98	14	05/21/98

TASK NAME	START DATE	DUR	END DATE
RECORD OF DECISION	**12/20/97**	**176**	**06/21/98**
Prepare Draft ROD	12/20/97	60	02/19/98
Army review Draft ROD	02/20/98	30	03/22/98
Comment Resolution	03/23/98	14	04/06/98
Prepare Draft Final ROD	04/07/98	14	04/21/98
Regulators review Draft Final ROD	04/22/98	30	05/22/98
Comment Resolution	05/23/98	14	06/06/98
Final ROD Approval	06/07/98	14	06/21/98
REMEDIAL DESIGN WORK PLAN	**12/20/97**	**191**	**07/04/98**
Prepare Draft RD Work Plan	12/20/97	75	03/05/98
Army review Draft RD WP	03/06/98	30	04/05/98
Comment Resolution	04/06/98	14	04/20/98
Prepare Draft Final RD WP	04/21/98	14	05/04/98
Regulators review Draft Final RD WP	05/05/98	30	06/04/98
Comment Resolution	06/05/98	14	06/19/98
Final RD WP Approval	06/20/98	14	07/04/98
REMEDIAL DESIGN	**07/05/98**	**372**	**08/01/99**
Prepare 30% Plans and Specs	07/05/98	30	08/04/98
Army review 30%	08/05/98	14	08/19/98
Comment Resolution	08/20/98	14	09/03/98
Regulators review 30%	09/04/98	14	09/18/98
Comment Resolution	09/19/98	14	10/03/98
Prepare 60% Plans and Specs	10/04/98	30	11/03/98
Army review 60%	11/04/98	14	11/18/98
Comment Resolution	11/19/98	14	12/03/98
Regulators review 60%	12/04/98	14	12/18/98
Comment Resolution	12/19/98	14	01/02/99
Prepare 90% Plans and Specs	01/03/99	30	02/02/99
Army review 90%	02/03/99	14	02/17/99
Comment Resolution	02/18/99	14	03/03/99
Regulators review 90%	03/04/99	14	03/18/99
Comment Resolution	03/19/99	14	04/02/99
Prepare Draft Remdial Design	04/03/99	30	05/03/99
Army review Draft RD	05/04/99	14	05/18/99
Comment Resolution	05/19/99	14	06/02/99
Prepare Draft Final RD	06/03/99	14	06/17/99
Regulators review Draft Final RD	06/18/99	14	07/02/99
Comment Resolution	07/03/99	14	07/17/99
Final Remedial Design Approval	07/18/99	14	08/01/99

INITIAL: ____ ____

TASK NAME	START DATE	DUR	END DATE
REMEDIAL ACTION WORK PLAN	**08/02/99**	**176**	**09/18/99**
Prepare Draft RA WP	08/02/99	60	10/01/99
Army review Draft RA WP	10/02/99	30	11/01/99
Comment Resolution	11/02/99	14	11/16/99
Prepare Draft Final RA WP	11/17/99	14	12/01/99
Regulators review Draft Final RA WP	12/02/99	30	01/01/00
Comment Resolution	01/02/00	14	01/16/00
Final Remedial Action WP Approval	01/17/00	14	01/31/00
REMEDIAL ACTION	**12/02/99**	**to**	**completed**
Procure contractor	12/02/99	90	02/27/00
Prepare Draft RA Field Work Plan	02/28/00	30	03/29/00
Army review Draft RA FWP	03/30/00	21	04/20/00
Comment Resolution	04/21/00	14	05/05/00
Prepare Final RA FWP	05/06/00	14	05/20/00
Mobilize to perform RA FW	05/21/00	7	05/28/00
Remedial Action begin	**05/29/00**		

SIGNATURE: _____ _____

WORK BREAKDOWN SCHEDULE
for 12,16,17,18,24,29,32
(as of 30 Nov 93)

