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U.S. Department of Energy

Oakland Operations Office, Oakland, California

FINAL VISUAL INSPECTION AND SAMPLING PLAN FOR THE UNDERGROUND RADIUM AND STRONTIUM TREATMENT TANKS

For the:

DOE AREAS AT THE LABORATORY FOR ENERGY-RELATED HEALTH RESEARCH (LEHR) UNIVERSITY OF CALIFORNIA AT DAVIS, CALIFORNIA

Prepared for:

Weiss Associates
5500 Shellmound Street
Emeryville, CA 94608-2411

Prepared by:

IT Corporation
4585 Pacheco Boulevard
Martinez, CA 94553

September 12, 1997
Rev. 0

DOE Oakland Operations Contract DE-AC03-96SF20686

WA Weiss Associates
Environmental and Geologic Services

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Approvals Page

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ABBREVIATIONS, ACRONYMS, AND SYMBOLS

Ag	Silver
AH-1	Animal Hospital number 1
AH-2	Animal Hospital number 2
ALARA	As Low As Reasonably Achievable
AOC	Area of Containment
As	Arsenic
ASTM	American Society for Testing and Materials
Ba	Barium
Be	Beryllium
CA	Contamination Area
CCR	California Code of Regulations
Cd	Cadmium
cm^2	squared centimeters
Co	Cobalt
Cu	Copper

D&D	Decontamination and Decommissioning
DOE	Department of Energy (United States)
dpm	disintegrations per minute
DQO	Data Quality Objectives
DTSC	Department of Toxic Substances Control
EE/CA	Engineering Evaluation/Cost Analysis
EPA	Environmental Protection Agency (United States)
FADL	Field Activity Daily Log
Fe	Iron
ft^2	squared feet
g	gram
H-3	Tritium
Hg	Mercury
HNO_3	Nitric Acid
H_2SO_4	Sulfuric Acid
HWP	Hazardous Work Permit
ICAP	Inductively Coupled Argon Plasma
IDW	Investigative Derived Waste
IT	International Technology Corporation
kg	kilogram
l	liter
LAS	LAS Laboratories
LEHR	Laboratory for Energy-Related Health Research
mg	milligrams

ml	milliliters
Mn	Manganese
ND	Not Detected
NDA	No Detectable Activity
Ni	Nickel
NIOSH	National Institute for Occupational Safety and Health
Pb	Lead
PCB	Polychlorinated Biphenyls
pCi	picoCuries
PHSP	Project Health and Safety Plan
PPE	Personal Protective Equipment
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
Ra-226	Radium-226
RCM	Radiation Control Manager
RSO	Radiation Safety Officer
Sb	Antimony
Se	Selenium
SOP	Standard Operating Procedure
Sr-90	Strontium-90
TCLP	Toxicity Characteristic Leaching Procedure
TDL	Technology Development Laboratory
Th-228	Thorium-228
Th-232	Thorium-232

Tl	Thallium
UC	University of California at Davis
V	Vanadium
VOA	Volatile Organic Analysis Vial
VOC	Volatile Organic Compounds
WA	Weiss Associates
Zn	Zinc
%	percent

1. INTRODUCTION

This plan outlines the procedures to perform a visual inspection of the 2 underground radium (Tanks A and B) and 9 strontium treatment tanks (Tanks A through I) at the Laboratory for Energy-Related Health Research (LEHR) at the University of California at Davis (UC Davis). In addition, this plan outlines the procedures to collect samples from Tank A of the strontium treatment system associated with the former Imhoff building.

The objective of the visual inspection is to examine the tanks in order to document the structural condition of the tanks, the presence of free liquid, and to collect observations of each tanks content. The objective of collecting samples from Tank A is to characterize tank contents to determine waste classification. Samples will be collected from only Tank A because the contents of the 10 other treatment tanks were previously removed and disposed (Chemical Waste, 1992).

Thorough descriptions of the underground radium and strontium treatment tanks are provided in the Final Report for the Liquid and Sludge Removal Project (Chemical Waste, 1992), Phase II Site Characterization Report (Dames and Moore, 1993), Final Draft - Remedial Investigation/Feasibility Study Work Plan (Dames and Moore, 1994), and Draft Final Site Characterization Summary Report (WA, 1997a). A brief description of these tanks are provided below. The locations of the tanks are shown in Figure 1.

1.1 Radium Treatment Tanks

The 2 underground radium treatment tanks (Tanks A and B) are part of a system once used for holding and processing laboratory animal biological wastes resulting from experimentation with radium-226 (Ra-226) in Animal Hospital number 2 (AH-2) (Chemical Waste, 1992). The 2 radium treatment tanks are plumbed in series. Each tank has 2 compartments separated by a weir. Four hatchways allow access to each compartment. Supernatant liquid from the tanks was discharged to a leach system comprised of dry wells and a seepage trench (Figures 1 and 2).

1.2 Strontium Treatment Tanks

The 9 underground strontium treatment tanks (Tanks A through I) are part of a system once used for holding and processing laboratory animal biological wastes resulting from experimentation with strontium-90 (Sr-90) in Animal Hospital number 1 (AH-1) (Chemical Waste, 1992). These tanks were located beneath the former Imhoff Building. Biological wastes from AH-1 initially drained into the sump tank. Wastes were pumped from the sump tank into a series of 3 settling and digestion tanks (i.e., Tanks A, B, and C) separated by weirs. The resultant supernatant from these 3 tanks would be pumped into the first 3 of 6 in-series tanks for chemical treatment (i.e., Tanks D, E, and F) when the settling and digestion tanks were predominantly full. The supernatant from the chemical treatment tanks would be pumped through a series of resin columns and placed in the final 3 storage tanks (Tanks G, H, and I). Following residence in the storage tanks, supernatant was discharged through a leach field into the subsurface. Each underground tank has 2 or more hatchways that are readily accessible as a result of the Imhoff Building D&D (IT, 1994). (Figures 1, 2, and 3).

2. HISTORICAL BACKGROUND

Activities to remove wastes from the underground radium and strontium treatment tanks were performed in 1992 (Chemical Waste, 1992). Wastes from the 2 radium tanks (Tanks A and B) and 8 of the 9 strontium tanks (Tanks B through I) were removed from the tanks, treated, packaged and shipped to the Department of Energy (DOE) Hanford disposal facility in Richland, Washington. Waste removal activities involved in this project did not include removal of waste from Tank A. In addition to the removal of the wastes from the tanks, inside tank wall surfaces were surveyed for radiation/contamination; samples of the tank walls and soil beneath the tanks were collected for analytical laboratory analysis; and, in the case of the strontium treatment tanks, some of the mastic coating was removed from some of the inner tank walls.

Wastes were reported to consist of sludge and free liquid (Chemical Waste, 1992) and were radioactive. Sludge consistency ranged from very hard and compact to a thick liquid containing large particles of sludge. Seven hundred and eighty-four drums and 2 liners of solidified waste associated with the strontium treatment system were transported to the DOE Hanford disposal facility in 14 shipments (Chemical Waste, 1992). Free liquid ranged from yellow to clear. High free liquid levels within the radium tanks was attributed to infiltrating precipitation.

Because a creosote-odor was reported in strontium treatment system Tank A wastes were not removed from or agitated within this tank (Chemical Waste, 1992). The presence of creosote, creosote-constituent chemicals, or other organic compounds may indicate that wastes in Tank A are mixed wastes. No provisions had been made to allow for removal, treatment, and shipping of mixed wastes because there was no basis to anticipate finding this type of material and the DOE Hanford disposal facility does not accept it. Consequently, wastes were not removed from strontium treatment system Tank A.

Radiation/contamination surveys performed on the inside tank walls following waste removal, give an indication of radiological conditions to be expected during this phase of tank inspections and are summarized below.

- Average loose alpha contamination: .5 to 37 disintegrations per minute per 100 square centimeters (dpm/100 cm^2).
- Average loose beta/gamma contamination: 52 to 6617 dpm/100 cm^2.
- Direct alpha frisk (fixed contamination): no detectable activity (NDA) above background to 204 dpm/probe.
- Direct beta/gamma frisk (fixed contamination): 9238 to 23337 dpm/probe.

These contamination values are greater than the allowable levels for uncontrolled areas, therefore, the tank inspection areas shall be treated as radiological areas (WA, 1997b).

Radionuclide analysis of the core samples collected from the tank walls ranged from less than .1 to 3.34 picoCuries per gram (pCi/g) for Ra-226, Sr-90, thorium-228 (Th-228), thorium-232 (Th-232), and tritium (H-3). Radionuclide analysis of soil samples collected from beneath the tanks ranged from less than .2 to 2.11 pCi/g for Ra-226, Sr-90, Th-228, Th-232, and H-3. Free liquid analysis are summarized below.

- Gamma spec: not detected (ND).
- Gross alpha: less than 2 to 14 picoCuries/liter (pCi/l).
- Gross beta: 29 to 193 pCi/l.
- Sr-90: 10.8 to 17.6 pCi/l.
- H-3: less than 500 to 921 pCi/l.

Volatile and semi-volatile organic compounds reported in detectable concentrations in a sludge sample collected from strontium treatment system Tank A included various napthalenes, anthracenes, and pyrenes; xylenes; fluorene; and chrysene. The concentrations of these compounds were reported to range from slightly greater than 9 to 2100 milligrams per kilogram (mg/kg).

3. VISUAL INSPECTION AND SAMPLING

This section describes the primary activities associated with performing the visual inspection and sampling plan for the underground radium and strontium treatment tanks.

