Yolo ~~LEHR Library~~ Copy

RECORD COPY
PROJECT: 17523
DOE Box
13.9.2. Disposal

LEHR
RECEIVED
AUG 5 1996

WORK PLAN
DOE DISPOSAL BOX AREA
EXCAVATION AND DISPOSAL

LABORATORY FOR ENERGY-RELATED HEALTH RESEARCH (LEHR)
UNIVERSITY OF CALIFORNIA AT DAVIS

Prepared for:

Battelle Pacific Northwest Laboratory
Richland, Washington

July 1996

Controlled Copy #: 01
Issued To: Dawn Mitchell
Issued: 8/2/96

LEHR
RECEIVED
NOV 22 1996

Mitchell controlled copy #1-2

INTERNATIONAL TECHNOLOGY CORPORATION

MEMORANDUM

U. C. Davis LEHR D&D Project
Davis, CA

November 5, 1996

To: Control Document Distribution
From: William D. Rankin, Field Coordinator
Subject: Copies of Controlled Documents

Effective immediately, all Controlled Copies of the below listed documents are reclassified as uncontrolled and no further updates will be issued. This reclassification is due to the closure of the project. Controlled documents need not be returned and may be retained as uncontrolled copies, or destroyed.

- UC Davis LEHR D&D Project Work Plan (Vol. 1 & 2)
- Work Plan, DOE Disposal Box Excavation and Sampling
- Work Plan, Limited Field Investigation
- Work Plan, DOE Disposal Box Excavation and Disposal

c: Doc. Dist.
T. Grummitt
R. Swatek

DOCUMENT TRANSMITTAL
U. C. DAVIS LEHR D&D PROJECT

The listed document(s) have been distributed to Dawn Mitchell
on 8/2/96 for the following reason:

☒ Initial Issue of Controlled Copy # 01

☐ Update of Controlled Copy #_____

☐ Information Only (Uncontrolled, will not be updated)

Document Name:	Revision
WORK PLAN, DOE DISPOSAL BOX AREA EXCAVATION AND DISPOSAL	0

Recieved by: [signature]

Company/Location:_____

Date Recieved:_____

Please sign indicating reciept of the listed documents in good condition and return this form within fifteen working days to:

LEHR D&D Project Document Control
IT Corporation c/o UC Davis
ITEH, Old Davis Road

Table of Contents

List of Tables iii
List of Figures iii
List of Acronyms iv
1.0 Introduction 1-1
1.1 DOE Box Area Background 1-1
1.2 Proposed Field Activities 1-2
1.3 Schedule of Proposed Field Activities 1-3
1.4 Organization 1-3
2.0 Field Activities 2-1
2.1 Site Preparation 2-1
2.2 Excavation Program 2-1
2.3 Separating the Labware from the Waste Matrix 2-2
2.4 Packaging the Waste Matrix for Disposal 2-2
2.5 Collecting Verification Soil Samples from Excavation 2-3
2.6 Backfilling the Excavation 2-3
2.7 Decontamination of Heavy Equipment 2-4
2.8 Shipping the Waste to an Off-Site Disposal Facility 2-4
3.0 Verification Sampling Activities 3-1
3.1 Chemical and Radiological Analysis 3-1
3.2 Sampling Methodology 3-1
3.3 Sample Documentation 3-1
3.3.1 Chain of Custody 3-3
3.3.2 Field Logbook 3-3
3.3.3 Sample Numbers 3-3
3.3.4 Sample Labels 3-4
3.3.5 Sample Seals 3-4
3.4 Sampling Procedures 3-4
4.0 Health and Safety Considerations 4-1
4.1 Hazard Analysis 4-1
4.1.1 Confined Space Entry 4-1

Table of Contents *(Continued)*

4.1.2 Radiological Exposure 4-1
4.1.3 Chemical Exposure 4-2
4.1.4 Heat Stress 4-2
4.2 Hazard Controls 4-2
4.2.1 Hazardous Work Permit 4-2
4.2.2 Boundaries 4-2
4.2.3 Heat Stress 4-3
4.2.4 PPE 4-3
4.2.5 Training 4-3
4.2.6 Buddy System 4-4
4.2.7 Safety Equipment 4-5
4.2.8 Air Monitoring 4-5
5.0 References 5-1
Appendix A - Standard Operating Procedures (SOP)

List of Tables

Table	Title	Page
3-1	DOE Box Analytical Sample Requirements	3-2

List of Figures

Figure	Title	Follows Page
1-1	Location Map	1-1
1-2	Site Plan	1-1
1-3	Project Organization	1-3
2-1	Disposal Area Plan	2-1

List of Acronyms

AA	Atomic Absorption
C	Centigrade
C-14	Carbon 14
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
COC	Chain of Custody
CQC	Contractor Quality Control
DAC	Derived Air Concentration
D&D	Decontamination and Decommissioning
DOE	Department of Energy (United States)
DOT	Department of Transportation (United States)
EPA	Environmental Protection Agency (United States)
EM	Electro Magnetics
EML	Environment Monitoring Laboratory
EZ	Exclusion Zone
FC	D&D Field Coordinator
GFAA	Graphite Furnace Atomic Absorption
GPR	Ground Penetrating Radar
H-3	Tritium
HNO_3	Nitric Acid
HSO	Health and Safety Officer
HSP	Health and Safety Procedure
HWP	Hazardous Work Permit
IATA	International Air Transport Association
ICAP	Inductively Coupled Argon Plasma
ID	Identification
IT	IT Corporation
LEHR	Laboratory for Energy Related Health Research
PID	Photoionization Detector
PM	Project Manager
PNL	Pacific Northwest Laboratories (Battelle)
PPE	Personal Protective Equipment
PQAS	Project Quality Assurance Specialist
PRG	Preliminary Remediation Goal
QA/QC	Quality Assurance/Quality Control
Ra	Radium
RCM	Radiological Control Manager
RCRA	Resource Conservation and Recovery Act
RCT	Radiation Control Technician
SCBA	Self Contained Breathing Apparatus

List of Acronyms (Continued)

SOP	Standard Operating Procedure
SQP	Standard Quality Procedure
Sr	Strontium
TCLP	Toxic Characteristic Leaching Procedure
TSM	Tailgate Safety Meeting
UCD	University of California at Davis
VOA	Volatile Organics Analysis

1.0 Introduction

This Work Plan has been prepared for the excavation, removal, and disposal of contaminated gravel and labware buried in the DOE Disposal Box Area at the Laboratory for Energy-Related Health Research (LEHR) at the University of California at Davis (UCD). The LEHR site is located southeast of the main campus on a 15-acre site leased from the University of California (Figure 1-1). The site consists of 15 buildings, including a Main Administration and Office Building, two animal hospitals, a laboratory and support buildings, waste storage facilities, numerous animal pens, and trench burial areas (Figure 1-2). The DOE Disposal Box Area was located and sampled in October 1995.

The objective of this Work Plan is to outline the field activities which will be undertaken to excavate, separate, backfill, and dispose of contaminated gravel and labware buried in the DOE Disposal Box area.

1.1 DOE Box Area Background

As part of a site investigation conducted in 1994, several significant anomalies were identified using Ground-penetrating Radar (GPR), Electro Magnetics (EM), and a magnetometer in an area believed to be the burial site for the DOE Box. This area is located on the west side of the asphalt road separating the two dog pen areas at the southern end and slightly to the north of an area where known burial of radioactive materials has been identified at LEHR (Figure 1-2). A visual examination of the general area showed a depression on the surface of the ground, indicating signs of uneven settlement in this area. The area had been previously disturbed as part of an investigation performed by Wahler and Associates in February of 1988. As part of the 1994 investigation, five soil gas probes were placed in the general area of the depression. They reported no indication of any volatiles being present in the area. A survey of the ground surface in this general area using radiological instruments indicated no activity above background.

In October 1995, IT Corporation (IT) performed a trenching program in this area to locate the DOE Box. The trenching program showed no evidence of a buried box but did find a disposal area in the same location where gravel and labware (consisting of bottles, vials, and syringes) were disposed. The disposal area was found to be approximately 36 feet by 9 feet