TASK NAME	START DATE	DUR	END DATE
INVESTIGATION & ANALYSIS			**06/26/95**
Phase I Field Work			
Phase I Sample Analysis			
Review/Summarize Phase I Data			
Prepare Phase I Field Summary Report (FSR)			
Army review Draft FSR	12/13/93	14	12/27/93
Comment Resolution	12/28/93	14	01/11/94
Prepare Draft Final FSR	01/12/94	14	01/26/94
Regulators review Draft Final FSR	01/27/94	14	02/10/94
Comment Resolution	02/11/94	7	02/18/94
Final Phase I FSR Approval	02/19/94	14	03/05/94
Prepare scope for Phase II	02/18/94	30	03/20/94
Procure A-E Contractor	03/21/94	90	06/19/94
Prepare Draft Phase II Work Plan Addm	06/20/94	45	08/04/94
Army review Draft Phase II WP Addm	08/05/94	14	08/19/94
Comment Resolution	08/20/94	14	09/03/94
Prepare Draft Final Phase II WP Addm	09/04/94	14	09/18/94
Regulators review Draft Final WP Addm	09/19/94	14	10/03/94
Comment Resolution	10/04/94	14	10/18/94
Final Phase II Work Plan Approval	10/19/94	14	11/02/94
Negotiation for Phase II Field Work	09/19/94	42	11/02/94
Mobilize for Phase II Field Work	11/03/94	7	11/10/94
Perform Phase II Field Work	11/11/94	120	03/11/95
Phase II Sample Analysis	03/12/95	75	05/26/95
Review/Summarize Phase II Data	05/27/95	30	06/26/95
SITE CHARACTERIZATION SUMMARY	**05/27/95**	**144**	**10/24/95**
Negotiation for SCS Report	05/27/95	30	06/26/95
Prepare Draft SCS Report	06/27/95	30	07/27/95
Army review Draft SCS Report	07/28/95	14	08/11/95
Comment Resolution	08/12/95	14	08/26/95
Prepare Draft Final SCS Report	08/27/95	14	09/10/95
Regulators review Draft Final SCS Report	09/11/95	14	09/25/95
Comment Resolution	09/26/95	14	10/10/95
Final SCS Report Approval	10/11/95	14	10/24/95

INITIAL: _____ _____

TASK NAME	START DATE	DUR	END DATE
RI REPORT	**09/26/95**	**204**	**04/24/96**
Negotiation for RI Report	09/26/95	28	10/24/95
Prepare Draft RI Report	10/25/95	60	12/24/95
Army review Draft RI Report	12/25/95	30	01/24/96
Comment Resolution	01/25/96	14	02/08/96
Prepare Draft Final RI Report	02/09/96	14	02/23/96
Regulators review Draft Final RI Report	02/24/96	30	03/25/96
Comment Resolution	03/26/96	14	04/09/96
Final RI Report Approval	04/10/96	14	04/24/96
RISK ASSESSMENT	**05/27/95**	**176**	**10/22/95**
Prepare Draft Risk Assessment Report	05/27/95	60	07/26/95
Army review Draft Risk Assessment Report	07/27/95	30	08/26/95
Comment Resolution	08/27/95	14	09/07/95
Prepare Draft Final RA Report	08/08/95	14	08/22/95
Regulators review Draft Final RA Report	08/23/95	30	09/22/95
Comment Resolution	09/23/95	14	10/07/95
Final Risk Assessment Report Approval	10/08/95	14	10/22/95
INITIAL SCREENING OF ALTERNATIVES	**11/16/93**	**237**	**07/22/94**
Prepare a list of Media of Concern	11/16/93	21	12/07/93
Army review list of Media of Concern	12/08/93	14	12/22/93
Comment Resolution	12/23/93	14	01/06/94
Regulators review list of Media of Concern	01/07/94	14	01/21/94
Comment Resolution	01/22/94	14	02/05/94
Final list of Media of Concern	02/05/94	14	02/19/94
Prepare Draft ISA Report	02/20/94	30	03/22/94
Army review Draft ISA Report	03/23/94	30	04/22/94
Comment Resolution	04/23/94	14	05/07/94
Prepare Draft Final ISA Report	05/08/94	14	05/22/94
Regulator review Draft Final ISA Report	05/23/94	30	06/22/94
Comment Resolution	06/23/94	14	07/07/94
Final ISA Report Approval	07/08/94	14	07/22/94
TREATABILITY STUDY/PILOT TESTING	**06/27/95**	**348**	**06/22/96**
Prepare Draft Pilot Study FI Report	06/27/95	90	09/25/95
Army review Draft Pilot Study	09/26/95	14	10/10/95
Comment Resolution	10/11/95	14	10/25/95
Prepare Draft Final Pilot Study	10/26/95	14	11/09/95
Regulators review Draft Final Pilot Study	11/10/95	14	11/24/95
Comment Resolution	11/25/95	14	12/09/95
Final Pilot Study Approval	12/10/95	14	12/24/95