3.1 Sample Collection Mock-Up

A sample collection mock-up will be completed prior to the readiness evaluation and collection of samples from the strontium treatment system Tank A. To minimize the potential for worker and environment contamination, the sample collection mockup will consist of a simulated tank hatch opening enclosed with a guardrail and surrounded by Herculite® or equivalent. Environmental Technicians and Radiological Control Personnel will walk-through each of the project activities under the supervision of the LEHR Site Health and Safety Officer, Radiation Safety Officer, and Field Coordinator. Sample collection from strontium treatment system Tank A presents a unique set of conditions, including beta-gamma activity greater than commonly encountered at LEHR.

3.2 Readiness Evaluation

A readiness evaluation will be performed prior to the commencement of the visual inspection and sampling activities to assure that project and task goals are achieved. The evaluation will verify that the procedures and guidelines specified in Section 5 "Quality Assurance" and Section 8 "Health and Safety" of this plan are satisfied. In addition, the evaluation will verify that the equipment and supplies listed below are accounted for prior to the commencement of work.

3.2.1 Tools, Material and Equipment

Tools, Material, and Equipment necessary to complete the scope of work may include the following:

- Miscellaneous hand tools
- Polyethylene sheeting
- Health physics supplies
- Radiological instrumentation

- Industrial hygiene monitoring equipment
- Sample collection and shipping supplies
- Photography/video equipment and supplies

Weather conditions and changes in the Scope of Work may present additional equipment requirements.

3.2.2 Work Zones

The Site Supervisor/Field Coordinator is responsible for ensuring that site access is controlled and work zones boundaries are defined and enforced. For the tasks described in this work plan, the existing fence and buildings will serve as boundaries/barriers. All gates and doorways that allow access to the Imhoff tank area will have will be posted and have boundary markings.

3.3 Visual Inspection of Underground Treatment Tanks

A visual inspection will be performed for all 11 underground radium and strontium treatment tanks at LEHR (Figures 1, 2, and 3). Visual inspections will be made through each hatchway of each tank. Tank contents, conditions, and features will be noted in the observer's field activity daily log (FADL). Sketches, photographs, and video footage will be used to document observations. Four to 6 photographs of the tank interiors will be made from each of the 24 treatment tank hatchways to provide a total of 96 to 144 photographs. Video footage of the tank interiors will also be made from the treatment tank hatchways.

No confined space entry will be required during the visual inspection. Metal, wood, and/or fiberglass probes will be used in making observations. Probes may be used to examine materials or features within the tanks and to aid the collection of levels, if free liquid is present.

Tank inspections will begin with the least contaminated tank and progress to the most contaminated. Consequently, inspections will culminate with strontium treatment system Tank A from which samples of tank contents will be collected. The contents of all other tanks were previously removed and radiation surveys were performed on the interior walls of these tanks (Chemical Waste, 1992). The specific order that the tanks will be inspected in is listed below and is based on reported average beta/gamma survey values (Chemical Waste, 1992).

Radium Tank A

Radium Tank B

Strontium Tank I

Strontium Tank H

Strontium Tank G

Strontium Tank D

Strontium Tank E

Strontium Tank F

Strontium Tank C

Strontium Tank B

Strontium Tank A

3.4 Strontium Treatment Tank A Sampling

This section describes the activities that will be performed in order to collect samples of the materials inside strontium treatment system Tank A. Tank A is approximately 24 ft. long, 6 ft. wide and 6 ft. deep. Tank A hatches are 31 inches long by 31 inches wide. The sludge in Tank A is located at an approximately 4 ft. depth. The wood material used to assist in sludge digestion are no longer in its operable locations and are scattered at various depths in Tank A. Samples of sludge, wood, and, if present, free liquid will be collected from strontium treatment system Tank A. Collected samples will be analyzed to characterize the tank contents and evaluate disposal and restoration options involving Tank A and its contents.

The maximum total number of samples that will be collected is 13 (Table 1). Four of these are discrete samples of sludge and wood, of which, one is a quality assurance/quality control (QA/QC) duplicate. Five are for making a composite sample of sludge. Two are equipment rinsate blanks. The final two samples will be free liquid that will only be collected if it is present with the sludge.

3.4.1 Surface Radiation Survey

A surface radiation/contamination survey will be performed from inside the hatchcovers of the strontium treatment system Tank A. The radiological survey instrument, a teletector®, will be lowered as close to the sludge as possible, while extending to as great an area of sludge as possible. The purpose of this survey is to identify, as much as possible, the location of highest radioactivity from which a sample of tank sludge will be collected.

3.4.2 Sludge Sampling

One discrete, 1 composite, and 1 QA/QC duplicate sample of sludge will be collected for analysis (Table 1). The discrete sludge sample will be collected from as close as possible to the location of highest activity identified in the surface radiation survey. Five subsamples of sludge will be collected to make the composite sample (Table 1). Subsamples will be collected from varying depths to better assure samples are representative. Subsample compositing will be performed by the contract laboratory conducting the analyses. The analysis of one QA/QC duplicate sample satisfies the Quality Assurance Project Plan (QAPP) stipulated 5 percent (%) frequency guideline (WA, 1997c).

Sludge samples will be collected through the 2 tank hatchways using a manual corer sampling device. Viscous/flowing sludge will be collected using a wide mouth plastic scoop attached to a metal extension rod. If sludge proves too hard to sample with the manual corer, the sludge will be broken inside the tank using the extension rod and collected with the plastic scoop. Retrieved samples and sampling devices will be placed on Herculite® or equivalent that surrounds the tank hatchcover. Herculite® or equivalent will be staged such that after each sample collection, a layer of plastic sheeting will be removed and bagged for disposal. If sludge is dry and flaky, the sampling method will include wetting down the sludge with a Hudson sprayer to mitigate any airborne hazard. If airborne hazards persist above contaminant action levels, personnel will upgrade Personal Protective Equipment (PPE) as described in Section 7.4.

Table 2 summarizes the chemical and radiological analyses that will be performed on the samples of sludge collected from strontium treatment system Tank A. In addition, Table 2 also summarizes the required sample containers and quantities for the indicated test parameters and parameter suites. Sludge samples that will be tested for inductively couple argon plasma (ICAP) metals, total chromium, hexavalent chromium, cyanide and sulfide reactivity, corrosively, and ignitability will be packed in glass jars. Sludge samples that will be tested for radionuclides, volatile organic compounds (VOC), semi-volatile organic compounds, organochlorine pesticides, polychlorinated biphenyls (PCB), nitrates, anions, and pH will be packed in brass sleeves or glass jars. The laboratory reporting detection limit and holding time for analyses listed in Table 2 are presented in Table 3.

Sufficient quantities of sludge will be collected to allow for metal analysis using the toxicity characteristic leaching procedure (TCLP). TCLP testing will be performed on collected sludge samples in which the total metal concentration is 20 timesgreater than the regulatory level specified by the Department of Toxic Substances Control (DTCS) in Title 22, California Code of Regulations, Section 66261 (22 CCR 66261) (Table 4).

If free liquid is observed with the sludge in strontium treatment system Tank A, then a maximum of 2 sludge samples will be collected for solidification mix design analysis (Table 1). Mix design analysis have been selected to evaluate simple solidification formulations in order to mitigate undesired stabilization problems associated with the disposal of sludge removed previously from the radium and strontium treatment system tanks (Chemical Waste, 1992) and will be consistent with stabilization media listed in the Hanford WAC as acceptable. Analyses identities, sample container, and sample quantity are presented in Table 2.

A description of the sludge in the tank will be recorded in the FADL that will include references to color, consistency, odor, quantity, thickness, and, if applicable, corer blow count.

3.4.3 Wood Sampling

Two discrete samples of wood from within strontium treatment system Tank A will be collected for analysis (Table 1). One wood sample will be collected from a point above the sludge in the tank and the other will be collected from a point below the surface of the sludge. The sample from above the sludge will be collected first.

Wood samples will be collected through the tank hatchways using a pole-mounted saw (i.e., tree limb saw) and a threaded skewer. The skewer will be inserted into the desired piece of wood to facilitate sawing and retrieval. Wood samples will be provided to the laboratory as chips made with a manual wood plane. Planing will be performed within a double bag or be wetted in order to control potential airborne contaminants. For the wood sample collected below the sludge surface, sludge will be removed from the wood prior to planing.

Table 2 summarizes the chemical and radiological analyses that will be performed on the samples of wood collected from strontium treatment system Tank A. In addition, Table 2 also summarizes the required sample containers and quantities for the indicated test parameters and parameter suites. Wood samples that will be tested for VOC, semi-volatile organic compounds, organochlorine pesticides, and PCB will be packed in glass jars. Wood samples that will be tested for all other indicated parameters will be packed in brass sleeves or plastic pails. The laboratory reporting detection limit and holding time for analyses listed in Table 2 are presented in Table 3.

Sufficient quantities of wood will be collected to allow for metal analysis using the TCLP. TCLP testing will be performed on collected wood samples in which the total metal concentration is greater than 20% of the regulatory level specified by DTSC in Title 22, California Code of Regulations, Section 66261 (22 CCR 66261) (Table 4).

A description of the wood in the tank will be recorded in the FADL that will include references to color, condition, odor, and quantity.

3.4.4 Equipment Rinsate Blank

Two equipment rinsate blanks will be collected to assess whether the sampling equipment or supplies are causing cross contamination of samples. Sample collection equipment and supplies will be rinsed with deionized/organic-free water (WA, 1997c) and collected in laboratory supplied sample containers.

Table 2 summarizes the chemical and radiological analyses that will be performed on the equipment rinsate blanks collected in association with strontium treatment system Tank A. In addition, Table 2 also summarizes the required sample containers and quantities for the indicated test parameters and parameter suites. The laboratory reporting detection limit and holding time for analyses listed in Table 2 are presented in Table 3.