DRAWN BY	SJZ 4-11-94	CHECKED BY / APPROVED BY	TPS 6-20-94 / TLS 6-20-94	DRAWING NUMBER	191226-A13

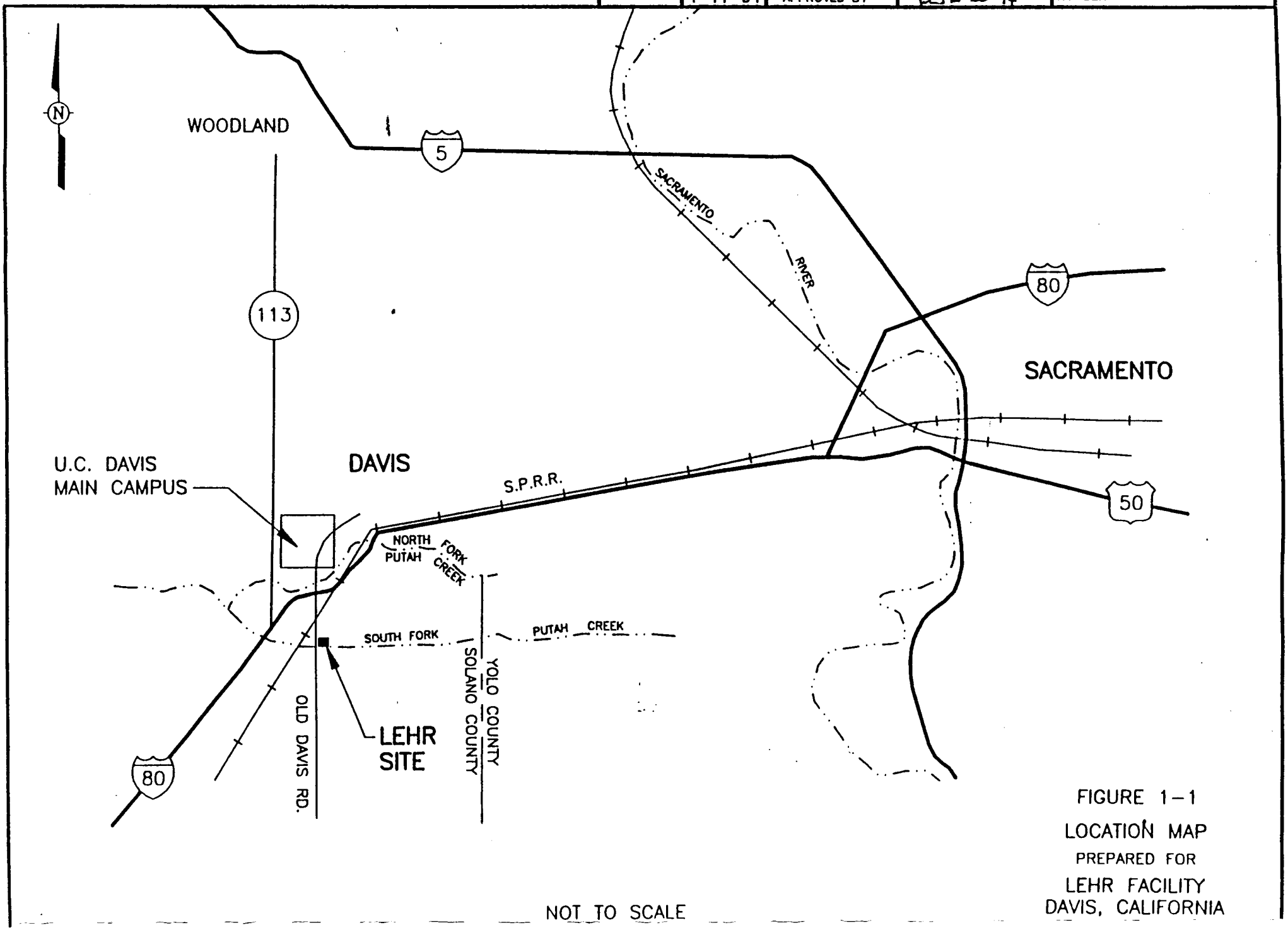


FIGURE 1-1
LOCATION MAP
PREPARED FOR
LEHR FACILITY
DAVIS, CALIFORNIA

DRAWN BY	SJZ 5-20-96	CHECKED BY	TPi 5-20-96	DRAWING NUMBER	191226-A30
		APPROVED BY	TPG 5-20-96		

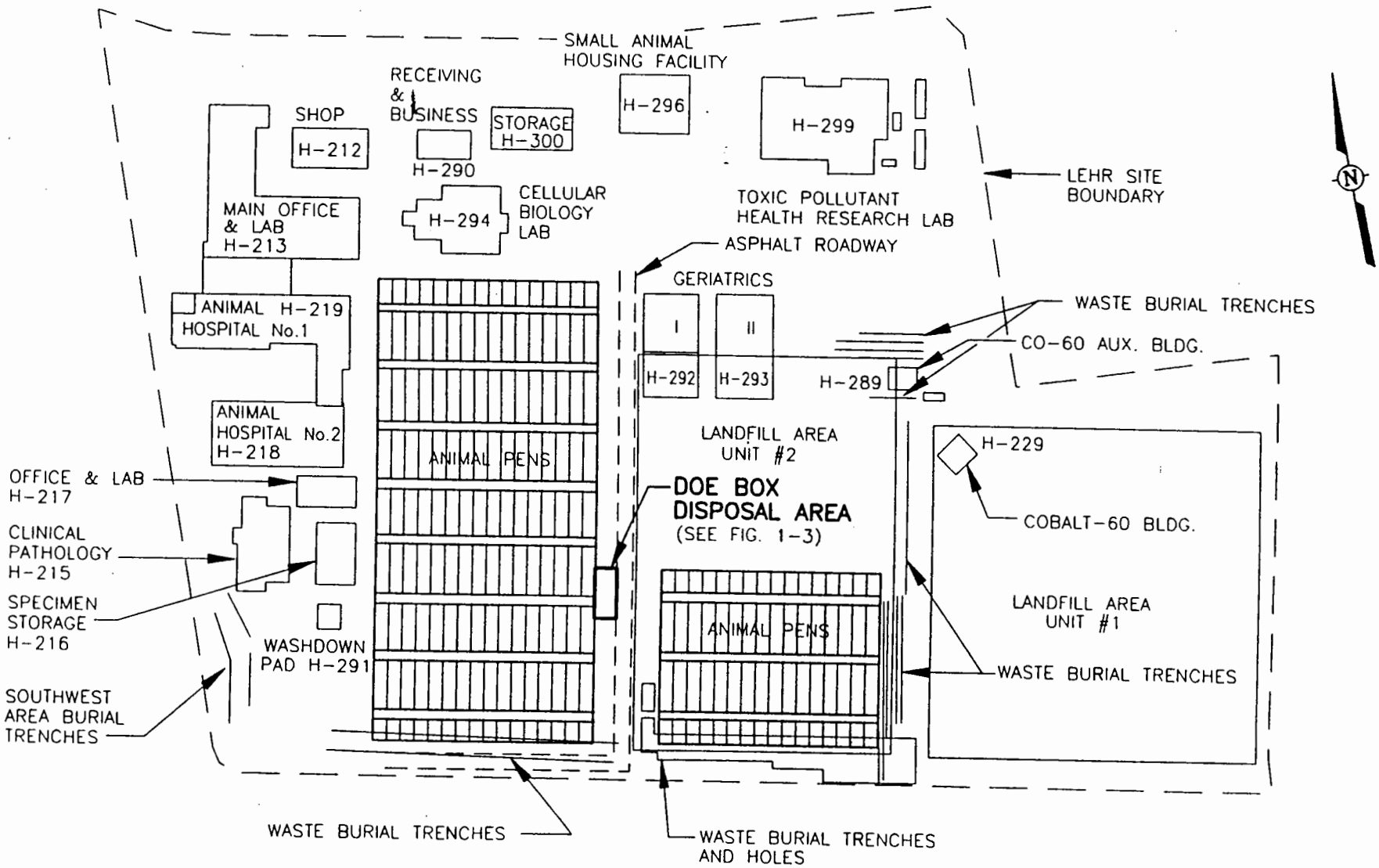


FIGURE 1-2

SITE PLAN

PREPARED FOR

LEHR FACILITY
DAVIS, CALIFORNIA

LE-DBX(LE3)

by 12 feet. The exterior boundary of the area was defined by metal revetment strips placed side by side. The top three feet of cover material in the disposal area were excavated and found to be free of any waste materials. Beneath this layer were fragments of deteriorated plywood overlaying a waste matrix consisting of gravel and labware. There were also signs of a white powdery substance found in the waste matrix. Samples of the gravel, labware, and soils were collected to depths of 10 feet and analyzed for ignitability, corrosivity, metals, radiochemistry, pesticides/PCBs, herbicides, volatile organic compounds, and semivolatile organic compounds. The laboratory results indicate that the waste matrix (gravel) contains elevated concentrations of Sr-90 and Ra-226. No chemical contaminants were identified in either the waste matrix or surrounding soils that exceeded either background or Environmental Protection Agency (EPA) Region IX preliminary remediation goals (PRGs). No radiological contaminants were identified in surrounding soils. The above sampling was consistent with reports that low-level contaminated gravel and lab trash had been disposed of in the area.

1.2 Proposed Field Activities

The following is a list of the proposed field activities which will be performed to excavate and remove the gravel and labware buried at the DOE Disposal Box Area at LEHR. These activities include:

- Preparing the site
- Excavating the gravel overburden from the work area
- Excavating the top 2-3 feet of soil from the excavation area
- Excavating the contaminated waste matrix (gravel and labware)
- Separating the labware from the waste matrix
- Packaging the contaminated waste matrix for disposal
- Collecting soil samples from the sides and bottom of the excavation
- Backfilling the excavation with non-contaminated soil
- Shipping the contaminated waste to an off-site disposal facility.

It should be noted that during the execution of the above activities, provisions will be made at each step of the way to stop work at any time should radiological or industrial hygiene field measurements indicate an unsafe situation. However, based on the data obtained during the prior trenching and sampling program, it is anticipated that field work can be conducted using modified Level D personal protective clothing (PPE). Modified Level D PPE is described in Section 4.2.4.

1.3 Schedule of Proposed Field Activities

The anticipated start date for the proposed field activities is mid-August 1996. It is estimated that this work will be completed over a three-week period. The actual start of work will be dependent on the approval of this Plan and documents required by CERCLA, including a time-critical Action Memorandum.

1.4 Organization

The project organization for this work is shown on Figure 1-3.

1.0 Introduction

This Work Plan has been prepared for the excavation, removal, and disposal of contaminated gravel and labware buried in the DOE Disposal Box Area at the Laboratory for Energy-Related Health Research (LEHR) at the University of California at Davis (UCD). The LEHR site is located southeast of the main campus on a 15-acre site leased from the University of California (Figure 1-1). The site consists of 15 buildings, including a Main Administration and Office Building, two animal hospitals, a laboratory and support buildings, waste storage facilities, numerous animal pens, and trench burial areas (Figure 1-2). The DOE Disposal Box Area was located and sampled in October 1995.

The objective of this Work Plan is to outline the field activities which will be undertaken to excavate, separate, backfill, and dispose of contaminated gravel and labware buried in the DOE Disposal Box area.