INITIAL: ____ ____

TASK NAME	START DATE	DUR	END DATE
TREATABILITY STUDY/PILOT TESTING (cont'd)			
Prepare Draft Treatability Study	12/25/95	90	03/24/96
Army review Draft TS	03/25/96	14	04/08/96
Comment Resolution	04/09/96	14	04/23/96
Prepare Draft Final TS	04/24/96	14	05/08/96
Regulators review Draft Final TS	05/09/96	14	05/23/96
Comment Resolution	05/24/96	14	06/07/96
Final TS Approval	06/08/96	14	06/22/96
DETAILED ANALYSIS OF ALTERNATIVES	**06/23/96**	**174**	**12/20/96**
Prepare Draft DAOA	06/23/96	90	09/21/96
Army review Draft DAOA	09/22/96	14	10/06/96
Comment Resolution	10/07/96	14	10/21/96
Prepare Draft Final DAOA	10/22/96	14	11/05/96
Regulators review Draft Final DAOA	11/06/96	14	11/20/96
Comment Resolution	11/21/96	14	12/05/96
Final DAOA Approval	12/06/96	14	12/20/96
FEASIBILITY STUDY REPORT	**12/21/96**	**206**	**07/21/97**
Prepare Draft FS Report	12/21/96	90	03/21/97
Army review Draft FS Report	03/22/97	30	04/21/97
Comment Resolution	04/22/97	14	05/06/97
Prepare Draft Final FS Report	05/07/97	14	05/21/97
Regulators review Draft Final FS Report	05/22/97	30	06/21/97
Comment Resolution	06/22/97	14	07/06/97
Final FS Report Approval	07/07/97	14	07/21/97
PROPOSED PLAN	**07/21/97**	**207**	**02/21/98**
Prepare Draft Proposed Plan	07/21/97	60	09/19/97
Army review Draft Proposed Plan	09/20/97	30	10/20/97
Comment Resolution	10/21/97	14	11/04/97
Prepare Draft Final Proposed Plan	11/05/97	14	11/19/97
Regulators review Draft Final PP	11/20/97	30	12/20/97
Comment Resolution	12/21/97	14	01/04/98
Final Proposed Plan Approval	01/05/98	14	01/19/98
Public Meeting	01/20/98	1	01/21/98
Public Comment Period	01/22/98	30	02/21/98
RESPONSIVENESS SUMMARY	**02/22/98**	**146**	**07/24/98**
Prepare Draft Responsiveness Summary	02/22/98	30	03/24/98
Army review Draft RS	03/25/98	30	04/24/98
Comment Resolution	04/25/98	14	05/09/98
Prepare Draft Final RS	05/10/98	14	05/24/98
Regulators review Draft Final RS	05/25/98	30	06/24/98
Comment Resolution	06/25/98	14	07/09/98
Final RS Approval	07/10/98	14	07/24/98

TASK NAME	START DATE	DUR	END DATE
RECORD OF DECISION	**02/22/98**	**176**	**08/24/98**
Prepare Draft ROD	02/22/98	60	04/24/98
Army review Draft ROD	04/25/98	30	05/25/98
Comment Resolution	05/26/98	14	06/09/98
Prepare Draft Final ROD	06/10/98	14	06/24/98
Regulators review Draft Final ROD	06/25/98	30	07/25/98
Comment Resolution	07/26/98	14	08/09/98
Final ROD Approval	08/10/98	14	08/24/98
REMEDIAL DESIGN WORK PLAN	**02/22/98**	**191**	**09/08/98**
Prepare Draft RD Work Plan	02/22/98	75	05/09/98
Army review Draft RD WP	05/10/98	30	06/09/98
Comment Resolution	06/10/98	14	06/24/98
Prepare Draft Final RD WP	06/25/98	14	07/09/98
Regulators review Draft Final RD WP	07/10/98	30	08/09/98
Comment Resolution	08/10/98	14	08/24/98
Final RD WP Approval	08/25/98	14	09/08/98
REMEDIAL DESIGN	**09/09/98**	**372**	**10/06/99**
Prepare 30% Plans and Specs	09/09/98	30	10/09/98
Army review 30%	10/10/98	14	10/24/98
Comment Resolution	10/25/98	14	11/08/98
Regulators review 30%	11/09/98	14	11/23/98
Comment Resolution	11/24/98	14	12/08/98
Prepare 60% Plans and Specs	12/09/98	30	01/08/99
Army review 60%	01/09/99	14	01/23/99
Comment Resolution	01/24/99	14	02/07/99
Regulators review 60%	02/08/99	14	02/22/99
Comment Resolution	02/23/99	14	03/08/99
Prepare 90% Plans and Specs	03/09/99	30	04/08/99
Army review 90%	04/09/99	14	04/23/99
Comment Resolution	04/24/99	14	05/08/99
Regulators review 90%	05/09/99	14	05/23/99
Comment Resolution	05/24/99	14	06/07/99
Prepare Draft Remdial Design	06/08/99	30	07/08/99
Army review Draft RD	07/09/99	14	07/23/99
Comment Resolution	07/24/99	14	08/07/99
Prepare Draft Final RD	08/08/99	14	08/22/99
Regulators review Draft Final RD	08/23/99	14	09/06/99
Comment Resolution	09/07/99	14	09/21/99
Final Remedial Design Approval	09/22/99	14	10/06/99

