FINAL PROJECT CLOSEOUT REPORT FOR FOUR DECONTAMINATED FACILITIES

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

Prepared for:

United States Department of Energy
Oakland Operations Office
Oakland, California

April 1997

MZ/04-03-97/UCDAVIS/96-0066.R2

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HEALTH RESEARCH (LEHR)
UNIVERSITY OF CALIFORNIA AT DAVIS
DAVIS, CALIFORNIA

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MZ/04-03-97/UCDAVIS/96-0066.R2

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Acronyms

ALARA	As low as reasonably achievable
AH-1	Animal Hospital 1
AH-2	Animal Hospital 2
cm^2	square centimeter
D&D	decontamination and decommissioning or decontaminate and decommission
DHS	Department of Health Services
DOE	United States Department of Energy
dpm	disintegrations per minute
EMS	Environmental Management Services
ft^3	cubic feet
HEPA	high efficiency particulate air
IT	IT Corporation
LEHR	Laboratory for Energy-Related Health Research
m^2	square meter
m^3	cubic meter
mrad/hr	millirad per hour
MOA	memorandum of agreement
mrem	millirem
NEPA	National Environmental Policy Act
NRC	U. S. Nuclear Regulatory Commission
ORISE	Oak Ridge Institute for Science and Education
pCi/g	picoCuries per gram
RHB	Radiologic Health Branch
S&M	surveillance and maintenance
UCD	University of California, Davis
uR/hr	micro Roentgen per hour
WA	Weiss Associates

Radionuclide Designators:

Am-241	americium 241
C-14	carbon 14
Cl-36	chlorine 36
Co-60	cobalt 60
Cs-137	cesium 137
H-3	tritium
I-129	iodine 129
Pu-241	plutonium 241
Ra-226	radium 226
Sr-90	strontium 90
Th-228	thorium 228

Executive Summary

The Laboratory for Energy-Related Health Research is located on a 15 acre parcel of land leased from the University of California, Davis. The facility was actively used from 1956 until 1988 to conduct research on animals using radionuclides, primarily strontium-90 and radium-226. In 1988 the Department of Energy's Office of Energy Research discontinued further research and initiated activities to decontaminate and decommission the LEHR facility and return ownership to University of California. Five buildings were used for animal research at LEHR. Animal Hospitals No. 1 and 2, and the Specimen Storage, Imhoff, and Cobalt-60 Buildings. Of these five buildings, the Animal Hospitals No. 1 and 2, and the Specimen Storage, and Cobalt-60 Buildings are addressed in this report.

Except for the Imhoff Building, this report describes the above buildings, their pre-decontamination status, the decontamination and decommissioning activities conducted, and their final radiological status. Briefly mentioned is the Imhoff Building status.

All decontamination and decommissioning activities at LEHR were conducted using approved workplans. Scoping, characterization, and final radiological surveys were performed for all buildings. The surveys were performed in accordance with nuclear regulations guidelines in NUREG/CR 5849 *"Manual for Conducting Radiological Surveys in Support of License Termination, Draft Report for Comment"* (ORAU 1992) and NUREG/CR 2082 *"Monitoring for Compliance with Decommissioning Termination Survey Criteria"* (ORNL 1981).

Residual surface contamination limits were based on guidelines established by the DOE (DOE 1990). Established limits were for alpha: 100 dpm/100 cm^2 average fixed, 300 dpm/100 cm^2 maximum, and 20 dpm/100 cm^2 loose; and for beta: 1000 dpm/100 cm^2 average fixed, 3000 dpm/100 cm^2 maximum, and 200 dpm/100 cm^2 loose. Residual contamination that exceeded the established limits was removed until all equipment and structural surfaces were within the established limits, as verified by surveys. All radioactive waste generated during the decontamination of the buildings and equipment was packaged and shipped for final disposal at the DOE's Hanford radioactive waste burial facility.

Results of all final status surveys indicate that the building surfaces in Animal Hospitals No. 1 and 2, the Specimen Storage Building, and the Cobalt-60 Building are within the established limits for surface contamination and that the buildings are ready for release to and

reuse by the University of California. Additionally, surveys and sampling indicate no radiological impact to the Animal Hospital-1 and Animal Hospital-2 trench soils.

1.0 Introduction

The Laboratory for Energy-Related Health Research (LEHR) is located on a 15-acre parcel of land leased from the University of California, Davis (UCD) (Figure 1-1). The facility was established in 1956 by the Atomic Energy Commission and research continued under the U.S. Department of Energy (DOE). Animal research focused on health effects from chronic exposure to radionuclides, primarily strontium-90 (Sr-90) and radium-226 (Ra-226), and health effects from cobalt-60 (Co-60) gamma-ray irradiation. DOE-sponsored research continued at LEHR until 1988, when DOE's Office of Energy Research decided to discontinue future research, decontaminate and decommission (D&D) the LEHR facility, and return ownership to UCD (DOE 1992).