1.1 DOE Box Area Background

As part of a site investigation conducted in 1994, several significant anomalies were identified using Ground-penetrating Radar (GPR), Electro Magnetics (EM), and a magnetometer in an area believed to be the burial site for the DOE Box. This area is located on the west side of the asphalt road separating the two dog pen areas at the southern end and slightly to the north of an area where known burial of radioactive materials has been identified at LEHR (Figure 1-2). A visual examination of the general area showed a depression on the surface of the ground, indicating signs of uneven settlement in this area. The area had been previously disturbed as part of an investigation performed by Wahler and Associates in February of 1988. As part of the 1994 investigation, five soil gas probes were placed in the general area of the depression. They reported no indication of any volatiles being present in the area. A survey of the ground surface in this general area using radiological instruments indicated no activity above background.

In October 1995, IT Corporation (IT) performed a trenching program in this area to locate the DOE Box. The trenching program showed no evidence of a buried box but did find a disposal area in the same location where gravel and labware (consisting of bottles, vials, and syringes) were disposed. The disposal area was found to be approximately 36 feet by 9 feet

by 12 feet. The exterior boundary of the area was defined by metal revetment strips placed side by side to an approximate depth of 10 feet. The top three feet of cover material in the disposal area were excavated and found to be free of any waste materials. Beneath this layer were fragments of deteriorated plywood overlaying a waste matrix consisting of gravel and labware. There were also signs of a white powdery substance found in the waste matrix. Samples of the gravel, labware, and soils were collected to depths of 10 feet and analyzed for ignitability, corrosivity, metals, radiochemistry, pesticides/PCBs, herbicides, volatile organic compounds, and semivolatile organic compounds. The laboratory results indicate that the waste matrix (gravel) contains elevated concentrations of Sr-90 and Ra-226. No chemical contaminants were identified in either the waste matrix or surrounding soils that exceeded either background or Environmental Protection Agency (EPA) Region IX preliminary remediation goals (PRGs). No radiological contaminants were identified in surrounding soils. The above sampling was consistent with reports that low-level contaminated gravel and lab trash had been disposed of in the area.

1.2 Proposed Field Activities

The following is a list of the proposed field activities which will be performed to excavate and remove the gravel and labware buried at the DOE Disposal Box Area at LEHR. These activities include:

- Preparing the site
- Excavating the gravel overburden from the work area
- Excavating the top 2-3 feet of soil from the excavation area
- Excavating the contaminated waste matrix (gravel and labware)
- Separating the labware from the waste matrix
- Packaging the contaminated waste matrix for disposal
- Collecting soil samples from the sides and bottom of the excavation
- Backfilling the excavation with non-contaminated soil
- Shipping the contaminated waste to an off-site disposal facility.

It should be noted that during the execution of the above activities, provisions will be made at each step of the way to stop work at any time should radiological or industrial hygiene field measurements indicate an unsafe situation. However, based on the data obtained during the prior trenching and sampling program, it is anticipated that field work can be conducted using modified Level D personal protective clothing (PPE). Modified Level D PPE is described in Section 4.2.4.

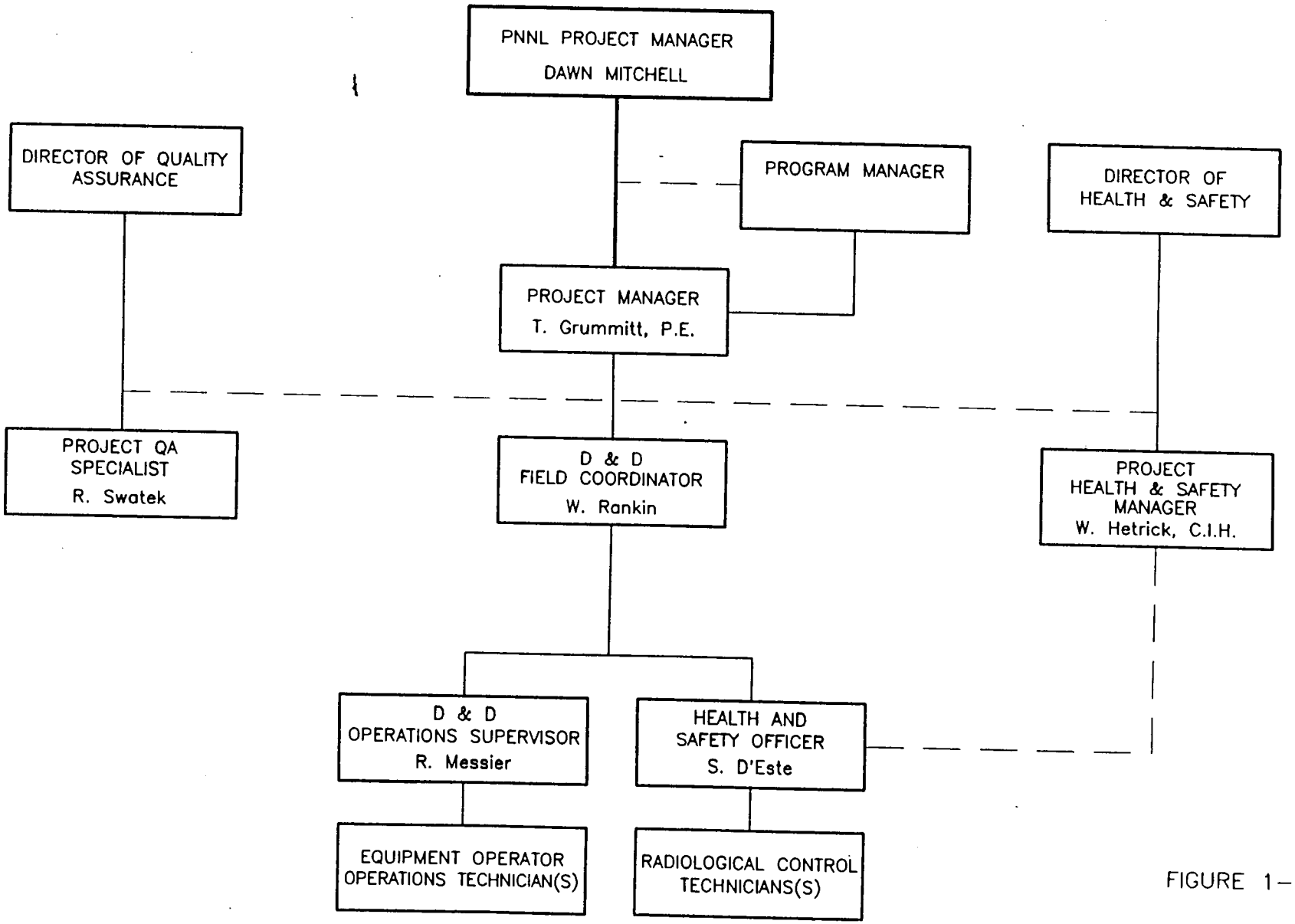
1.3 Schedule of Proposed Field Activities

The anticipated start date for the proposed field activities is mid-August 1996. It is estimated that this work will be completed over a three-week period. The actual start of work will be dependent on the approval of this Plan and documents required by CERCLA, including a time-critical Action Memorandum.

1.4 Organization

The project organization for this work is shown on Figure 1-3.

DRAWN BY	SJZ 9-20-95	CHECKED BY	TPG 5-20-96	DRAWING NUMBER	191226-A26
		APPROVED BY	TPG 5-20-96		



DENOTES LINE OF RESPOSIBILITY

DENOTES LINE OF COMMUNICATION

FIGURE 1-3

PROJECT ORGANIZATION
PREPARED FOR
LEHR FACILITY
DAVIS, CALIFORNIA

LE-ORB1(LE3)

2.0 Field Activities

The field activities to be performed for excavating, removing, backfilling, and disposal of the waste matrix at DOE Disposal Box Area are described below.

2.1 Site Preparation

The trenching program performed by IT in October 1995 defined a burial area of approximately 36 feet long by 9 feet wide (Figure 2-1). A tree stump, which is located at the north end of the disposal area, will be removed prior to the start of excavation activities. Following removal of the tree stump and weeds, the work area will be staked for future field activities. Following the staking, the boundaries of the proposed excavation will be identified with white paint. The LEHR Site Engineer will initiate the UCD Digging Permit, "Location Map, and Acceptance Form." The UCD Building and Maintenance Department, Communications Department as well as USA (800-642-2444) will be contacted to confirm the absence of any underground utilities in the general area.

A 16-foot by 36-foot Laydown Area, which will be used to temporarily store the removed waste matrix, will be established on the asphalt road east of the Disposal Area (Figure 2-1). A 16-foot by 40-foot Separation and Packaging Area will also be established south of the disposal area on both sides of the asphalt road. These two areas will be connected by a Bobcat Travel Area (Figure 2-1). All three areas will be prepared by laying 6-mil poly sheeting over the ground surface and placing 4'x8'x1/2" plywood sheets over it. The plywood sheets will then be covered with 20-mil Herculiner. Following the establishment of these areas, the work areas will be posted.

2.2 Excavation Program

Once all utilities have been cleared and permits obtained, a backhoe will be mobilized to the site. The backhoe will be positioned on the asphalt road adjacent to the site at one of two locations shown on Figure 2-1. The excavation work will initially begin at the south end of the disposal area.