3.4.5 Free Liquid Sampling

If free liquid is observed with the sludge in strontium treatment system Tank A, then a maximum of 2 samples of it will be collected for laboratory analysis. Samples will be collected through the hatchways using pre-cleaned disposable bailers.

Table 2 summarizes the chemical and radiological analyses that will be performed on the free liquid samples collected in association with strontium treatment system Tank A. In addition, Table 2 also summarizes the required sample containers and quantities for the indicated test parameters and parameter suites. The laboratory reporting detection limit and holding time for analyses listed in Table 2 are presented in Table 3.

3.4.6 Sample Information Documentation

Sample information documentation will be performed as applicable according to Section 8.2.1 of the QAPP (WA, 1997c).

3.4.7 Sampling Handling Procedures

Sample Handling Procedures will be performed as applicable according to Section 8.5 of the QAPP (WA, 1997c).

4. QUALITY ASSURANCE

The quality assurance requirements applicable to the visual inspection and sampling plan for the underground radium and strontium treatment tanks are detailed in the Quality Assurance Project Plan (QAPP), Revision 0, for the environmental restoration activities at the LEHR site (WA, 1997c). The QAPP is based upon the requirements of DOE Order 5700.6c "Quality Assurance" and QAMS 005/80 (EPA, December 19, 1980) "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans" as they are applicable to the scope of work.

Specific QAPP (WA, 1997c) procedures applicable to the work scope are listed below.

5. Personnel training and Qualifications

    5.1 Project Personnel

7. Procurement Quality Assurance Activities

    7.1 General

    7.2 Procurement Document Control

    7.3 Procurement Quality Assurance Documentation Revision

    7.4 Control of Purchased Items and Services

    7.5 Procurement Quality Assurance Source Evaluation and Selection

8. Field Sampling Activities

    8.1 Quality Assurance/Quality Control Sample Types

    8.2 Field Documentation

    8.3 Field Equipment, Containers, and Supplies

    8.4 Sampling Activities

    8.5 Sampling Handling Procedures

5. DATA MANAGEMENT

Samples collected for chemical and radiological analyses will be analyzed by an EPA, California and Utah certified laboratory (LAS Laboratories (LAS) in Las Vegas, Nevada). Laboratory report hard copies and electronic files will be forwarded from LAS to Weiss Associates (WA). If samples are collected for design mix testing they will either be tested on-site by International Technology Corporation's (IT) Northern California Landfill Sites Engineering Group personnel or off-site at the IT Technology Development Laboratory (TDL) in Knoxville, Tennessee. Laboratory report hard copies will be forwarded from IT to WA. Results will be validated and transferred to the project database by WA in accordance with procedures described in the QAPP (WA, 1997b).

Data receipt, sample tracking, data entry, data storage and data reporting will be managed by WA according to the procedures defined for these activities in the QAPP (WA, 1997b).

5.1 Data Quality Objectives

Data Quality Objective (DQO) necessary for this plan are based on EPA document number EPA-5440-R-93-071, Data Quality Objectives Process for Superfund, Interim Final Guidance, where applicable.

The collection of environmental data specified in this plan will be used in the preparation of an Engineering Evaluation/Cost Analysis (EE/CA). The radium and strontium underground treatment system tanks have been targeted for inspection and sampling in an attempt to supplement information presently available about them. Previous data collection activities were completed in 1992 and were not designed to address the characterization of waste in strontium treatment system Tank A.

The data resultant from the completion of this plan will be used to evaluate the structural condition and presence of free liquid of the underground treatment system tanks and for characterization of waste in strontium treatment system Tank A necessary for determination of waste classification.

The rationale for the collection of waste samples from strontium treatment system Tank A is to provide the minimum data necessary to complete the following activities.

- Characterize the waste;
- Identify the types and condition of the waste present in the tank; and

- Estimate the volume of the wastes in the tank.

In addition, if free liquid is present within the tank the rationale for the collection of wastes for testing is to prepare simple, effective solidification formulations that will avoid the offgassing problems experienced when tank wastes were disposed of previously.

The sampling network design is engineered to assess waste characterization and, if free liquid is present, to facilitate the preparation of solidification formulations. Sample collection locations will be determined using field instruments to identify characteristic and representative samples. Samples collected from strontium treatment system Tank A will be sludge, wood, and, if present, free liquid. Samples prepared as equipment rinsate blanks will be liquid water. Section 3.4 and Table 1 in this plan provide detailed information regarding samples types that are required.

Measurement parameters that will be recorded, if possible, in the completion of the proposed activities in this plan include waste material descriptions, collection locations recorded by depth and relative positioning, and waste volumes.

6. INVESTIGATION DERIVED WASTE

Activities associated with the visual inspection and sampling of the underground radium and strontium treatment tanks that have the potential to generate investigation-derived wastes (IDW) include probing the tank interiors and collection of waste samples from strontium treatment system Tank A. The management of IDW in the proposed plan is in accordance with the LEHR Waste Management Plan (WA, 1997d) and with the United States Environmental Protection Agency (EPA) document "Management of Investigation Derived Waste During Site Inspections" (EPA, 1991), and DOE Order 5820.2a, "Radioactive Waste Management" (DOE, 1988). The approach to IDW management in the plan focuses on protecting human health and environment while applying the Area of Containment (AOC) unit concept (EPA, 1991) for each of the inspection and sampling area. This concept or approach involves leaving a site in a condition no worse than that which existed prior to the inspection, minimizing the quantity of generated wastes, and leaving wastes on-site that do not require off-site disposal or extended above ground containerization.

Decontamination solutions will consist of water and detergent used to clean the probes and sample collection tools and personnel wash water. When possible, preliminary decontamination will be conducted so that the material from probing and sampling will be discharged into each subject tank. Excess sample material will be released into the tank it was originally collected from. Excess decontamination solutions will be collected in a shallow trough and allowed to evaporate.

7. HEALTH AND SAFETY

Health and safety procedures applicable to performing the visual tank inspection and sampling are described in this section.

7.1 General Procedures

Health and safety procedures that will be followed during the completion of this plan are provided in the Project Health and Safety Plan (PHSP) (WA, 1997e). In addition to the general requirements outlined in the PHSP, the following specific elements of the PHSP will be followed:

Section 2.3:	As Low As Reasonably Achievable (ALARA) principles
Section 3.4:	Safety Meetings
Section 4.41:	Waste Characterization
Section 5.4.1:	Chemical Hazard Management Program
Section 5.4.2:	Physical Hazards Management Program
Section 5.4.3:	Environmental Hazards Management Program
Section 5.4.4:	Radiological Hazards Management Program
Section 5.4.6:	Project Hazards
Section 6.1:	Chemical Action Levels
Section 6.2:	Radiological Action Levels
Section 7.1:	Work Zones
Section 9:	Personal Protective Equipment (PPE)
Section 11:	Air Monitoring
Section 12:	Site Emergency Response Plan/Contingency Plan
Section 13:	Spill and Discharge Control Plan

Section 14: Personnel Training Requirements

Section 15: Hazard Communications

Section 18: Worker Medical Surveillance, including Dosimetry section 18.2

Standard Operating Procedure (SOP) 24.1: Radiological Areas and Postings

SOP 25.1: Radiological Surveys and Instrumentation

SOP 32.1: Contamination Control

In addition, applicable hazard analysis and controls are discussed in Sections 8.1 through 8.2 in IT, 1997. A task specific Activity Hazard Analysis is presented in Appendix A.

7.2 Hazardous Work Permit

A hazardous work permit (HWP) will be prepared by the Radiation Safety Officer (RSO) with concurrence from the Radiation Control Manager (RCM). The HWP will be used to control work in the contamination area (CA) as it pertains to worker health and safety. The HWP will be issued according to procedures specified in the Health and Safety Plan (WA, 1997e). The following information will be included in the HWP:

- Scope of work to be performed.
- Anticipated radiological, safety and industrial hygiene conditions.
- PPE and respiratory requirements.
- Radiological and industrial hygiene monitoring requirements.
- Dosimetry requirements.
- Activity Hazard Analysis.
- Duration of permit validity.
- Additional requirements for CA entry.

7.3 Task-specific Hazards

The following summary is included as part of this task specific work plan in accordance with the Project Health and Safety Plan (WA, 1997e). Based upon review of the above text, the following radiological risks and controls must be considered for the tasks described in this document.

Radioactive Isotopes Present	Radiation Emitted	Potential Hazards
Sr-90	Beta	Internal exposure, Lenses of eyes, skin
Ra-226	Alpha, Beta, Gamma	Whole body exposure, internal exposure, lens of the eyes, and skin
H-3	Beta	Internal exposure, Lenses of eyes, skin
Pu-241	Alpha, Beta, Gamma	Whole body exposure, internal exposure, lens of the eyes, and skin
Th-228	Alpha, Beta, Gamma	Whole body exposure, internal exposure, lens of the eyes, and skin
Th-232	Alpha, Beta, Gamma	Whole body exposure, internal exposure, lens of the eyes, and skin

The following is a summary of possible exposure pathways associated with radiological work and their corresponding methods of control.

Potential Pathway	Methods to Minimize Exposure
Inhalation	Engineering Controls (all dry media will be wetted prior to handling), Proper PPE, Administrative Controls, trained workers, follow posted and verbal instructions, appropriate health physics coverage etc., baseline air monitoring will be performed in advance to evaluate the need for respiratory protection.
Ingestion	Proper donning and doffing of PPE, Administrative Controls, trained workers, follow posted and verbal instructions, appropriate health physics coverage etc.
Absorption	Proper donning and doffing of PPE, Administrative Controls, trained workers, follow posted and verbal instructions, appropriate health physics coverage etc.
Injection	Safe work practices, housekeeping, Proper PPE, trained workers, etc.
Whole body exposure to ionizing radiation	Time, distance, and shielding as appropriate, following standard ALARA concepts, trained workers, adequate Health Physics Coverage

7.4 Atmospheric Monitoring and Action Levels

The following is a summary of possible contaminants, monitoring instrumentation, and action levels to be used during this task.