This report was prepared for the United States Department of Energy Oakland Operations Office by IT Corporation (IT), Martinez, California and Knoxville, Tennessee and reviewed by Weiss Associates (WA), Emeryville, California, and Environmental Management Services (EMS), Concord, California.

2.0 Purpose

This report documents the successful D&D of four buildings operated by DOE at the LEHR site: Animal Hospitals No. 1 and 2 (H-219 and H-218), the Cobalt-60 Building (H-229), and the Specimen Storage Building Room 425 (H-216) (Figure 2-1). Future D&D and remedial actions will be addressed in a separate report. This report references documents supporting the DOE's certification and verification.

3.0 Description of LEHR Facilities

The LEHR site is located in the southeast quarter of Section 21, Township 8 North, Range 2 East, Mount Diablo Base and Meridian. The site is approximately 1.5 miles south of the main UCD campus and the town of Davis, and approximately 0.75 miles south of Interstate 80 on County Road 79 (Old Davis Road) in Solano County, California (Figure 1-1). The facility consists of 16 buildings, of which the subject four buildings are a part (Figure 2-1). A summary description of each building and the activities conducted therein is presented in Exhibit I in Section 2.0 of this document.

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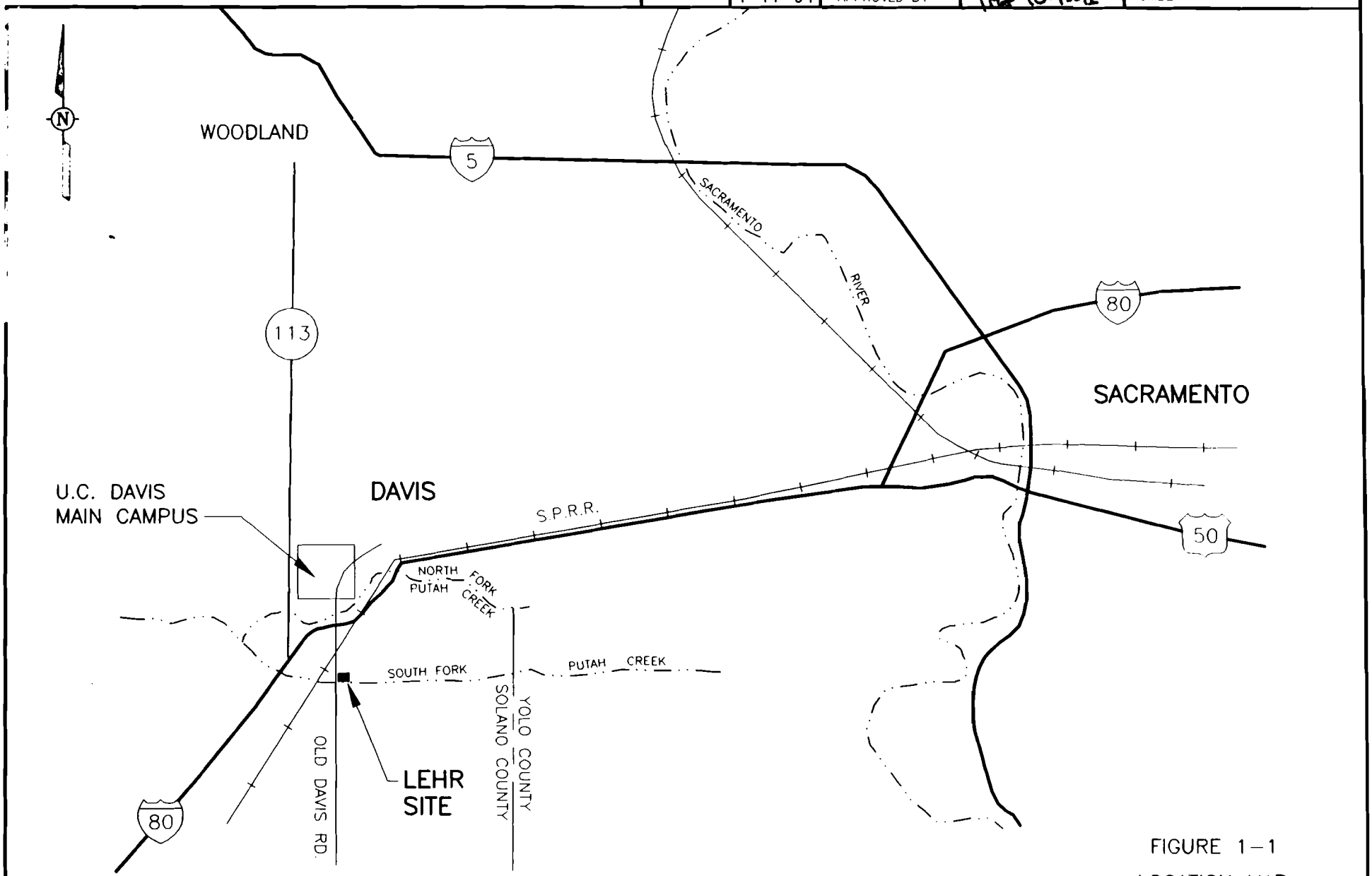