The first step of the excavation program will be to remove the gravel overburden from the top of the disposal area and the area immediately surrounding the excavation. The removed

DRAWN BY	SJZ 5-20-96	CHECKED BY	TPG - 5-20-96	DRAWING NUMBER	191226-A31
		APPROVED BY	TPG - 5-20-96		

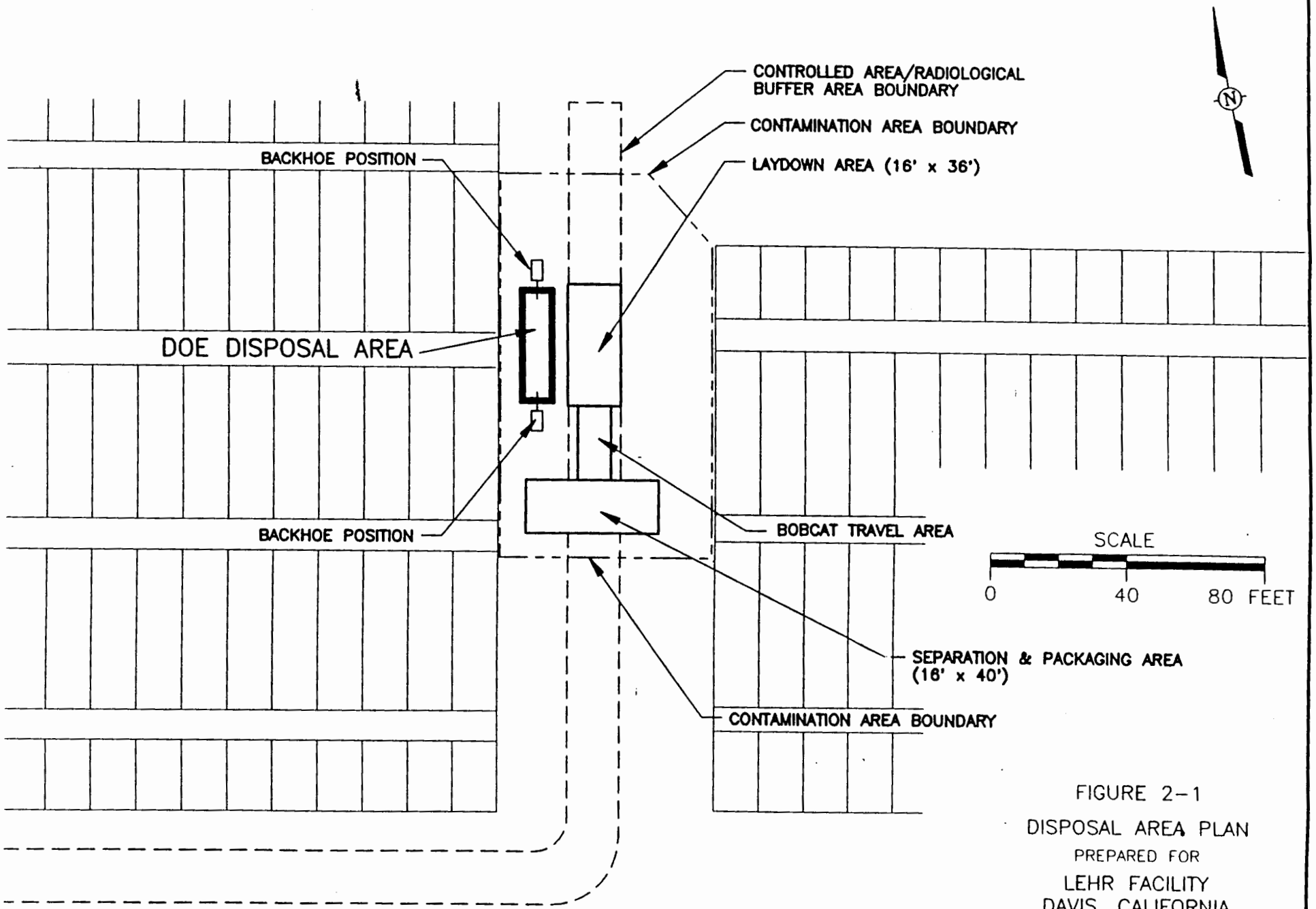


FIGURE 2-1

DISPOSAL AREA PLAN

PREPARED FOR

LEHR FACILITY

DAVIS, CALIFORNIA

material will be stored in the separation area so it can be reused upon completion of backfill activities.

The second step of the program will be to remove the first two to three feet of non-contaminated soil overlaying the waste matrix. This material will be excavated starting at the south end and moving to the north. The excavated soil will be placed in the Laydown Area to the east of the excavation. It will then be moved using a bobcat to a section of the Separation and Packing Area where it will be stored.

The third step of the excavation program will be to remove the contaminated waste matrix (gravel and labware). The waste matrix extends from a depth of approximately three feet to a depth of ten feet. The backhoe bucket will be used to bring all waste to surface where it will be placed in the Laydown Area. A bobcat will then be used to move the waste matrix to an unused portion of the Separation and Packing Area where it will be spread and separated. During the excavation process, provisions will be made to support the sides of the excavation as necessary to prevent sloughing.

The final step of the program will entail overexcavating the excavation by approximately six inches on the bottom and each side. This will ensure that all contaminated materials have been removed so that soil samples can be collected in the native material.

2.3 Separating the Labware from the Waste Matrix

Once the waste is excavated to the surface using the backhoe bucket, it will be immediately moved by a bobcat to a section of the Separation and Packing Area where it will be separated. The separation process will entail a raking process where field personnel using rakes will separate the labware from the gravel. During the separation process, the gravel and labware will be placed in separate piles where they can be containerized for disposal.

2.4 Packaging the Waste Matrix for Disposal

Following separation, the labware will be placed in 55-gallon shipping drums using shovels. The gravel will be placed in B-25 steel boxes primarily using a bobcat. Shovels will be used as necessary. Once the drums and B-25 Boxes are full, they will be moved to the on-site waste storage facility (WSF) where they will be stored pending shipment for disposal.

A radiological survey of each waste container will be performed in accordance with OP-02 "Radiological Surveys and Instrumentation" in Appendix A of Reference 1. Containers will be packaged and shipped to a PNNL-designated waste facility in accordance with the disposal site instructions, 49 CFR 173, "Shippers General Requirements for Shipments and Packaging" (Reference 2); site procedures OP-11 "Waste Processing and Packaging"; and OP-13 "Radioactive Waste Shipment" in Appendix A of Reference 1.

2.5 Collecting Verification Soil Samples from Excavation

After the waste matrix and the steel revetments have been removed from the excavation, soil samples will be collected from the bottom of the excavation and along the sides of the excavation in the native soil approximately two to three feet from the bottom. Grab samples will be collected using the backhoe bucket at the appropriate location. Composite sampling will be utilized for the walls. The purpose of the sampling, which is described in Section 3.0, is to determine if all contaminated material has been removed from the excavation. It should be noted that there will be no confined space entry to collect soil samples. Following the collection of samples, temporary fencing will be placed around the excavation and the opening will be tarped until the laboratory results can be reviewed.

2.6 Backfilling the Excavation

Once the soil sample results have been reviewed and verification that all waste has been removed from the excavation, backfilling will begin. All non-contaminated soil removed during the excavation process will be placed back in the excavation starting at the south end of the excavation to form a ramp. This will be accomplished by using the loader bucket on the front of the backhoe. Any additional soil required to backfill the excavation will come from either clean off-site soil or from drummed soil currently stored in the yard behind the Cobalt-60 Building. This soil was previously removed from the trenches in Animal Hospitals No. 1 and 2 and has been analyzed and found to be essentially background. The drums will be transported on pallets via forklift from the yard to the excavation. Here the drums will be picked up and emptied in piles in the Laydown Area using a drum handler. The loader bucket on the backhoe will then be used to pick up the material and place it in the excavation. This material will be placed in lifts and then spread and compacted using the backhoe bucket. No compaction limits or density testing will be performed.

2.7 Decontamination of Heavy Equipment

The backhoe will be decontaminated as required during excavation activities and upon completion of trenching and loading operations. Appropriate personal protective equipment, as specified in Section 4.2.4, will be worn by personnel performing decontamination operations. Gross material caked on the backhoe will be removed by scraping. Decontamination will be conducted using a decontamination solution containing Alconox and water. The solution will be dispensed using a garden sprayer. The surfaces being decontaminated will be scrubbed with a stiff brush and then rinsed with clear water. Upon completion of decontamination, the equipment will be radiologically surveyed before being released from the work area.

2.8 Shipping the Waste to an Off-Site Disposal Facility

The containerized waste will be prepared for shipment to an off-site disposal facility. The disposal facility will be designated by PNNL based on the waste matrix analytical results collected during the October 1995 trenching and sampling program.

3.0 Verification Sampling Activities

This Section describes the sampling methodology and procedures to be followed in sampling the excavation. The sampling standard operating procedures (SOPs) which will be followed are presented in Appendix A. The sampling objective is to verify that there is no contamination in the remaining native soil.

3.1 Chemical and Radiological Analysis

The sampling of the excavation bottom and its walls will be conducted prior to backfilling the excavation in order to verify that there is no residual contamination in native material following the waste matrix removal.

The native soil will be analyzed for the radiological constituents listed in Table 3-1. These analytes are consistent with the contaminants identified during the initial characterization sampling performed in October 1995. The laboratory results indicated elevated concentrations of Sr-90 and Ra-226 in the waste matrix. No chemical contaminants were identified in either the waste matrix or surrounding soils above background or EPA Region IX PRG's.

3.2 Sampling Methodology

The number of samples and their locations will be determined in the field. A minimum of five samples will be collected from the bottom of the excavation with one sample being collected from each corner and one sample from the center. A minimum of one sample shall be collected from each wall of the excavation approximately 2-3 feet from the bottom. If it is determined necessary, a composite sample may be collected from the wall of the excavation.

3.3 Sample Documentation

The usability of the data obtained during this sampling effort will depend on it's quality. A number of factors relate to quality of data. Sample collection methods are as important to consider as the methods used for sample analysis. Properly following procedures for both sample collection and analysis reduces sampling and analytical error. To ensure sample integrity, complete chain-of-custody documentation along with following sample preservation techniques, holding times, and proper shipment methods are required. Obtaining valid and comparable data also requires adequate QA/QC procedures and documentation.