INITIAL: _____ _____

TASK NAME	START DATE	DUR	END DATE
REMEDIAL ACTION WORK PLAN	**10/07/99**	**176**	**04/04/00**
Prepare Draft RA WP	10/07/99	60	12/06/99
Army review Draft RA WP	12/07/99	30	01/06/00
Comment Resolution	01/07/00	14	01/21/00
Prepare Draft Final RA WP	01/22/00	14	02/03/00
Regulators review Draft Final RA WP	02/04/00	30	03/05/00
Comment Resolution	03/06/00	14	03/20/00
Final Remedial Action WP Approval	03/21/00	14	04/04/00
REMEDIAL ACTION	**02/04/00**	**to**	**completed**
Procure contractor	02/04/00	90	05/04/00
Prepare Draft RA Field Work Plan	05/05/00	30	06/04/00
Army review Draft RA FWP	06/05/00	21	06/26/00
Comment Resolution	06/27/00	14	07/11/00
Prepare Final RA FWP	07/12/00	14	07/26/00
Mobilize to perform RA FW	07/27/00	7	08/03/00
Remedial Action begin	**08/04/00**		

SIGNATURE: _____ _____

WORK BREAKDOWN SCHEDULE
for 145 Sumps
(as of 1 Dec 93)

TASK NAME	START DATE	DUR	END DATE
INVESTIGATION & ANALYSIS			**05/02/95**
Phase I Field Work			
Phase I Sample Analysis			
Review/Summarize Phase I Data			
Prepare Phase I Field Summary Report (FSR)			
Army review Draft FSR	01/07/94	14	01/21/94
Comment Resolution	01/22/94	14	02/05/94
Prepare Draft Final FSR	02/06/94	14	02/20/94
Regulators review Draft Final FSR	02/21/94	14	03/07/94
Comment Resolution	03/08/94	7	03/15/94
Final Phase I FSR Approval	03/16/94	14	03/30/94
Prepare Draft Phase II Work Plan Addm	03/07/94	45	04/21/94
Army review Draft Phase II WP Addm	04/22/94	14	05/06/94
Comment Resolution	05/07/94	14	05/21/94
Prepare Draft Final Phase II WP Addm	05/22/94	14	06/05/94
Regulators review Draft Final WP Addm	06/06/94	14	06/10/94
Comment Resolution	06/11/94	14	06/25/94
Final Phase II Work Plan Approval	06/26/94	14	07/10/94
Mobilize for Phase II Field Work	07/11/94	7	07/18/94
Perform Phase II Field Work	07/19/94	180	01/15/95
Phase II Sample Analysis	01/16/95	75	04/01/95
Review/Summarize Phase II Data	04/02/95	30	05/02/95
SITE CHARACTERIZATION SUMMARY	**05/03/95**	**144**	**09/30/95**
Prepare Draft SCS Report	05/03/95	60	07/02/95
Army review Draft SCS Report	07/03/95	14	07/17/95
Comment Resolution	07/18/95	14	08/01/95
Prepare Draft Final SCS Report	08/02/95	14	08/16/95
Regulators review Draft Final SCS Report	08/17/95	14	08/31/95
Comment Resolution	09/01/95	14	09/15/95
Final SCS Report Approval	09/16/95	14	09/30/95

INITIAL: ____ ____

TASK NAME	START DATE	DUR	END DATE
RI REPORT	**10/01/95**	**204**	**05/30/96**
Prepare Draft RI Report	10/01/95	120	01/29/96
Army review Draft RI Report	01/30/96	30	02/29/96
Comment Resolution	03/01/96	14	03/15/96
Prepare Draft Final RI Report	03/16/96	14	03/30/96
Regulators review Draft Final RI Report	03/31/96	30	04/30/96
Comment Resolution	05/01/96	14	05/15/96
Final RI Report Approval	05/16/96	14	05/30/96
RISK ASSESSMENT	**04/02/95**	**176**	**11/30/95**
Prepare Draft Risk Assessment Report	04/02/95	120	07/31/95
Army review Draft Risk Assessment Report	08/01/95	30	08/31/95
Comment Resolution	09/01/95	14	09/15/95
Prepare Draft Final RA Report	09/16/95	14	09/30/95
Regulators review Draft Final RA Report	10/01/95	30	10/31/95
Comment Resolution	11/01/95	14	11/15/95
Final Risk Assessment Report Approval	11/16/95	14	11/30/95
INITIAL SCREENING OF ALTERNATIVES	**11/16/93**	**237**	**07/22/94**
Prepare a list of Media of Concern	11/16/93	21	12/07/93
Army review list of Media of Concern	12/08/93	14	12/22/93
Comment Resolution	12/23/93	14	01/06/94
Regulators review list of Media of Concern	01/07/94	14	01/21/94
Comment Resolution	01/22/94	14	02/05/94
Final list of Media of Concern	02/05/94	14	02/19/94
Prepare Draft ISA Report	02/20/94	30	03/22/94
Army review Draft ISA Report	03/23/94	30	04/22/94
Comment Resolution	04/23/94	14	05/07/94
Prepare Draft Final ISA Report	05/08/94	14	05/22/94
Regulator review Draft Final ISA Report	05/23/94	30	06/22/94
Comment Resolution	06/23/94	14	07/07/94
Final ISA Report Approval	07/08/94	14	07/22/94
TREATABILITY STUDY/PILOT TESTING	**05/03/95**	**348**	**04/15/96**
Prepare Draft Pilot Study FI Report	05/03/95	90	08/01/95
Army review Draft Pilot Study	08/02/95	14	08/16/95
Comment Resolution	08/17/95	14	08/31/95
Prepare Draft Final Pilot Study	09/01/95	14	09/15/95
Regulators review Draft Final Pilot Study	09/16/95	14	09/17/95
Comment Resolution	09/18/95	14	10/02/95
Final Pilot Study Approval	10/03/95	14	10/17/95