FIGURE 1-1

LOCATION MAP

PREPARED FOR

LEHR FACILITY
DAVIS, CALIFORNIA

NOT TO SCALE

LE-LM(LE2)

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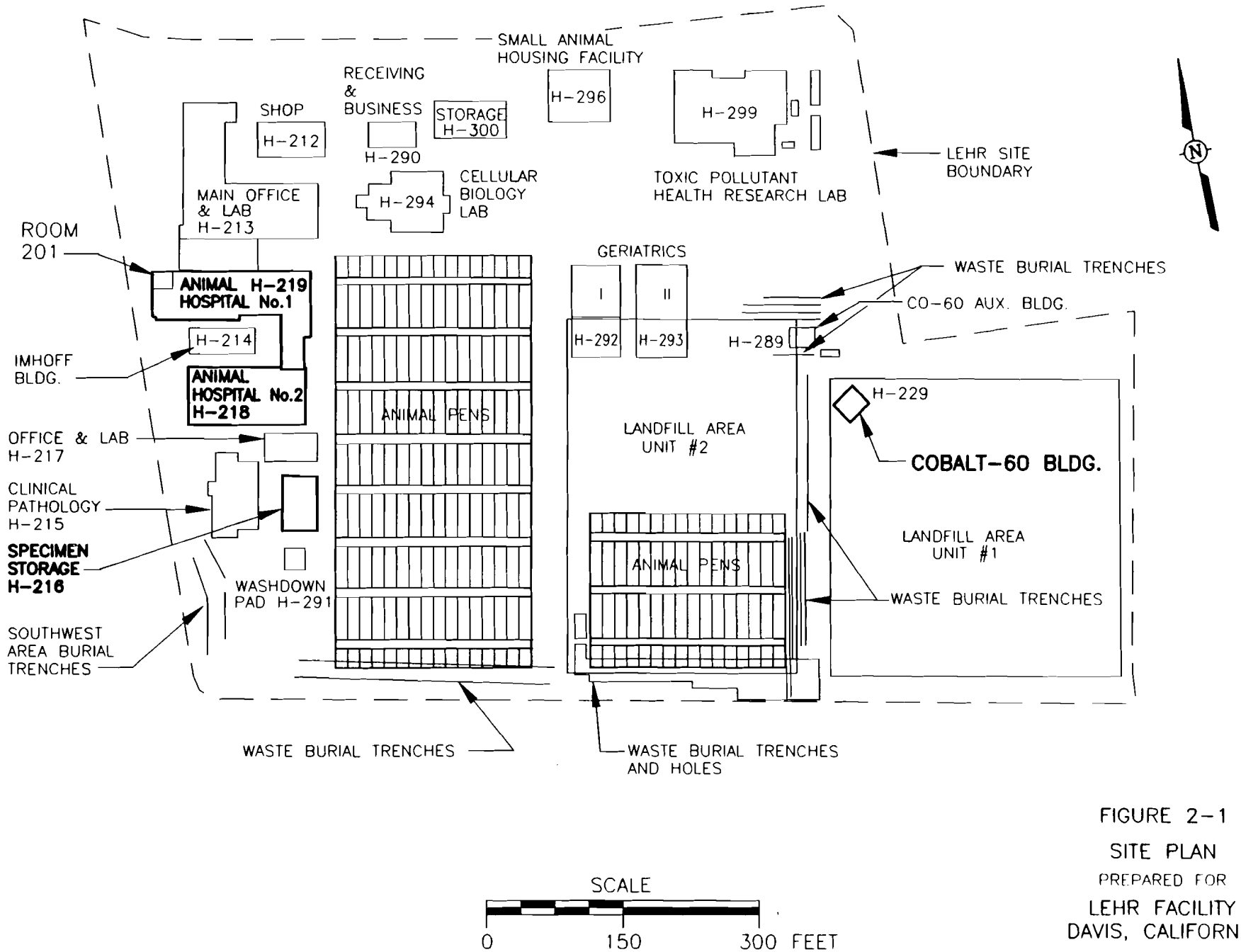

FIGURE 2-1

SITE PLAN

PREPARED FOR

LEHR FACILITY
DAVIS, CALIFORNIA

LE-SP8(LE3)

4.0 Report Organization

Exhibit I summarizes the D&D activities supporting the conclusion that conditions at the four buildings operated by DOE at the LEHR facility comply with applicable guidelines, and that future use of these buildings will not result in exposure above DOE criteria and/or standards established to protect members of the general public and occupants of the site. Further details of each activity beyond those included in Exhibit I can be found in the referenced documents.

Exhibit II lists documents supporting the conclusion that the LEHR facility has no radiological restrictions that limit future use of the site.

Exhibit III lists references used in this report.