TABLE 3-1
DOE BOX ANALYTICAL SAMPLE REQUIREMENTS

Analytical Parameter	Analytical Technique	Sample Volume	Sample Container	Preservation Method	Hold Time
H-3 / C-14 / Ra-226 / Sr-90	EML Procedures Manual	8 oz.	8 oz. Wide mouth with Teflon lid	None	6 Months
Gamma Spec	EML Procedures Manual	8 oz.	8 oz. Wide mouth with Teflon lid	None	6 Months
Gross Alpha & Gross Beta	Method 9310	8 oz.	8 oz. Wide mouth with Teflon lid	None	6 Months

The components of the sample documentation and custody system will include the following:

- Chain of Custody (COC) Form
- Field Logbook
- Sample Numbers
- Sample Labels
- Sample Seals.

3.3.1 Chain of Custody

Chain of Custody (COC) forms will be completed by the sample team members to track sample custody as well as to specify the requested analysis. COC forms will be completed in accordance with the requirements of SOP-3, "Chain of Custody," in Appendix A.

3.3.2 Field Logbook

Descriptions and observations made during field and sampling activities will be documented in the Field Notebook. The following will be recorded in the Field Logbook:

- Project name and number
- Location of site
- Purpose of sampling
- Description of field activities
- Names of sampling personnel
- Date and time of entries
- Sample matrix
- Date and time of sample collection
- Sample locations, ID number and methodology
- Field observations
- Results of field measurements
- Results of field calibrations for instruments used.

3.3.3 Sample Numbers

All sample numbers will begin with a unique identifier (LEHR) and be numbered sequentially. The matrix of the sample will be identified by a letter in the middle of the sample number such as L-liquid or S-solids. LEHR-S-10 is an example of the tenth solid sample obtained at LEHR.

3.3.4 Sample Labels

Sample labels will be attached to individual sample containers and will contain the following information:

- Project number
- Sample ID number
- Date and time collected
- Initials of sampler
- Requested analytes.

3.3.5 Sample Seals

Sample seals will be used to detect tampering and will be placed over the lid of the container and annotated with the following information:

- Project number
- Sample ID number
- Date and time
- Initials of sampler.

3.4 Sampling Procedures

The following methodology will be followed in order to collect the samples described in this Plan.

A sample preparation area will be established adjacent to the excavation. The sample preparation area will be set up on an elevated work surface such as a table. This work surface will be covered with poly sheeting to minimize the spread of any contamination. The following equipment will then be staged in the vicinity of the work area:

- Spill kit
- Sample containers
- Demineralized water
- Sampling tools
- Sample seals and custody forms
- Preservatives as required.

Samples will be collected from the appropriate locations, as determined in Section 3.2, "Sampling Methodology," following SOP-1, "Soil Sampling," in Appendix A of this Work Plan.

Note: Confined Space entry will not be required during the performance of sampling activities. When necessary, structural planking will be used to allow worker access over the excavation and facilitate sampling.

4.0 Health and Safety Considerations

The Health and Safety Plan and Health and Safety Procedures contained in Appendices D and E of Reference 1 shall be followed during the field activities outlined in this Work Plan. A hazard analysis for these activities as well as specific additional controls measures to be followed are described below. This Section is intended to supplement the health and safety requirements of Reference 1 and in all cases the most restrictive requirements will apply. All excavation work will be performed in accordance with HSP-61, "Excavation and Trenching," in Appendix E of Reference 1.

4.1 Hazard Analysis

The job hazard analysis identifies potential safety, health and environmental hazards and provides for the protection of personnel, the community, and the environment. A conservative approach will be taken to ensure that excavation and sampling safety concerns are met. During excavation and sampling activities, the Field Coordinator (FC) and Health and Safety Officer (HSO) will monitor the site for any changes in conditions which would require modification of work conditions (i.e., PPE). In the event that changes arise in radiological or industrial health and safety conditions warrant, this Work Plan will be modified in accordance with the procedures contained in SQP-07, "Control and Distribution of Plans, Procedures and Variances," in Appendix C of Reference 1.

4.1.1 Confined Space Entry

Confined space entry will not be required during the performance of any excavation or sampling activities. All activities have been engineered such that the excavation will not be entered. In the event that the need arises to perform activities within a confined space, as defined by 29 CFR 1910.146, "Permit Required Confined Space." IT Health and Safety Procedure HSP-26, "Confined Spaces," in Appendix C of Reference 1 will be followed.

4.1.2 Radiological Exposure

The waste matrix is known to contain solids (gravel and labware) contaminated with low-level radioactive material from prior animal research activities. The predominant nuclides used during these activities were Ra-226 and Sr-90. The excavation and removal of the waste matrix may present a risk of radiological exposure to personnel through direct exposure to

radioactive materials as well as through ingestion and inhalation. Personnel in the vicinity of the excavation shall wear modified Level D PPE as described in Section 4.2.4.

4.1.3 Chemical Exposure

During excavation and sampling activities, grab samples and direct instrumentation will be used to detect the presence of hazardous chemicals. Sampling of the soil and waste matrix performed in October 1995 did not detect the presence of hazardous chemicals in the waste matrix.

4.1.4 Heat Stress

This work activity is scheduled to be performed at a time when workers may possibly be affected by heat related injuries. Heat stress may be a concern due to the open nature of the work area and the time of year at which activities are scheduled to be performed.

4.2 Hazard Controls

The following control measures will be implemented during excavation activities. These control measures are intended to supplement the controls specified in Appendix D (Health and Safety Plan) of Reference 1. In all cases the most restrictive requirements are to be implemented.

4.2.1 Hazardous Work Permit

A Hazardous Work Permit (HWP), will be used to control work in the exclusion zone. The HWP will be issued in accordance with the procedures specified in HSP-52, "Hazardous Work Permits," in Appendix E of Reference 1. The following information will be described in the HWP:

- Scope of work to be performed
- Anticipated radiological, safety and industrial hygiene conditions
- PPE and respiratory protection requirements
- Radiological and industrial hygiene monitoring requirements
- Dosimetry requirements
- Period for which the HWP is valid
- Additional requirements for entry.

4.2.2 Boundaries

The work area will be enclosed by plastic fencing supported with stations. The placement of the stations and fencing will be controlled by the FC to facilitate access to the work area for the excavator. The boundaries will enclose the disposal area as well as the laydown area. Boundaries of the contamination area (CA) will be posted with signs stating "Contamination Area, Authorized Personnel Only."

4.2.3 Heat Stress

To minimize the effects of heat related injuries, an area will be established to conduct entrance/exit activities, sample preparation and other support functions. This area will be covered with a portable tarp to provide the workers with shade. The controls associated with heat stress are specified in Section 4.2.14, Appendix D (Health and Safety Plan), of Reference 1. The HSO shall ensure that all workers are aware of the signs and symptoms of heat stress, engineering control measures, and the need to replenish body fluids will be re-emphasized during morning tailgate safety meetings (TSM). Integrated heat stress monitoring will be performed daily to determine the proper work/rest regiment.

4.2.4 PPE

Workers in the support zone will wear modified Level D PPE in accordance with the PPE selection Matrix in Appendix D, Section 5.4 (Health and Safety Plan), of Reference 1.

Modified Level D PPE will consist of:

- Hard hat, ANSI approved
- Steel-toed impermeable PVC boots
- Tyvek hooded coveralls
- Chemical resistant gloves
- Full tape of wrists, ankles and hood
- Leather work gloves.

4.2.5 Training

Personnel performing activities associated with the excavation of the DOE Disposal Area will receive training covering this Work Plan. All on-site project personnel shall have completed at least 40 hours of hazardous waste operations-related training, as required by OSHA Regulation 29 CFR 1910.120. All field employees receive a minimum of three days of actual field experience under the direct supervision of a trained, experienced supervisor. Those

personnel who completed the 40-hour training more than 12 months prior to the start of the field activities shall have completed an 8-hour refresher course within the past 12 months. The FC shall have completed an additional 8 hours of relevant supervisory health and safety training. In addition, any workers who will enter radiological control zones shall have successfully completed Radiological Worker II training and site-specific Radworker training. All site workers shall receive training covering the LEHR site contingency plan. Personnel performing activities within the contamination area will receive the training in accordance with the requirements specified in Section 4.2 of SQP-02, "Indoctrination and Training," in Appendix C of Reference 1 for the specific job assignments.

4.2.6 Buddy System

The buddy system will be utilized to protect personnel in the work area. The system will be implemented in the following manner:

- At least two persons will be required to be in the work area when work is conducted in the exclusion zone which might result in worker contamination.

The buddy system is a method of organizing employees into work groups and is designed to provide those employees with assistance when needed. Each employee in a work group is designated to be observed by at least one other person. Assignment of designated partners should take place during the Tailgate Safety Meeting (TSM).

The responsibility of the buddy is to:

- Provide assistance, if needed
- Maintain line of sight contact or verbal contact with workers in the CA
- Observe for signs of chemical or physical trauma or heat stress such as:
  - changes in complexion and skin discoloration
  - changes in coordination or demeanor
  - excessive saliva and pupillary response
  - changes in speech pattern
- Periodically verify the integrity of all protective clothing
- Notify the Project FC if emergency help is needed.

5.0 References

1. Work Plan For the Decontamination and Decommissioning of the Imhoff Building, Cobalt-60 Building, and Tank Trailer at the Laboratory for Energy Related Health Research University of California at Davis.

2. 49 CFR 173, Shippers General Requirements for Shipments and Packaging

APPENDIX A

STANDARD OPERATING PROCEDURES (SOP)

1.0 Soil Sampling

2.0 Sample Handling, Packaging and Shipping

3.0 Chain of Custody

SOIL SAMPLING

STANDARD OPERATING PROCEDURE

1.0 Purpose

This Procedure establishes guidelines and procedures for use by field personnel in the collection and documentation of soil samples for physical and chemical analysis. Proper collection procedures are necessary to assure the quality and integrity of all samples. Additional specific procedures and requirements will be provided in the Work Plan.