INITIAL: ____ ____

TASK NAME	START DATE	DUR	END DATE
TREATABILITY STUDY/PILOT TESTING (cont'd)			
Prepare Draft Treatability Study	10/18/95	90	01/16/96
Army review Draft TS	01/17/96	14	01/31/96
Comment Resolution	02/01/96	14	02/15/96
Prepare Draft Final TS	02/16/96	14	03/01/96
Regulators review Draft Final TS	03/02/96	14	03/16/96
Comment Resolution	03/17/96	14	03/31/96
Final TS Approval	04/01/96	14	04/15/96
DETAILED ANALYSIS OF ALTERNATIVES	**04/16/96**	**174**	**10/13/96**
Prepare Draft DAOA	04/16/96	90	07/15/96
Army review Draft DAOA	07/16/96	14	07/30/96
Comment Resolution	07/31/96	14	08/14/96
Prepare Draft Final DAOA	08/15/96	14	08/29/96
Regulators review Draft Final DAOA	08/30/96	14	09/13/96
Comment Resolution	09/14/96	14	09/28/96
Final DAOA Approval	09/29/96	14	10/13/96
FEASIBILITY STUDY REPORT	**10/14/96**	**206**	**05/14/97**
Prepare Draft FS Report	10/14/96	90	01/12/97
Army review Draft FS Report	01/13/97	30	02/12/97
Comment Resolution	02/13/97	14	02/27/97
Prepare Draft Final FS Report	02/28/97	14	03/14/97
Regulators review Draft Final FS Report	03/15/97	30	04/14/97
Comment Resolution	04/15/97	14	04/29/97
Final FS Report Approval	04/30/97	14	05/14/97
PROPOSED PLAN	**05/15/97**	**207**	**12/16/97**
Prepare Draft Proposed Plan	05/15/97	60	07/14/97
Army review Draft Proposed Plan	07/15/97	30	08/14/97
Comment Resolution	08/15/97	14	08/29/97
Prepare Draft Final Proposed Plan	08/30/97	14	09/13/97
Regulators review Draft Final PP	09/14/97	30	10/14/97
Comment Resolution	10/15/97	14	10/29/97
Final Proposed Plan Approval	10/30/97	14	11/13/97
Public Meeting	11/14/97	1	11/15/97
Public Comment Period	11/16/97	30	12/16/97
RESPONSIVENESS SUMMARY	**12/17/97**	**146**	**05/17/98**
Prepare Draft Responsiveness Summary	12/17/97	30	01/16/98
Army review Draft RS	01/17/98	30	02/16/98
Comment Resolution	02/17/98	14	03/03/98
Prepare Draft Final RS	03/04/98	14	03/18/98
Regulators review Draft Final RS	03/19/98	30	04/18/98
Comment Resolution	04/19/98	14	05/02/98
Final RS Approval	05/03/98	14	05/17/98

TASK NAME	START DATE	DUR	END DATE
RECORD OF DECISION	**12/17/97**	**176**	**06/17/98**
Prepare Draft ROD	12/17/97	60	02/15/98
Army review Draft ROD	02/16/98	30	03/18/98
Comment Resolution	03/19/98	14	04/02/98
Prepare Draft Final ROD	04/03/98	14	04/17/98
Regulators review Draft Final ROD	04/18/98	30	05/18/98
Comment Resolution	05/19/98	14	06/02/98
Final ROD Approval	06/03/98	14	06/17/98
REMEDIAL DESIGN WORK PLAN	**12/17/97**	**191**	**07/02/98**
Prepare Draft RD Work Plan	12/17/97	75	03/02/98
Army review Draft RD WP	03/03/98	30	04/02/98
Comment Resolution	04/03/98	14	04/17/98
Prepare Draft Final RD WP	04/18/98	14	05/02/98
Regulators review Draft Final RD WP	05/03/98	30	06/02/98
Comment Resolution	06/03/98	14	06/17/98
Final RD WP Approval	06/18/98	14	07/02/98
REMEDIAL DESIGN	**07/03/98**	**372**	**07/29/99**
Prepare 30% Plans and Specs	07/03/98	30	08/02/98
Army review 30%	08/02/98	14	08/16/98
Comment Resolution	08/17/98	14	08/31/98
Regulators review 30%	09/01/98	14	09/15/98
Comment Resolution	09/16/98	14	09/30/98
Prepare 60% Plans and Specs	10/01/98	30	10/31/98
Army review 60%	11/01/98	14	11/15/98
Comment Resolution	11/16/98	14	11/30/98
Regulators review 60%	12/01/98	14	12/15/98
Comment Resolution	12/16/98	14	12/30/98
Prepare 90% Plans and Specs	12/31/98	30	01/30/99
Army review 90%	01/31/99	14	02/14/99
Comment Resolution	02/15/99	14	02/29/99
Regulators review 90%	03/01/99	14	03/15/99
Comment Resolution	03/16/98	14	03/30/99
Prepare Draft Remdial Design	03/31/99	30	04/30/99
Army review Draft RD	05/01/99	14	05/15/99
Comment Resolution	05/16/99	14	05/30/99
Prepare Draft Final RD	05/31/99	14	06/14/99
Regulators review Draft Final RD	06/15/99	14	06/29/99
Comment Resolution	06/30/99	14	07/14/99
Final Remedial Design Approval	07/15/99	14	07/29/99