This report and associated references will be archived by DOE through the Assistant Secretary for Management and Administration. Copies will be available for public review between 9:00 a.m. and 4:00 p.m., Monday through Friday (except Federal holidays), at the DOE Public Reading Room located in Room 1E-190 of the Forrestal Building, 1000 Independence Avenue, S.W., Washington, D.C. Additional locations are: DOE, Oakland Operations Office, First Floor Reading Room, Federal Building, 1301 Clay Street, Oakland, California; and Yolo County Library, 315 E. 14th Street, Davis, California. Hours for the DOE Oakland Operations Office are 9:00 a.m. to 4:00 p.m., Monday through Friday (except Federal holidays). Hours for the Yolo County Library are 1:00 p.m. to 9:00 p.m. on Monday; 10:00 a.m. to 9:00 p.m. on Tuesday and Wednesday; 10:00 a.m. to 5:30 p.m. on Friday and Saturday; and 1:00 p.m. to 5:00 p.m. on Sunday.

Exhibit I

Summary of D&D Activities at the LEHR Facility

Exhibit I
Summary of D&D Activities at the LEHR Facility

1.0 Site History

Research at LEHR focused on health effects of chronic exposure to radionuclides and gamma-ray irradiation. From 1956 through 1988 (BEI 1993), studies were conducted on a variety of laboratory animals to determine the long-term biological effects of ionizing radiation. Radionuclides characteristic of nuclear weapons fallout were used in the studies. From 1961 through 1969, the animals were fed Sr-90, with the majority of this research being conducted in Animal Hospital No. 1 (AH-1). In 1963, Ra-226 injection experiments were conducted on the animals, primarily using the facilities in Animal Hospital No. 2 (AH-2). Other experiments involving small amounts of plutonium-241 (Pu-241) and thorium-228 (Th-228) were conducted in AH-1 (PNL 1995). Other trace quantity isotopes used at LEHR included carbon-14 (C-14), tritium (H-3), chlorine-36 (Cl-36), and iodine-129 (I-129).

The Imhoff Building, located between Buildings AH-1 and AH-2 (Figure 2-1) contained laboratory equipment and was built over several below ground waste receiver tanks called the Sr-90 tanks. This building was demolished to grade to facilitate future D&D of the tanks. Radioactive wastes generated were packaged and shipped to the DOE's Hanford, Washington facility for final disposal. Post demolition surveys indicate that the concrete pad and surrounding area were not radiologically impacted by these activities. Pertinent information regarding the Imhoff Building has been included in Sections 6.0, 7.0, and 9.0 to supplement that gained in performing the D&D of the four buildings covered in this report.

2.0 Site Description

The four buildings at the LEHR facility operated by DOE are shown on Figure 2-1 and are briefly described below.

2.1 Animal Hospitals No. 1 and 2

AH-1 (H-219) is a single story wood-framed building with a stucco exterior. AH-1 contained nine laboratories for conducting animal studies using materials spiked with Sr-90. It also housed built-in cage rooms for research animals. Room function and radiological status is documented in earlier reports (BEI 1993). Three laboratories (Rooms 301, 302, and 304) that

connect AH-1 and AH-2 were previously surveyed and released to UCD and are not discussed in this report.

Room 202 of AH-1, which is still used by DOE contractors and UCD contractors and personnel as an instrument/counting laboratory, is not discussed in this report.

AH-2 (H-218) is a single story wood-framed building with a stucco exterior. AH-2 was used for surgical work, radiography, and Ra-226 experiments. Room function and radiological status are documented in earlier reports (BEI 1993). All rooms in AH-2 except Rooms 310, 310A, 310B, and 310C were previously released to UCD based on surveys conducted by Rockwell International (RI 1984) and Lawrence Livermore National Laboratory (LAY 1989) and are therefore not addressed in this report.

2.2 Cobalt-60 Building

The Cobalt-60 Building (H-229), located at the east end of the site, is a single-story, poured concrete building. Roof construction is concrete covered with composition roofing. Originally built to house and use a Co-60 irradiation source, the building contains a small control room with a leaded glass window and a much larger treatment room for animal irradiation with the Co-60 source. Following the removal of the Co-60 source in 1993, the exposure room of the Cobalt-60 Building was used to store lead bricks, an americium-241 (Am-241)/Pu-241 glovebox, bagged electrical motors, miscellaneous radioactive sources and vials contained in a safe, and other miscellaneous DOE items. Building function and radiological status are documented in the final release survey report (IT 1997).

2.3 Specimen Storage Building (Room 425)

The Specimen Storage Building is a single story building constructed with concrete block walls. The north half of the building was previously released by DOE and is not discussed in this report. The Specimen Storage Room (Room 425), a single large room attached to the Specimen Storage Building, was used to store both radioactive and non-radioactive animal samples (BEI 1993).