2.0 References

2.1 EPA, September 1987, Compendium of Superfund Field Operations Methods, EPA 540/P-87/001a, OSWER 9355.0-14.

2.2 EPA, August 1988, EPA Guidelines for Conducting Remedial Investigation and Feasibility Studies under CERCLA, Interim Final OSWER Directive 9355.3-01.

2.3 SOP 2.0 - Sample Handling, Packaging and Shipping (Appendix A)

2.4 SOP 3.0 - Chain of Custody (Appendix A)

3.0 Definitions

3.1 Surface Soil Sample

Soil collected between a depth of zero and six inches.

3.2 Subsurface Soil Sample

Soil collected at any depth interval greater than six inches.

3.3 Disturbed Soil Sample

A soil sample in which the in situ physical structure and fabric has been disturbed as the direct result of sample collection.

3.4 Undisturbed Soil Sample

A soil sample in which the in situ physical structure and fabric has not been disturbed as the result of sample collection.

3.5 Grab Samples

Representative disturbed soil sample that is collected by using such devices as a shovel, stainless steel spoon, etc.

3.6 Composite Samples

A soil sample comprised of material from more than one source or location.

4.0 Procedures

This section contains both the responsibilities and procedures involved with soil sampling. Proper sampling procedures are necessary to ensure the quality and integrity of the samples. The details within this SOP will be used in conjunction with the Work Plan. The Work Plan will provide the following information:

- Sample collection objectives
- Locations and depths of samples to be collected
- Numbers and volumes of samples to be collected
- Types of analyses to be conducted for the samples
- Specific quality control (QC) procedures and sampling required
- Any additional sampling requirements or procedures beyond those covered in this SOP, as necessary.

4.1 Responsibilities

4.1.1 The Field Coordinator will be responsible for ensuring that all sample collection activities are conducted in accordance with this SOP and any other appropriate procedures. This will be accomplished through staff training and by maintaining quality assurance/quality control (QA/QC).

4.1.2 The Project Quality Assurance Specialist (PQAS) will be responsible for periodic review of field generated documentation associated with this SOP. The PQAS will also responsible for implementation of corrective action (i.e., retraining personnel, additional review of work plans and procedures, variances to QC sampling requirements, issuing nonconformances, etc.) if problems occur.

4.1.3 Field personnel assigned to sampling activities will be responsible for completing their tasks according to specifications outlined in this SOP and other appropriate procedures. All staff will be responsible for reporting deviations from procedures to the Field Coordinator, IT Project Manager, or the PQAS.

4.2 Sample Collection

Due to the wide variety of sampling conditions, types of samples, and purpose for collecting soil samples, several possible methods may be used to collect the soil sample. Specific procedures for various methods are described below. There are numerous procedures that can be followed for most soil sampling methods, and exact methodologies to be used will be specified in the Work Plan. The procedures include:

- Prepare sample collection logs and record relevant data on Field Activity Daily Logs prior to sampling

- Decontaminate sampling equipment as specified in the Work Plan or to EPA protocol, if samples destined for chemical analysis are to be collected

- Clear surface vegetation, rocks, and other material not designated for sampling from the sampling point

- Review all forms and diagrams documenting the location of the cleared sampling locations, as well as that of any underground utilities or lines or other buried objects

- As required, calibrate any health and safety monitoring equipment according to the instrument manufacturer's specifications. Calibration results will be recorded on the appropriate forms, as specified on the Work Plan. Instruments that cannot be calibrated according to the manufacturer's specifications will be removed from service and tagged "non-operational."

- Use drilling or penetration methods if necessary to reach the desired sampling depth

- Collect samples using appropriate sampling method described in Section 4.3 below

- Lithologically log the sample and boring, if necessary

- Fill necessary sample containers

- Affix sample container with appropriate labels, being sure to provide required information

- Place the properly labeled sample container in an appropriate carrying container at required temperature

- Either discard or decontaminate all items which contact the sample such as trowel, split-spoon sampler, and gloves before proceeding to the next sampling location

- Add information pertaining to the sample to the COC, Field Activity Daily Log, and Sample Collection Logs

- Package and ship samples as described in SOP 2.0 (Reference 2.3).

4.3 Soil Sampling

Several methods may be used to collect soil samples at any interval. Some of the procedures for the more common sampling methods are described below.

4.3.1 Surface Soil Sampling

A number of devices are available for the collection of surface soil samples. These include, but are not limited to: core samplers, hand augers, spoons, scoops, trowels, shovels, triers, etc. These devices are constructed of a number of materials including, but not limited to, stainless steel, brass, glass, teflon, etc.

The sampling and analytical requirements, as well as site characteristics, must be taken into account when determining the proper surface soil sampling equipment to use.

At present, the method commonly used for the collection of surface and subsurface samples, both disturbed and undisturbed, is a core sampler. The core sampler is usually a hollow, stainless steel cylinder, tapered at the leading end. A sample sleeve (brass, stainless steel, lexan, etc.) is inserted into the trailing end. The trailing end is then connected to a piston-type drive hammer. The core is driven into the soil by the hammer so that a relatively undisturbed sample is collected in the sleeve. The sample is then handled and shipped in the sample sleeve.

When a core sample is not feasible or planned, a sample can be collected by using such devices as a shovel, hand auger, trowel, or stainless steel spoon, etc. The soil is transferred from the collection device into decontaminated sample containers (commonly glass jars). The Work Plan will specify the type of sampling equipment to be used. The sample containers to be used will also be specified in the Work Plan.

- Don appropriate personal protection equipment as specified in the Work Plan.
- If using the coring device, place the sleeve into the device and drive the assembly into the soil using the drive hammer. Drive the device into the soil until the trailing end of the sleeve is at the soil surface.
- Retrieve the device; check to see that soil recovery is adequate in the sample sleeve. If there is sufficient recovery, mark or note the leading end of the sample sleeve.
- If using a different sample collection device (other than the coring device), use the other device to scoop or collect soil and directly transfer the soil into the

sample container (e.g., glass jar, brass sample sleeve, etc.). Fill the sample container such that little to no head-space exists.

- If using sample sleeves, place teflon tape over each end of the sleeve and seal each end with plastic end caps. With a permanent marker, write a "T" for top on the trailing end and a "B" for bottom on the leading end. Place custody tape over each end cap so that any attempt to remove the cap will cause the tape to be broken.

- If using glass jars, cap or seal the jars appropriately and place custody tape over the cap so that any attempt to remove the cap will cause the tape to be broken.

4.3.2 Subsurface Soil Sampling

The common method to collect subsurface samples is to use a hand auger to bore to the desired sampling depth and then retrieve the sample with a core sampler. The hand auger might also be used to recover the sample for direct transfer into glass jars. The exact methodology to be used will be specified in the Work Plan.

For subsurface samples of less than 18 inches in depth, successive drives of the core sampler may potentially be used to recover shallow subsurface soil samples. In all methods cited above, borehole stability should be maintained to prevent the recovery of slough in the samples. If sloughing cannot be controlled, then another sampling methodology may have to be considered.

- Prior to sampling and between sampling locations, decontaminate the sample equipment according to procedures outlined in the Work Plan unless clean, disposable sample equipment is used.

- Ensure that all subsurface soil sampling locations have been appropriately cleared of all underground utilities and buried objects per the Work Plan. Review all forms and diagrams documenting the location of the cleared sampling locations, as well as that of any underground utilities or lines, or other buried objects.

- As required, calibrate any health and safety monitoring equipment according to the instrument manufacturer's specifications. Calibration results will be recorded on the appropriate form(s), as specified in the Work Plan. Instruments that

cannot be calibrated according to the manufacturer's specifications will be removed from service and tagged.

- Don appropriate personal protection equipment as specified in the Work Plan.
- If using the coring device, place the sleeve into the device and drive the assembly into the soil using the drive hammer. Drive the device into the soil until the trailing end of the sleeve is at the soil surface.
- Retrieve the device; check to see that soil recovery is adequate in the sample sleeve. If there is sufficient recovery, mark or note the leading end of the sample sleeve.
- If using a different sample collection device (other than the coring device), use the other device to scoop or collect soil and directly transfer the soil into the sample container (e.g., glass jar, brass sample sleeve, etc.). Fill the sample container such that little to no head-space exists.
- If using sample sleeves, place teflon tape over each end of the sleeve and seal each end with plastic end caps. With a permanent marker, write a "T" for top on the trailing end and a "B" for bottom on the leading end. Place custody tape over each end cap so that any attempt to remove the cap will cause the tape to be broken.
- If using glass jars, cap or seal the jars appropriately and place custody tape over the cap so that any attempt to remove the cap will cause the tape to be broken.

4.3.3 Borehole Sampling

When the desired depth has been reached, the borehole will be prepared for sampling. To prepare for sampling, the borehole should be cleaned out to the desired sampling depth using equipment that will ensure that the material to be sampled is not disturbed by the operation. When drilling in saturated sands and silts, the bit should be withdrawn slowly, to prevent loosening of the soil around the hole. When using dual tube or casing hammer methods, care will be taken not to drive the casing below the desired sampling depth before the sample is collected.

When the desired sampling depth has been reached and the borehole has been prepared, there are several subsurface methods that will commonly be used to collect samples.

Samples will be collected with either a continuous coring or shelby tube sampler. The determination of which sampling procedure to use is a function of the specific activity at hand. Sonic drilling, for example, will predominantly utilize continuous coring for sample collection. Excavation trenching, for example, will predominantly utilize a shelby tube sampler for collection.

Continuous core sampling system methods may be specified where continuous soil cores are to be recovered by sonic drilling. The continuous sampling system utilizes a barrel which recovers a soil core from the interval the barrel is advanced through. The barrel is recovered after the total depth of the borehole is attained.

Representative samples of the soil cores can be placed in glass jars or brass sleeves for future analysis. The entire length of the soil cores will be placed in core boxes, should it be necessary to retain them. Care will be taken to mark intervals of core loss with styrofoam blocks.