Instrument	Contaminant	Frequency/ Location	Action Level	Action
Photoionization Detector (PID)	Volatile organic vapors	Baseline, Worker breathing zone when any tank access is opened	5 PPM	▪ Upgrade to level C with full-face respirators with organic vapor cartridges, or stop work and allow area to ventilate ▪ Notify SHSO of concentrations
LEL/O_2	Explosive atmosphere (Methane)	Inside tank, prior to activity that could cause a spark	10 % LEL	Stop activities and allow area to ventilate
Hi-volume air pump with appropriate filter head	Radioactive airborne particulate	Baseline, Worker breathing zone when any tank access is opened	5.0E-14µCi/ml α or 2E-10µCi/ml β,γ	Institute engineering controls and consider using respiratory protection.

7.5 Site Evacuation

It is unlikely that a work incident would require evacuation of the LEHR site. The emergency discoverer will have sole responsibility for determining whether all or part of the facility needs to be evacuated. If evacuation is necessary, the following procedures will be followed:

- The emergency evacuation signal will be sounded. The signal is one long blast with a compressed air horn;
- All personnel will move to the gathering point at the northwest corner of the LEHR site. If that location is unsuitable, the gathering point will be the Northeast corner gate between the Toxic Pollutant Health Research Lab and the Small Animal Housing building;
- The Incident Commander will check the area to ensure that all personnel have left. Only authorized maintenance and public safety personnel will be allowed in the area;
- A head count will be taken at the gathering point. Each contractor/ subcontractor will be responsible for taking a head count of their personnel. The name(s),

description(s) and last reported location of any missing personnel must then be given to the Incident Commander; and,

- No one may re-enter the evacuated area until the Incident Commander authorizes.

7.6 Personnel Protective Equipment (PPE)

All personnel will use the appropriate PPE as required in the approved HWP for this task. PPE requirements may be upgraded or downgraded based on actual monitoring results for airborne contaminants or radioactive contamination levels. Action levels are stated in Section 7.4 of this plan. Heat stress conditions will be taken into consideration when work is being performed in PPE and work/rest cycles will be adjusted accordingly.

8. REFERENCES

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WA, 1997a, Draft Final Site Characterization Summary Report for the U.S. Department of Energy Areas at the Laboratory for Energy-Related Health Research, University of California at Davis, Davis, California, Weiss Associates, January, 1997.

WA, 1997b, Draft LEHR Radiological Control Manual for LEHR Environmental Restoration/Waste Management, Laboratory for Energy-Related Health Research (LEHR) University of California at Davis, California, February 1997.

WA, 1997c, Quality Assurance Project Plan for the Laboratory for Energy-Related Health Research (LEHR) University of California at Davis, California, Weiss Associates, June, 1997.

WA, 1997d, Waste Management Plan for Laboratory for Energy-Related Health Research (LEHR) University of California at Davis, California, August, 1997.

WA, 1997e, Draft Project Health and Safety Plan for Environmental Restoration/Waste Management, Laboratory for Energy-Related Health Research (LEHR), University of California at Davis, California, Weiss Associates, February, 1997.

Table 1. Strontum System Tank A Sample Collection Matrix.

<table>
<tr><th>Matrix</th><th colspan="2">Discrete</th><th colspan="2">Composite</th></tr>
<tr><td rowspan="4">Sludge</td><td colspan="2">Area of highest activity measured from surface</td><td colspan="2">1</td></tr>
<tr><td colspan="2" rowspan="3">1</td><td colspan="2">Subsamples</td></tr>
<tr><td>East Hatchway</td><td>West Hatchway</td></tr>
<tr><td>3</td><td>2</td></tr>
<tr><td rowspan="2">Sludge QA/QC</td><td colspan="2">Area of highest activity measured from surface</td><td colspan="2" rowspan="2">—</td></tr>
<tr><td colspan="2">1</td></tr>
<tr><td rowspan="2">Wood</td><td>From within sludge</td><td>From above sludge</td><td colspan="2" rowspan="2">—</td></tr>
<tr><td>1</td><td>1</td></tr>
<tr><td>Equipment Rinsate Blanks</td><td colspan="2">2</td><td colspan="2">—</td></tr>
<tr><td>Free Liquid (if present)</td><td colspan="2">2</td><td colspan="2"></td></tr>
</table>

Table 2. Chemical, Radiological And Physical Analyses

Parameter	Sludge Method	Containers/Quantities
Gross Alpha	EPA 9310	6 2"x6" Brass Sleeves or
Gross Beta	EPA 9310	6 9 oz Glass Jars
Tritium	EPA 906.0	
Carbon-14	LSC	
Radium-226	EPA 903.1	
Strontium-90	EPA 905.0	
Americium-241	LAS 0108[a]	
Plutonium-241	LAS 0108[a]	
Gamma Emiters	EPA 901.1	
Volatile Organic Compounds	EPA 8240	
Formaldehyde	3500 Modified NIOSH	
Semi-Volatile Organic Compounds	EPA 8270	
Organochlorine Pesticides (and PCBs)	EPA 8080	
Nitrate	EPA 300.0	
Anions	EPA 300.0	
pH	EPA 9045	
Total Chromium	EPA 6010	
Hexavalent Chromium	EPA 7196	
ICAP Metals (Sb, As, Ba, Be, Cd, Co, Cu, Fe, Pb, Mn, Hg, Mo, Ni, Se, Ag, Tl, V, Zn)	EPA 6010	2 9 oz Glass Jars
Reactivity with Cyanide and Sulfide	SW-846 Ch7	2 9 oz Glass Jars
Corrosivity	EPA 9045	
Ignitability	EPA Modified 1010	
(In the presence of free liquid)		
Moisture Content	ASTM D2216	Approximately 20 lbs
Organic Content	ASTM D2974	(5-gallon pail)
Paint Filter Test	EPA 9095	

Parameter	Wood Method	Containers/Quantities
Gross Alpha	EPA 9310	6 2"x6" Brass Sleeves or
Gross Beta	EPA 9310	3 1-gallon Plastic Pails
Tritium	EPA 906.0	
Carbon-14	LSC	
Radium-226	EPA 903.1	
Strontium-90	EPA 905.0	
Americium-241	LAS 0108[a]	
Plutonium-241	LAS 0108[a]	
Gamma Emiters	EPA 901.1	
Volatile Organic Compounds	EPA 8240	
Formaldehyde	3500 Modified NIOSH	
Semi-Volatile Organic Compounds	EPA 8270	

Table 2. Chemical, Radiological And Physical Analyses (continued).

Organochlorine Pesticides (and PCBs)	EPA 8080	
Nitrate	EPA 300.0	
Anions	EPA 300.0	
pH	EPA 9045	
Total Chromium	EPA 6010	
Hexavalent Chromium	EPA 7196	
ICAP Metals (Sb, As, Ba, Be, Cd, Co, Cu, Fe, Pb, Mn, Hg, Mo, Ni, Se, Ag, Tl, V, Zn)	EPA 6010	2 9 oz Glass Jars
Reactivity with Cyanide and Sulfide	SW-846 Ch7	included in containers for radionuclide parameters
Corrosivity	EPA 9045	
Ignitability	EPA Modified 1010	

Parameter	Equipment Rinsate Blank Method	Containers/Quantities
Gross Alpha	EPA 9310	4 liter cube pres. HNO_3,
Gross Beta	EPA 9310	1 liter amber pres.
Tritium	EPA 906.0	HSO_4, 1 liter plastic
Carbon-14	LSC	pres. HNO_3, 1 liter
Radium-226	EPA 903.1	plastic, 250 ml amber.
Strontium-90	EPA 905.0	3 40 ml VOA pres.
Americium-241	LAS 0108[a]	HCl, 2x1liter amber
Plutonium-241	LAS 0108[a]	
Gamma Emiters	EPA 901.1	
Volatile Organic Compounds	EPA 8240	
Formaldehyde	3500 Modified NIOSH	
Semi-Volatile Organic Compounds	EPA 8270	
Organochlorine Pesticides (and PCBs)	EPA 8080	
Nitrate	EPA 300.0	
Anions	EPA 300.0	
pH	EPA 9045	
Total Chromium	EPA 6010	
Hexavalent Chromium	EPA 7196	
ICAP Metals (Sb, As, Ba, Be, Cd, Co, Cu, Fe, Pb, Mn, Hg, Mo, Ni, Se, Ag, Tl, V, Zn)	EPA 6010	500 ml Glass/Plastic Bottle pres. HNO_3
Reactivity with Cyanide and Sulfide	SW-846 Ch7	40 ml Glass/VOA
Corrosivity	EPA 9045	100 ml Glass/Plastic Bottle
Ignitability	EPA Modified 1010	250 ml Glass Bottle

Parameter	Free Liquid Method	Containers/Quantities
Gross Alpha	EPA 9310	4 liter cube pres. HNO_3,
Gross Beta	EPA 9310	1 liter amber pres.
Tritium	EPA 906.0	HSO_4, 1 liter plastic

Table 2. Chemical, Radiological And Physical Analyses (continued).