3.0 Radiological History of the LEHR Facility

The radiological characterization and final surveys conducted at LEHR followed the guidance in the *"Manual for Conducting Radiological Surveys in Support of License Termination, Draft*

Report for Comment," NUREG/CR 5849 (ORAU 1992). This document was prepared for the Nuclear Regulatory Commission (NRC) for the purpose of providing guidance to contractors performing radioactive decontamination of facilities and equipment and performing surveys to document that the residual contamination meets the requirements in Table 1 of Regulatory Guide 1.86, *"Termination of Operating Licenses for Nuclear Reactors"* (NRC 1974). The Table 1 values were incorporated into DOE Order 5400.5 (DOE 1990) and these values are presented in Table II-1 of this report.

Guidance found in NUREG/CR 5849 describes survey densities for affected and unaffected areas. An affected area is one where activities were conducted with radioactive materials and it is reasonable to anticipate that contamination still exists. An unaffected area is an area where it is known, or is highly likely, that no radioactive materials were used or stored and it is anticipated that no radioactive contamination exists. Surveys conducted in affected areas rely on gridding of the walls, up to 2 meters high, and floors into 1 square meter (m^2) areas. Each grid is scanned over 100 percent of the area, and at a minimum 1 smear and 1 fixed count is conducted in every 2 m^2 area. If the minimum detectable activity of the survey equipment is greater than 25 percent of the Table 1 limits, then the minimum smear and fixed count density is increased. Surveys are to be performed on wall areas higher than 2 meters at a more limited density unless residual contamination is found that exceeds 25 percent of the Table 1 limits. When this occurs, the survey density is the same as for the floor and lower walls.

Dose rate measurements, in micro Roentgen per hour (μR/hr) are performed at a minimum frequency of once per four grids. The dose rate is measured 1 meter from the affected surface.

Unaffected area surveys are random. Survey density for scans is at a frequency of 10 percent of all surfaces, smears and fixed counts taken in at least 30 locations or an average of 1 every 50 m^2 of surface area, and dose rate measurements in at least 30 locations. Detection of contamination at 25 percent of Table 1 limits changes the survey frequency to that of an affected area.

Exterior surfaces are surveyed at building entrance/exit points, exhaust stacks, and walking surfaces leading away from the building.

At the LEHR facility, affected area surveys used smear, fixed count rates, and dose rate surveys at frequencies that exceeded the NUREG/CR 5849 guidance. Fixed count rate and smear surveys were performed at a frequency of five per grid, with one measurement in the center of the grid and one near each corner. Wall surfaces above 2 meters high were gridded in 3 m^2 areas (BEI 1993). This frequency was used for both characterization and final surveys. Using this technique expedited the overall survey duration as those grids found to have residual contamination within the guidance limits found in Table II-1 required no further survey as the existing survey data were sufficient to document the radiological status. Only those areas that were decontaminated required a final survey.

The following describes the radiological conditions in buildings as documented in the characterization surveys. Residual activities on most of the building surfaces were found to be below the residual guidance values. The following summary identifies those items and structures that were found to be contaminated.

3.1 Animal Hospitals No. 1 and 2

AH-1 was used for Sr-90 work. Plumbing and ventilation systems of the animal cages were contaminated with beta activity (Sr-90) levels to greater than 1,000,000 disintegrations per minute (dpm)/100 cm^2 and alpha activity up to 10,000 dpm/100 cm^2.

Several animal cages in Room 310 of AH-2 had alpha activity that ranged from a low of 360 to a high of 12,000 net dpm/100 cm^2. Results of smear or wipe measurements indicate that residual alpha activity is not easily removed (i.e., fixed). Many of the cages in Room 310 of AH-2 had beta activities which ranged from a low of 3,000 to a high of 92,000 net dpm/100 cm^2. In addition cesium-137 (Cs-137) was detected by isotopic analysis in trace amounts in both buildings (BEI 1991).

3.2 Cobalt 60 Building

The sealed 390 curie Co-60 source and its enclosure on the roof were removed and shipped off the LEHR site in January 1993. Source strength in January 1993 was approximately 100 curies.

Pre-decontamination radiological surveys detected loose surface contamination on the walls, floor, and structures of the exposure room. Surface contamination levels ranged from 200 to 80,000 dpm/100 cm^2 and resulted from radioactive material stored in the building.

3.3 Specimen Storage Building (Room 425)

The Specimen Storage Room (Room 425) had localized areas (i.e., "spots") of fixed contamination on the floor and on the sample rack.

4.0 Criteria for Selection of Decontamination and Decommissioning Options

Three options were initially evaluated for remedial action at the LEHR. These options included: (1) no action consisting of cessation of all activities in these buildings, including surveillance and maintenance (S&M); (2) continued S&M in the buildings; and (3) the D&D of the buildings and removal of the Co-60 source (DOE 1992).

Option 3 was selected since it removed contamination and the potential for adverse environmental impacts, returned buildings to UCD in accordance with the Memorandum of Agreement (MOA) (JTD 1990), and was the most cost-effective alternative.

The D&D option included on-site removal of the elevated alpha, beta, and beta-gamma contaminated cages, piping, equipment, components, structures, and waste with radioactivity levels greater than those permitted for unrestricted release of the property. This option also included the removal and disposal of the Co-60 source from the roof of the Cobalt-60 Building.

