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ANNUAL SITE ENVIRONMENTAL REPORT

FOR THE

LABORATORY FOR ENERGY-RELATED HEALTH RESEARCH

UNIVERSITY OF CALIFORNIA, DAVIS

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ACRONYMS AND ABBREVIATIONS

AH-1	Animal Hospital 1
AH-2	Animal Hospital 2
ALARA	As Low As Reasonably Achievable
ANSI	American National Standards Institute
Ba-137	Barium-137
BEI	Bechtel Environment Inc.
BHC	Hexachlorocyclohexane
CAA	Clean Air Act
CEQA	California Environmental Quality Act
CEP	Controls for Environmental Pollution, Inc.
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
Ci	Curie
Co-60	Cobalt-60
CPT	Cone Penetrometer Testing
CrVI	Hexavalent Chromium
Cs-137	Cesium 137
CWA	Clean Water Act
DCG	Derived Concentration Guide
D&D	Decontamination and Decommissioning
DHS	California Department of Health Services
DOE	U.S. Department of Energy
DDE	Dichloroethane
D&M	Dames & Moore
DTSC	California Department of Toxic Substances Control
DW	Domestic Well
EA	Environmental Assessment
EH&S	Environmental Health and Safety Office
ESO	Environmental Services Operations
EPA	U.S. Environmental Protection Agency
EPIP	Environmental Protection Implementation Plan
ER	Environmental Restoration
ESA	Endangered Species Act
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FONSI	Finding of No Significant Impact
g	Gram
Ger	Geriatrics Building
H-3	Tritium
HEPA	High Efficiency Particulate Air Filter
HSU	Hydrostratigraphic Unit
IAW	In Accordance With
IMH	Imhoff Building
ITEH	Institute Toxicology and Environmental Health
IW	Irrigation Well

L	Liter
LEHR	Laboratory for Energy-Related Health Research
LSC	Liquid Scintillation Counter
MCL	Maximum Contaminant Level
MDA	Minimum Detectable Amount
MeV	Megaelectron-volts
mg	milligram
mL	milliliter
mrem	millirem
nCi	Nanocurie
ND	Not Detected
NEPA	National Environmental Policy Act
NESHAPS	National Emission Standard for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NPDES	National Pollution Discharge Elimination System
NPL	National Priorities List
NQA	National Quality Assurance
OMB	Office of Management and Budget
ORPS	Occurrence Reporting and Processing System
OSHA	Occupational Safety and Health Administration
PCB	Polychlorinated Biphenyl
PCD	Putah Creek Downstream
pCi	Picocurie
PCU	Putah Creek Upstream
Pu-241	Plutonium-241
QA	Quality Assurance
QAM	Quality Assurance Manual
QC	Quality Control
Ra-226	Radium 226
Rad	Radiation Absorbed Dose
RCRA	Resource Conservation and Recovery Act
RDC	Radiation Detection Company
rem	Roentgen Equivalent Man
RI/FS	Remedial Investigation/Feasibility Study
RWQCB	Regional Water Quality Control Board
SDWA	Safe Drinking Water Act
SPCC	Spill Prevention Controls and Countermeasures
Sr-90	Strontium-90
SSDC	System Safety and Development Center
Stor	Storage
STPO	Wastewater (Sewage) Treatment Plan Outfall
SWAT	Solid Waste Assessment Test
Th-228	Thorium-228
Th-232	Thorium-232
TLD	Thermoluminescent Dosimeter

TSCA	Toxic Substances Control Act
UCD	University of California at Davis
uCi	microcurie
ug/l	Micrograms per liter
VOC	Volatile Organic Compound
WEQAP	Work Element Quality Assurance Plan

1.0 EXECUTIVE SUMMARY

This Annual Site Environmental Report describes environmental activities for the Department of Energy's Environmental Restoration Project at the Laboratory for Energy-Related Health Research. The report provides information about the site and its environmental monitoring operation throughout calendar year 1992. Environmental data for the year are summarized for both radiological and non-radiological monitoring. This report also describes activities conducted during 1992 in support of the site environmental restoration efforts, and information about the impact of these activities on the public and the environment.

During 1992, the LEHR site and local environment were monitored for ambient radiation fields as well as radiological and non-radiological contaminants in the groundwater and surface water. Air effluent monitoring was also performed periodically during decontamination and/or abatement activities for specific site buildings. The scope of the environmental monitoring program was increased during the year through publication of the Environmental Monitoring and Surveillance Plan for the LEHR site, with full implementation of these changes to be achieved in fiscal year 1993.

1.1 Overview of 1992 Monitoring Results

Results of the LEHR Environmental Monitoring Program during the year indicated that, with few exceptions, the majority of monitoring measurements were found to be within previously determined ranges for background levels. Data collected outside background levels have been evaluated for trends to determine both cause and corrective action, and to assess the need for additional information. Summaries of 1992 environmental data are below, and further data is contained in Chapters 5 and 6 of this report.

Ambient radiation monitoring was conducted at 17 locations around the site. The only areas recording over 4 mrem above background for any quarter in the year were the designated radiological waste storage areas and, for the first quarter only, the location where sludge was being removed from the underground Imhoff tanks. Complete data summaries of environmental dosimetry are provided in Table 5.5 through 5.8.

Groundwater and surface water monitoring results showed elevated levels of the following: chloroform and other volatile compounds, tritium, chromium, and nitrate. Additional water and soil investigations are being planned to determine the source of these contaminants and the extent of any necessary remediation.

Air effluent monitoring of specific activities conducted for the environmental restoration project has found no radiological effluents above background levels released as a result of these operations.

1.2 Assessment of Radiological Impact of LEHR Operations

With few exceptions, most of the environmental monitoring data collected have indicated results of such low concentrations that they are not detectable above natural background levels by conventional monitoring procedures. Therefore, radiation doses to members of the public in the site vicinity have been calculated with mathematical models which use known transport mechanisms for atmospheric and liquid releases and known major pathways of exposure to man. The EPA-approved CAP88-PC and/or AIRDOS-PC computer codes were utilized to develop these estimates.

The LEHR site has no active liquid effluent streams. Environmental restoration activities within buildings have been accomplished under engineering controls to prevent release of contaminants. Airborne releases are directed through double HEPA filtration and are monitored so that prompt action could be taken if necessary to maintain ALARA (As Low As Reasonably Achievable) guidelines. To assure that site activities have minimal effects on the public or environment, calculations have been performed to determine the maximum potential dose an individual would receive from site sources.

From existing residual contamination with no remediation activities in progress, the maximum dose to a member of the public has been calculated to be less than 0.001 mrem. These calculations were based upon the residual radioactive material contamination measured during site characterization activities.

Remedial activities accomplished as part of the site environmental restoration program may provide a potential for release of airborne contamination. Calculations have been developed to estimate potential effective dose equivalent prior to the start of such activities so that appropriate measures are incorporated during the planning stages in order to prevent, reduce, and/or monitor releases.

Site environmental restoration activities during 1992 involved work on one major project and the completion of another project initiated in 1991. The sludge removal project was begun in the fall of 1991, and completed in early 1992. The calculations for this project were described in the 1991 National Emission Standard for Hazardous Air Pollutants (NESHAPS) report. This report calculated an estimated effective dose equivalent of 4.0E-5 mrem per year for the maximally exposed individual at the site boundary for all pathways. The next remedial action in 1992 was the decontamination and decommissioning of the Animal Hospital buildings. A conservative estimate of 0.003 mrem per year was calculated for this activity in the 1992 NESHAPS report. Neither of these remedial activities would contribute even 1% of the limit set by NESHAPS. Further details defining impacts of these activities are provided in Chapter 5 of this report.

2.0 INTRODUCTION

2.1 History

The Laboratory for Energy-Related Health Research (LEHR) was established in 1958 at its present location by the Atomic Energy Commission. Research at LEHR originally focused on the health effects from chronic exposures to radionuclides, primarily strontium-90 (Sr-90) and radium-226 (Ra-226), using beagles to simulate radiation effects on humans. In 1988, pursuant to a memorandum of agreement between the U.S. Department of Energy (DOE) and the University of California, DOE's Office of Energy Research initiated activities to close out the research program at LEHR, with the goal of returning the facilities and site to the University of California, Davis after remediation is complete.

2.2 Remediation

The decontamination and decommissioning (D&D) of LEHR is managed by the San Francisco Operations Office (SF) under DOE's Environmental Restoration Program. From October 1989, through February 1990, an interim contract with UC Davis was implemented to succeed the Maintenance and Operations contract for the purpose of continuing certain necessary site D&D work at LEHR. In March 1990, DOE selected Battelle's Environmental Services Operations (ESO) to perform overall LEHR Environmental Restoration (ER) project management. ESO has since contracted with various organizations, including UC Davis, to perform specific services required by the project.

Functions essential to achieving remediation objectives include: soil and groundwater site characterization, building assessment, D&D activities necessary to remediate site buildings and dog pens, waste management, source removal (radioactive sludge, cobalt-60 sealed source), chemical and radiological risk assessment, remediation of DOE contaminated trenches, soil, and underground tanks, community relations, and landlord/general site services. Project management, health and safety, and quality assurance are components of all actions undertaken. Completion of the D&D and remediation efforts will allow DOE to transfer the buildings and facilities to UC Davis. These efforts are the major objectives of the LEHR ER Project.

2.3 The Site

The LEHR site is located on a 15-acre parcel of land owned by the Regents of the University of California. It is 1.5 miles south of the main UC Davis campus in a rural agricultural area (Figure 2.1). The site is presently occupied by the UC Davis Institute of Toxicology and Environmental Health (ITEH). Research at ITEH is directed towards toxicology, epidemiology, and radiation biology and radiochemistry. Research related to the former LEHR Project is limited to data compilation and preparation of journal articles and scientific papers.

The LEHR facilities consist of 16 buildings, including a main administration and office building, two animal hospitals, a laboratory and support buildings, cargo container waste storage facilities, and numerous dog pens. A diagram of the current site is shown in Figure

2.2. Authorized historic use of specific facilities and/or areas on the LEHR site has left an environmental impact, which is currently being investigated and remediated. Former facilities included: radioactive fluid waste treatment systems, indoor/outdoor cobalt-60 beam irradiator, radioactive waste burial ground, the animal hospitals, and outdoor dog pens. In addition, LEHR is the location of two inactive campus landfill units and numerous inactive campus low level radioactive disposal sites (trenches and holes), which were used by UC Davis and DOE to dispose of waste. Ongoing remediation involves all of these areas.

FIGURE 2.1 General Location Map of the LEHR Site

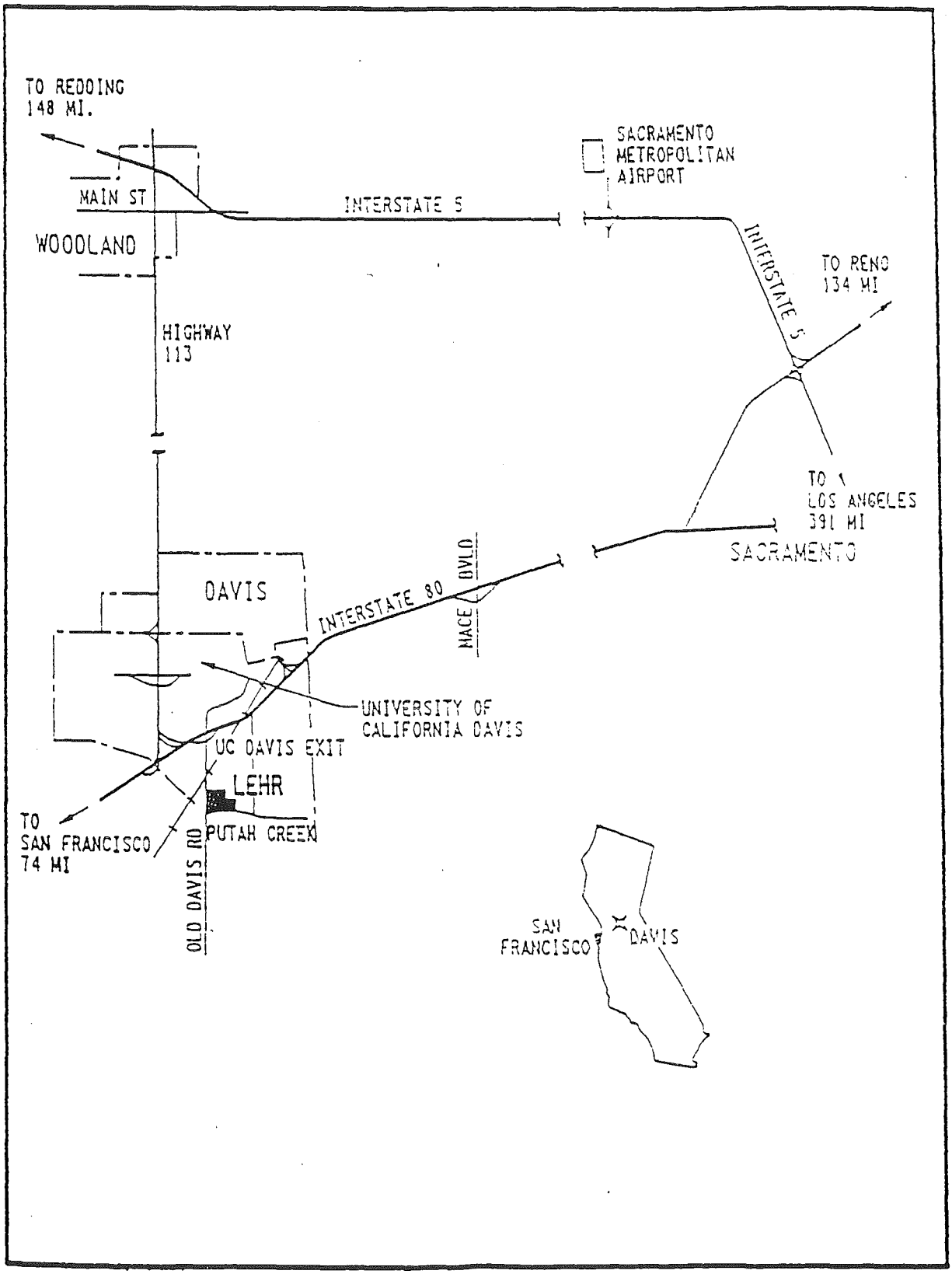
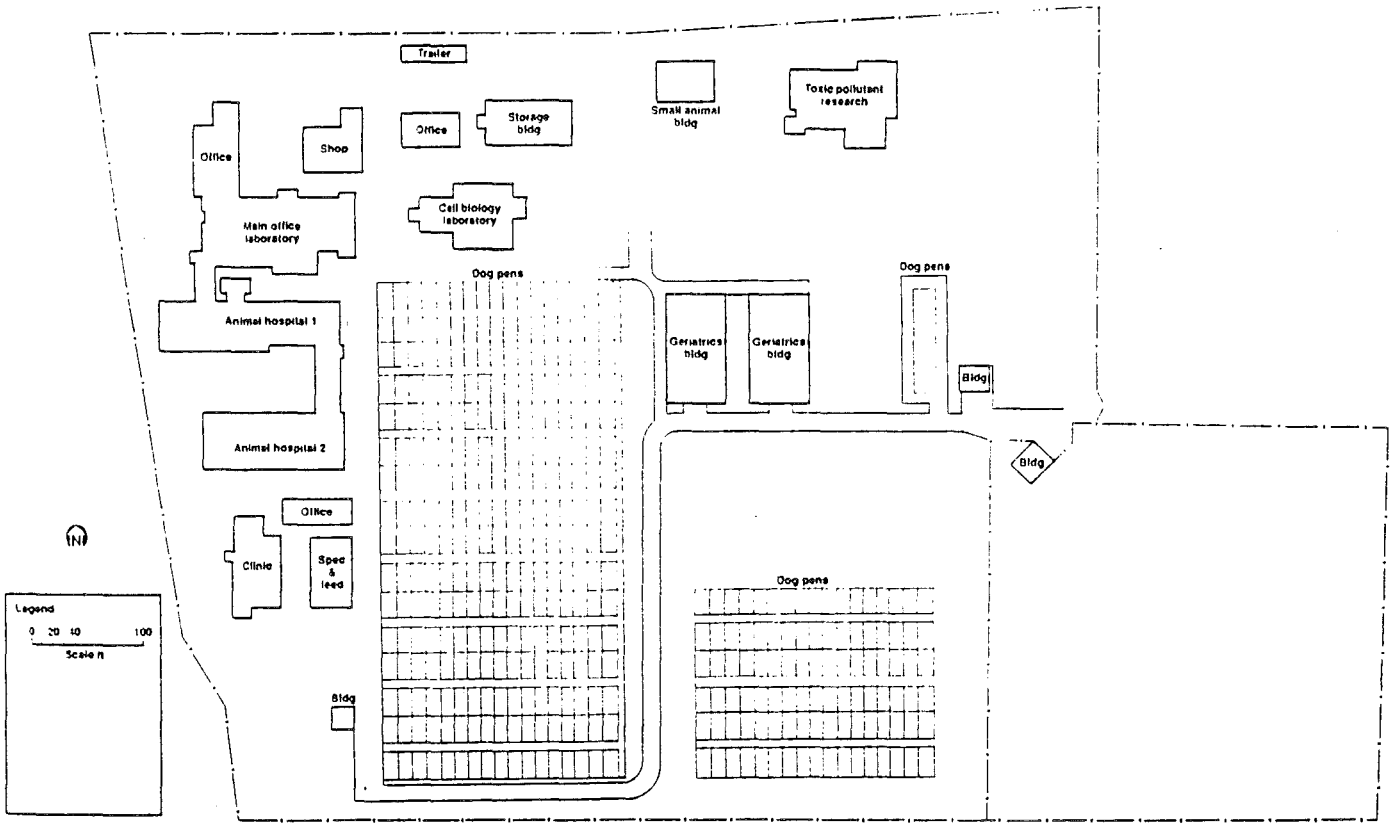


FIGURE 2.2 LEHR Plot Plan



2.4 Population Data

2.4.1 Site Population

During the current D&D remediation, the LEHR site is shared by the university and the DOE to support both ongoing research and remediation objectives.