Carbon-14	LSC	pres. HNO_3, 1 liter
Radium-226	EPA 903.1	plastic, 250 ml amber.
Strontium-90	EPA 905.0	3 40 ml VOA pres.
Americium-241	LAS 0108[(a)]	HCl, 2x1 liter amber
Plutonium-241	LAS 0108[(a)]	
Gamma Emiters	EPA 901.1	
Volatile Organic Compounds	EPA 8240	
Formaldehyde	3500 Modified NIOSH	
Semi-Volatile Organic Compounds	EPA 8270	
Organochlorine Pesticides (and PCBs)	EPA 8080	
Nitrate	EPA 300.0	
Anions	EPA 300.0	
pH	EPA 9045	
Total Chromium	EPA 6010	
Hexavalent Chromium	EPA 7196	
ICAP Metals (Sb, As, Ba, Be, Cd, Co, Cu, Fe, Pb, Mn, Hg, Mo, Ni, Se, Ag, Tl, V, Zn)	EPA 6010	500 ml Glass/Plastic Bottle pres. HNO_3
Reactivity with Cyanide and Sulfide	SW-846 Ch7	40 ml Glass/VOA
Corrosivity	EPA 9045	100 ml Glass/Plastic Bottle
Ignitability	EPA Modified 1010	250 ml Glass Bottle

(a) LAS Laboratory Standard Operating Procedure.

Table 3. Laboratory Reporting Detection Limits and Holding Times.

Analyte			Detection	Holding Time
Gross Alpha			7 pCi/g	180 days
Gross Beta			7 pCi/g	180 days
Tritium			300 pCi/g	180 days
Carbon 14			2 pCi/g	180 days
Radium 226			0.5 pCi/g	180 days
Strontium 90			1 pCi/g	180 days
Americium 241			0.1 pCi/g	180 days
Gamma Spec pCi/g		Ac-228	0.3	180 days
		Bi-214	0.3	180 days
		Cs-134	0.05	180 days
		Cs-137	0.06	180 days
		Co-57	0.02	180 days
		Co-60	0.05	180 days
		Pb-212	0.1	180 days
		Pb-214	0.1	180 days
		K-40	0.5	180 days
		Tl-208	0.06	180 days
		Th-234	1	180 days
		U-235	0.2	180 days
Volatiles			see attached	14 days
Formaldehyde			1 ppm	28 days
Semi-Volatiles			see attached	7 ext/40 analysis
Pest/PCB			see attached	7 ext/ 40 analysis
Nitrate			0.1 mg/kg	48 hours from extraction
Anions:		Bromide	0.4 mg/kg	28 days
		Chloride	0.2 mg/kg	28 days
		Nitrite	0.5 mg/kg	28 days
		Sulfate	1 mg/kg	28 days
pH/Corrosivity			NA	asap
total Chromium			1.0 mg/kg	180
Hexavalent Chromium			0.2 mg/kg	24 hours from extraction
Total Metals		see attached table		180 days/ Hg 28 days
Reactivity	Cyanide		0.5 mg/kg	NA
	Sulfide		30 mg/kg	NA
Ignitiability			NA	NA
DETECTION LIMITS MAY INCREASE BASED UPON THE MATRIX				
THESE ARE BASED UPON A STANDARD SOIL MATRIX.				

Table 3 Attachment.

INSTRUMENTS AND REPORTING DETECTION LIMITS FOR METAL CONSTITUENTS
THIRD QUARTER 1997
Effective Date: 07/01/97 through 10/01/97

		Aqueous (mg/L)		Solid (mg/Kg)	
Constituent	Analytical Method	Instrument Detection Limit (IDL)	Reporting Detection Limit (RDL)	Instrument Detection Limit (IDL)	Reporting Detection Limit (RDL)
Aluminum	200.7/6010/6010A/CLP	0.035	0.200	3.5	20.0
Aluminum	200.8/ 6020	0.007	0.050	0.7	5.0
Aluminum	6010A by ICP-Trace	0.013	0.200	1.3	20.0
Antimony	200.7/6010/6010A/CLP	0.030	0.060	3.0	6.0
Antimony	200.8/ 6020	0.001	0.005	0.1	0.5
Antimony	6010A by ICP-Trace	0.002	0.060	0.2	6.0
Antimony	204.2/7041/GFAA-CLP	0.007	0.060	0.7	6.0
Arsenic	200.7/6010/6010A/CLP	0.021	0.200	2.1	20.0
Arsenic	200.8/ 6020	0.004	0.010	0.4	1.0
Arsenic	6010A by ICP-Trace	0.003	0.010	0.3	1.0
Arsenic	200.9/7060/GFAA-CLP	0.002	0.010	0.2	1.0
Barium	200.7/6010/6010A/CLP	0.001	0.200	0.1	20.0
Barium	200.8/ 6020	0.001	0.050	0.1	5.0
Barium	6010A by ICP-Trace	0.001	0.200	0.1	20.0
Beryllium	200.7/6010/6010A/CLP	0.001	0.005	0.1	0.5
Beryllium	200.8/ 6020	0.001	0.005	0.1	0.5
Beryllium	6010A by ICP-Trace	0.001	0.005	0.1	0.5
Boron	200.7/6010/6010A/CLP	0.015	0.200	1.5	20.0
Boron	200.8/ 6020	0.012	0.100	1.2	10.0
Cadmium	200.7/6010/6010A/CLP	0.003	0.005	0.3	0.5
Cadmium	200.8/ 6020	0.001	0.005	0.1	0.5
Cadmium	6010A by ICP-Trace	0.001	0.005	0.1	0.5
Calcium	200.7/6010/6010A/CLP	0.028	5.000	2.8	500.0
Calcium	200.8/ 6020	0.027	0.500	2.7	50.0
Calcium	6010A by ICP-Trace	0.015	5.000	1.5	500.0
Cerium	200.8/ 6020	0.001	0.005	0.1	0.5
Cesium	200.8/6020	0.001	0.005	0.1	0.5
Chromium	200.7/6010/6010A/CLP	0.004	0.010	0.4	1.0
Chromium	200.8/ 6020	0.002	0.010	0.2	1.0
Chromium	6010A by ICP-Trace	0.001	0.010	0.1	1.0
Cobalt	200.7/6010/6010A/CLP	0.004	0.050	0.4	5.0
Cobalt	200.8/ 6020	0.001	0.005	0.1	0.5
Cobalt	6010A by ICP-Trace	0.001	0.050	0.1	5.0
Copper	200.7/6010/6010A/CLP	0.004	0.025	0.4	2.5
Copper	200.8/ 6020	0.003	0.005	0.3	0.5
Copper	6010A by ICP-Trace	0.001	0.025	0.1	2.5
Iron	200.7/6010/6010A/CLP	0.014	0.100	1.4	10.0
Iron	200.8/ 6020	0.030	0.050	3.0	5.0
Iron	6010A by ICP-Trace	0.018	0.100	1.8	10.0
Lead	200.7/6010/6010A/CLP	0.036	0.100	3.6	10.0
Lead	239.2/7421/CLP	0.002	0.003	0.2	0.3
Lead (Organic)	California Luft	ND	5.000	ND	500.0

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Table 3 Attachment.

INSTRUMENTS AND REPORTING DETECTION LIMITS FOR METAL CONSTITUENTS
THIRD QUARTER 1997
Effective Date: 07/01/97 through 10/01/97

		Aqueous (mg/L)		Solid (mg/Kg)	
Constituent	Analytical Method	Instrument Detection Limit (IDL)	Reporting Detection Limit (RDL)	Instrument Detection Limit (IDL)	Reporting Detection Limit (RDL)
Lead (TETRAETHYL)[1]	LAL-SOP-96-0372	0.00005	0.0002	0.01	0.02
Lead	200.8/ 6020	0.001	0.003	0.1	0.3
Lead	6010A by ICP-Trace	0.002	0.003	0.2	0.3
Lithium	200.7/6010/6010A/CLP	0.003	0.100	0.3	10.0
Lithium	200.8/ 6020	0.002	0.005	0.2	0.5
Magnesium	200.7/6010/6010A/CLP	0.041	5.000	4.1	500.0
Magnesium	200.8/ 6020	0.003	0.500	0.3	50.0
Magnesium	6010A by ICP-Trace	0.019	5.000	1.9	500.0
Manganese	200.7/6010/6010A/CLP	0.002	0.015	0.2	1.5
Manganese	200.8/ 6020	0.001	0.015	0.1	1.5
Manganese	6010A by ICP-Trace	0.001	0.015	0.1	1.5
Mercury	245.2/7470/7471	0.0002	0.0002	0.1	0.1
Molybdenum	200.7/6010/6010A/CLP	0.006	0.200	0.6	20.0
Molybdenum	200.8/ 6020	0.001	0.005	0.1	0.5
Molybdenum	6010A by ICP-Trace	0.001	0.200	0.1	20.0
Nickel	200.7/6010/6010A/CLP	0.006	0.040	0.6	4.0
Nickel	200.8/ 6020	0.001	0.005	0.1	0.5
Nickel	6010A by ICP-Trace	0.001	0.040	0.1	4.0
Phosphorus	200.7/6010/6010A/CLP	0.031	0.250	3.1	25.0
Potassium	200.7/6010/6010A/CLP	1.200	5.000	120.0	500.0
Potassium	200.8/ 6020	0.088	0.500	8.8	50.0
Selenium	200.7/6010/6010A/CLP	0.064	0.300	6.4	30.0
Selenium	270.2/7740/CLP	0.004	0.005	0.4	0.5
Selenium	200.8/ 6020	0.004	0.005	0.4	0.5
Selenium	6010A by ICP-Trace	0.003	0.005	0.3	0.5
Silicon	6010A by ICP-Trace	0.003	0.100	0.3	10.0
Silver	200.7/6010/6010A/CLP	0.004	0.010	0.4	1.0
Silver	200.8/ 6020	0.001	0.005	0.1	0.5
Silver	6010A by ICP-Trace	0.001	0.010	0.1	1.0
Sodium	200.7/6010/6010A/CLP	0.052	5.000	5.2	500.0
Sodium	200.8/ 6020	0.066	0.500	6.6	50.0
Strontium	200.7/6010/6010A/CLP	0.001	0.100	0.1	10.0
Strontium	200.8/ 6020	0.001	0.005	0.1	0.5
Thallium	200.7/6010/6010A/CLP	0.048	0.500	4.8	50.0
Thallium	279.2/7841/GFAA-CLP	0.003	0.010	0.3	1.0
Thallium	200.8/ 6020	0.001	0.005	0.1	0.5
Thallium	6010A by ICP-Trace	0.004	0.010	0.4	1.0
Thorium	200.8/ 6020	0.001	0.005	0.1	0.5
Tin	200.7/6010/6010A/CLP	0.021	0.200	2.1	20.0
Tin	200.8/ 6020	0.001	0.005	0.1	0.5
Titanium	200.7/6010/6010A/CLP	0.002	0.100	0.2	10.0
Titanium	200.8/ 6020	0.001	0.005	0.1	0.5

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Table 3 Attachment.