5.0 Summary of Decontamination Activities and Final Radiological Status

The approach for implementing the D&D option involved the decontamination of building structures, dismantling where necessary, and removal and disposal of contaminated equipment. Residual contamination of the buildings was reduced to levels consistent with use of the facilities without restriction. The general decontamination process was the same for the AH-1, AH-2, Cobalt 60, and Specimen Storage buildings.

In general, the decontamination processes involved the following sequence of activities:

- Performing a comprehensive radiological survey to scope and plan the D&D effort,
- Preparing D&D work plans based on the survey results,

- Isolating the area(s) to be decontaminated and installing access control,
- Surveying and removing uncontaminated equipment and packaging contaminated equipment for disposal,
- Decontaminating ceilings, walls, floors, tanks, drains, and pipes,
- Conducting surveys for residual contamination and decontaminating as necessary,
- Performing systematic release surveys, and
- Performing independent verification surveys as specified in the DOE Decommissioning Resource Manual.

All of the D&D activities were carried out with suitable technical and administrative controls to minimize the risks of inadvertent exposure and contamination. The following sections summarize the D&D activities performed in the subject four buildings. Additional information can be found in the final survey reports for the respective buildings (Exhibit II).

In general, passive decontamination techniques such as high-efficiency particulate air (HEPA) vacuuming, damp cloth wiping, and, to a limited degree, hand washing/scrubbing were applied first. However, when the contaminants were more tightly bound to the surface material, such as in AH-1 and AH-2 where it was trapped in layers of fiberglass and epoxy, more aggressive decontamination methods were applied such as surface removal by chipping and grinding (i.e., scabbling/scarification).

5.1 Animal Hospitals No. 1 and 2

Decontamination and decommissioning of each building commenced with the decontamination of internal components and support equipment, as appropriate. When decontamination was no longer cost-effective, the remaining contaminated material was removed, volume reduced, and packaged for disposal.

Sub-floor soil and construction material (e.g., stone) samples were taken and analyzed for radioactive contamination, with specific emphasis on material below slab cracks and expansion joints, and adjacent to penetrations, such as floor drains and clean-out ports. Neither on-site soil screening nor off-site laboratory analyses revealed any contamination above natural background concentrations.

Final radiological status, as shown by survey, indicated that the residual radioactivity within the building and/or equipment was within the applicable limits established for release of the buildings and equipment for unrestricted use. The buildings are radiologically ready to be released to and reused by UCD (PNL 1995).

5.2 Cobalt-60 Building

Prior to initiating the characterization survey, all fully characterized materials stored in the Cobalt-60 Building were packaged in accordance with LEHR guidance manuals.

The Cobalt-60 Building was surveyed for the presence of residual activity. Fixed radioactive contamination was encountered on the exposure room floor and in two grids of the adjoining walls. All contaminated surfaces were decontaminated. Post-decontamination survey results demonstrate the decontamination effort successfully removed the fixed radioactivity.

Results of the final survey demonstrate that residual contamination in all areas inside and outside the Cobalt-60 Building are within the Table II-1 limits established for the LEHR site. This building meets the radiological conditions for release to and reuse by UCD (IT 1997).

5.3 Specimen Storage Building (Room 425)

Fixed contamination identified during previous surveys was successfully decontaminated as demonstrated by the post-decontamination survey results.

Results of the final survey demonstrate that residual contamination in Room 425 and on equipment was within the limits in Table II-1 established for release of the buildings and equipment at LEHR. This building meets the radiological conditions for release to and reuse by UCD (PNL 1995).

6.0 Waste Volume Generated and Disposal

Decontamination of the two Animal Hospitals, Specimen Storage and Cobalt-60 buildings generated a total of 560 m^3 (20,000 ft^3) of low-level radioactive waste. In addition, approximately 170 m^3 (6,000 ft^3) of low-level radioactive waste was generated from the Imhoff Facility demolition. This waste was volume-reduced, packaged in B-25 boxes, and shipped to the DOE Hanford Site in the State of Washington for disposal.

7.0 Personnel Radiation Exposure

All personnel working on the LEHR D&D projects were monitored for both external and internal dose exposure. Over the five year duration of the project, only two workers received measurable doses that were related to D&D activities of the four buildings. These two workers received a maximum of 10 mrem each, which is well below the 5,000 mrem/yr DOE exposure limit to radiation workers.

8.0 Cost and Schedule Performance Evaluation

Overall the LEHR budget for performance of the D&D activities was approximately $14 million, actual costs were approximately $13 million. D&D activities were scheduled to be completed by 1997, actual completion date was 1996.

As shown above, the LEHR D&D program was completed ahead of schedule and under budget. However, the D&D of several individual facilities experienced both negative and positive cost and schedule impacts. These impacts are summarized below:

Delay in D&D Start Date
This delay was primarily due to obtainment of an approved Environmental Assessment as required by the National Environmental Policy Act (NEPA).