If the sample is transferred from the sonic corer into jars or sleeves, fill the sample container such that little or no head-space exists. If using sample sleeves, place teflon tape over each end of the sleeve and seal with plastic caps. Place custody tape over each end cap so that any attempt to remove the cap will cause the tape to be broken. If using glass jars, cap or seal the jars and place custody tape over the cap so that any attempt to remove the cap will break the tape.

4.4 Equipment Blanks

Equipment blanks will be collected during soil sampling activities to provide an additional check on possible sources of contamination related to field sampling instruments. Laboratory-supplied distilled or deionized water is passed through or over clean sampling equipment and collected directly into empty sample containers for analysis. Equipment blanks will be handled and transported in the same manner as the samples acquired that day. Equipment blanks will be analyzed for a specific parameter list according to water analytical methods. Equipment blanks will be collected as specified in the Work Plan. The equipment blanks will be tested for the analytes specified in the Work Plan.

4.5 Sample Documentation

4.5.1 Appropriately label and number the sample containers per the Work Plan. The label will be filled out with waterproof ink and will contain, at a minimum, the following information:

- Project number
- Sample number
- Sample location
- Sample depth
- Sample type
- Date and time of collection
- Parameters for analysis
- Sampler's initials.

4.5.2 Document the sampling event and any pertinent field observations, conditions or problems in the Field Activity Daily Log (Attachment 1). Record sample collection on the Sample Collection Log (Attachment 2). Any encountered problems or unusual conditions should also be immediately brought to the attention of the Field Coordinator.

4.5.3 Appropriately preserve, handle, package, and ship the samples per SOP 2.0 (Reference 2.3). The samples shall also be maintained under custody per SOP 3.0, "Chain of Custody" (Reference 2.4).

5.0 Records

5.1 Records generated as a result of this SOP will be controlled and maintained in the project record files.

6.0 Attachment

6.1 Attachment 1, Field Activity Daily Log

6.2 Attachment 2, Sample Collection Log

ATTACHMENT 1

SAMPLE COLLECTION LOG

INTERNATIONAL TECHNOLOGY CORPORATION

DATE	
TIME	
PAGE	OF
PAGE	
PROJECT NO.	

PROJECT NAME _____

SAMPLE NO. _____

SAMPLE LOCATION _____

SAMPLE TYPE _____

COMPOSITE _____ YES _____ NO

COMPOSITE TYPE _____

DEPTH OF SAMPLE _____

WEATHER _____

CONTAINERS USED	AMOUNT COLLECTED

COMMENTS:

PREPARED BY: _____

ATTACHMENT 2

FIELD ACTIVITY DAILY LOG

TECHNOLOGY CORPORATION

DAILY LOG			
	DATE		
	NO.		
	SHEET	OF	

FIELD ACTIVITY DAILY LOG

PROJECT NAME	PROJECT NO.
FIELD ACTIVITY SUBJECT:	
DESCRIPTION OF DAILY ACTIVITIES AND EVENTS:	
VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS.
WEATHER CONDITIONS:	IMPORTANT TELEPHONE CALLS:
IT PERSONNEL ON SITE:	
SIGNATURE	

327A-7-86

SAMPLE HANDLING, PACKAGING AND SHIPPING

STANDARD OPERATING PROCEDURE

1.0 Purpose

This Procedure outlines the methods and responsibilities for field personnel to use in the packaging and shipping of environmental samples, hazardous materials and hazardous waste samples for chemical and physical analysis.

2.0 References

2.1 EPA, September 1987, Compendium of Superfund Field Operations Methods, EPA 540/P-87/001a, OSWER 9355.0-14.

2.2 EPA, August 1988, EPA Guidelines for Conducting Remedial Investigation and Feasibility Studies under CERCLA, Interim Final OSWER Directive 9355.3-01.

2.3 Code of Federal Regulations, DOT 49 CFR parts 100 to 177, Revised October 1, 1992.

2.4 Dangerous Goods Regulations, IATA, January 1, 1994.

2.5 SOP 1.0 - Soil Sampling (Appendix A).

2.6 SOP 3.0 - Chain of Custody (Appendix A).

3.0 Definitions

3.1 Environmental Sample

A limited quantity, low concentration sample that does not require Department of Transportation (DOT) or International Air Transportation Association (IATA) hazardous waste labelling as a hazardous waste or material.

3.2 Hazardous Waste Sample

Medium or high concentration sample requiring either DOT or IATA labelling as a hazardous waste or material.

3.3 Hazardous Waste

Any substance listed in 40 CFR Subpart D (260.30 et seq.) or otherwise characterized as ignitable, corrosive, reactive, or toxic as specified in Subpart C (261.20 et seq.) that would be subject to manifest and packaging requirements specified in 40 CFR 262. Hazardous waste is defined and regulated by the Environmental Protection Agency (EPA).

3.4 Hazardous Material

A substance or material in a quantity or form which may pose an unreasonable risk to health, safety, and/or property when transported in commerce. Hazardous material is defined and regulated by DOT (49 CFR 173.2 and 172.101) and IATA (Section 4.2).

3.5 Sample

Physical evidence collected from a facility or the environment which is representative of conditions at the point and time at which the sample is collected.

4.0 Procedure

4.1 Responsibilities

4.1.1 Compliance with this procedure is the responsibility of project management, site management, health and safety, and field personnel.

4.1.2 Project Manager - is responsible for the development and review of site-specific work plans which address the specific sample handling, packaging, and shipping requirements for the project. Review the project specific documentation forms to ensure they are appropriate for the field activities.

4.1.3 Field Coordinator (FC) - is responsible for seeing that field personnel receive proper training and maintain quality assurance/quality control (QA/QC). The FC is additionally

responsible for approving, coordinating, and supervising all field activities associated with this Work Plan.

4.1.4 Project Quality Assurance Specialist (PQAS) - is responsible for the periodic review of documentation generated during sample handling, packaging, and shipping and the periodic review and audit of field personnel as they perform the work.

If problems arise, the PQAS is also responsible for swift implementation of corrective action (i.e., retraining personnel, additional review of work plans and procedures, variances to requirements, issuing nonconformances).

4.1.5 Health and Safety Officer (HSO) - is responsible for ensuring complete compliance with the Health and Safety Plan by all personnel on site. He is responsible for ensuring all appropriate protective measures are identified and implemented to adequately protect site workers.

4.1.6 Radiological Controls Technician (RCT) - is responsible for assisting the HSO in the performance of monitoring, posting and evaluation of worksite safety and radiological controls conditions.

4.2 Sample Handling

4.2.1 Inspect the sampling containers (obtained from the analytical laboratory prior to the sampling event) to ensure that they are appropriate for the samples being collected, correctly preserved, and undamaged.

4.2.2 When collecting a sample always use approved/site specific personal protective equipment (e.g., gloves, etc.) to prevent cross-contamination from sample to sample but also as a health and safety requirement.

4.3 Field Packaging

4.3.1 Collect the samples in accordance with the site-specific work plans and SOP No. 1 (Appendix A).

4.3.2 As soon as possible after sample collection, tightly seal the container, and place a piece of custody tape over or around the cap. The custody tape should be placed over the cap so that any attempt to remove the cap will cause the tape to be broken. Do not place custody tape over a volatile organic analysis (VOA) vial septum.

4.3.3 Place all containers in separate, appropriately sized, airtight, seam sealing polyethylene bags (e.g., Ziploc™). Seal the bag, removing any excess air.

4.3.4 Place the bagged container inside an insulating shipping container, "cooler." This cooler should have frozen blue ice inside to assure samples remain cool, "4°," during transit from field to the packaging location.

4.3.5 Because blue ice does not maintain the 4°C standard required for sample shipping, it should only be used while in the field collecting samples.

4.3.6 Maintain the samples under chain of custody (COC) in accordance with the Work Plan and SOP 3.0, Chain of Custody (Appendix A).

4.4 Sample Packaging

Environmental samples shall be packaged in the following manner. Additional packaging requirements for samples identified as containing a known hazardous material or hazardous waste are contained in References 2.3 and 2.4. The FC shall determine the appropriate hazard classification and shall identify any additional packaging requirements and ensure that they are completed.

4.4.1 Inspect the integrity of the shipping container. The container is generally a "cooler" constructed of heavy plastic or metal with appropriate insulating properties so that variations in temperature during shipping are minimized. Also make sure that the drain plug has been sealed and covered with nylon reinforced strapping tape or mailing tape.

4.4.2 Place two to four inches of absorbent packaging material (e.g., Vermiculite™) in the bottom of the shipping container.

4.4.3 Carefully check the COC record against the collected sample labels and containers to ensure that the sample numbers, sample description, date and time of collection, container type and volume, preservative, and the required analytical methods are correct and in agreement.

4.4.4 Place the samples in the shipping container, allowing sufficient room between the samples to place ice and/or packing material.

4.4.5 Double bag and seal crushed or cubed ice in heavy-duty polyethylene bags. Place these bags of ice on top of and between samples. Blue ice should not be used for sample shipping; it does not maintain the 4°C temperature necessary for regulatory compliance.

4.4.6 All samples requiring temperature preservation stated at 4°C will be acceptable "as in" within the range of 4°C $\pm$ 2°C. The laboratory should record the temperature of receipt upon the COC. For all samples received from 6°C to 10°C, the sample(s) and temperature (in 1°C increments) will be noted on the COC and then analyzed. For samples with temperatures greater than 10°C, the samples will be rejected by the laboratory for analysis and immediately reported to the Project Manager. For VOA samples below 0°C, the samples will be rejected and also reported.

4.5 Sample Shipping

Environmental samples shall be shipped in the following manner. Additional shipping requirements for samples identified as containing a known hazardous material or hazardous waste are contained in References 2.3 and 2.4. The FC shall identify any additional shipping requirements and ensure that they are completed.