INSTRUMENTS AND REPORTING DETECTION LIMITS FOR METAL CONSTITUENTS
THIRD QUARTER 1997
Effective Date: 07/01/97 through 10/01/97

		Aqueous (mg/L)		Solid (mg/Kg)	
Constituent	Analytical Method	Instrument Detection Limit (IDL)	Reporting Detection Limit (RDL)	Instrument Detection Limit (IDL)	Reporting Detection Limit (RDL)
Titanium	6010A by ICP-Trace	0.001	0.100	0.1	10.0
Uranium (235)	200.8/ 6020	0.0001	0.0001	0.01	0.01
Uranium (238)	200.8/ 6020	0.001	0.001	0.1	0.1
Uranium	KPA	ND	0.001	ND	0.1
Vanadium	200.7/6010/6010A/CLP	0.004	0.050	0.4	5.0
Vanadium	200.8/ 6020	0.005	0.005	0.5	0.5
Vanadium	6010A by ICP-Trace	0.001	0.050	0.1	5.0
Zinc	200.7/6010/6010A/CLP	0.003	0.020	0.3	2.0
Zinc	200.8/ 6020	0.004	0.020	0.4	2.0

ND : Not determined at this time.
N/A : Not applicable
**/UR : These methods of determination for these analytes will be performed upon request
Note 1 . Detection limits for solid matrix samples are calculated based on a conversion factor of 200 (sample weight of 1.00g to a final volume of 100 mLs) and of 500 for mercury (sample weight of 0.2g to final volume of 100 mLs).
Note 2 : IDLs for the EPA methods 200.8/6020 are determined using the HP 4500 System.
Note 3 : IDLs for the ICP - Trace were determined using the TJA 61E Trace Analyzer.
Note 4 : IDLs for methods 200.7/6010 were determined using the TJA 61E ICP .
Parameter [1]: Result of MDL determination

Table 3 Attachment.

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METHOD AND REPORTING DETECTION LIMITS FOR SOLID SAMPLES USING MUFFLED SAND
EPA METHOD 608/8080/8080A/8081 - ORGANOCHLORINE PESTICIDES & PCBs

Method 608/80808080A/8081 - Muffled Sand Samples		
Analyte	MDL[a] (µg/Kg)	RDL[b] (µg/Kg)
Aldrin	0.6	1.7
alpha-BHC	0.2	1.7
beta-BHC	0.2	1.7
delta-BHC	0.2	1.7
gamma-BHC (Lindane)	0.2	1.7
alpha-Chlordane	0.3	1.7
gamma-Chlordane	0.6	1.7
4,4'-DDD	0.4	3.3
4,4'-DDE	0.5	3.3
4,4'-DDT	0.3	3.3
Dieldrin	0.3	3.3
Endosulfan I	0.2	1.7
Endosulfan II	0.5	3.3
Endrin Aldehyde	0.9	3.3
Endrin	0.3	3.3
Endrin Ketone	0.6	3.3
Endosulfan Sulfate	0.9	3.3
Heptachlor	0.2	1.7
Heptachlor Epoxide	0.3	1.7
Methoxychlor	1.3	1.7
Toxaphene	16[d]	170
PCB - 1016	4[e]	33
PCB - 1221	16[f]	67
PCB - 1232	17[f]	33
PCB - 1242	19[f]	33
PCB - 1248	20[f]	33
PCB - 1254	6[f]	33
PCB - 1260	6[e]	33
Technical chlordane	7[f]	33[c]

a - Determined 2/14/96 using 3µL injection volume.
b - Adopted from CRQLs of CLP 3/90 protocol.
c - Adopted from CRQL for PCBs; technical chlordane is not required by CLP 3/90 Protocol
d - Determined 2/24/96 using 3µL injection volume.
e - Determined 2/22/96 using 3µL injection volume.
f - Determined 7/8/96 through 7/12/96 using 3µL injection volume.

Table 3 Attachment.

METHOD AND REPORTING DETECTION LIMITS FOR SOIL SAMPLES USING EPA METHODS 624, 8240, 8240B, 8260, 8260A - VOLATILE ORGANIC ANALYSES BY GC/MS

METHOD 624/8240/8240B/8260/8260A - SOIL SAMPLES		
Routine Analytes	MDL[a] (μg/kg)	RDL[b] (μg/kg)
Chloromethane	1	5
Vinyl Chloride	1	5
Bromomethane	1	5
Chloroethane	1	10
Trichlorofluoromethane	1	5
Acetone	5	10
2-Chloroethyl vinyl ether	1	20
1,1-Dichloroethene	1	5
Methylene Chloride	4	5
Carbon Disulfide	1	5
Vinyl Acetate	3	10
1,1-Dichloroethane	1	5
2-Butanone	2	10
trans-1,2-Dichloroethene	1	5
cis-1,2-Dichloroethene	1	5
Chloroform	1	5
1,1,1-Trichloroethane	1	5
Carbon Tetrachloride	1	5
1,2-Dichloroethane	1	5
Benzene	1	5
Trichloroethene (TCE)	1	5

a - Determined on 1/31/97.

b - The LAS RDLs met the estimated quantitation limits (PQLs) specified in Method 8260 of 5 μg/L for all the target compounds listed in table 1 in Method 8260. For the analytes that are not listed in Method 8260, such as ketones, the LAS RDLs are generated based on MDL study.

Table 3 Attachment.

METHOD 624/8240/8240B/8260/8260A - SOIL SAMPLES		
Routine Analytes	**MDL[a] (µg/kg)**	**RDL[b] (µg/kg)**
1,2-Dichloropropane	1	5
Bromodichlormethane	1	5
4-Methyl-2-pentanone	2	10
2-Hexanone	2	10
cis-1,3-Dichloropropene	1	5
trans-1,3-Dichloropropene	1	5
1,1,2-Trichloroethane	1	5
Toluene	1	5
Dibromochloromethane	1	5
Tetrachloroethene (PCE)	1	5
Chlorobenzene	1	5
Ethyl Benzene	1	5
m,p-Xylenes	1	5
o-Xylene	1	5
Styrene	1	5
Bromoform	1	5
1,1,2,2-Tetrachloroethane	2	5
1,3-Dichlorobenzene	1	5
1,4-Dichlorobenzene	1	5
1,2-Dichlorobenzene	1	5

a - Determined on 1/31/97.

b - The LAS RDLs met the estimated quantitation limits (PQLs) specified in Method 8260 of 5 µg/L for all the target compounds listed in table 1 in Method 8260. For the analytes that are not listed in Method 8260, such as ketones, the LAS RDLs are generated based on MDL study.

Table 3 Attachment.

Issued on 2/14/97 by QAD

METHOD AND REPORTING DETECTION LIMITS FOR SOLID SAMPLES USING EPA METHOD 3550/3550A/625/8270/8270A/8270B SEMIVOLATILE ANALYSES BY GC/MS

Method 3550/3550A/625/8270/8270A/8270B - Solid Samples		
CONSTITUENT	MDL* (µg/kg)	RDL* (µg/kg)
Phenol	100	660
bis(2-Chloroethyl)ether	90	660
2-Chlorophenol	110	660
1,3-Dichlorobenzene	120	660
1,4-Dichlorobenzene	90	660
Benzyl alcohol	190	1300
1,2-Dichlorobenzene	120	660
2-Methylphenol	130	660
bis(2-Chloroisopropyl)ether	120	660
4-Methylphenol	280	660
N-Nitroso-di-n-propylamine	200	660
Hexachloroethane	130	660
Nitrobenzene	170	660
Isophorone	180	660
2-Nitrophenol	150	660
2,4-Dimethylphenol	100	660
bis(2-Chloroethoxy)methane	120	660
Benzoic acid	120	3300
2,4-Dichlorophenol	190	660
1,2,4-Trichlorobenzene	160	660

Table 3 Attachment.

Issued on 2/14/97 by QAD

Method 3550/3550A/625/8270/8270A/8270B - Solid Samples		
CONSTITUENT	MDL* (µg/kg)	RDL* (µg/kg)
Naphthalene	160	660
4-Chloroaniline	140	1300
Hexachlorobutadiene	150	660
4-Chloro-3-methylphenol	110	1300
2-Methylnaphthalene	160	660
Hexachlorocyclopentadiene	90	660
2,4,6-Trichlorophenol	180	660
2,4,5-Trichlorophenol	200	660
2-Chloronaphthalene	170	660
2-Nitroaniline	200	3300
Dimethyl phthalate	250	660
Acenaphthylene	210	660
2,6-Dinitrotoluene	200	660
3-Nitroaniline	190	3300
Acenaphthene	190	660
2,4-Dinitrophenol	190	3300
4-Nitrophenol	190	3300
Dibenzofuran	200	660
2,4-Dinitrotoluene	150	660
Diethylphthalate	100	660
4-Chlorophenyl phenyl ether	210	660
Fluorene	160	660
4-Nitroaniline	270	3300
4,6-Dinitro-2-methylphenol	240	3300
N-Nitrosodiphenylamine	140	660
4-Bromophenyl phenyl ether	130	660

Table 3 Attachment.