Mid-Stream Change in D&D Approach
The original approach to the Animal Hospital dog cages D&D focused on removal of contamination while preserving the cages for future animal research. However, the excessive and inaccessible contamination discovered inside these cages resulted in a management decision to remove all cages.

Waste Management
The waste management practices of the D&D operations focused on waste minimization and volume reduction. For example, a capital investment of $70,000 for a shredder and a compactor resulted in a net savings of about $800,000 in waste transportation and disposal cost.

Asbestos Contaminated D&D Waste
The D&D operations involved removal of asbestos contaminated materials. Rather than landfilling these materials in a Class I California site, LEHR took advantage of the fact that asbestos is not considered to be a hazardous waste in the State of Washington and therefore, may be placed in B-25 D&D low-level disposal boxes as void space filler. This action, which was approved by the State of Washington and the DOE Hanford Site, not only eliminated the need for

the costly disposal of hazardous waste in California, but also provided a proper and cost effective void space filler for the disposal boxes as required by the DOE Hanford Site Waste Acceptance Criteria.

9.0 Lessons Learned

Lessons learned over the life of the LEHR D&D project include:

- The choice of demolition, as opposed to decontamination, should have been the preferable D&D method for the cages in the two Animal Hospital buildings.

- Waste volume reduction techniques such as scabbling of concrete, sizing of metal and wood parts by cutting into smaller pieces, crushing of components, nesting of piping, and shredding can be very beneficial in reducing waste disposal costs. Cost savings are realized in the following areas: waste packaging, storage, handling, manifesting, transportation, final disposal, and taxes.

- Waste minimization techniques such as cutting open ventilation ducting to facilitate decontamination, using multiple decontamination solutions on metal containers, selection of decontamination techniques to minimize waste generated, segregation of wastes, and administratively controlling entry of unnecessary materials into contaminated areas, were useful techniques.

- Waste should be properly characterized prior to waste size reduction and packaging to determine if the waste would be classified as hazardous under the Resource Conservation and Recovery Act. There are many subtle and potentially overlooked components of waste, such as lead based paint or lead solder, that if shredded or size reduced, would result in large volumes of radioactive waste potentially being categorized as mixed hazardous waste.

- Determination of the final radiological status of individual portions of a D&D project should be made before the deactivation of building support systems or the start of other D&D activities that will impose major interference with subsequent remedial work. For example following the removal of the HEPA-filtered ventilation system in AH-2 and partial removal in AH-1, the D&D subcontractor found that further decontamination of the dog cages would be required.

Exhibit II

Documents Supporting the Certification of the Four Decontaminated LEHR Facilities

Exhibit II
Documents Supporting the Certification of the Four Decontaminated LEHR Facility

1.0 D&D and Stabilization Criteria

Surface residual radioactivity guidelines are shown on Table II-1. These guidelines are those presented in DOE Order 5400.5, Figure IV-1 (DOE 1990).

2.0 Designation of Authorization Documents

A MOA was reached between DOE and UCD concerning the environmental restoration of the DOE occupied land and facilities at LEHR, as well as collateral issues surrounding UCD's occupancy of certain government owned facilities at the site. The MOA was transmitted by letter dated March 13, 1990 to Ms. Janet Hamilton, *"Memorandum of Agreement Covering LEHR Environmental Restoration Activities"* from James T. Davis (JTD 1990).

3.0 Characterization Report

3.1 Animal Hospitals No. 1 and 2

In 1991, a survey to characterize the radiological content and distribution in Animal Hospitals No. 1 and 2 was completed. The characterization survey is documented in *"Characterization Report for the Animal Hospital Buildings (AH-1 & 2)"* (BEI 1991). The results identified several areas and various pieces of equipment that were contaminated above the release criteria in Table II-1.

TABLE II-1
SURFACE RESIDUAL RADIOACTIVITY GUIDELINES*

	Allowable Total Residual Surface Contamination (dpm/100 cm^2)[1]		
Radionuclides[2]	Average[3,4]	Maximum[4,5]	Removable[4,6]
Transuranics, I-125, I-129, Ra-226, Ac-227, Ra-228, Th-228, Th-230, Pa-231.	100	300	20
Th-Natural, Sr-90, I-126, I-131, I-133, Ra-223, Ra-224, U-232, Th-232.	1,000	3,000	200
U-Natural, U-235, U-238, and associated decay products, alpha emitters.	5,000	15,000	1,000
Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.[7]	5,000	15,000	1,000

[1]As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute measured by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[2] Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for the alpha- and beta-gamma-emitting nuclides should apply independently.

[3]Measurements of average contamination should not be averaged over an area of more than 1 m^2. For objects of less surface area, the average should be derived for each such subject.

[4]The average and maximum dose rates associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/h and 1.0 mrad/h, respectively, at 1 cm.

[5]The maximum contamination level applies to an area of not more than 100 cm^2.