INITIAL: _____ _____

TASK NAME	START DATE	DUR	END DATE
REMEDIAL ACTION WORK PLAN	**07/30/99**	**176**	**12/14/99**
Prepare Draft RA WP	07/30/99	60	09/28/99
Army review Draft RA WP	09/29/99	30	10/29/99
Comment Resolution	10/30/99	14	11/13/99
Prepare Draft Final RA WP	11/14/99	14	11/28/99
Regulators review Draft Final RA WP	11/29/99	30	12/29/00
Comment Resolution	12/30/99	14	01/13/00
Final Remedial Action WP Approval	01/14/00	14	01/28/00
REMEDIAL ACTION	**11/29/99**	**to**	**completed**
Procure contractor	11/29/99	90	03/02/00
Prepare Draft RA Field Work Plan	03/03/00	30	04/02/00
Army review Draft RA FWP	04/03/00	21	04/24/00
Comment Resolution	04/25/00	14	05/09/00
Prepare Final RA FWP	05/10/00	14	05/24/00
Mobilize to perform RA FW	05/25/00	7	06/01/00
Remedial Action begin	**06/02/00**		

SIGNATURE: _____ _____

WORK BREAKDOWN SCHEDULE
for IRA at 18 & 24
(as of 30 Nov 93)

TASK NAME	START DATE	DUR	END DATE
INVESTIGATION & ANALYSIS	**11/08/93**		**11/03/94**
Phase I Field Work	11/08/93	29	12/07/93
Phase I Sample Analysis	12/08/93	21	12/29/93
Data Validation	12/30/93	30	01/29/94
Review/Summarize Phase I Data	01/30/94	14	02/13/94
Prepare Draft Phase II Project Plan	09/24/93	42	11/05/93
Army review Draft Phase II PP	11/06/93	14	11/20/93
Comment Resolution	11/21/93	7	11/28/93
Prepare Draft Final Phase II PP	11/29/93	14	12/13/93
Regulators review Draft Final PP	12/14/93	14	12/28/93
Comment Resolution	12/29/93	7	01/05/94
Final Phase II PP Approval	01/06/94	14	01/20/94
Prepare Phase II Field Work Plan	12/14/93	45	01/28/94
COE review Phase II FW Plan	01/29/94	14	02/12/94
Commnet Resolution	02/13/94	7	02/20/94
Mobilize for Phase II Field Work	02/20/94	7	02/27/94
Perform Phase II Field Work	02/28/94	120	06/28/94
Phase II Sample Analysis	06/29/94	21	07/20/94
Review/Summarize Phase II Data	07/21/94	14	08/04/94
Prepare Draft Phase II FSR	08/05/94	14	08/19/94
Army review Draft Phase II FSR	08/20/94	14	09/03/94
Comment Resolution	09/04/94	7	09/11/94
Prepare Draft Final Phase II FSR	09/12/94	14	09/26/94
Regulators review Draft Final FSR	09/27/94	14	10/11/94
Comment Resolution	10/12/94	7	10/19/94
Final Phase II FSR Approval	10/20/94	14	11/03/94
RISK ASSESSMENT	**10/02/93**	**161**	**03/18/94**
Prepare Draft Risk Assessment Report	10/02/93	45	11/16/93
Army review Draft Risk Assessment Report	11/17/93	30	12/17/93
Comment Resolution	12/18/93	14	01/01/94
Prepare Draft Final RA Report	01/02/94	14	01/16/94
Regulators review Draft Final RA Report	01/17/94	30	02/16/94
Comment Resolution	02/17/94	14	03/03/94
Final Risk Assessment Report Approval	03/04/94	14	03/18/94