Issued on 2/14/97 by QAD

Method 3550/3550A/625/8270/8270A/8270B - Solid Samples		
CONSTITUENT	MDL[a] (μg/kg)	RDL[b] (μg/kg)
Hexachlorobenzene	170	660
Pentachlorophenol	130	3300
Phenanthrene	90	660
Anthracene	100	660
Carbazole	100	660[c]
Di-n-butyl phthalate	90	660
Fluoranthene	230	660
Pyrene	220	660
Butyl benzyl phthalate	110	660
3,3′-Dichlorobenzidine	70	1300
Benzo(a)anthracene	110	660
bis(2-Ethylhexyl)phthalate	130	660
Chrysene	140	660
Di-n-octyl phthalate	160	660
Benzo(b)fluoranthene	120	660
Benzo(k)fluoranthene	290	660
Benzo(a)pyrene	120	660
Indeno(1,2,3-cd)pyrene	150	660
Dibenz(a,h)anthracene	210	660
Benzo(g,h,i)perylene	240	660

a - Determined on 1/10/97 using a 30-g sample, with GPC cleanup, and a 1 μL injection.

b - Adopted from the PQLs specified by Method 8270, SW-846, Third Edition.

c - Adopted from the EQL specified for Phenanthrene due to similar response.

Table 4. Toxicity Characteristic Leaching Procedure (Tclp) Decision Matrix.

PARAMETER	TCLP REGULATORY LEVEL (Mg/L)	TCLP TEST THRESHOLD (Unitless)
Antimony (Sb)	Not specified by DTSC for TCLP	
Arsenic (As)	Not specified by DTSC for TCLP	
Barium (Ba)	100.0	20.0
Beryllium (Be)	Not specified by DTSC for TCLP	
Cadmium (Cd)	1.0	0.2
Cobalt (Co)	Not specified by DTSC for TCLP	
Copper (Cu)	Not specified by DTSC for TCLP	
Iron (Fe)	Not specified by DTSC for TCLP	
Lead (Pb)	5.0	1.0
Manganese (Mn)	Not specified by DTSC for TCLP	
Mercury (Hg)	0.2	.04
Nickel (Ni)	Not specified by DTSC for TCLP	
Selenium (Se)	1.0	0.2
Silver (Ag)	5.0	1.0
Thallium (Tl)	Not specified by DTSC for TCLP	
Vanadium (V)	Not specified by DTSC for TCLP	
Zinc (Zn)	Not specified by DTSC for TCLP	

DRAWN BY	T.R.S. 8-26-97	CHECKED BY / APPROVED BY	7/2/97 / 9/2/97	DRAWING NUMBER	770529-A13

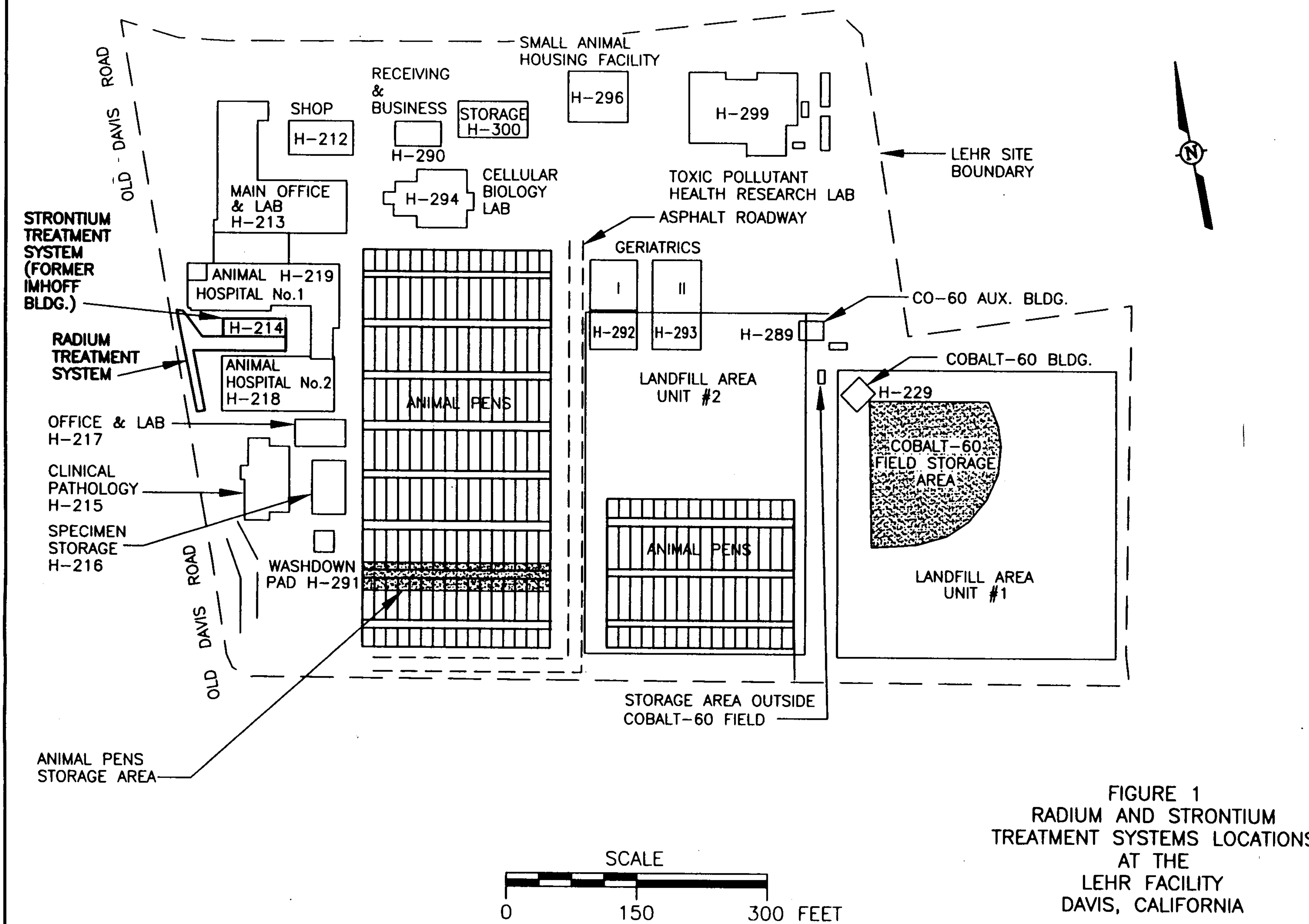


FIGURE 1
RADIUM AND STRONTIUM TREATMENT SYSTEMS LOCATIONS AT THE LEHR FACILITY DAVIS, CALIFORNIA

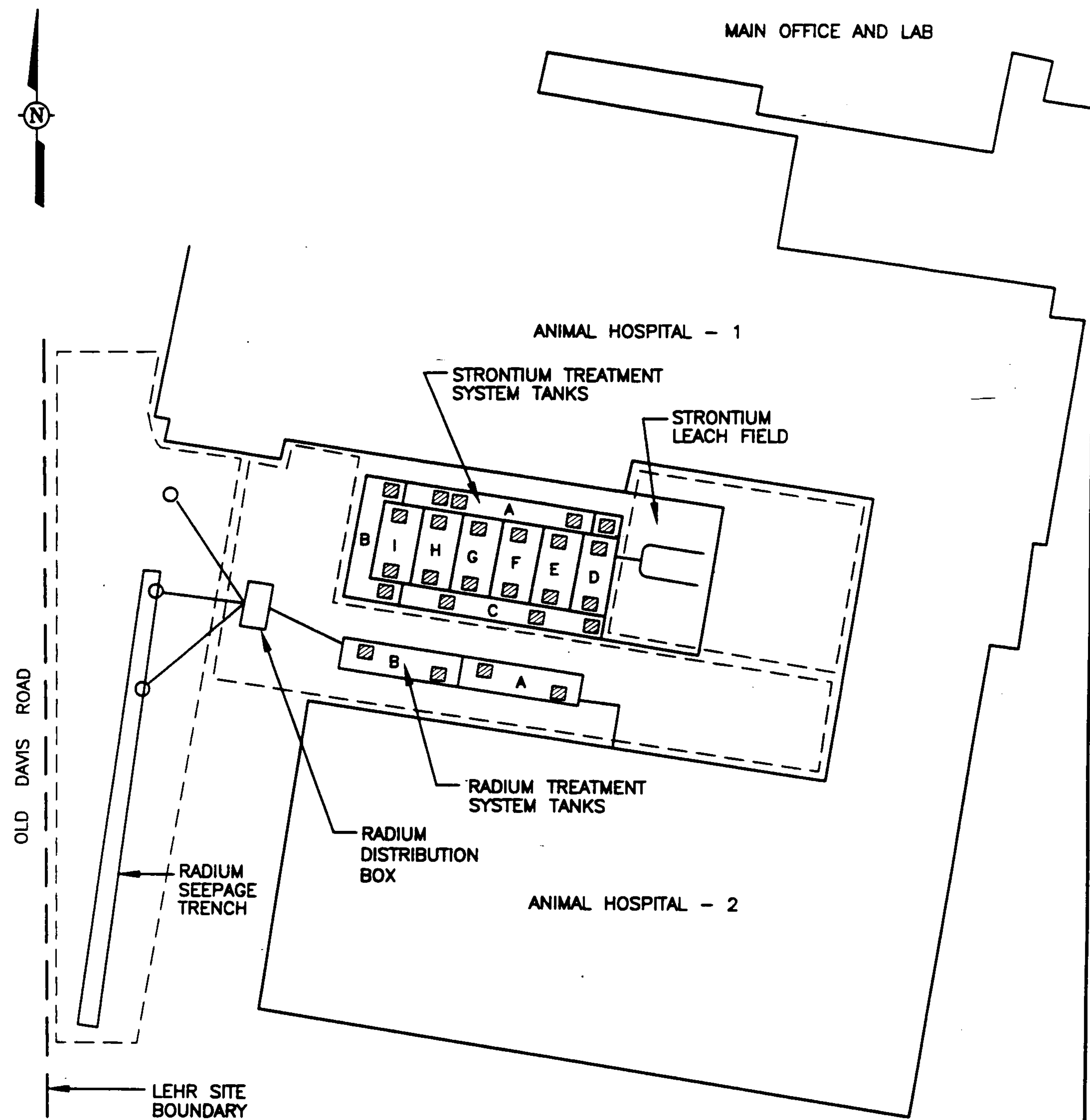
LE-RSTSL(LE4)