UC Davis' Institute of Toxicology and Environmental Health (ITEH) consists of a number of facilities on the LEHR site where health research is conducted. ITEH activities involve 150 university researchers and support staff. These include: 15 faculty, 52 research and technical staff, 14 administrative staff, 13 post-doctoral fellows, 19 graduate students, and 37 undergraduates. Like most campus researchers, ITEH researchers have varying schedules and are not all present at the LEHR site at the same time.

The LEHR environmental restoration (ER) project is managed by ESO, who employs subcontractors responsible for specific aspects of the project. Total LEHR ER site personnel currently include 35 employees and 5 part-time students.

2.4.2 Local Population

UC Davis has a student population of approximately 21,000 and employs approximately 12,000 full-time faculty and staff. The current population of Davis is approximately 46,000 and the current total population of Yolo County is about 141,000. The LEHR site is located in a rural area in northern Solano County just outside of Davis. The more densely populated and metropolitan Sacramento area is approximately 12 miles east of LEHR. The current population of Sacramento County is about 1,040,000, and approximately 370,000 people live in the City of Sacramento.

2.5 Environmental Features

LEHR is bordered on the south by a levee located on the north side of the South Fork of Putah Creek. The LEHR site lies outside the 100-year flood plain, which is bounded by the levee just north of Putah Creek.

2.5.1 Land Use

The land within a one-mile radius of the LEHR site is owned both privately and by UC Davis. It is used for animal research, agriculture, and recreation (fishing and swimming). Privately-owned lands toward the south and east of the site include permanent residences and are used to produce wheat, tomatoes, corn, barley, and oats. Private property to the south is separated from the site by the south fork of Putah Creek; property to the east is adjacent to non-LEHR, UC Davis-owned research facilities. The property immediately west, north and south (Putah Creek Reserve) of the site is owned by UC Davis and is currently used for various types of animal, agricultural, and health research facilities.

2.5.2 Meteorology

The climate in the region of the LEHR site is Mediterranean, with mild winters and long summers. In winter, the average temperature is 46.9 degrees Fahrenheit (°F), and the average daily minimum temperature is 37.6 °F. The mean annual precipitation is 17.0 inches, most of which occurs between October and April. The average daily relative humidity is about 80% in the winter, and 40% in the summer and early fall. Local humidity generally increases at night.

The sun shines approximately 95 % of the time in summer and about 45 % in winter. The prevailing wind direction is from the south, reflecting frequent incursion of marine air through the Carquinez Strait into the Sacramento Valley. Changes in wind direction are common, with flows from the northwest occurring diurnally. Several times a year, strong winds blow from the north, generally following the passage of Pacific storm systems. When winds are present, 40% of the time, speeds are less than 3.7 miles per hour (mph); 50% of the time they are less than 8.1 mph; and exceed 16.2 mph only 10% of the time for short periods. (DOE, 1992b)

2.5.3 Topography

The regional topography surrounding the LEHR site is typical of the relatively flat Sacramento Valley. The Sacramento River, the primary drainage of the Sacramento Valley, is approximately 12 miles east of the site. The site is situated on flat-lying land termed the Putah Plain. Average site elevation is approximately 50 feet above mean sea level. Relief across the site is about two feet, with the lowest portion in the area of the former Cobalt-60 irradiation field. (DOE, 1992b)

2.5.4 Hydrology

The major groundwater sources for public and private water supplies in the Sacramento Valley are the unconsolidated deposits of Pliocene and Pleistocene age, and the older alluvium (Dames and Moore, 1992). Groundwater is recharged through leakage from streams and rivers, and direct infiltration from precipitation and irrigation.

The geohydrology of the Sacramento Valley is characterized by both unconfined and confined aquifers in the near flat-lying or gently sloping sedimentary deposits in the upper 3,000 feet of section beneath the valley. No regionally-identified confining units exist in the Sacramento Valley.

Groundwater is encountered beneath the site at depths ranging from approximately 45 to 70 feet below ground surface. (DOE, 1992b)

2.5.5 Water Supply and Quality

The regional groundwater is of very good quality, according to state, county and local water agency officials. Stream flow as a result of rainfall runoff and releases from Lake Berryessa is of good quality. Poorer water quality occurs in late summer when flows are low. The higher flows during the winter are generally of better quality, but are higher in sediments and turbidity. (Dames and Moore, 1990 and California Dept. of Water Resources 1978)

Seasonal groundwater levels fluctuate about 10 feet between fall and spring months. In general, movement of groundwater is from west to east. However, local variations in the water table surface are present. Local depressions in the water table reflect discharge due to pumping. Since most municipal and industrial water in the area is supplied by groundwater, these depressions are most pronounced near the urban areas. (Dames and Moore, 1990 and California Dept. of Water Resources 1978)

Many domestic and supply wells are located near the LEHR site. Thirty-four groundwater wells are located within approximately one mile of the LEHR site. Although the purpose of some of these wells is not documented, some are used for irrigation and some for domestic purposes (Dames and Moore 1992).

2.5.6 Sanitary Sewer Systems

LEHR discharges its sanitary wastewater to the UC Davis Wastewater Treatment Plant. UC Davis operates the plant under the conditions specified in its National Pollutant Discharge Elimination System (NPDES) permit, granted by the EPA in conjunction with the California Central Valley Regional Water Quality Control Board.

2.5.7 Storm Drainage System

Stormwater runoff at LEHR is controlled through an underground drainage system that feeds into two collection points on the site. One system is connected to a stormwater lift station, which pumps excess water directly to the South Fork of Putah Creek upstream of the LEHR site, the other is a combined sanitary/storm system. Some areas on the site do have drainage problems which allow water to pond during heavy rains.

2.5.8 Biological Resources

Research conducted for an Environmental Assessment (EA) prepared for building D&D activities identified no observation of sensitive, rare, threatened, or endangered plants at the project site. It did find, however, that Swainson's hawk (a state-listed threatened species) is present within 1/4 mile of the site. Four other sensitive biological resources were also identified with a potential for occurrence in the vicinity of the project site. These species include: the valley elderberry longhorn beetle, the giant garter snake, the western snowy plover, and the burrowing owl.

2.5.9 Historical and Archeological Resources

An archeological evaluation of the area was conducted during the Phase II Soil and Groundwater Characterization of the LEHR site by the DOE. No evidence of cultural resources, historical or archeological sensitive areas was encountered.

3.0 COMPLIANCE SUMMARY

This summary describes the environmental regulatory compliance status for the LEHR Environmental Restoration Project. Until October 1, 1989, LEHR was an organized research unit of UC Davis. With the cessation of the DOE-sponsored LEHR research program, all DOE-related work involves the environmental restoration and cleanup of the LEHR site. Due to the non-operational status of the site from a DOE standpoint, compliance with many of the pertinent acts, regulations (other than DOE orders) or permits is made through UC Davis. LEHR's status with respect to major environmental statutes is summarized as follows:

3.1 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

The LEHR site is currently being reviewed for inclusion on the National Priorities List (NPL) under CERCLA. The U.S. Environmental Protection Agency (EPA) prepared a Preliminary Assessment of the LEHR site in 1989-90, and concluded that certain areas of the site are potential sources of soil and groundwater contamination.

The site is not currently under any CERCLA enforcement actions. However, the environmental restoration program for LEHR continues to include investigations of the extent of soil and groundwater contamination. During 1992, work continued on the Phase II Site Characterization. Data obtained during Phase II was collected and evaluated according to EPA quality assurance criteria (Level III and below). This data was used to identify areas requiring further investigation.

More data is needed to adequately evaluate and confirm some of the findings of the Phase II study. In addition, other areas, such as the waste burial trenches and old campus landfill, must be further investigated. To complete the soil and groundwater investigation, DOE, in coordination with UC Davis, is preparing a work plan for the RI/FS. Information from the RI/FS will be used to develop plans for soil and groundwater remediation, as necessary.

3.1.1 Phase II Investigation

Results of the Phase II Characterization of site soil and water have recently been finalized. A more detailed discussion of the results is presented in Chapter 7. Below is a summary of the findings.

Results of soil testing show that low levels of nitrate, a few volatile organic chemicals, chlordane, several radionuclides and several trace metals are present in site soils in various locations. Further testing is needed to determine whether the levels exceed those that exist in surrounding, off-site areas.

Groundwater and surface water samples were collected and analyzed quarterly during the Phase II investigation. Data obtained during the study indicate that carbon 14, tritium, chromium, nitrate, a few organic chemicals, and some chlorinated pesticides are present in shallow groundwater (about 45-70 feet deep) under and adjacent to LEHR. Concentrations of some of these constituents are above primary drinking water standards. In surface water samples collected upstream and downstream of the site, small amounts of metals, nitrate, organic chemicals, and radionuclides were detected. Concentrations in surface water samples have rarely exceeded drinking water standards. Since groundwater from the LEHR site does not flow into adjacent surface water, additional tests are necessary to determine the significance of these constituents with respect to LEHR.

3.2 Resource Conservation and Recovery Act (RCRA)

In 1989, UC Davis, as operator, and the DOE, as owner, submitted a Part A permit application to EPA for the storage of mixed waste generated during DOE-funded research work. In 1990, LEHR was contacted by the State of California, Toxic Substances Division, Department of Health Services (DHS), now the Department of Toxic Substances Control (DTSC), requesting a copy of the permit application. LEHR submitted a copy of the application as requested. Contact with DTSC has indicated that LEHR is considered to be under interim status while the application is in process. No formal action, such as notification of interim status, has been taken by the EPA or DTSC.

Prior to the completion of the sludge removal from the underground Imhoff tanks (completed in March 1992), the U.S. EPA (Region IX) concurred with the conclusion of UC Davis and the DOE San Francisco Operations Office (DOE/SF), that the sludge in the tanks was not RCRA hazardous waste.

Current decontamination and decommissioning (D&D) activities are not expected to encounter any RCRA waste. If hazardous wastes are discovered, they will be disposed of in accordance with applicable state and RCRA regulations.

3.3 National Environmental Policy Act (NEPA)

As part of the LEHR Environmental Restoration Project, certain decommissioning, decontamination and remedial action tasks require that an appropriate environmental analysis is performed prior to performing those tasks. The two activities undertaken in 1992 which required such documentation included the completion of the sludge removal from the Imhoff & Radium-226 underground tanks, and the current D&D project which includes AH-1, AH-2, and Co-60 source removal.

For the sludge removal, the DOE Office of Environmental Restoration and Waste Management issued a Memorandum-to-File in 1991. This memorandum was prepared in accordance with DOE guidelines for documenting NEPA compliance. Environmental effects of the sludge packaging and disposal were found to be insignificant and would not affect the quality of the human environment.

An environmental assessment (EA) was prepared and approved in 1992. All environmental aspects related to the Animal Hospital D&D, removal of a contaminated tank trailer and the Cobalt-60 source were analyzed in the EA. Based on the EA analysis, DOE determined that the proposed action (current D&D project activities) would not constitute a major federal action significantly affecting the quality of the human environment within the meaning of NEPA. Therefore, an environmental impact statement was not required. A Finding of No Significant Impact (FONSI) was issued prior to the commencement of the current D&D project activities.

3.4 Clean Air Act (CAA)

The LEHR ER Project Environmental Monitoring and Surveillance Program presently does not monitor any airborne effluent streams. Based on analysis of potential point and diffuse airborne effluent sources on the LEHR site, no additional airborne effluent streams will require monitoring as part of the fiscal year 1993 additions to the Environmental Monitoring and Surveillance Program.

Calculations using the EPA-approved CAP88-PC computer code show that the maximum credible dose equivalent to a member of the public from residual contamination on the LEHR site is less than 0.001 mrem. These calculations were based upon the residual radioactive material contamination measured during site characterization activities. Environmental surveillance of the ambient air at the LEHR site would not be able to provide useful information because radioactive and hazardous material contamination is no longer being generated on-site and the low-levels of residual contamination would not be measurable with current technology even if there were active ventilation systems. If analysis of upcoming D&D and ER activities suggest that continuous air sampling is beneficial at a future date, air sampling stations will be sited in accordance with applicable regulatory guidance.

Specific activities associated with remedial actions during 1992 also addressed each activity's potential impact on air quality:

3.4.1 Sludge Removal

The majority of sludge removal was performed in 1991. In 1992, the remaining sludge activity consisted of residual sludge removal from difficult tank access areas, tank entry, cleaning, and surveys, as well as solidification of the remaining sludge removed from the tanks during these activities.

A NESHAPS model calculation was utilized prior to the initiation of activities. This model indicated that it was not necessary to monitor air continuously during the removal activities. Periodic monitoring was performed to verify compliance with air quality requirements.

3.4.2 Decontamination and Decommissioning of Animal Hospitals

No adverse air quality impact is expected to result from D&D activity. The potential for some of the previously fixed contamination within the buildings to become airborne during D&D has been recognized. Steps have been taken to prevent release to the external environment. Buildings undergoing D&D are under containment and isolated from the external environment through engineering controls. These controls include High Efficiency Particulate Air (HEPA) filters with 99.97% efficiency; sealed plastic linings for inner building surfaces; pressurization of work areas for prevention of contaminant release; controlled access to buildings; and exit survey checkpoints. To monitor the effectiveness of the engineering controls, continuous air monitors are employed in the area being decontaminated to detect and measure airborne radioactive contamination. Frequent air sampling is also conducted outdoors near exhaust stacks. Continuous air monitoring of the exhaust stacks was not required during this D&D activity. This sampling has verified that the D&D activity has not been detrimental to the environment.

A NESHAPS calculation was prepared for this activity, utilizing the EPA computer code CAP88-PC. The evaluation considered the possibility that 10% of the source might be rendered airborne and discharged through building stacks filtered to 95%. This is considered conservative, since most of the contamination is fixed, and the stacks have two HEPA filters installed in sequence, each with 99.97% efficiency.

Results of the modeling determined that potential exposure from the above conditions would be 0.003 mrem per year. This is 0.03% of the NESHAPS dose limit.

3.4.3 Asbestos Remediation under Decontamination and Decommissioning

In order to accomplish D&D of the Animal Hospitals, it was necessary to remove some asbestos-containing building materials (such as floor tiles). Air monitoring was conducted both within the work environment and periodically outside during the asbestos abatement activities, completed in November and December of 1992. Results verified that containment was successful and that releases were below allowable emission limits.

3.5 Clean Water Act (CWA)

The site discharges its sanitary waste to the UC Davis Wastewater Treatment Plant. The plant is subject to the conditions set forth in the National Pollutant Discharge Elimination System (NPDES) permit CA0077895 and Waste Discharge Requirements Order No. 92-040, granted by the California Central Valley Regional Water Quality Control Board (RWQCB).

The applicability of the stormwater permitting requirements to the LEHR site is being evaluated. The two self-contained structures on the site that contain RCRA waste may be subject to stormwater permit regulations because they could be considered "hazardous waste management units" IAW 22 CCR 66260.10. However, the stormwater runoff from one of the storage areas cannot physically enter the site storm drain system due to its physical location and the site topography. The other unit is located in an area served by a combined system, which is not subject to stormwater permitting requirements. The only areas that contribute to the site storm drain system are parking lots, which are not subject to stormwater permitting requirements.

3.6 Safe Drinking Water Act (SDWA)/California Porter-Cologne Water Quality Control Act/California Safe Drinking Water and Toxics Enforcement Act (Proposition 65)

Current DOE activities do not contribute to hazardous discharges. The two facilities at LEHR that historically released liquid effluents to the environment, the Imhoff treatment facility and the radium-226 septic system, have ceased operation and are included in D&D remedial actions.