INITIAL: _____ _____

TASK NAME	START DATE	DUR	END DATE
PROPOSED PLAN	**02/14/94**	**131**	**09/02/94**
Prepare Draft Proposed Plan	02/14/94	45	03/31/94
Army review Draft Proposed Plan	04/01/94	30	05/01/94
Comment Resolution	05/02/94	14	05/16/94
Prepare Draft Final Proposed Plan	05/17/94	14	05/31/94
Regulators review Draft Final PP	06/01/94	30	07/01/94
Comment Resolution	07/02/94	14	07/16/94
Final Proposed Plan Approval	07/17/94	14	07/31/94
Public Meeting	08/01/94	1	08/02/94
Public Comment Period	08/03/94	30	09/02/94
RESPONSIVENESS SUMMARY	**09/03/94**	**91**	**01/24/95**
Prepare Draft Responsiveness Summary	09/03/94	21	09/24/94
Army review Draft RS	09/25/94	30	10/25/94
Comment Resolution	10/26/94	14	11/09/94
Prepare Draft Final RS	11/10/94	14	11/24/94
Regulators review Draft Final RS	11/25/94	30	12/25/94
Comment Resolution	12/26/94	14	01/09/95
Final RS Approval	01/10/95	14	01/24/95
RECORD OF DECISION	**09/03/94**	**161**	**02/17/95**
Prepare Draft ROD	09/03/94	45	10/18/94
Army review Draft ROD	10/19/94	30	11/18/94
Comment Resolution	11/19/94	14	12/03/94
Prepare Draft Final ROD	12/04/94	14	12/18/94
Regulators review Draft Final ROD	12/19/94	30	01/18/95
Comment Resolution	01/19/95	14	02/02/95
Final ROD Approval	02/03/95	14	02/17/95
IRA WORK PLAN	**09/03/94**	**176**	**03/03/95**
Prepare Draft RD Work Plan	09/03/94	60	11/02/94
Army review Draft RD WP	11/03/94	30	12/03/94
Comment Resolution	12/04/94	14	12/18/94
Prepare Draft Final RD WP	12/19/94	14	01/02/95
Regulators review Draft Final RD WP	01/03/95	30	02/02/95
Comment Resolution	02/03/95	14	02/17/95
Final RD WP Approval	02/17/95	14	03/03/95
IRA FINAL DESIGN/CONSTRUCTION			
Procure Contractor	09/03/94	90	12/02/94
Mobilize for IRA	03/04/95	14	03/18/95
IRA begin	**03/19/95**		

SIGNATURE: _____ - _____

LONGHORN ARMY AMMUNITION PLANT MEETING AGENDA

MEETING: TECHNICAL REVIEW COMMITTEE (TRC) & PROGRAM MANAGERS

LOCATION: LONGHORN ARMY AMMUNITION PLANT MARSHALL , TEXAS BLDG. 703

DATE / TIME: DECEMBER 8, 1993 9:00 A.M. THRU DECEMBER 9, AS REQUIRED

SIGN IN: AT ENTRANCE OF LHAAP THERE IS A GATE HOUSE WHERE YOU SIGN IN. THE GUARD WILL ISSUE A TEMPORARY BADGE. IF YOU BRING A CAMERA PLEASE REQUEST A CAMERA PERMIT.

AGENDA -TRC

I. COMMENTS & STATUS.- R. I. /PHASE I
   - A. EBASCO-SITES LHAAP - 1,11,13,14,XX,27
   - B. SVERDRUP -SITES LHAAP - 12,16,17,18,24,29,32
   - C. SUMPS- COE -SITE LHAAP - 35
   - D. WESTON - ADDENDUM - SITE LHAAP-1 -IN PROCESS
   - E. AWD - PHASE I IRA SITES 18 & 24

II. SCHEDULES

III. INVESTIGATION DERIVED WASTES

IV. SCOPING POTENTIAL SITE CLOSURES

ATTENDANCE ROSTER

007315

PLEASE PRINT: NAME; ORGANIZATION/LOCATION; OFFICE SYMBOL; AND PHONE NUMBER

PROJECT: IRC Meeting for LAAP-IRP

SUBJECT:

LOCATION: Longhorn Army Ammunition Plant, Marshall, Texas DATE:

NAME	ORGANIZATION	TELEPHONE
1. Lisa Mant Price	: EPA	: 214 655 6744
2. JOHN SOWA, LTC.	: LHAAP	: 903-679-2100
3. Scott Weber	: Corps/Southwestern Div, Dallas	: 214/767-2406/FAX 4373
4. IRA NATHAN	: LHAAP	: 903-679-2613
5. LYNN MUCKELRATH	: LHAAP	: 903-628-2580
6. CYRIL ONEWOKAE	: HQ AMCCOM, AMSMC-EQE	: (309) 782-1350
7. MICHAEL MOORE	: TNRCC SUPERFUND INVESTIGATION	: (512) 239-2483
8. JERALD BROUGHTON	: SFIM-AEC/CEWES	: 601-634-3328
9. Kathleen Buchi	: SFIM-AEC-IRP	: 410-671-1541
10. Bill Sniffen	: Thiokol Corp	: 318-459-5633
11. STEVE NOLEN	: COE - Tulsa	: 918-669-7120
12. Clif Warren	: COE - Tulsa	: 918-669-7505
13. Doyle Williams	: L.A.A.P.	: 318-459-5108
14. Walter Kneib	: COE Tulsa	: 918-669-7045
15. JOANNA POLK	: COE-TULSA	: 918/669-7046
16. Scott Henderson	: COE - Tulsa	: 918/669-7500
17. Wade Anderson	: COE - Tulsa	: 918 669-7153
18. John Wagner	: COE - Tulsa	: 918-669-7239
19. JIM CARTER	: CORPS - FT WORTH EASTERN AREA	: 318-676-3365
20. Pamela Jones	: Metcalf & Eddy	: 713-690-2585

ATTENDANCE ROSTER

007316

PLEASE PRINT: NAME; ORGANIZATION/LOCATION; OFFICE SYMBOL; AND PHONE NUMBER

PROJECT: _____

SUBJECT: _____

LOCATION: _____ DATE: _____

NAME	ORGANIZATION	TELEPHONE
1. Alvie L Nichols	TNRCC, Superfund Engineer	(512) 239-2439
2. H.L. "Bud" Jones	TNRCC, Region 5, Tyler (DoD Rep.)	903-595-5466
3. CPT Ross Nguyen	Tulsa District, COE	918-669-7557
4.	:	:
5.	:	:
6.	:	:
7.	:	:
8.	:	:
9.	:	:
10.	:	:
11.	:	:
12.	:	:
13.	:	:
14.	:	:
15.	:	:
16.	:	:
17.	:	:
18.	:	:
19.	:	:
20.	:	:

Start 12/13/

December 8, 1993
TRC meeting

007317

INSTALLATION RESTORATION PROGRAM
for
LONGHORN ARMY AMMUNITION PLANT

LONGHORN ARMY AMMUNITION PLANT

RI PHASE I ACCOMPLISHMENT

007318

- RI Phase I for 13 areas was completed in June 1993.
  * Drilled 76 soil borings (5 to 25 ft bgs).
  * Installed 21 monitoring wells (25 to 45 ft bgs).
  * Analyzed 409 soil samples, 166 water samples, 63 surface water samples, and 63 sediment samples.

- RI Phase I for 145 sumps was completed in August 1993.
  * Drilled 290 soil borings.
  * Analyzed 656 soil samples.

LONGHORN ARMY AMMUNITION PLANT

ENVIRONMENTAL ACTIVITIES SINCE 16 NOV 93

007319

- Draft Baseline Risk Assessment was sent to Army for review on 17 Nov 93.
- Draft Final Field Summary Report was sent to the regulators for review on 23 Nov 93.
- RI Phase I Field Investigation for Area 1A began on 30 Nov 93.
- AWD (cost-plus contractor) was mobilized on 30 Nov 93 to Longhorn to conduct waste characterization on Phase I IDWs.
- Completed Phase I IRA Field Work at Burning Ground #3 & UEP on 6 Dec 93.
- A revised Deadlines for Primary and Secondary documents was sent to the regulators for review on 2 Dec 93.

LONGHORN ARMY AMMUNITION PLANT

PHASE I RI at AREA LHAAP-1A

007320

- Mobilized on 30 Nov 93.

- The field investigation will include the following:
  * Drill 4 soil borings (7 feet deep).
  * Install 5 monitoring wells (25 feet deep).
  * Collect 27 soil samples.
  * Collect 5 groundwater samples.

LONGHORN ARMY AMMUNITION PLANT

PRELIMINARY RESULTS FROM RMIS 35 (SUMPS) RI

007321

- Soil samples from 20 waste racks (100%) and 115 waste sumps (92%) showed a total metals concentration higher than background and and the risk reduction standard #2 levels.

- There are 5 toxic metals prevalent throughout this investigation. They are: arsenic, barium, chromium, cadmium, and lead.

- For organics, only 2 sumps out of 145 have exceed the risk reduction standard #2 levels.

LONGHORN ARMY AMMUNITION PLANT

PHASE I IRA at BURNING GROUND #3 & UEP

007322

- Began on 8 Nov 93. Ended 6 Dec 93.
- Installed 4 shallow monitoring wells.
- Drilled and sampled 8 soil borings.
- Installed 1 vertical extraction well.
- Groundwater sampling and testing of the newly installed monitoring wells, extraction well, and 50 existing monitoring wells.
- Collected 6 soil samples using trenching methods.