DRAWING NUMBER 770529-A14

DRAWN BY T.R.S. 8/8/97

CHECKED BY [initials] 8/8/97

APPROVED BY WCS 8/8/97



LEGEND

▨	HATCHWAY
O	EXSITING RADIUM TREATMENT SYSTEM DRY WELL
——	DISTRIBUTION LINE

SCALE

0 30 FEET

FIGURE 2

RADIUM AND STRONTIUM TREATMENT SYSTEMS AT THE LEHR FACILITY DAVIS, CALIFORNIA

LE-RADST(LE4)

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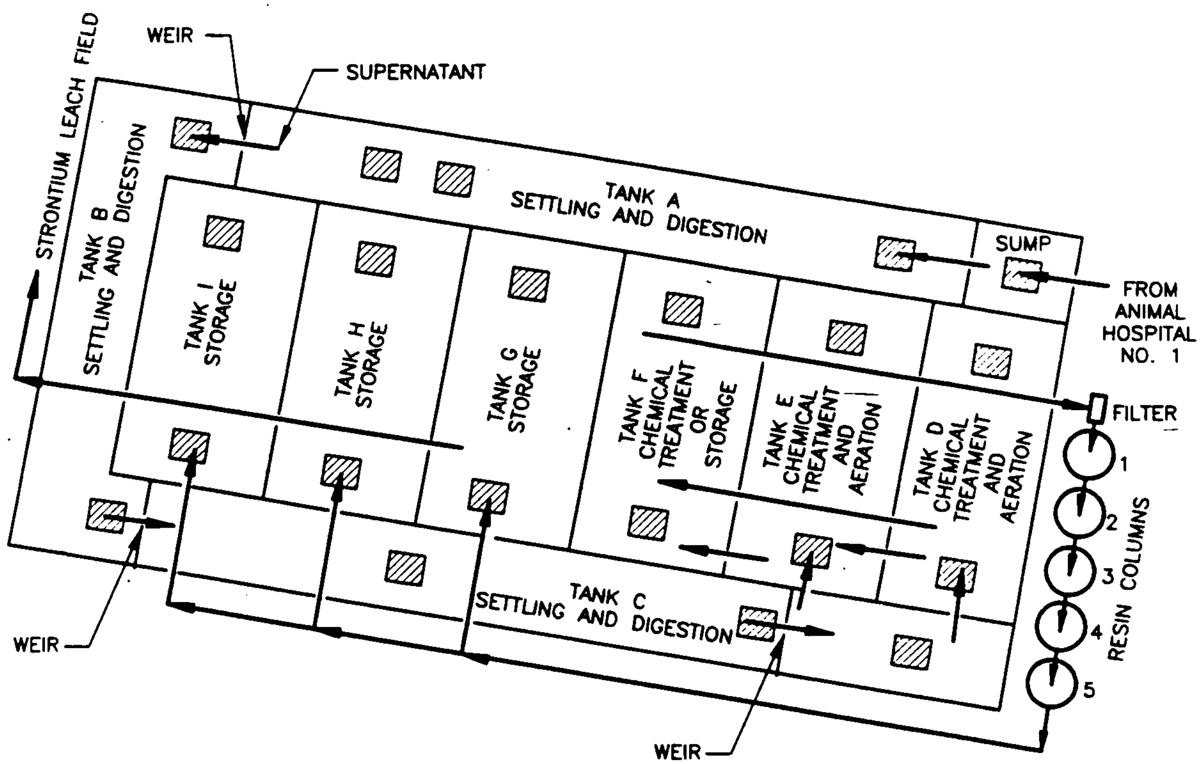

LEGEND

HATCHWAY

SUPERNATANT FLOW

SCALE

0 10 FEET

FIGURE 3

STRONTIUM TREATMENT SYSTEM AT THE LEHR FACILITY DAVIS, CALIFORNIA

LE-STTS(LE4)

APPENDIX A

ACTIVITY HAZARD ANALYSIS

Work Activity	**Procedure Steps**	**Associated Hazard**	**Hazard Control Method**
Initial/baseline surveys	1. Perform surveys in Imhoff tank area using radiological monitoring instrumentation.	1. Radiological exposure and contamination concerns. 2. Heat Stress hazard from working outdoors in PPE. 3. Slip, trip, and fall hazard.	1. Wear PPE in accordance with HWP. Adhere to ALARA principles. 2. Follow standard Heat Stress monitoring protocol and appropriate work/rest cycles. 3. Employee awareness and good housekeeping.
Setup of work area/ equipment and materials.	1. Staging of equipment and supplies.	1. Heat Stress 2. Slip, trip, and fall hazards. 3. Material handling.	1. Follow standard heat stress monitoring protocol and appropriate work/rest cycles. 2. Employee awareness and good housekeeping practices. 3. Use only qualified operators and use proper equipment for given task.

Work Activity	Procedure Steps	Associated Hazard	Hazard Control Method
Visual inspection of tank interiors	1. Open tank hatches, perform visual inspection, videotaping, physical probing.	1. Exposure to chemical hazards. 2. Spread of radiological contamination. 3. Radiation exposure. 4. Tank openings 5. Heat Stress 6. Slip, trip, and fall hazards.	1. Perform appropriate IH monitoring and use of PPE prescribed in HWP. 2,3 a. Continuous job coverage by a qualified RCT, b. Application of standard ALARA and Health physics practices, c. All workers involved will be currently qualified as RW II. 4. Openings will be equipped with a standard railing and use of technician as "Spotter". 5. Use standard heat stress monitoring practices and use appropriate work/ rest cycles. 6. Employee awareness and good housekeeping practices and use of technician as "Spotter".

Work Activity	Procedure Steps	Associated Hazard	Hazard Control Method
Sampling Activities	1. Open tank hatches, perform visual inspection, perform sample collection, videotaping. 2. Removal of contaminated sludge/wood/liquid from Tank "A". 3. Size wood for samples. 4. Containerize samples.	1. Exposure to chemical hazards. 2. Spread of radioactive contamination. 3. Airborne radioactivity. 4. Heat Stress. 5. Tank openings. 6. Slip, trip, fall hazards.	1. Perform appropriate IH monitoring and use of PPE as prescribed in HWP. 2,3. a. Continuous job coverage by a qualified RCT, b. Application of standard ALARA and Health physics practices, c. All workers involved will be currently qualified as RW II. d. If needed, use appropriate dust controls to limit airborne dust hazards. 4. Conduct standard heat stress monitoring and ensure appropriate work/rest cycles are adhered to. 5. Openings to be equipped with a standard railing and use of technician as "Spotter". 6. Employee awareness and good housekeeping practices and use of technician as "Spotter".

Work Activity	Procedure Steps	Associated Hazard	Hazard Control Method
Manual decontamination of tools, sample containers, etc.	1. Use of dry decontamination techniques, (damp towels, etc.)	1. Over exertion of extremities. 2. Heat Stress 3. Airborne radioactivity. 4. Spread of radioactive contamination	1. Use work gloves and take breaks when needed in order to avoid fatigue. 2. Conduct standard heat stress monitoring and ensure appropriate work/rest cycles are adhered to. 3,4. a. Continuous job coverage by a qualified RCT, b. Application of standard ALARA and Health physics practices, c. All workers involved will be currently qualified as RW II. d. If needed, use appropriate dust controls to limit airborne dust hazards.

Work Activity	Procedure Steps	Associated Hazard	Hazard Control Method
Packaging of waste	1. Segregate clean materials from contaminated items. 2. Place wastes into appropriate packagings according to radiological/ hazardous status. 3. Marking/labeling of waste packagings. 4. Placement of waste packages into appropriate storage areas.	1. Exposure to chemical hazards. 2. Spread of radiological contamination. 3. Radiation exposure. 4. Material handling 5. Heat Stress 6. Slip, trip, and fall hazards.	1. Perform appropriate IH monitoring and use of PPE prescribed in HWP. 2,3 a. Continuous job coverage by a qualified RCT, b. Application of standard ALARA and Health physics practices, c. All workers involved will be currently qualified as RW II. 4. Proper lifting techniques, use proper equipment for each task, use qualified equipment operators. 5. Use standard heat stress monitoring practices and use appropriate work/ rest cycles. 6. Employee awareness and good housekeeping practices.