Concerns that groundwater may be affected by previously utilized waste burial sites are being investigated. DOE and UC Davis are working closely with the California Department of Health Services and the Regional Water Quality Control Board (RWQCB) to determine the extent of contamination and remedial action to be taken.

3.6.1 Quarterly Monitoring of Surface and Groundwater

Quarterly monitoring of groundwater is performed using 18 of the 23 monitoring wells located on or near the LEHR site. The remaining 5 wells are not utilized because they have been and continue to be dry due to shallow completion depths. Slightly deeper adjacent wells were installed during previous investigations to obtain data from these locations. Water levels in all 23 wells are measured regularly. If groundwater levels increase to the depth of shallower wells, monitoring requirements will be re-evaluated.

3.7 Toxic Substances Control Act (TSCA)

Asbestos abatement was conducted as part of the D&D remedial actions. DOE plans to utilize the asbestos-containing material as void filler in processing low level radioactive waste for shipment to the Hanford site. This process is in accordance with the LEHR Waste Minimization Plan and is acceptable to the Hanford site. Any such waste will be handled in accordance with TSCA and state requirements.

3.8 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

Herbicides were used on the LEHR site in 1992 by UC Davis Physical Plant/Grounds Crew to control weeds for fire suppression. Registered pesticides were applied following applicable campus and local regulations.

3.9 Endangered Species Act (ESA)

Current D&D activities do not involve any potential habitat disturbance in the vicinity of the project site. Therefore, there are no biological resources impacted. There have been no reported observations of sensitive, rare, threatened or endangered species on the site. However, a number of sensitive biological resources with a potential for occurrence in the vicinity of the project site were described in the September 1992 Environmental Assessment. These resources may need to be considered during future remedial activity planning. They include Swainson's hawk, the valley elderberry longhorn beetle, the giant garter snake, the western snowy plover, and the burrowing owl.

3.10 National Historic Preservation Act (NHPA)

All areas affected by current D&D activities involve existing building structures located on previously graded and developed land. An archeological evaluation (described in the September 1992 EA) was conducted during the Phase II Soil and Groundwater Characterization of the LEHR site. No evidence of cultural resources, historical or agriculturally sensitive areas was encountered.

3.11 Executive Order 11988, "Floodplain Management" and Executive Order 11990, "Protection of Wetlands"

The LEHR site is not on a floodplain, nor is it designated as a wetland.

3.12 Summary of Permits

The following permits are related to operations at LEHR:

1. NPDES Permit #CA0077895 (EPA) and WDR 92-040 (California RWQCB, Central Valley Region)

   UC Davis permits for discharge of wastewater from the UC Davis Wastewater Treatment Plant to the south fork of Putah Creek.

2. California Radioactive Material License #1334-57

   UC Davis license for authorizing the use of radioactive materials on campus property, including the LEHR site.

3. EPA RCRA Permit #CAD982469702.

Part A Permit for storage of mixed waste (application in process).

3.13 Current Issues and Actions

3.13.1 Compliance Status

Resource Conservation and Recovery Act (RCRA):

RCRA Part A Application is currently being revised and updated to include changes in storage locations and additions to waste inventory which have occurred since the permit was originally filed.

Clean Water Act (CWA):

The applicability of stormwater permit regulations to the LEHR site is currently being reevaluated by the DOE and UC Davis to assure all compliance and permitting requirements have been met. Refer to section 3.5 for additional information on stormwater permitting for the site.

3.13.2 Other Ongoing Environmental Activities

Environmental Monitoring and Surveillance Plan:

In September 1992, the Environmental Monitoring and Surveillance Plan for the Laboratory for Energy-related Health Research Environmental Restoration Project was approved and issued. This plan provides for an extension of the previous site environmental program to include sampling for soil, sediment and vegetation beginning FY93.

Groundwater Protection Management Program

A draft Water Monitoring Plan has been prepared for the site which complies with the requirements within the DOE Groundwater Protection Management Program. This program will be implemented when finalized and integrated. Until that time, ground and surface water will continue to be monitored as indicated in the Environmental Monitoring Plan.

Plans for Remedial Investigation/Feasibility Study:

Site investigations are planned to characterize source areas for contamination. The focus of the investigations will include the old burial trenches and landfill, along with collection of additional data to further characterize areas examined in the Phase II study. To complete the soil and groundwater investigation, DOE, in coordination with UC Davis, is preparing a RI/FS work plan according to CERCLA criteria.

Continuation of Site Decontamination and Decommissioning:

The cobalt-60 source was removed in January 1993. The current D&D of Animal Hospitals 1 and 2 is progressing. Additionally, plans are being prepared for further D&D remedial actions which include the Imhoff and Specimen Storage Buildings, disassembly and removal of the tank trailer, and removal of the sludge treatment tanks, and dog pens.

DOE EH-24 Environmental Audit

An Environmental Baseline Audit was conducted at LEHR in May 1993. The scope of this audit was comprehensive for all aspects of environmental management for this site. Specific areas of interest included: air, surface water/drinking water, groundwater, soil/sediment/biota, waste management, toxic and chemical material, quality assurance, radiation, inactive waste sites, and environmental management. In the preliminary report, sixteen compliance and eight best management findings were identified. Two areas designated as having key findings were waste management and formality of operations, although no imminent hazards were found in any areas. Corrective action--including revision of the RCRA Part A Application--is already in progress. A Final Action Plan will be formalized once the final report is received.

4.0 ENVIRONMENTAL PROGRAM INFORMATION

4.1 Environmental Program Overview

This section of the report provides an overview of LEHR's environmental surveillance program as well as the rationale for each specific component. Additional details will be provided in subsequent sections.

DOE Orders require that contractor-managed sites, such as LEHR, comply with applicable DOE, Federal, State, and local environmental regulations. Overall program requirements are defined in DOE Order 5400.1.

4.2 Environmental Management Policy

It is the policy of LEHR to conduct operations in an environmentally safe and sound manner, The environmental protection program at LEHR shall reflect the policy stated in the ESO Project Manager's Environmental Management Policy (Attachment 1). This program shall ensure the project's operation in compliance with applicable Federal, State, and local regulations and with DOE orders and management directives and will be proactive in preventing environmental problems.

4.3 Summary of Environmental Protection Program

The environmental protection program at LEHR shall consist of ongoing programs which include monitoring for compliance and any other relevant environmental protection requirements.

This program shall consist of, but is not limited to, those actions needed for compliance with the following areas:

- Hazardous waste management, including storage, segregation, characterization, designation and disposal;
- Oversight of remedial actions involving cleanup of past actions;
- Documentation under the National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) if required;
- Hazardous materials inventory and usage and other reports and information as requested or required by regulatory agencies;
- Groundwater, surface water, soil, sediment, air, and vegetation monitoring for the site investigation and Environmental Monitoring Plan;
- Reports to DOE, including the Annual Site Environmental Report, Office of Management and Budget (OMB) Circular A-106, and other reports required by DOE Orders;
- EPA permit requirements for storage of mixed waste;
- Long range environmental planning requirements defined through the Environmental Protection Implementation Plan.

4.4 Notification of Environmental Occurrences and Reporting

Requirements regarding notification and reporting of environmental occurrences are defined in DOE orders and/or in the regulations governing release of hazardous materials. Environmental monitoring personnel have been instructed to notify appropriate management personnel if monitoring data indicates that hazardous material has been released above the reportable quantities.

The ESO Project Manager is responsible for reporting environmental occurrences under DOE Orders 5484.1 and 5000.3B. These reports are submitted to DOE for review, analysis and inclusion within annual summary reports. The reports are transmitted to System Safety and Development Center (SSDC) and Headquarters. Occurrence Reporting and Processing System

(ORPS) is utilized in this process. All reports are available for review by any organization, and can be obtained by contacting SSDC, DOE, or the LEHR site office.

4.5 General Planning and Reporting

- Annual Site Environmental Report
- Environmental Protection Implementation Plan
- OMB Circular A-106
- Other environmental status reports as required

In addition to this Annual Site Environmental Report, general planning and reporting for the site environmental management program is facilitated through documentation prepared by the DOE Prime Contractor. This assures comprehensiveness of the environmental monitoring program at LEHR. Primary documents for the program include the OMB Circular A-106 and the EPIP.

4.5.1 Office of Management and Budget (OMB) Circular A-106 Pollution Abatement Plan

All federal agencies are required to prepare an annual pollution abatement plan to provide OMB with information needed to evaluate environmental budget requests. Information for the LEHR site is incorporated through the Federal Agency Pollution Abatement Plan (FAPAP) computerized system. The plan includes estimates of future costs to achieve compliance with environmental requirements. The data for this annual plan is compiled and verified for the LEHR site by the ESO Project Manager. The plan is then submitted to the DOE Office of Environmental Compliance (EH-22), which utilizes the information to prepare an agency-wide pollution control plan for EPA assessment.

4.5.2 Environmental Protection Implementation Plan

The LEHR Environmental Protection Implementation Plan (EPIP) sets specific site environmental policies, objectives, and implementation strategies. The EPIP describes an integrated approach to maintaining and ensuring that LEHR and its environs are not adversely impacted by the decontamination and decommissioning and remediation activities performed at LEHR. The EPIP for the LEHR site has been updated and is currently under review.

4.6 Special Programs

Special environmental programs are required at LEHR for evaluating the impact of the ER Project on the environment. Oversight and documentation for effectiveness of each program will be made by the ESO Project Manager. Review and update of the programs will also be

the responsibility of the ESO Project Manager. Overviews of each program are summarized below.

4.6.1 Groundwater Protection Management Program

The Groundwater Protection Management Program will consist of routine groundwater monitoring, characterization, reporting and remediation plans as necessary. The LEHR project is developing a Water Monitoring Plan which will further enhance groundwater protection management for the site.

4.6.2 Waste Minimization and Characterization Program

A Waste Minimization Plan was developed prior to the start of current D&D activities. Its purpose is to establish and implement a Waste Minimization Plan for the environmental restoration project at LEHR. This plan specifies those activities and methods which will be employed to reduce the quantity of waste generated at the LEHR site as mandated by DOE Order 5400.1/5820.2A. Compliance with this order will satisfy the requirements of the Solid Waste Disposal Act , as amended by RCRA, Hazardous and Solid Waste Amendments of 1984, and the Pollution Prevention Act of 1990. It also complies with the intent of NEPA in developing waste management and minimization methodology to reduce the impact of these wastes on natural resources and the environment.

4.7 Environmental Monitoring Programs

LEHR performs environmental monitoring in accordance with permit and regulatory requirements for background information and to monitor operations related to site restoration activities. The ESO Project Manager has responsibility for the oversight of these programs, and assures that plans are reviewed and updated as required by DOE orders.

4.7.1 Environmental Monitoring and Surveillance Plan

The environmental monitoring program for LEHR is described in the Environmental Monitoring and Surveillance Plan, developed in accordance with DOE Order 5400.1, for implementation in fiscal year 1993. Its purpose is to develop and operate a program for sampling and analyzing air, water, soil, flora and fauna from the environs of the site for both radioactive and nonradioactive pollutants. Through plan implementation, environmental releases are measured and documented. Data collected are evaluated to determine the effects of DOE operations at LEHR on the environment, both on-site and off-site. These programs support environmental compliance requirements, and serve to achieve the goals of the site environmental management policy.

4.7.2 Summary of Environmental Monitoring Performed

Groundwater Assessment

Analysis of samples taken quarterly from monitoring wells on and near the site have provided information on levels of groundwater contamination. Locations of groundwater monitoring wells are shown in Figure 5.2. Carbon-14, tritium, chromium, nitrate, a few volatile organic chemicals and some chlorinated pesticides have been found in shallow groundwater (about 45 to 70 feet deep) under and adjacent to the site. Concentrations of chromium, nitrate, and some of the volatile organic chemicals detected are above drinking water standards in a few of the shallow test wells. Tritium levels were also found to slightly exceed the drinking water standards in one of the shallow wells. Tritium and carbon-14 have been detected in deeper test wells, but did not exceed drinking water standards.

Surface Water

DOE is conducting ongoing quarterly testing of Putah Creek in three locations for possible contaminants from the LEHR site. Locations of surface water sampling are shown in Figure 5.2. Low levels of metals and nitrate and trace amounts of some organic chemicals have been detected in samples collected upstream and downstream from the site. Contamination from LEHR is unlikely, since the creek supplies water to, rather than draws from, shallow groundwater in the area. Also, a levee separates the creek from the site, which helps prevent surface water run-off from directly entering the creek. No contamination that can be directly attributed to the site has been found to date. Testing will continue as part of the site cleanup process.

Soil

Routine annual sampling of soil will begin in 1993 as defined in the Environmental Monitoring and Surveillance Plan for LEHR. Soil samples were not collected and analyzed in 1992, but were a significant part of the Phase II Site Characterization study. These results were reported in the 1991 Annual Site Environmental Report. In soil testing to date, low levels of nitrate, a few volatile organic chemicals, chlordane and radionuclides such as strontium-90 and radium-226 have been detected, along with several trace metals. Further work is necessary to determine whether the levels exceed those that occur naturally in the surrounding area. The estimated time for the completion of soil assessment and remediation is 1997.

Air

Air sampling was performed in the fall of 1992 on a weekly basis, as required by Addendum 1 of the site Environmental Monitoring and Surveillance Plan. There are no airborne effluent streams on the LEHR site which require continuous monitoring. The periodic sampling is performed to monitor the adequacy of engineering controls designed to prevent airborne effluent release during the D&D activities. Based on the discharge source for D&D activities,

pages 8&9, starting here

NESHAP modeling calculations determined the effluent to be below the criteria in which continuous air sampling, per EPA standards and requirements, is necessary. This periodic sampling fills the requirements of NESHAPs periodic confirmatory sampling requirements.

Air samples are taken at the discharge points for the buildings' ventilation systems. Animal Hospital 1 has two such discharge points, and Animal Hospital 2 has one. Results of this sampling have verified that D&D work has not been detrimental to the environment, since concentrations were consistent with site background levels.

4.8 Site Environmental Training

Site-specific environmental training has been conducted to instruct D&D workers and other environmental restoration project personnel in methods of pollution prevention, waste minimization, and procedures to ensure environmental controls are adequately maintained during remediation activities. This training is conducted as part of the site orientation training, and also prior to any new activity with the potential of impacting the environment. Daily safety meetings reinforce this training and specify steps needed to assure adequate environmental protection during that day's activities.

Before an employee is allowed to begin site work, he or she must complete the 40-hour OSHA "Hazardous Waste Operations". In addition, prior to working on site, pollution prevention is included within the site-specific "Hazard Communication Training". This training assures that the worker is aware of proper handling, usage, and disposal of chemicals used on the job. It also covers spill prevention and control as well as proper storage and chemical disposal methods. To prevent the spread of radioactivity to the environment, workers are trained in radiological control methods, and in the proper use of D&D equipment.

4.9 Summary of Permits

The following permits are related to operations at LEHR:

1. NPDES Permit #CA0077895 (EPA) and WDR 92-040 (California RWQCB, Central Valley Region). Permit expires March 23, 1995.

   Davis permits for discharge of wastewater from the UC Davis Wastewater Treatment Plant.

2. California Radioactive Material License #1334-57 (expires November 1994).

   UC Davis license for authorizing the use of radioactive materials on campus property, including the LEHR site.

3. EPA RCRA Permit #CAD982469702. (application in process)

   Part A Permit for storage of mixed waste.

4.10 Environmental Assessment

An Environmental Assessment (EA) was developed and approved in 1992 prior to the start of the current D&D activities. This EA analyzed all environmental aspects of the Animal Hospital D&D as well as the removal of the Cobalt-60 source and a contaminated tanker trailer. The EA concluded that proceeding with the D&D activities was the most appropriate alternative for the site.

4.11 Special Studies

Phase II Site Characterization Report

This study examined site soil and water (both surface and groundwater) for chemical and radioactive contamination. Results are provided with more detail in the following sections of this report. The study identified areas that will need additional investigation to define the precise sources and extent of low level contamination due to previous site activities. Low levels of radioactivity, chromium and trace metals, nitrate, a few volatile organic chemicals, and some chlorinated pesticides were identified in soil and water on and near the site.

Remediation Investigation/Feasibility Study

In late 1992, plans were under development to begin further investigations to be accomplished under CERCLA criteria through the cooperative efforts of DOE and UC Davis. This study will provide additional information to evaluate data collected during the Phase II study and also investigate environmental effects from the waste burial trenches and an old campus landfill.

5.0 ENVIRONMENTAL RADIOLOGICAL PROGRAM INFORMATION

5.1 Radioactive Effluent

There are no active radioactive effluent discharges from DOE-operated LEHR facilities to the environment. The two facilities at LEHR that historically released liquid effluents to the environment, the Imhoff treatment facility and the radium-226 septic system, have ceased operation and are subject to D&D as part of the LEHR ER Project.