4.5.1 The person in charge of sample custody will time, date, and sign over relinquishment of custody on the COC. When a common carrier is to be used for sample shipment, also record the air/waybill number (tracking number) and the name of the carrier on the COC record. Place the original copy of the COC record in a sealed, clear plastic envelop or bag and tape the COC record envelope to the inside lid of the shipping container. Retain a copy of the COC record for tracking purposes.

4.5.2 Using nylon reinforced strapping tape or mailing tape, seal the shipping container.

4.5.3 Place custody tape over opposite ends of the lid.

4.5.4 Mark the container "THIS END UP," or apply arrow labels that indicate the proper position to be maintained during shipping.

4.5.5 Apply a label stating the name and address of the shipper and the receiving laboratory on the outside of the cooler.

4.5.6 Turn the sample over to the courier or carrier for delivery to the laboratory. All samples should be shipped by the fastest available method to the laboratory as soon as possible after sample collection.

NOTE: The courier or carrier is not responsible for sample custody and is not required to sign the COC.

4.5.7 Contact the appropriate laboratory personnel to advise them of the sample shipment.

4.5.8 Review the COC and sample collection forms for completeness and turn them over to site or project management.

5.0 Records

5.1 Records generated as a result of implementation of this procedure will be controlled and maintained in the project record files.

CHAIN OF CUSTODY

STANDARD OPERATING PROCEDURE

1.0 Purpose

This Procedure establishes the method and responsibilities associated with the maintenance and custody of samples which are to be used to provide data relative to making project related decisions. It outlines the general procedures for maintaining and documenting sample chain of custody from the time of sample collection through sample disposition.

2.0 References

2.1 IT LEHR Quality Assurance Project Plan, Appendix B, *Work Plan for the Decontamination and Decommissioning of the Imhoff Building, Cobalt-60 Building, and Tank Trailer at the Laboratory for Energy Related Health Research, University of California at Davis*, IT Corporation, 1994.

3.0 Definitions

3.1 Chain of Custody (COC)

The COC is the written record that traces the sample possession from the time each sample is collected until its final disposition, sometimes called the "cradle to grave" record. Chain of Custody is maintained by compliance with one of the following criteria:

- The sample is in the individual's physical possession
- The sample is maintained in the individual's physical view after being in his/her possession
- The sample is transferred to a designated secure area restricted to authorized personnel
- The sample is sealed and maintained under lock and key to prevent tampering, after having been in physical possession.

3.2 Waybill

A document that contains a list of the goods and shipping instructions relative to a shipment.

3.3 Common Carrier

For the purpose of this procedure, the common carrier is any commercial carrier utilized for the transportation of the sample(s) from the field to the laboratory.

4.0 Procedure

4.1 Responsibilities

4.1.1 Field Coordinator - The Field Coordinator is responsible for assuring proper COC is initiated at the time the sample(s) are collected and maintained throughout the handling and subsequent transportation of the sample(s) to the designated laboratory. Additionally, he/she is the project authority for determining the disposition and fate of sample(s) which have identified deficiencies (e.g., missed holding times, elevated temperature at receipt, etc.).

4.1.2 Sample Team Member(s) - Sample team members are responsible for properly documenting and maintaining the COC from the time of sample collection until the sample is delivered to the lab.

4.1.3 Laboratory - Laboratory personnel are responsible for receipt and entry of samples into the laboratory which have been submitted under a COC Record. Additionally, samples received will be entered into the laboratory COC procedures by properly documenting and maintaining COC from the moment that they take custody of the sample at the laboratory until the sample is disposed of or returned to the client.

4.2 General

4.2.1 An overriding consideration for data resulting from laboratory analyses is the ability to demonstrate that the samples were obtained from the locations stated and that they reached the laboratory without alteration. Evidence of collection, shipment, laboratory receipt, and laboratory custody until disposal must be documented to accomplish this. Documentation will be accomplished through a COC Record that lists each sample and the individuals performing the sample collection, shipment, and receipt.

4.2.2 The IT COC Record is a preprinted form with a unique six-digit control number in the upper right-hand corner. The white copy will accompany the samples while the yellow field copy will be retained in the project file.

4.3 Field Sample Custody

4.3.1 Sampling personnel upon collection of samples to be analyzed for project information will properly complete a COC Record form (Attachment 1). The COC Record form will be the controlling document to assure that sample maintenance and custody are maintained thereby assuring the sample(s) are representative of the environment from which they were collected. At a minimum, the following information will be recorded on the COC Record form:

- The unique identification number assigned to each sample.
- A brief description of the sampling location and a physical description of the sample type.
- The date and time of the sample collection.
- Container type (e.g., glass, poly, brass sleeve, etc.).
- Sample volume and number of containers (e.g., 2 x 40 ml, 3 x 1 liter).
- Sample preservation (e.g., HNO_3, H_2SO_4, 4°C).
- Requested analyses.
- Special instructions to the laboratory including handling requirements, quality assurance/quality control, health and safety, and sample disposition.
- The project name and number.
- The date the analytical report is due.
- The names of all sampling personnel.
- The name and phone number of the project contact.
- The name and phone number of the laboratory contact.

- The name of the courier and the waybill number (if applicable).
- A unique document reference number.

4.3.2 The COC Record form will be initiated in the field by the person collecting the sample and signed by each individual who has the samples in their possession. Each time that sample custody is transferred, the former custodian must sign over the COC as Relinquished By, and the new custodian must sign on to the COC as Received By. Each signature must be accompanied by the date, time, and the name of their project or company affiliation.

4.3.3 Transferring of COC from sampling personnel to the analytical laboratory will be performed in accordance with the requirements stated below.

4.3.3.1 If the sampling personnel deliver the samples to the laboratory, transfer of COC occurs as follows:

- The sample collector delivers the samples to the laboratory and relinquishes the sample directly to a laboratory representative.
- The collector signs the COC listing his/her name, affiliation, the date, and time. Any person involved in the collection of the sample may act as the sample custodian.
- The laboratory representative must receive the samples by signing his/her name, affiliation, the date, and time on the COC. The laboratory representative may decline to take receipt of the samples if the COC is not properly completed or if the samples are not properly packaged. All designated laboratory personnel may act as the sample custodian.
- One copy of the COC is given to the sample collector to be returned to the project files and one copy is maintained with the samples at the laboratory.

4.3.3.2 If the sampling personnel transfer sample(s) to the laboratory utilizing a common carrier, sampling personnel will retain COC responsibility and the common carrier is not responsible for maintaining sample custody. The sample collectors are responsible for packaging the samples in a manner that meets the COC definition criteria, that is, the samples

are sealed to prevent tampering. When transferring samples to the courier for transport, COC procedures are maintained as follows:

- The sample collector lists the courier affiliation and waybill number on the COC.
- The sample collector relinquishes custody by signing his name, affiliation, date, and time. The collector keeps a copy of the relinquished COC for the project file.
- The relinquished original COC is sealed in a watertight plastic bag and taped to the inside of the lid of the container used for transportation.
- The transportation container is sealed to prevent tampering and given to the courier for delivery to the laboratory.
- The sample collector obtains a copy of the waybill from the courier for the project file.
- The laboratory representative must receive the samples by signing his/her name, affiliation, the date, and time on the COC. This copy is maintained with the samples at the laboratory.
- The laboratory representative obtains a copy of the waybill from the courier for the project file.

4.4 Analytical Laboratory Custody

4.4.1 Upon receipt at the analytical laboratory, the field generated COC Record form will be signed, dated, time marked, temperature marked, and laboratory identification will be provided in the appropriate spaces.

4.4.2 Laboratory receipt personnel will enter the samples into the laboratory by implementing the sample custody procedures addressed within their approved QA Program.

4.4.3 After completion of analytical testing, sample remnants not consumed during testing may be kept for six months beyond the completion of analysis, unless otherwise specified by Battelle PNNL Project Management. Once this time period has elapsed, the samples will be

disposed of and the disposal record number will be recorded on the laboratory record copy of the COC.

5.0 Records

5.1 Records generated as a result of this SOP will be controlled and maintained in the project files.

6.0 Attachment

6.1 Attachment 1, Chain of Custody Record Form

ATTACHMENT 1

CHAIN OF CUSTODY RECORD FORM

SOP NO. 3.0
REVISION NO. 1
DATE: 07/24/96

INTERNATIONAL TECHNOLOGY CORPORATION

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD*

Reference Document No. 371464
Page 1 of ___

Project Name/No. [1]
Sample Team Members [2]
Profit Center No. [3]
Project Manager [4]
Purchase Order No. [5]
Required Report Date [11]

Samples Shipment Date [7]
Lab Destination [8]
Lab Contact [9]
Project Contact/Phone [12]
Carrier/Waybill No. [13]

Bill to: [6]

Report to: [10]

NOTE: 3 ACCOMPANY SAMPLES *SEND FIELD COPY *See back of form for special instructions

ONE CONTAINER PER LINE

Sample Number [14]	Sample Description/Type [15]	Date/Time Collected [16]	Container Type [17]	Sample Volume [18]	Pre-servative [19]	Requested Testing Program [20]	Condition on Receipt [21]	Disposal Record No. [22]

Special Instructions: [23]

Possible Hazard Identification: [24]
Non hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown ☐

Sample Disposal: [25]
Return to Client ☐ Disposal by Lab ☐ Archive (mos.)

Turnaround Time Required: [26]
Normal ☐ Rush ☐

QC Level: [27]
I ☐ II ☐ III ☐ Project Specific (specify):

1. Relinquished by [28] (Signature/Affiliation)	Date: Time:	1. Received by [28] (Signature/Affiliation)	Date: Time:
2. Relinquished by (Signature/Affiliation)	Date: Time:	2. Received by (Signature/Affiliation)	Date: Time:
3. Relinquished by (Signature/Affiliation)	Date: Time:	3. Received by (Signature/Affiliation)	Date: Time:

Comments: [29]