[6]The amount of removable material per 100 cm^2 of surface area should be determined by wiping the area of that size with a dry filter or soft absorbent paper, applying moderate pressure, and measuring the amount of radioactive material on the wiping with an appropriate instrument of known efficiency. When removable contamination on objects of surface area less than 100 cm^2 is determined, the activity per unit area should be based on the actual area and the entire surface should be wiped. It is not necessary to use wiping techniques to measure removable contamination levels if direct scan surveys indicate that the total residual surface contamination levels are within the limits for removable contamination.

[7]This category of radionuclides includes mixed fission products, including the Sr-90 which is present in them. It does not apply to Sr-90 which has been separated from the other fission products or mixtures where the Sr-90 has been enriched.

*Source: DOE Order 5400.5 (DOE 1990)

3.2 Cobalt 60 Building

Radiation, contamination, and airborne radiological surveys were performed within the Cobalt-60 Building immediately prior to commencing D&D activities to establish baseline radiological conditions and the appropriate hazardous work permit and entry requirements. Survey results are documented in the *"Cobalt-60 Building and Room 201 of Animal Hospital No. 1 Release Survey Report,"* (IT 1997).

3.3 Specimen Storage Building (Room 425)

No characterization report is available for this building. However, there is a letter report that documents characterization survey results. The data were transmitted by a letter dated April 26, 1993 to Salem A. Attiga, Ph.D., *"LEHR ER Project - Bechtel Job No. 21429 Surveys of the Specimen Storage Room BEI File No. LEHR-887"* from William C. Borden (WCB 1993).

4.0 NEPA Documents

NEPA documentation pertinent to LEHR certification is included in the *"Environmental Assessment for the Decommissioning and Decontamination of Contaminated Facilities at the Laboratory for Energy-Related Health Research, University of California, Davis,"* (DOE 1992).

5.0 Post D&D Final Survey Reports

The D&D activities discussed in this report were performed over a three year period by several contractors. The following individual survey reports encompass D&D and survey activities associated with the four buildings covered in this report.

5.1 Animal Hospitals No. 1 and 2/Specimen Storage Room

Radiological survey results are contained in the *Final Draft, "AH-1/AH-2/Specimen Storage Room Final Survey Report"* (PNL 1995). D&D activities in Room 201 of AH-1 are described in the *"Cobalt-60 Building and Room 201 of Animal Hospital No. 1 Release Survey Report"* (IT 1997).

5.2 Cobalt-60 Building

D&D and final survey activities within the Cobalt-60 Building are described in the *"Cobalt-60 Building and Room 201 of Animal Hospital No. 1 Release Survey Report"* (IT 1997).

6.0 Independent Verification Contractor Report

The Oak Ridge Institute for Science and Education (ORISE) was contracted to perform an independent verification survey of AH-1 and AH-2 and the Specimen Storage Room. The survey is documented in *"Verification Survey of Buildings AH-1, AH-2, and the Specimen Storage Room, Laboratory for Energy-Related Health Research, University of California, Davis, Davis, California,"* (TJV 1995). The survey determined that all building areas were within the release criteria guideline values.

In addition, ORISE was contracted to review the survey report prepared by IT for the Cobalt-60 Building and Room 201 of AH-1. ORISE performed a Type A verification, and their results are documented in *"Type A Verification Report for the Co-60 Building and Room 201 of Animal Hospital No. 1, Laboratory for Energy-Related Health Research, University of California, Davis,"* (TJV 1996). The survey report was acceptable to ORISE reviewers and the survey determined that the Cobalt-60 Building and Room 201 are within the release criteria guideline values.

7.0 State, County, and Local Comments on Adequacy

The California Department of Health Services (DHS), Environmental Health Services Section reviewed, as a service to UCD, the final survey report for AH-1/AH-2 and the Specimen Storage Room (PNL 1995) and found that the report ".... adequately addresses the decontamination and decommissioning of the areas described in the report." (RBH 1994).

The California DHS, Radiologic Health Branch (RHB), reviewed, as a service to UCD, the final survey report for AH-1/AH-2 and the Specimen Storage Room (PNL 1995). There were four comments that resulted from their review. These comments were transmitted to Mr. Jim Littlejohn of the U.S. DOE, Oakland Operations Office (GW 1995). The RHB comments were resolved and incorporated into the verification report by ORISE (TJV 1995). In addition, RHB verified the adequacy of the D&D through field survey and soil sample testing.

The California DHS, RHB, reviewed, as a service to UCD, the draft survey report for the Cobalt-60 Building and Room 201 of AH-1. Their comments, transmitted to Mr. Jim Littlejohn of DOE (GW, 1996), were resolved and incorporated into the final report (IT, 1997). Following review of the amended report, RHB concurred with the results of the release survey.

8.0 Restrictions

Residual radioactive contamination in all buildings has been shown to be within the limits of Table II-1. The results of all surveys indicate that no future use restrictions should be applied to the four buildings discussed in this report.

Exhibit III

References

Exhibit III
References

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