Periodic air sampling has been conducted to monitor the effectiveness of engineering controls during D&D of the Animal Hospital buildings. Details of this monitoring are described for both in-stack and ambient air. Analysis of sample data indicated that effluent from the buildings undergoing D&D contained no more than background levels of contaminants. With few exceptions, 1992 data reported for both in-stack and ambient air monitoring were below detection limits. To assure adequate protection of site workers and the public, sample results are compared to the derived concentration guides (DCGs) defined in DOE Order 5400.5 for radionuclides previously used in site research conducted by DOE.

In addition to air effluent monitoring, quarterly sampling of surface water and groundwater was conducted in 1992 to assess potential contamination from previous on-site burial locations. Groundwater and surface water sampling analysis results are summarized in sections 5.3 and 5.4. Ambient radiation monitoring was also conducted site-wide in 1992, and results are presented in section 5.5.

5.1.1 Results of In-Stack Monitoring

Remediation activities within the Animal Hospital buildings have been conducted under containment. This has included both negative pressure within the work areas and the use of HEPA filters in sequence to filter air released through the ventilation systems. To verify that the containment has been effective, continuous air monitors have tracked radioactive particulates in the filtered air stream before it is released from the stacks.

To determine the optimum sampling velocity for particulate collection, air flow velocities were measured in two-inch increments across each stack, and these readings were averaged to obtain the mean velocity of air within the stack in cubic feet per minute. The air sampler flow rate was set slightly higher than the stack velocity. This was done to assure that particulates would be collected in the filter for measurement in equal or greater numbers than average for the air stream. All stack samples have been evaluated against the DCG concentrations listed in DOE 5400.5 for the isotopic content at LEHR. All samples except one were below the DCG criteria. This one sample, from the AH-2 sampling location, was less than the minimum detectable amount (MDA), but, due to the small volume sampled (less than a 24 hour period), the sample exceeded the DCG. Since that date, all stack samples have been collected at minimum one week intervals. Results of the stack sampling data collected from October through December of 1992 are summarized by sample location in Table 5.1.

TABLE 5.1 Results Of In-Stack Monitoring For Animal Hospital (AH) D&D Concentrations reported in μCi/mL

Sample Location	Number of Samples	Analysis	Average	Minimum	Maximum
AH-1 West Stack	19	Alpha	1.E-14	<2.E-16	3.E-14
		Beta	9.E-14	<2.E-14	2.E-13
AH-1 East Stack	15	Alpha	1.E-14	<1.E-15	3.E-14
		Beta	9.E-14	<2.E-14	2.E-13
AH-2 Stack	17	Alpha	2.E-14	<2.E-15	2.E-13
		Beta	9.E-14	<2.E-14	2.E-13

DCG Standards (DOE Order 5400.5)	Alpha:	4.E-14	(Thorium 228)
	Beta:	1.E-12	(Plutonium 241)

5.1.2 Periodic Air Effluent Monitoring

Periodic samples of ambient air were taken outside the Animal Hospital roof stacks to compare with results of in-stack monitoring, and to verify that there were no radioactive particulate releases to the environment attributable to D&D activities. This periodic sampling fills the requirements of NESHAPS periodic confirmatory sampling requirements, and was performed in accordance with the site Environmental Monitoring and Surveillance Plan.

Air samples were taken weekly during Animal Hospital D&D, which began in October 1992. Air was sampled for a continuous working period of time (approximately 8 to 10 hours) at the discharge point for the buildings' ventilation systems, during the most active time of discharge. If the discharge was expected to be consistent for that week, a day was selected randomly. Equipment for collecting samples consisted of Allegro A-100 High Volume air samplers, with a collection medium of 25 mm glass fiber filters, grade AAA.

Samples were screened at the UC Davis EH&S radiological counting laboratory or sent for analysis to an outside laboratory. Screening was done on the Baird/Accucount Planchet counter, the Wallac 1410 Pharmacia LSC and/or the Beckman LS 1701 LSC. The screening consisted of analyses for alpha, beta and gamma (primarily for radium-226, strontium-90, cesium-137, and plutonium-241) activity. The outside laboratory analysis consisted of gamma spectralanalysis, strontium-90, and plutonium-241. Results are shown in Table 5.2.

5.2 Soil Sampling

Soil sampling was not conducted in 1992 for the LEHR site. However, the Environmental Monitoring and Surveillance Plan has defined requirements for both soil and sediment sampling to be implemented in 1993. Extensive soil sampling is planned under the RI/FS. This will not only define the extent of contamination from site sources, but will also provide additional background environmental levels that will be used for data comparison purposes.

TABLE 5.2 Air Effluent Monitoring For Animal Hospital (AH) D&D Concentrations reported in μCi/mL

BACKGROUND SAMPLES:

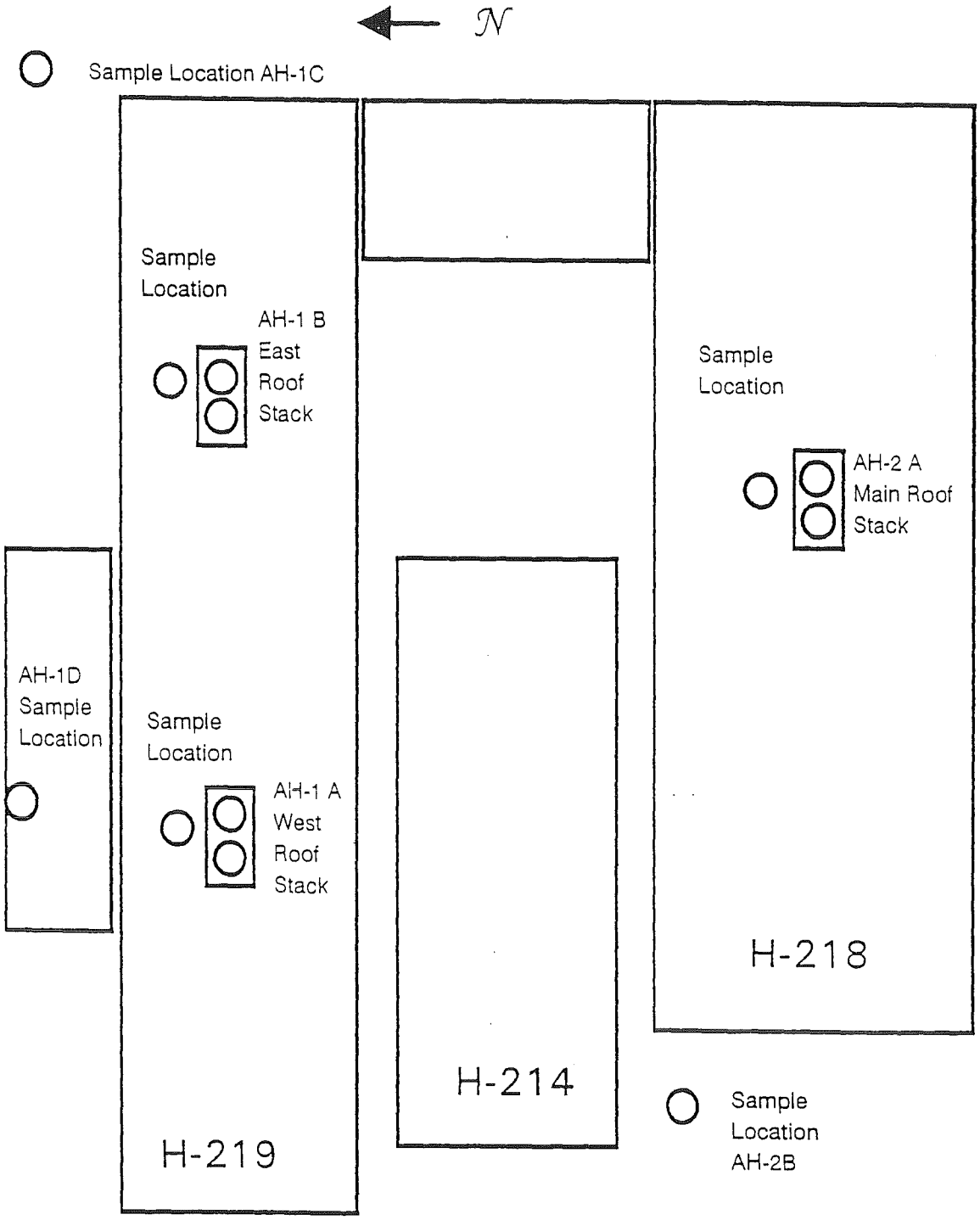
Date	Sample Location[1]	Alpha	Beta	Gamma	^{241}Pu	^{90}Sr
9-23-92	1A	-(5.E-13)	-(1.E-13)	5.E-12	*	*
9-23-92	1B	-(5.E-13)	-(5.E-14)	5.E-12	*	*
9-23-92	2A	-(9.E-13)	3.E-14	1.E-12	*	*
9-24-92	1A	*	*	<1.E-12	<2.E-14	7.E-13
9-24-92	1B	*	*	<1.E-12	<2.E-14	<2.E-13
9-24-92	2A	*	*	<1.E-12	<2.E-14	<2.E-13

D & D MONITORING:

Date	Sample Location[1]	Alpha	Beta	Gamma	^{241}Pu	^{90}Sr
10-08-92	1A	-(4.E-13)	8.E-14	-(2.E-12)	*	*
10-16-92	1A	-(1.E-12)	-(3.E-12)	8.E-12	*	*
10-23-92	1B	1.E-13	-(4.E-13)	-(6.E-12)	*	*
10-30-92	1A	*	*	<1.E-12	<2.E-14	<2.E-13
11-13-92	1A	-(2.E-13)	-(4.E-13)	-(4.E-12)	*	*
11-20-92	1A	*	*	<1.E-12	<2.E-14	<2.E-13
11-24-92	1B	4.E-14	8.E-14	7.E-13	*	*
12-03-92	2A	*	*	<1.E-12	<2.E-14	<2.E-13
12-10-92	2A	3.E-13	-(2.E-13)	-(4.E-12)	*	*
12-16-92	1A	5.E-13	-(8.E-14)	-(5.E-12)	*	*
12-22-92	1A	4.E-13	3.E-13	-(3.E-12)	*	*
DETECTION LIMITS:[2]		8.E-13	6.E-13	7.E-12	2.E-14	2.E-13
DCG STANDARD (DOE 5400.5)[2]		1.E-12	5.E-11	4.E-10	1.E-12	5.E-11

Negative numbers are amounts below counter background average.
* Analysis not conducted
[1] For sample locations, refer to map (Figure 5.1).
[2] Detection limits and standards based on site-specific radionuclides:
Alpha: ^{226}Ra
Beta: ^{90}Sr
Gamma: ^{137}Cs

FIGURE 5.1 Map Of Air Sample Locations For Animal Hospitals



5.3 Groundwater Sampling

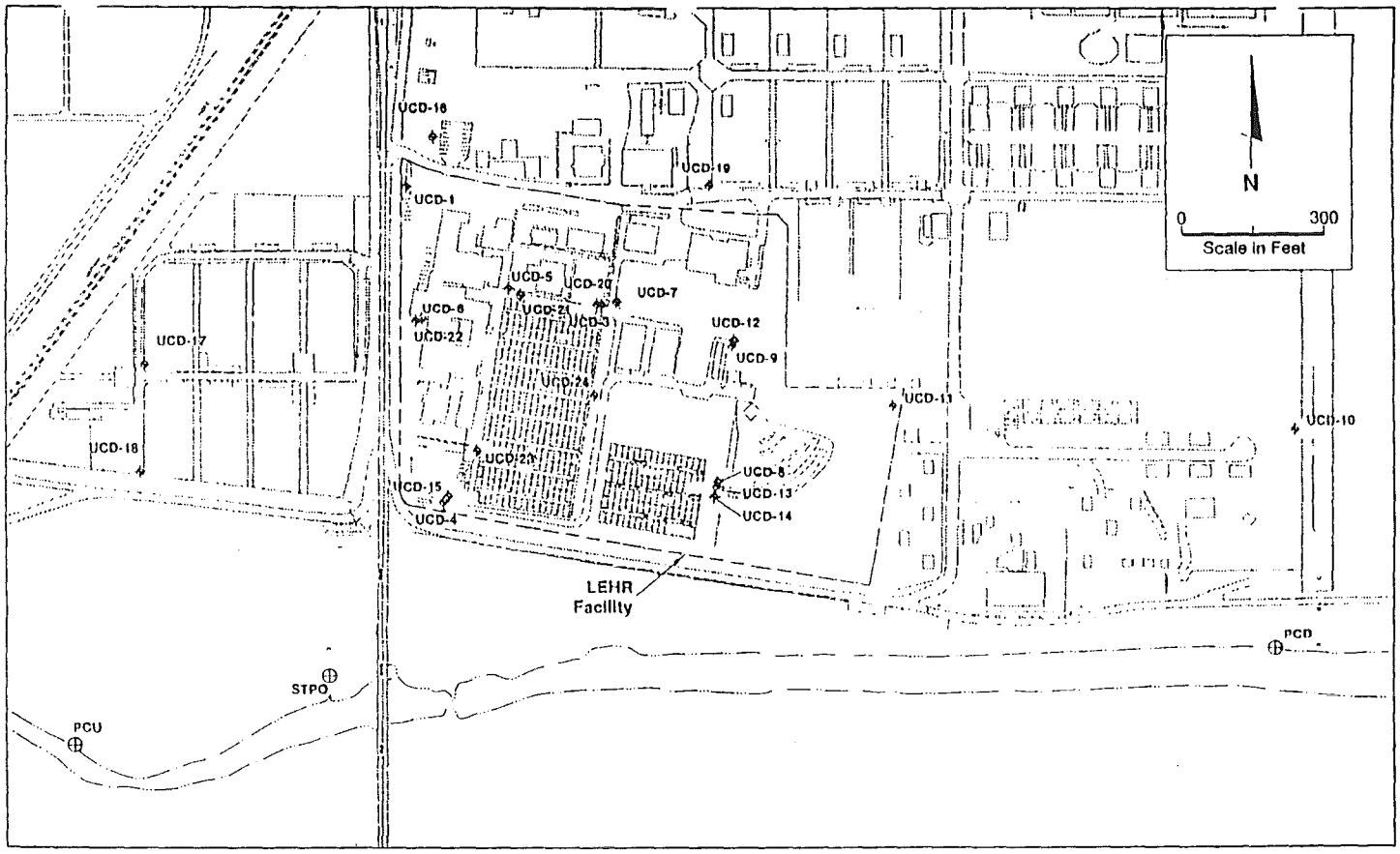
5.3.1 Quarterly Sampling of Site Wells

Quarterly groundwater samples were collected in February, May, August, and November 1992 from 18 on- and off-site monitoring wells, except where indicated. Well locations are shown on Figure 5.2. Groundwater samples were analyzed for tritium, carbon-14, strontium-90, gross alpha and beta radioactivity, and gamma emitters (e.g., radium-226, thorium-232, cesium-137). A summary of constituents detected in sampling rounds is shown in Tables 5.3A-D.

5.4 Surface Water Sampling

Quarterly surface water samples were collected from Putah Creek in February, May, August, and November 1992. Surface water sampling locations are shown on Figure 5.2. Surface water samples were analyzed for tritium, carbon-14, strontium-90, gross alpha and beta radioactivity, and gamma emitters (e.g., radium-226, thorium-232, cesium-137). A summary of constituents detected in the sampling rounds is shown in Table 5.4.

FIGURE 5.2 Groundwater Monitoring Wells and Surface Water Sampling Locations



EXPLANATION

- Monitoring Wells
- Surface Water Monitoring Point

LOCATION MAP
GROUNDWATER MONITORING WELLS
AND SURFACE WATER MONITORING POINTS
Water Monitoring Plan
LEHR Environmental Restoration

TABLE 5.3A Summary of Radiological Detections in Groundwater, February 1992

	SAMPLE	MCL	TB-43	TB-44	TB-45	TB-46	TB-47	TB-48	TB-49	TB-50	TB-51	UCD-01
	DATE		02/18/92	02/19/92	02/20/92	02/20/92	02/24/92	02/24/92	02/25/92	02/25/92	02/27/92	02/24/92
	QA		T	T	T	T	T	T	T	T	T	
RADIOCHEMICAL ANALYSES (pCi/liter)	CARBON-14		-	-	-	-	-	-	-	-	-	-
	GROSS ALPHA	15	-	-	-	-	-	-	-	-	-	4
	GROSS BETA	50	-	-	-	-	-	-	-	-	-	4
	STRONTIUM-90	8	-	-	-	-	-	-	-	-	-	-
	TRITIUM	20000	-	-	-	-	-	-	-	-	-	-

	SAMPLE	MCL	UCD-04	UCD-07	UCD-10	UCD-11	UCD-12	UCD-13	UCD-14	UCD-14B	UCD-15	UCD-16
	DATE		02/24/92	02/24/92	02/25/92	02/25/92	02/27/92	02/25/92	02/20/92	02/20/92	02/18/92	02/19/92
	QA									D		
RADIOCHEMICAL ANALYSES (pCi/liter)	CARBON-14		-	-	-	-	-	2464	-	-	-	-
	GROSS ALPHA	15	4	4	-	3	-	10	-	-	-	-
	GROSS BETA	50	20	-	-	-	-	10	6	-	-	-
	STRONTIUM-90	8	-	-	-	-	-	-	4	-	-	-
	TRITIUM	20000	-	-	-	-	-	22594	-	-	-	-

	SAMPLE	MCL	UCD-17	UCD-18	UCD-19	UCD-20	UCD-21	UCD-22	UCD-23	UCD-24
	DATE		02/18/92	02/18/92	02/20/92	02/19/92	02/19/92	02/27/92	02/18/92	02/20/92
	QA									
RADIOCHEMICAL ANALYSES (pCi/liter)	CARBON-14		-	-	-	-	-	-	-	-
	GROSS ALPHA	15	-	-	3	3	-	-	-	-
	GROSS BETA	50	-	-	4	4	6	-	-	7
	STRONTIUM-90	8	-	17	-		61	-	-	-
	TRITIUM	20000	-	-	-	-	-	-	-	-

- = denotes either not detected or not analyzed.
D = duplicate sample.
T or TB = trip blank.
MCL = Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.
UCD-XX = monitoring well numbers

TABLE 5.3B Summary of Radiological Detections in Groundwater, May 1992

	SAMPLE DATE QA	MCL	TB-57 05/13/92 T	TB-58 05/13/92 T	TB-59 05/14/92 T	UCD-01 05/19/92	UCD-04 05/19/92	UCD-07 05/13/92	UCD-10 05/12/92	UCD-11 05/14/92	UCD-12 05/13/92	UCD-13 05/12/92
RADIOCHEMICAL ANALYSES (pCi/liter)	CARBON-14		-	-	-	-	-	-	-	-	-	1875
	GROSS ALPHA	15	-	-	-	10	4	4	4	-	6	3
	GROSS BETA	50	-	-	-	13	5	6	-	-	5	-
	TRITIUM	20000	-	-	-	-	-	-	-	-	-	20589

	SAMPLE DATE QA	MCL	UCD-14 05/12/92	UCD-15 05/13/92	UCD-15B 05/13/92 D	UCD-16 05/11/92	UCD-17 05/11/92	UCD-18 05/11/92	UCD-19 05/12/92	UCD-20 05/19/92	UCD-20B 05/19/92 D	UCD-21 05/13/92
RADIOCHEMICAL ANALYSES (pCi/liter)	CARBON-14		-	-	-	-	-	-	-	-	-	-
	GROSS ALPHA	15	-	-	-	-	-	-	-	-	-	-
	GROSS BETA	50	6	-	-	-	-	4	-	-	-	-
	TRITIUM	20000	3848	5302	-	-	-	-	-	-	-	-

	SAMPLE DATE QA	MCL	UCD-22 05/14/92	UCD-23 05/14/92	UCD-24 05/14/92
RADIOCHEMICAL ANALYSES (pCi/liter)	CARBON-14		-	-	-
	GROSS ALPHA	15	-	3	-
	GROSS BETA	50	-	6	-
	TRITIUM	20000	-	2081	-

- = denotes either not detected or not analyzed.
D = duplicate sample.
T or TB = trip blank.
MCL = Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.
UCD-XX = monitoring well numbers

TABLE 5.3C Summary of Radiological Detections in Groundwater, August 1992

	SAMPLE DATE QA	MCL	TB-63 08/03/92 T	TB-65 08/05/92 T	TB-66 08/05/92 T	TB-67 08/06/92 T	TB-68 08/06/92 T	TB-69 08/10/92 T	TB-70 08/10/92 T	UCD-07 08/04/92	UCD-14 08/04/92	UCD-15 08/05/92
RADIOCHEMICAL ANALYSES (pCi/liter)	CARBON-14		-	-	-	-	-	-	-	-	1598	-
	GROSS ALPHA	15	-	-	-	-	-	-	-	-	6	16
	GROSS BETA	50	-	-	-	-	-	-	-	4	8	12
	STRONTIUM-90	8	-	-	-	-	-	-	-	-	-	-
	TRITIUM	20000	-	-	-	-	-	-	-	691	5525	-

	SAMPLE DATE QA	MCL	UCD-16 08/05/92	UCD-16B 08/05/92 D	UCD-17 08/06/92	UCD-17B 08/06/92 D	UCD-18 08/03/92	UCD-19 08/05/92	UCD-20 08/05/92	UCD-21 08/10/92	UCD-22 08/10/92	UCD-23 08/10/92
RADIOCHEMICAL ANALYSES (pCi/liter)	CARBON-14		-	-	-	-	-	-	-	-	-	-
	GROSS ALPHA	15	-	5	3	-	-	6	40	4	5	4
	GROSS BETA	50	-	-	-	-	7	7	24	6	7	22
	STRONTIUM-90	8	-	-	-	-	-	10.6	-	-	1.4	2.5
	TRITIUM	20000	-	-	-	-	965	-	-	-	-	-

	SAMPLE DATE QA	MCL	UCD-24 08/06/92
RADIOCHEMICAL ANALYSES (pCi/liter)	CARBON-14		-
	GROSS ALPHA	15	5
	GROSS BETA	50	4
	STRONTIUM-90	8	-
	TRITIUM	20000	-

- = denotes either not detected or not analyzed.
D = duplicate sample.
T or TB = trip blank.
MCL = Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.
UCD-XX = monitoring well numbers

Note: Monitoring wells UCD-1 and UCD-4 were dry and could not be sampled.

TABLE 5.3D Summary of Radiological Detections in Groundwater, November 1992

	SAMPLE DATE QA	MCL	TB-73 11/17/92 T	TB-74 11/17/92 T	TB-75 11/18/92 T	TB-76 11/18/92 T	TB-77 11/18/92 T	UCD-01 11/23/92	UCD-07 11/24/92	UCD-10 11/23/92
RADIOCHEMICAL ANALYSES (pCi/liter)	CARBON-14		-	-	-	-	-	-	-	-
	GROSS ALPHA	15	-	-	-	-	-	4	-	3
	GROSS BETA	50	-	-	-	-	-	21	-	8
	STRONTIUM-90	8	-	-	-	-	-	-	-	1.2
	TRITIUM	20000*	-	-	-	-	-	-	-	-

	SAMPLE DATE QA	MCL	UCD-11 11/18/92	UCD-12 11/23/92	UCD-13 11/24/92	UCD-14 11/24/92	UCD-15 11/23/92	UCD-16 11/18/92	UCD-17 11/18/92	UCD-18 11/18/92
RADIOCHEMICAL ANALYSES (pCi/liter)	CARBON-14		-	-	1784	-	-	-	-	-
	GROSS ALPHA	15	-	5	-	-	-	-	-	-
	GROSS BETA	50	-	8	4	-	-	-	-	-
	STRONTIUM-90	8	-	1	-	-	0.9	-	-	-
	TRITIUM	20000*	-	-	29838	1204	-	1200	-	614

	SAMPLE DATE QA	MCL	UCD-19 11/17/92	UCD-20 11/17/92	UCD-21 11/17/92	UCD-22 11/18/92	UCD-22B 11/18/92 D	UCD-23 11/18/92	UCD-23B 11/18/92 D	UCD-24 11/17/92
RADIOCHEMICAL ANALYSES (pCi/liter)	CARBON-14		-	-	-	-	-	-	-	-
	GROSS ALPHA	15	-	-	-	6	10	-	4	-
	GROSS BETA	50	-	-	-	12	18	-	7	-
	STRONTIUM-90	8	-	-	-	-	-	-	-	-
	TRITIUM	20000*	-	-	509	-	-	-	-	-

- = denotes either not detected or not analyzed.
D = duplicate sample.
T or TB = trip blank.
MCL = Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.
UCD-XX = monitoring well numbers

Note: Monitoring wells UCD-1 and UCD-4 were dry and could not be sampled.

TABLE 5.4 Summary of Radiological Detections in Surface Water: February, May, August and November 1992

	SAMPLE DATE QA	MCL	PCD-01 02/26/92	PCU-01 02/26/92	STPO 02/26/92	STPO-B 02/26/92 D	TB-23 02/26/92 T	TB-24 02/26/92 T
RADIOCHEMICAL ANALYSES (pCi/liter)	GROSS ALPHA	15	-	-	3	3	-	-
	GROSS BETA	50	4	7	15	13	-	-
	TRITIUM	20000	754	-	752	-	-	-

	SAMPLE DATE QA	MCL	PCD-01 05/18/92	PCU-01 05/18/92	PCU-B 05/18/92 D	STPO 05/18/92
RADIOCHEMICAL ANALYSES (pCi/liter)	GROSS BETA	50	10	4	5	6

	SAMPLE DATE QA	MCL	PCD-01 08/11/92	PCU-01 08/11/92	STPO 08/11/92	STPO-B 08/11/92 D	TB-27 08/11/92 T	TB-28 08/11/92 T
RADIOCHEMICAL ANALYSES (pCi/liter)	GROSS ALPHA	15	3	3	-	-	-	-
	GROSS BETA	50	16	15	7	-	-	-
	STRONTIUM-90	8	2.5	6.9	1.5	-	-	-
	TRITIUM	20000	800	650	-	-	-	-

	SAMPLE DATE QA	MCL	PCD-01 11/19/92	PCU-01 11/19/92	STPO 11/19/92	STPO-B 11/19/92 D
RADIOCHEMICAL ANALYSES (pCi/liter)	GROSS ALPHA	15	9	6	12	9
	GROSS BETA	50	34	29	37	43
	STRONTIUM-90	8	-	0.9	-	-
	TRITIUM	20000*	851	-	1724	-

- = denotes either not detected or not analyzed.
D = duplicate sample.
T or TB = trip blank.
MCL = Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.
PCU = Putah Creek upstream.
PCD = Putah Creek downstream.
STPO = Wastewater (Sewage) Treatment Plant Outfall.

5.5 Ambient Radiation Monitoring

Perimeter fence line dose rates, radioactive waste storage areas, and various work areas around the LEHR site are monitored by environmental dosimeters. In 1992, there were 20 locations monitored for penetrating radiation through the use of thermoluminescent dosimeters (TLDs). Additionally, several TLDs are placed to find natural background radiation and control dosimeters are used to ensure continued accuracy during transport to off-site processing.

Results of the environmental dosimetry readings are provided in Tables 5.5 through 5.8. Most locations were monitored in 1992 by two dosimeters, one changed monthly and the other changed quarterly. (Therefore, all locations except the first five in Table 5.5 correspond to those listed in Table 5.6, and the locations in Table 5.7 correspond to those in Table 5.8.) Figures 5.3 A-C, which follow the tables, are maps which show locations for each group of dosimeters.

The only areas to show significant above-background levels were the radioactive material/waste storage areas. One such storage area indicated a TLD reading of over 600 millirem for the year. This storage area is a metal cargo container with the environmental dosimeters placed on the outside. As waste items were moved into and within the radioactive material storage area, at several times items were placed against the wall adjacent to the dosimeter. This caused a measurement on the dosimeter which reflected the proximity of the waste items.

Calculations were performed to determine maximum potential exposure to an individual in the vicinity of this radioactive material storage location. The storage container itself is situated in an area where site employees and visitors rarely visit. Averaged over the year, it is estimated that the maximum dose for an individual from this source would have been less than 9 millirem. This calculation is based on surface contact, assuming an individual would spend 30 minutes each work day leaning against the building. At one meter, the distance a person would possibly walk by the storage container, the dose drops to .01 millirem per month--even when averaged over a month in which the reading was highest (several months had zero). Both calculations are based on ANSI N543-1974, with an occasional occupancy factor of 1/16 (30 minutes per work day), which is much higher than the actual occupancy for this location.

TABLE 5.5 1992 Quarterly Radiation Monitoring Results, Group 63 (Results in mrem)

LOCATION	1/1/92-3/31/92	4/1/92-6/30/92	7/1/92-9/30/92	10/1/92-12/31/92	ANNUAL TOTAL 1992
South #1	0	0	2	3	5
South #2	0	0	4	3	7
North #1	0	0	2	3	5
East #1	0	0	1	3	4
East #2	0	0	2	3	5
AH-2	23	0	0	1	24
Ger I East	0	0	0	1	1
Ger I North	0	0	0	0	0
Ger I South	0	0	0	0	0
Ger I West	0	0	0	0	0
IMH Fence	0	0	0	1	1
Mixed Waste	10	10	12	18	50
Rad Stor NE	50	13	17	9	89
Rad Stor SE	62	350	195	5	612
SW Corner	0	0	2	2	4
Control	0	0	0	0	0
Background	0	0	0	0	0
RDC Background	27	23	19	19	88

All exposure rates are measured in mR above the RCD background.
The RDC background is calibrated to Co-60 with a precision of +/- 2 or 10%.

TABLE 5.6 1992 Monthly Radiation Monitoring Results, Group 88
(Results in mrem)

LOCATION	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
AH-2 North	0	0	0	0	0	0	0	0	0	0	0	0	0
Geriatrics I East	0	0	0	0	0	0	0	0	0	0	0	0	0
Geriatrics I North	0	0	0	0	0	0	0	0	0	0	0	0	0
Geriatrics I South	0	0	0	0	0	0	0	0	0	0	0	0	0
Geriatrics I West	0	0	0	0	0	0	0	0	0	0	0	0	0
Imhoff Fence	0	0	0	0	0	0	0	0	0	0	0	0	0
Mixed Waste	0	0	0	0	0	0	0	0	0	0	0	0	0
Rad Storage N.E	0	0	0	0	0	0	0	0	0	0	0	0	0
Rad Storage S.E.	25	20	0	100	100	110	110	50	0	0	110	0	625
SW Corner	0	0	0	0	0	0	0	0	0	0	0	0	0
Control	0	0	0	0	0	0	0	0	0	0	0	0	0
Background	0	0	0	0	0	0	0	0	0	0	0	0	0

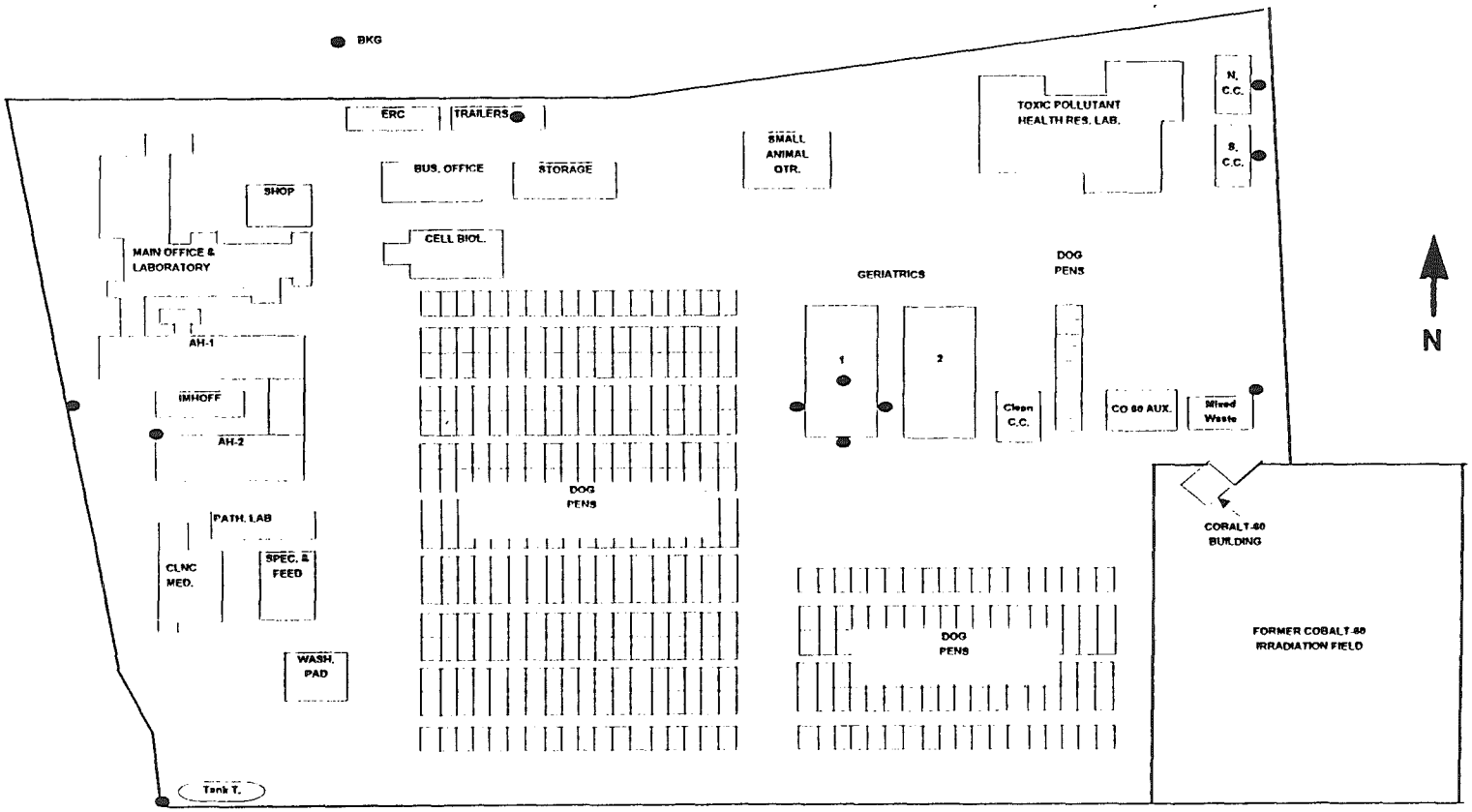
TABLE 5.7 1992 Quarterly Radiation Monitoring Results, Group 83 (Results in mrem)

LOCATION	01/01/92-03/31/92	04/01/92-06/30/92	07/01/92-09/30/92	10/01/92-12/31/92
Bulletin Board	0	0	0	0
Desk	0	0	0	0
Freezer	30	0	0	0
Calibrator W.	0	0	0	0
Kitchen	0	0	0	0

TABLE 5.8 1992 Monthly Radiation Monitoring Results, Group 82 (Results in mrem)

LOCATION	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Bulletin Board	0	0	0	0	0	0	0	0	0	0	0	0
Desk	0	0	0	0	0	0	0	0	0	0	0	0
Freezer	0	0	0	0	0	0	0	0	0	0	0	0
Calibrator W.	0	0	0	0	0	0	0	0	0	0	0	0
Kitchen	0	0	0	0	0	0	0	0	0	0	0	0

FIGURE 5.3A: TLD Locations For Group 88



NOT TO SCALE

● = Environmental Dosimeter Location

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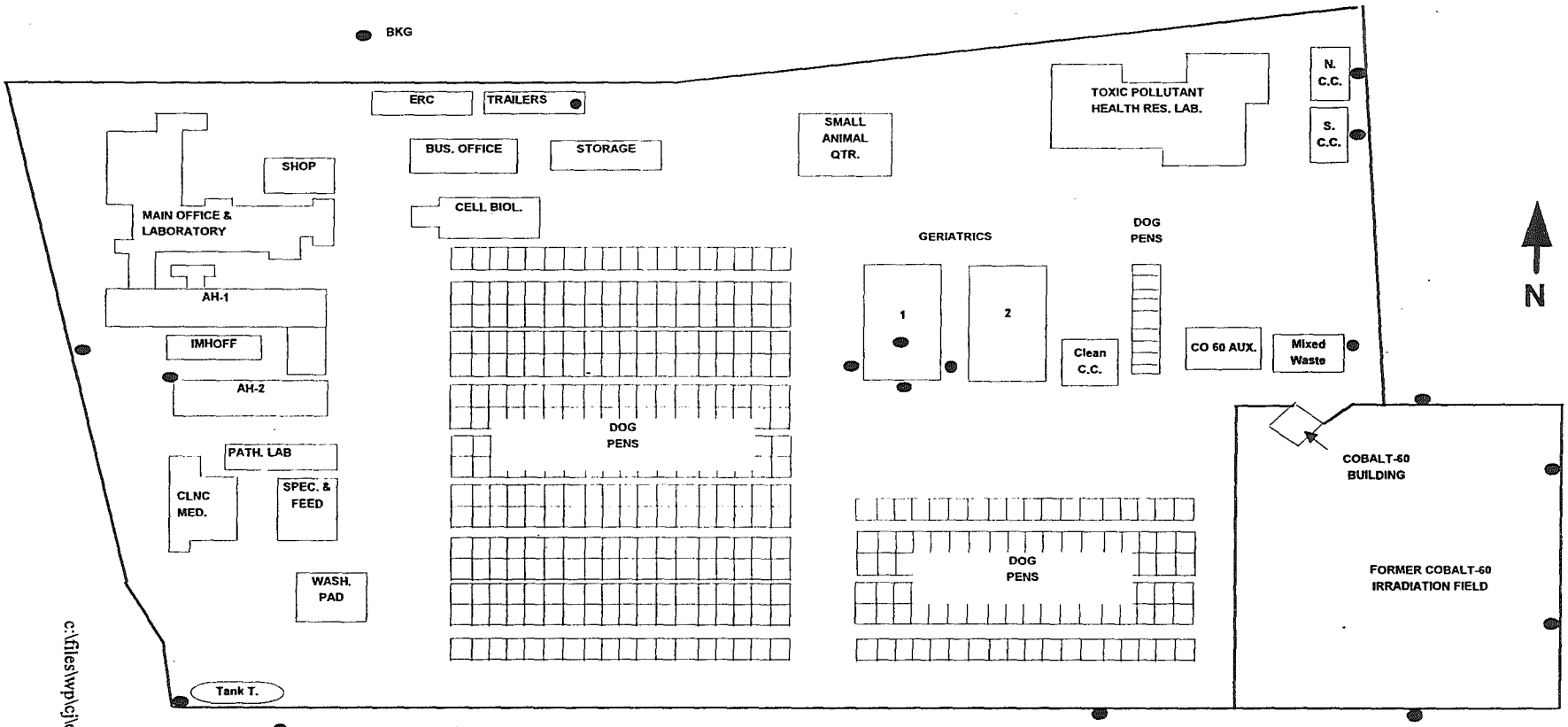
FIGURE 5.3B: TLD Locations For Group 63



● = Environmental Dosimeter Location

Exchanged Quarterly

NOT TO SCALE

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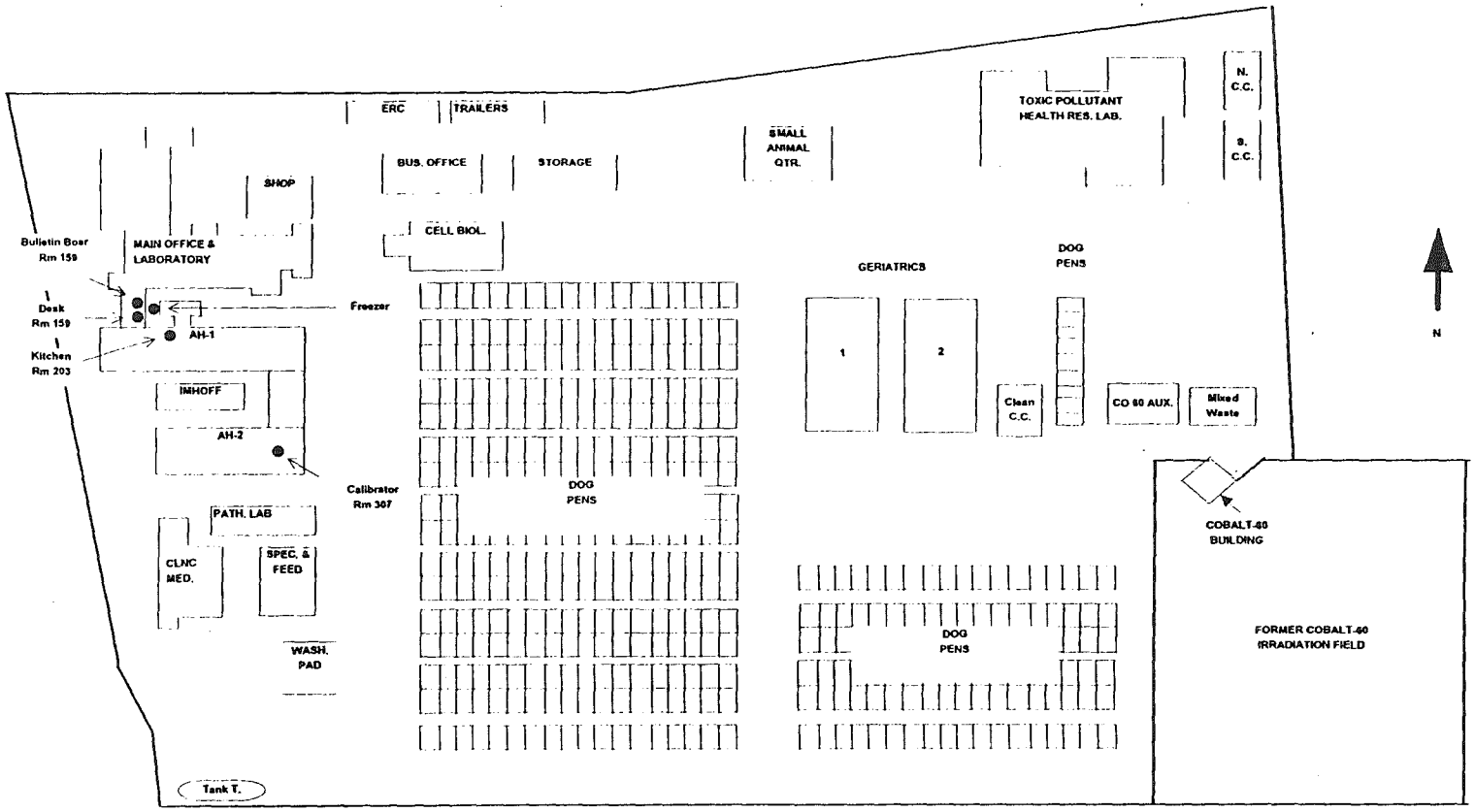
FIGURE 5.3C: TLD Locations For Groups 82 AND 83



NOT TO SCALE

● = Environmental Dosimeter Location -Groups 82 and 83

Two Sets: one exchanged monthly and the other exchanged quarterly.

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5.6 NESHAPS Dose Estimation Calculations

Calculations were performed to determine the potential or estimated dose from site sources to members of the public. These calculations were based on both site residual contamination and/or the remediation activities which were accomplished during the year. All estimates of potential dose were well below the NESHAPS limit of 10 mrem per year.

5.6.1 Site Residual Contamination

To determine the potential effects from site residual contamination, calculations were performed using the EPA-approved CAP88-PC computer code. Results indicated that the maximum credible dose equivalent to a member of the public from residual contamination on the LEHR site is less than 0.001 mrem per year. These calculations were based upon the residual radioactive material contamination measured during site characterization activities.

5.6.2 Sludge Removal

Radioactive sludge was removed from the Imhoff and radium-226 underground storage tanks as a part of the site environmental restoration project. The majority of sludge removal was performed in 1991. The remaining remediation sludge activity in 1992 consisted of residual sludge removal from difficult tank access areas, tank entry, cleaning, and survey as well as solidification of the remaining sludge removed from tanks as a result of these activities. It was determined from the LEHR tank clean-out that the following radionuclides were present: radium-226, strontium-90, tritium, plutonium-241, cesium-137, thorium-228 and thorium-232. During this process, there was a potential for small amounts of these radionuclides to become airborne. Great care was taken to keep exposure and emissions to a minimum using all available engineering controls. These controls included the use of HEPA filters (99.9% efficiency) during the sludge pumping to ensure air leaving the area was free of radionuclide contaminants.

The AIRDOS-PC program was used to calculate the effective dose equivalent for the maximally exposed individual present during the entire period of operations. It is highly unlikely that an individual would have been at the boundary 10 hours per day for the entire length of the project. Given this scenario, however, the effective dose equivalent to a member of the public was determined to be 4.0E-05 mrem/yr from all pathways at a distance of 300 meters southwest of the operation. This compares to approximately 0.004% of the NESHAPS limit. The dose estimation is principally from radium-226, strontium-90, and thorium-228. Tables 5.9 A-D provide more detailed information concerning release of radioactivity from this operation and dose equivalent information.

TABLE 5.9A Radioactive Summary: Imhoff And Radium Septic Sludge Removal Process

CALCULATIONS FOR RELEASE OF RADIOACTIVITY TO THE ENVIRONMENT

Total Activity in Waste							
Isotope	Ra-226	Sr-90	H-3	Pu-241	Cs-137	Th-228	Th-232
*u*Ci	3820.44	66706.12	7171.44	191.03	0.00	2674.84	60.27

Assumptions:

1) Assume water would vaporize based on the partial pressure (0.50683/14.696) at 80°F.
2) Assume 0.5% of radionuclide particulate would go airborne.
3) Assume particulate would go airborne based on atomic weight as compared to tritium.
4) For each radionuclide, the following formula was used to calculate radioactivity going airborne.

(Partial Pressure)*(airborne percentage risk)*(ratio of atomic weights of tritium/radionuclide).

Total Activity Released to Environment							
Isotope	Ra-226	Sr-90	H-3	Pu-241	Cs-137	Th-228	Th-232
*u*Ci	8.745	383.423	1236.629	0.410	0.000	6.069	0.134

TABLE 5.9B Sludge Removal Process Dose Estimation

EFFECTIVE DOSE EQUIVALENT AS A FUNCTION OF DISTANCE IN THE DIRECTIONS OF THE MAXIMALLY EXPOSED INDIVIDUAL FOR ALL RADIONUCLIDES AND ALL PATHWAYS

DIRECTION: SOUTHWEST

DISTANCE (meters)	**EFFECTIVE DOSE EQUIVALENT** (mrem/yr)
300	4.0E-05
1,000	3.9E-06
3,000	6.1E-07
10,000	9.5E-08
80,000	2.8E-09

TABLE 5.9C Sludge Removal Process Dose Estimation

DOSE TO THE MAXIMALLY EXPOSED INDIVIDUAL BY PATHWAY FOR ALL RADIONUCLIDES

PATHWAY	EFFECTIVE DOSE EQUIVALENT (mrem/yr)	DOSE EQUIVALENT TO THE ORGAN WITH THE HIGHEST DOSE ENDOSTEUM (mrem/yr)
INGESTION	1.2E-05	1.4E-04
INHALATION	2.8E-05	1.4E-04
AIR IMMERSION	2.7E-13	3.3E-13
GROUND SURFACE	7.8E-09	9.3E-09
TOTAL:	**4.0E-05**	**2.8E-04**

TABLE 5.9D Sludge Removal Process Dose Estimation

DOSE TO THE MAXIMALLY EXPOSED INDIVIDUAL BY RADIONUCLIDE FOR ALL PATHWAYS

RADIONUCLIDE	EFFECTIVE DOSE EQUIVALENT (mrem/yr)	DOSE EQUIVALENT TO THE ORGAN WITH THE HIGHEST DOSE ENDOSTEUM (mrem/yr)
Ra-226	9.3E-06	1.5E-05
Sr-90	1.4E-05	1.2E-04
H-3	9.0E-09	6.7E-09
Pu-241	1.7E-08	2.7E-07
Cs-137	6.3E-30	4.2E-30
Th-232	1.6E-05	1.4E-04
Ba-137M	3.3E-28	3.2E-28
TOTAL:	**4.0E-05**	**2.8E-04**

5.6.3 Animal Hospitals (AH-1 and AH-2) D&D

The potential for some of the previously fixed contamination within the animal hospital buildings to become airborne during D&D has been recognized. Buildings undergoing D&D are under containment and isolated from the environment through engineering controls and controlled exits. The engineering controls include HEPA filters in sequence to filter air before it is released through the buildings' exhaust systems. Both personnel and items must undergo a survey to check for contamination prior to release from the buildings.

A NESHAPS calculation was prepared for this activity, utilizing the EPA computer code, CAP88-PC. The most realistic case calculated a dose of 0.003 mrem/yr, primarily from airborne releases of radium-226 and strontium-90. In the calculation summary (see Table 5.10) for the potential release term associated with the Animal Hospital D&D activities, it is estimated that 10% of the source would be rendered airborne and discharged through building filtration with a particulate efficiency of 95%, prior to discharge through the building stacks. This is considered conservative, since most of the contamination within the buildings is fixed. Additionally, the HEPA filters are designed to achieve 99.97% efficiency and are tested for leaks after installation.

TABLE 5.10 Potential Radiological Releases From Animal Hospital D&D Activities

RADIONUCLIDE	STACK 1 AH-1, RM 209	STACK 2 AH-1, RM 200	STACK 3 AH-2, RM 310
Sr-90	5.385E-03	5.385E-03	25.E-06
Ra-226			481.E-06
Th-228	15.8E-06	15.8E-06	
H-3	5.4E-06	5.4E-06	
C-14	5.4E-06	5.4E-06	
Pu-241	5.4E-09	5.4E-09	

Note: Source Terms for each Stack are given in Ci. Only three stacks were considered in this calculation because 3 of the 5 stacks in AH-1 have been closed off, and their blowers were de-energized during D&D operations. The Source Term for AH-1 was equally divided between stacks 1 and 2.

6.0 ENVIRONMENTAL NON-RADIOLOGICAL PROGRAM INFORMATION

Environmental monitoring for non-radiological information in 1992 consisted primarily of surface water and groundwater monitoring. Quarterly rounds of sampling were conducted for groundwater and surface water on and near the site. Neighbors' wells were also monitored for non-radiological information twice during the year. The neighbors' wells are monitored by UC Davis as a courtesy to these landowners, and are not included in the Environmental Monitoring and Surveillance Plan for the site. In addition, outdoor ambient air monitoring was performed periodically to check for external asbestos levels during asbestos remediation activities.

6.1 National Pollutant Discharge Elimination System (NPDES) Data

LEHR discharges its sanitary waste to the UC Davis Wastewater Treatment Plant, which is permitted according to NPDES requirements. Current DOE activities on site do not contribute to hazardous discharges, however, the applicability of stormwater permit requirements to the site is under review.

6.2 Groundwater Sampling

6.2.1 Quarterly Sampling of Site Wells

Quarterly groundwater samples were collected in February, May, August, and November 1992 from 18 on- and off-site monitoring wells, except where indicated. Well locations are shown on Figure 5.2. Groundwater samples were analyzed for volatile and semi-volatile organic compounds (EPA methods 624/625); chlorinated pesticides and PCBs (EPA method 608); metals (atomic absorption and inductively-coupled argon plasma methods specific to each metal); and anions and cations and general water quality parameters (various EPA methods). A summary of constituents detected in the sampling rounds is shown in Tables 6.1A-D.

6.3 Surface Water Sampling

Quarterly surface water samples were collected from Putah Creek in February, May, August, and November 1992. Surface water sampling locations are shown on Figure 5.2. Surface water samples were analyzed for volatile and semi-volatile organic compounds (EPA methods 624/625); chlorinated pesticides and PCBs (EPA method 608); metals (atomic absorption and inductively-coupled argon plasma methods specific to each metal); anions and cations and general water quality parameters (various EPA methods). A summary of constituents detected in the sampling rounds is shown in Tables 6.2A-D.

6.4 Air Monitoring for Asbestos

During the asbestos remediation phase of D&D for the Animal Hospitals and the building which formerly housed the Cobalt-60 irradiator, ambient air outside the buildings was monitored for asbestos (see Figures 5.1 and 6.1). Results demonstrated that the building containment was successful and that releases were below allowable emission limits. The

monitoring was conducted in compliance with the site Environmental Monitoring and Surveillance Plan. Sample analysis results are provided in Table 6.3.

TABLE 6.1A Summary of Non-Radiological Detections in Groundwater, February 1992

	SAMPLE	MCL	TB-43	TB-44	TB-45	TB-46	TB-47	TB-48	TB-49	TB-50	TB-51	UCD-01
	DATE		02/18/92	02/19/92	02/20/92	02/20/92	02/24/92	02/24/92	02/25/92	02/25/92	02/27/92	02/24/92
	QA		T	T	T	T	T	T	T	T	T	
	ANALYTE											
GENERAL CHEMICAL PARAMETERS	ALKALINITY TOTAL(AS CACO3) (mg/liter)		-	-	-	-	-	-	-	-	-	760
	CHEMICAL OXYGEN DEMAND (mg/liter)		-	-	-	-	-	-	-	-	-	9.57
	EC-F ((umhos/cm)		-	-	-	-	-	-	-	-	-	1368
	TEMPERATURE (degrees C)		-	-	-	-	-	-	-	-	-	17.9
	TOTAL DISSOLVED SOLIDS (mg/liter)		-	-	-	-	-	-	-	-	-	648
	TURBIDITY (NTU)		-	-	-	-	-	-	-	-	-	108.7
	TURBIDITY-F (NTU)		-	-	-	-	-	-	-	-	-	101.8
	pH-F		-	-	-	-	-	-	-	-	-	7.27
METALS (ug/liter)	ANTIMONY (TOTAL)	5	-	-	-	-	-	-	-	-	-	10
	BARIUM (TOTAL)	1000	-	-	-	-	-	-	-	-	-	250
	CHROMIUM (TOTAL)	50	-	-	-	-	-	-	-	-	-	80
	CHROMIUM, HEXAVALENT (+6)		-	-	-	-	-	-	-	-	-	30
	NICKEL (TOTAL)	100*	-	-	-	-	-	-	-	-	-	-
	SELENIUM (TOTAL)	10	-	-	-	-	-	-	-	-	-	-
	THALLIUM (TOTAL)	2*	-	-	-	-	-	-	-	-	-	20
ANIONS AND CATIONS (ug/liter)	CALCIUM (TOTAL)		-	-	-	-	-	-	-	-	-	59400
	CHLORIDE		-	-	-	-	-	-	-	-	-	14900
	MAGNESIUM (TOTAL)		-	-	-	-	-	-	-	-	-	136000
	NITROGEN, NITRATE (AS N)	10000	-	-	-	-	-	-	-	-	-	11500
	PHOSPHATE, TOTAL (AS P)		-	-	-	-	-	-	-	-	-	100
	POTASSIUM (TOTAL)		-	-	-	-	-	-	-	-	-	1100
	SODIUM (TOTAL)		-	-	-	-	-	-	-	-	-	30200
	SULFATE	400000*	-	-	-	-	-	-	-	-	-	52400
VOLATILE ORGANICS (ug/liter)	1,1-DICHLOROETHANE	5	-	-	-	-	-	-	-	-	-	-
	1,1-DICHLOROETHENE	6	-	-	-	-	-	-	-	-	-	-
	1,2-DICHLOROETHANE	0.5	-	-	-	-	-	-	-	-	-	-
	CHLOROFORM	100	-	-	-	-	-	-	-	-	-	-
	METHYLENE CHLORIDE	5*	3.7	6.7	3.7	3.3	4.4	4.4	4.8	8.4	4.1	-
SEMIVOLATILE ORGANICS (ug/liter)	BIS(2-ETHYLHEXYL)PHTHALATE	4	-	-	-	-	-	-	-	-	-	-
	DI-N-BUTYLPHTHALATE		-	-	-	-	-	-	-	-	-	-
CHLORINATED PESTICIDES AND PCBS (ug/liter)	GAMMA-BHC	4	-	-	-	-	-	-	-	-	-	0.004

- = denotes either not detected or not analyzed
D = duplicate sample.
T or TB = trip sample, analyzed for volatile organics only.
F = measured in the field.
UCD-XX = monitoring well.
MCL = Maximum Contaminant level (primary), Title 22, Division 4, Chapter 15.
* = Proposed USEPA MCL.

TABLE 6.1A Summary of Non-Radiological Detections in Groundwater, February 1992 (cont.)

	SAMPLE DATE QA	MCL	UCD-04 02/24/92	UCD-07 02/24/92	UCD-10 02/25/92	UCD-11 02/25/92	UCD-12 02/27/92	UCD-13 02/25/92	UCD-14 02/20/92	UCD-14B 02/20/92 D	UCD-15 02/18/92	UCD-16 02/18/92
	ANALYTE											
GENERAL CHEMICAL PARAMETERS	ALKALINITY TOTAL (AS CACO3) (mg/liter)		366	400	673	499	735	861	357	348	359	364H
	CHEMICAL OXYGEN DEMAND (mg/liter)		-	-	-	-	7.02	-	-	-	-	-
	EC-F ((umhos/cm)		889	883	1856	1203	2740	1641	746	746	910	886
	TEMPERATURE (degrees C)		17.8	17.8	17.5	17.3	17.9	18.1	17.4	17.4	17.2	17.5
	TOTAL DISSOLVED SOLIDS (mg/liter)		525	572	1320	727	1340	1020	458	459	452	467
	TURBIDITY (NTU)		437	610	2.4	2.02	3.3H	0.872	1.78	1.532	0.82	0.12
	TURBIDITY-F (NTU)		200	1.26	6.63	6.77	7.37	3.48	18.4	18.4	0.24	0.42
	pH-F		7.64	7.88	7.88	7.85	7.85	7.83	7.93	7.93	8.28	7.31
METALS (ug/liter)	ANTIMONY (TOTAL)	5	-	-	-	-	-	-	-	-	-	-
	BARIUM (TOTAL)	1000	240	180	-	190	190	330	130	140	160	140
	CHROMIUM (TOTAL)	50	30	60	100	370	210	130	30	30	-	50
	CHROMIUM, HEXAVALENT (+6)		-	30	50	330	153	80	10	10	11	20
	NICKEL (TOTAL)	100*	-	-	-	-	-	-	-	-	-	-
	SELENIUM (TOTAL)	10	-	-	12	12	13	-	-	-	-	-
	THALLIUM (TOTAL)	2*	-	30	30	130	130	100	-	-	-	20
ANIONS AND CATIONS (ug/liter)	CALCIUM (TOTAL)		46200	37500	44800	39400	68400	65700	33200	35200	38800	34900
	CHLORIDE		66600	14800	35600	58800	182000	38900	28600	28300	21500	19400
	MAGNESIUM (TOTAL)		68000	63000	151000	92000	173000	164000	59400	56000	48000	55600
	NITROGEN, NITRATE (AS N)	10000	1930	12400	21000	24100	52700	15800	2660	2680	2540	3060
	PHOSPHATE, TOTAL (AS P)		200	-	-	-	200	100	100	-	-	-
	POTASSIUM (TOTAL)		1100	800	1700	1000	7000	9200	800	900	800	700
	SODIUM (TOTAL)		29800	42600	153000	57000	73000	54600	32400	34400	25600	48100
	SULFATE	400000*	42800	44100	897000	232000	103000	246000	44900	40800	39100	42300
VOLATILE ORGANICS (ug/liter)	1,1-DICHLOROETHANE	5	-	-	-	-	6.3	-	-	-	-	-
	1,1-DICHLOROETHENE	6	-	-	-	-	7.6	-	-	-	-	-
	1,2-DICHLOROETHANE	0.5	-	-	-	-	3.6	-	-	-	-	-
	CHLOROFORM	100	-	-	-	-	160	-	2.1	1.7	-	-
	METHYLENE CHLORIDE	5*	-	-	-	-	2.8	-	-	-	-	-
SEMIVOLATILE ORGANICS (ug/liter)	BIS(2-ETHYLHEXYL)PHTHALATE	4	-	-	-	-	9.7	-	8.7H	-H	-	-
	DI-N-BUTYLPHTHALATE		-	-	-	-	-	-	-H	-H	-	-
CHLORINATED PESTICIDES AND PCBS (ug/liter)	GAMMA-BHC	4	-	-	-	-	-	-	-	-	-H	-

- = denotes either not detected or not analyzed
D = duplicate sample.
T or TB = trip sample, analyzed for volatile organics only.
F = measured in the field.
UCD-XX = monitoring well.
MCL = Maximum Contaminant level (primary), Title 22, Division 4, Chapter 15.
* – Proposed USEPA MCL.

TABLE 6.1A Summary of Non-Radiological Detections in Groundwater, February 1992 (cont.)

	SAMPLE DATE QA	MCL	UCD-17 02/18/92	UCD-18 02/18/92	UCD-19 02/20/92	UCD-20 02/19/92	UCD-21 02/19/92	UCD-22 02/27/92	UCD-23 02/18/92	UCD-24 02/20/92
	ANALYTE									
GENERAL CHEMICAL PARAMETERS	ALKALINITY TOTAL(AS CACO3) (mg/liter)		349	411	864	465H	648H	378	408	495
	CHEMICAL OXYGEN DEMAND (mg/liter)		-	-	-	-	-	2.35	-	-
	EC-F ((umhos/cm)		870	1102	1250	1202	1766	889	1053	1325
	TEMPERATURE (degrees C)		17.6	17.8	18.9	18.7	19.8	19.5	19.8	19.3
	TOTAL DISSOLVED SOLIDS (mg/liter)		444	560	941	690	993	487	519	852
	TURBIDITY (NTU)		0.7	28.5	0.79	5.78	7.9	6.5H	28.7	0.76
	TURBIDITY-F (NTU)		0.65	24.8	8.47	1.89	4.84	12	30.3	0.55
	pH-F		8.06	7.6	7.7	7.55	7.52	7.81	7.75	7.54
METALS (ug/liter)	ANTIMONY (TOTAL)	5	-	-	-	-	10	-	-	-
	BARIUM (TOTAL)	1000	140	120	70	110	130	80	60	120
	CHROMIUM (TOTAL)	50	-	30	300	80	90	-	-	60
	CHROMIUM, HEXAVALENT (+6)		15	-	270	70	60	-	-	30
	NICKEL (TOTAL)	100*	-	30	-	-	-	-	-	-
	SELENIUM (TOTAL)	10	-	-	-	-	-	-	-	-
	THALLIUM (TOTAL)	2*	-	-	40	20	110	-	-	10
ANIONS AND CATIONS (ug/liter)	CALCIUM (TOTAL)		37100	37900	58000	38500	55000	27800	33100	45800
	CHLORIDE		18200	33800	13400	10400	22200	36800	34000	26400
	MAGNESIUM (TOTAL)		46000	70000	107000	74000	98000	51000	66000	83000
	NITROGEN, NITRATE (AS N)	10000	1900	5090	10500	25200	40300	500	3940	42900
	PHOSPHATE, TOTAL (AS P)		-	100	-	-	-	-	100	-
	POTASSIUM (TOTAL)		700	1200	1200	1400	1700	1200	1200	1300
	SODIUM (TOTAL)		26000	35300	60500	45500	77100	57100	34900	63400
	SULFATE	400000*	39800	43600	85100	51900	76200	34800	34200	63700
VOLATILE ORGANICS (ug/liter)	1,1-DICHLOROETHANE	5	-	-	-	-	-	-	-	-
	1,1-DICHLOROETHENE	6	-	-	-	-	-	-	-	-
	1,2-DICHLOROETHANE	0.5	-	-	-	-	-	-	-	-
	CHLOROFORM	100	-	-	-	-	2.6	-	-	-
	METHYLENE CHLORIDE	5*	-	-	-	9.6	-	3.7	-	-
SEMIVOLATILE ORGANICS (ug/liter)	BIS(2-ETHYLHEXYL)PHTHALATE	4	-	-	-	-	-	10.4	-	-H
	DI-N-BUTYLPHTHALATE		-	-	-	2.8	-	-	-	-H
CHLORINATED PESTICIDES AND PCBS (ug/liter)	GAMMA-BHC	4	-	-	-	-	-	-	-H	-

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D = duplicate sample.
T or TB = trip sample, analyzed for volatile organics only.
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UCD-XX = monitoring well.
MCL = Maximum Contaminant level (primary), Title 22, Division 4, Chapter 15.
* = Proposed USEPA MCL.

TABLE 6.1B Summary of Non-Radiological Detections in Groundwater, May 1992

	SAMPLE	MCL	TB-57	TB-58	TB-59	UCD-01	UCD-04	UCD-07	UCD-10	UCD-11	UCD-12	UCD-13
	DATE		05/13/92	05/13/92	05/14/92	05/19/92	05/19/92	05/13/92	05/12/92	05/14/92	05/13/92	05/12/92
	QA		T	T	T							
	ANALYTE											
GENERAL CHEMICAL PARAMETERS	ALKALINITY TOTAL (AS CACO3) (mg/liter)		-	-	-	703	529	406	655	500	777	783
	CHEMICAL OXYGEN DEMAND (mg/liter)		-	-	-	55	65	-	-	-	15	30
	EC-F (umhos/cm)		-	-	-	1351	1122	1088	1907	1153	3080	1633
	TEMPERATURE (degrees C)		-	-	-	18.4	18.9	17.7	18.6	18	18.7	17.8
	TOTAL DISSOLVED SOLIDS (mg/liter)		-	-	-	906	763	786	1450	915	2451	1180
	TURBIDITY (NTU)		-	-	-	949	441	1.67	3.26	1.74	27.7	2.54
	TURBIDITY-F (NTU)		-	-	-	200	200	2.9	15.3	7.04	12.36	10.19
	pH-F		-	-	-	7.21	7.47	7.65	7.66	7.53	7.94	7.65
METALS (ug/liter)	BARIUM (TOTAL)	1000	-	-	-	190	280	200	-	180	430	260
	CADMIUM (TOTAL)		-	-	-	-	-	-	-	-	-	-
	CHROMIUM (TOTAL)	50	-	-	-	60	40	120	70	320	260	120
	CHROMIUM, HEXAVALENT (+6)		-	-	-	34	13	80	53	290	180	79
	COBALT (TOTAL)		-	-	-	-	-	-	-	-	-	-
	LEAD (TOTAL)	50	-	-	-	4	18	63	-	4	-	-
	MERCURY (TOTAL)	2	-	-	-	-	-	-	1.1	-	-	-
	MOLYBDENUM (TOTAL)		-	-	-	-	-	20	20	-	10	20
	NICKEL (TOTAL)	100*	-	-	-	-	10	30	20	20	30	20
	SELENIUM (TOTAL)	10	-	-	-	-	-	-	-	-	-	-
	VANADIUM (TOTAL)		-	-	-	20	10	10	20	-	30	20
	ZINC (TOTAL)		-	-	-	20	20	20	20	30	20	20
ANIONS AND CATIONS (ug/liter)	CALCIUM (TOTAL)		-	-	-	45900	44300	29800	34300	31100	73800	52300
	CHLORIDE		-	-	-	12500	60600	25300	34400	49800	370000	38700
	MAGNESIUM (TOTAL)		-	-	-	152000	101000	100000	174000	111000	333000	184000
	NITROGEN, NITRATE (AS N)	10000	-	-	-	18700	3000	34100	13200	27400	9800	9800
	PHOSPHATE, TOTAL (AS P)		-	-	-	580	590	720	720	710	710	920
	POTASSIUM (TOTAL)		-	-	-	1120	1120	900	1260	1140	4500	2800
	SODIUM (TOTAL)		-	-	-	36700	37900	52600	128000	81900	102000	48900
	SULFATE	400000*	-	-	-	32400	38800	41200	402000	45100	123000	84500
VOLATILE ORGANICS (ug/liter)	1,1-DICHLOROETHANE	5	-	-	-	-	-	-	-	-	24	-
	1,1-DICHLOROETHENE	6	-	-	-	-	-	-	-	-	44	-
	1,2-DICHLOROETHANE	0.5	-	-	-	-	-	-	-	-	15	-
	CHLOROFORM	100	-	-	-	-	-	-	-	-	16000	1.6
	METHYLENE CHLORIDE	5*	2.8	3	2.8	-	-	-	-	-	-	-
SEMIVOLATILE ORGANICS (ug/liter)	BIS(2-ETHYLHEXYL)PHTHALATE	4	-	-	-	-	13.6	6.4	2.7	-	-	-
CHLORINATED PESTICIDES AND PCBS (ug/liter)	DIELDRIN		-	-	-	-	-	-	-	-	-	0.06
	ENDRIN	0.2	-	-	-	-	-	-	-	-	-	0.05
	GAMMA-BHC	4	-	-	-	-	-	-	-	-	-	0.004

- = denotes either not detected or not analyzed
D = duplicate sample.
T or TB = trip sample, analyzed for volatile organics only.
F = measured in the field.
UCD-XX = monitoring well.
MCL = Maximum Contaminant level (primary), Title 22, Division 4, Chapter 15.
* = Proposed USEPA MCL.

TABLE 6.1B Summary of Non-Radiological Detections in Groundwater, May 1992 (cont.)

	SAMPLE DATE QA	MCL	UCD-14 05/12/92	UCD-15 05/13/92	UCD-15B 05/13/92 D	UCD-16 05/11/92	UCD-17 05/11/92	UCD-18 05/11/92	UCD-19 05/12/92	UCD-20 05/19/92	UCD-20B 05/19/92 D	UCD-21 05/13/92
	ANALYTE											
GENERAL CHEMICAL PARAMETERS	ALKALINITY TOTAL (AS CACO3) (mg/liter)		526	336	339	357	449	338	719	439	439	582
	CHEMICAL OXYGEN DEMAND (mg/liter)		-	-	-	35	20	25	-	20	35	5
	EC-F ((umhos/cm)		1113	571	571	716	675	1036	1343	914	914	1549
	TEMPERATURE (degrees C)		17.4	18.7	18.7	18.9	18.3	18.9	19.7	19	19	20.2
	TOTAL DISSOLVED SOLIDS (mg/liter)		890	631	595	592	548	887	983	602	630	1040
	TURBIDITY (NTU)		2.04	1.26	0.22	0.365	0.206	25.7	0.87	14.15	11.12	9.14
	TURBIDITY-F (NTU)		2.12	0.77	0.77	0.58	0.66	26.3	5.95	23.8	23.8	54.2
	pH-F		7.64	7.8	7.8	7.8	7.85	7.51	7.68	7.68	7.68	7.51
METALS (ug/liter)	BARIUM (TOTAL)	1000	240	140	140	140	150	170	70	90	80	100
	CADMIUM (TOTAL)		-	-	-	-	-	-	-	2	-	-
	CHROMIUM (TOTAL)	50	60	-	30	40	30	40	270	30	50	70
	CHROMIUM, HEXAVALENT (+6)		42	10	10	30	10	20	260	44	46	60
	COBALT (TOTAL)		-	-	-	-	-	-	-	-	-	-
	LEAD (TOTAL)	50	-	-	-	-	-	-	-	-	-	-
	MERCURY (TOTAL)	2	1	-	-	-	-	-	1.4	-	-	-
	MOLYBDENUM (TOTAL)		20	10	-	10	-	20	10	-	-	10
	NICKEL (TOTAL)	100*	-	10	10	-	-	30	20	-	-	10
	SELENIUM (TOTAL)	10	-	-	-	-	-	-	10	-	-	-
	VANADIUM (TOTAL)		10	10	-	-	10	10	20	10	10	10
	ZINC (TOTAL)		20	20	20	20	20	30	20	20	20	20
ANIONS AND CATIONS (ug/liter)	CALCIUM (TOTAL)		39100	26400	27500	25800	29300	31200	37100	24700	23100	38800
	CHLORIDE		33600	20700	21400	19400	19900	41800	13700	8920	8920	17100
	MAGNESIUM (TOTAL)		121000	62700	63900	60700	60500	98900	144000	79400	80900	131000
	NITROGEN, NITRATE (AS N)	10000	11500	8500	2850	1990	1920	18800	10000	21300	21600	44900
	PHOSPHATE, TOTAL (AS P)		770	490	890	-	-	-	810	180	190	810
	POTASSIUM (TOTAL)		980	810	780	690	620	1000	1500	1300	1360	1830
	SODIUM (TOTAL)		39400	41000	23600	37400	25800	40100	61800	47200	45000	86300
	SULFATE	400000*	64300	32600	36600	68600	32900	40100	88600	49800	48200	82300
VOLATILE ORGANICS (ug/liter)	1,1-DICHLOROETHANE	5	-	-	-	-	-	-	-	-	-	-
	1,1-DICHLOROETHENE	6	-	-	-	-	-	-	-	-	-	-
	1,2-DICHLOROETHANE	0.5	-	-	-	-	-	-	-	-	-	-
	CHLOROFORM	100	2.4	-	-	-	-	-	-	-	-	-
	METHYLENE CHLORIDE	5*	-	-	-	-	-	-	-	-	-	-
SEMIVOLATILE ORGANICS (ug/liter)	BIS(2-ETHYLHEXYL)PHTHALATE	4	-	2.8	3	2.7	5.3	10.1	-	3.3	4.8	3
CHLORINATED PESTICIDES AND PCBS (ug/liter)	DIELDRIN		-	-	-	-	-	-	-	-	-	-
	ENDRIN	0.2	-	-	-	-	-	-	-	-	-	-
	GAMMA-BHC	4	-	-	-	-	-	-	-	-	-	-

- = denotes either not detected or not analyzed
D = duplicate sample.
T or TB = trip sample, analyzed for volatile organics only.
F = measured in the field.
UCD-XX = monitoring well.
MCL = Maximum Contaminant level (primary), Title 22, Division 4, Chapter 15.
* = Proposed USEPA MCL.

TABLE 6.1B Summary of Non-Radiological Detections in Groundwater, May 1992 (cont.)

	SAMPLE DATE QA	MCL	UCD-22 05/14/92	UCD-23 05/14/92	UCD-24 05/14/92
	ANALYTE				
GENERAL CHEMICAL PARAMETERS	ALKALINITY TOTAL (AS CACO3) (mg/liter)		382	473	512
	CHEMICAL OXYGEN DEMAND (mg/liter)		-	-	-
	EC-F (umhos/cm)		885	989	1336
	TEMPERATURE (degrees C)		19.8	21.2	19.9
	TOTAL DISSOLVED SOLIDS (mg/liter)		611	651	1090
	TURBIDITY (NTU)		5.33	28.6	6.59
	TURBIDITY-F (NTU)		9.19	65.5	3.09
	pH-F		7.64	7.63	7.5
METALS (ug/liter)	BARIUM (TOTAL)	1000	50	60	160
	CADMIUM (TOTAL)		-	-	-
	CHROMIUM (TOTAL)	50	40	40	70
	CHROMIUM, HEXAVALENT (+6)		-	-	30
	COBALT (TOTAL)		10	-	10
	LEAD (TOTAL)	50	-	-	-
	MERCURY (TOTAL)	2	-	-	-
	MOLYBDENUM (TOTAL)		10	- -	-
	NICKEL (TOTAL)	100*	50	170	10
	SELENIUM (TOTAL)	10	-	-	-
	VANADIUM (TOTAL)		-	-	10
	ZINC (TOTAL)		30	20	30
ANIONS AND CATIONS (ug/liter)	CALCIUM (TOTAL)		22600	27700	34400
	CHLORIDE		36600	30600	21500
	MAGNESIUM (TOTAL)		58200	89600	126000
	NITROGEN, NITRATE (AS N)	10000	4140	8010	56400
	PHOSPHATE, TOTAL (AS P)		730	840	830
	POTASSIUM (TOTAL)		1370	1150	1090
	SODIUM (TOTAL)		69000	37100	69700
	SULFATE	400000*	31800	27800	52700
VOLATILE ORGANICS (ug/liter)	1,1-DICHLOROETHANE	5	-	-	-
	1,1-DICHLOROETHENE	6	-	-	-
	1,2-DICHLOROETHANE	0.5	-	-	-
	CHLOROFORM	100	-	-	-
	METHYLENE CHLORIDE	5*	-	-	-
SEMIVOLATILE ORGANICS (ug/liter)	BIS(2-ETHYLHEXYL)PHTHALATE	4	2.6	-	-
CHLORINATED PESTICIDES AND PCBS (ug/liter)	DIELDRIN		-	-	-
	ENDRIN	0.2	-	-	-
	GAMMA-BHC	4	-	-	-

- = denotes either not detected or not analyzed
D = duplicate sample.
T or TB = trip sample, analyzed for volatile organics only.
F = measured in the field.
UCD-XX = monitoring well.
MCL = Maximum Contaminant level (primary), Title 22, Division 4, Chapter 15.
* = Proposed USEPA MCL.

TABLE 6.1C Summary of Non-Radiological Detections in Groundwater, August 1992

	SAMPLE	MCL	TB-63	TB-65	TB-66	TB-67	TB-68	TB-69	TB-70	UCD-07	UCD-14	UCD-15
	DATE		08/03/92	08/05/92	08/05/92	08/06/92	08/06/92	08/10/92	08/10/92	08/04/92	08/04/92	08/05/92
	QA		T	T	T	T	T	T	T			
	ANALYTE											
GENERAL CHEMICAL PARAMETERS	ALKALINITY TOTAL (AS CACO3) (mg/liter)		-	-	-	-	-	-	-	384	719	350
	CHEMICAL OXYGEN DEMAND (mg/liter)		-	-	-	-	-	-	-	1.91	3.81	5.45
	EC-F ((umhos/cm)		-	-	-	-	-	-	-	770	1342	440
	TEMPERATURE (degrees C)		-	-	-	-	-	-	-	19.7	18.9	19.1
	TOTAL DISSOLVED SOLIDS (mg/liter)		-	-	-	-	-	-	-	564	896	420
	TURBIDITY (NTU)		-	-	-	-	-	-	-	0.289	0.626	-
	TURBIDITY-F (NTU)		-	-	-	-	-	-	-	1.38	4.02	0.17
	pH-F		-	-	-	-	-	-	-	7.72	7.42	7.73
METALS (ug/liter)	BARIUM (TOTAL)	1000	-	-	-	-	-	-	-	170	300	150
	BERYLLIUM (TOTAL)	1	-	-	-	-	-	-	-	-	-	-
	CHROMIUM (TOTAL)	50	-	-	-	-	-	-	-	60	100	30
	CHROMIUM, HEXAVALENT (+6)		-	-	-	-	-	-	-	34	51	-
	NICKEL (TOTAL)	100*	-	-	-	-	-	-	-	-	40	-
	SILVER (TOTAL)	50	-	-	-	-	-	-	-	-	-	-
ANIONS AND CATIONS (ug/liter)	CALCIUM (TOTAL)		-	-	-	-	-	-	-	33300	53800	31600
	CHLORIDE		-	-	-	-	-	-	-	24000	36500	21100
	MAGNESIUM (TOTAL)		-	-	-	-	-	-	-	66200	133000	57000
	NITROGEN, NITRATE (AS N)	10000	-	-	-	-	-	-	-	9530	6350	830
	PHOSPHATE, TOTAL (AS P)		-	-	-	-	-	-	-	100	120	110
	POTASSIUM (TOTAL)		-	-	-	-	-	-	-	700	900	600
	SODIUM (TOTAL)		-	-	-	-	-	-	-	44600	47900	27300
	SULFATE	400000*	-	-	-	-	-	-	-	41300	88400	35400
VOLATILE ORGANICS (ug/liter)	CHLOROFORM	100	-	-	-	-	-	-	-	-	-	-
	METHYLENE CHLORIDE	5*	-	-	-	-	-	2.3	2.4	-	-	-
	TOLUENE	1000#	12	4.9	13	4	4	15	3.5	-	-	13
	TRICHLOROETHENE	5	-	-	-	-	-	1.3	2.3	-	-	1.5
	TRICHLOROFLUOROMETHANE	150	-	-	-	-	-	4.5	-	-	-	-
SEMIVOLATILE ORGANICS (ug/liter)	BIS(2-ETHYLHEXYL)PHTHALATE	4	-	-	-	-	-	-	-	10.1	-	5.7

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# = USEPA MCL.
UCD-XX = monitoring well.

Note: Monitoring wells UCD-1 and UCD-4 were dry and could not be sampled.

TABLE 6.1C Summary of Non-Radiological Detections in Groundwater, August 1992 (cont.)

	SAMPLE DATE QA	MCL	UCD-14 05/12/92	UCD-15 05/13/92	UCD-15B 05/13/92 D	UCD-16 05/11/92	UCD-17 05/11/92	UCD-18 05/11/92	UCD-19 05/12/92	UCD-20 05/19/92	UCD-20B 05/19/92 D	UCD-21 05/13/92
	ANALYTE.											
GENERAL CHEMICAL PARAMETERS	ALKALINITY TOTAL (AS CACO3) (mg/liter)		526	338	339	357	449	338	719	439	439	582
	CHEMICAL OXYGEN DEMAND (mg/liter)		-	-	-	35	20	25	-	20	35	5
	EC-F (µmhos/cm)		1113	571	571	718	675	1038	1343	914	914	1549
	TEMPERATURE (degrees C)		17.4	18.7	18.7	18.9	18.3	18.9	19.7	19	19	20.2
	TOTAL DISSOLVED SOLIDS (mg/liter)		890	631	595	592	548	887	983	602	630	1040
	TURBIDITY (NTU)		2.04	1.26	0.22	0.365	0.206	25.7	0.87	14.15	11.12	9.14
	TURBIDITY-F (NTU)		2.12	0.77	0.77	0.58	0.66	28.3	5.95	23.8	23.8	54.2
	pH-F		7.64	7.8	7.8	7.8	7.85	7.51	7.68	7.68	7.68	7.51
METALS (ug/liter)	BARIUM (TOTAL)	1000	240	140	140	140	150	170	70	90	80	100
	CADMIUM (TOTAL)		-	-	-	-	-	-	-	2	-	-
	CHROMIUM (TOTAL)	50	60	-	30	40	30	40	270	30	50	70
	CHROMIUM, HEXAVALENT (+6)		42	10	10	30	10	20	260	44	46	60
	COBALT (TOTAL)		-	-	-	-	-	-	-	-	-	-
	LEAD (TOTAL)	50	-	-	-	-	-	-	-	-	-	-
	MERCURY (TOTAL)	2	1	-	-	-	-	-	1.4	-	-	-
	MOLYBDENUM (TOTAL)		20	10	-	10	-	20	10	-	-	10
	NICKEL (TOTAL)	100*	-	10	10	-	-	30	20	-	-	10
	SELENIUM (TOTAL)	10	-	-	-	-	-	-	10	-	-	-
	VANADIUM (TOTAL)		10	10	-	-	10	10	20	10	10	10
	ZINC (TOTAL)		20	20	20	20	20	30	20	20	20	20
ANIONS AND CATIONS (ug/liter)	CALCIUM (TOTAL)		39100	26400	27500	25800	29300	31200	37100	24700	23100	38800
	CHLORIDE		33600	20700	21400	19400	19900	41800	13700	6920	6920	17100
	MAGNESIUM (TOTAL)		121000	62700	63900	60700	60500	98900	144000	79400	80900	131000
	NITROGEN, NITRATE (AS N)	10000	11500	9500	2850	1990	1920	19800	10000	21300	21600	44900
	PHOSPHATE, TOTAL (AS P)		770	490	690	-	-	-	810	180	190	810
	POTASSIUM (TOTAL)		980	810	780	690	620	1000	1500	1300	1360	1830
	SODIUM (TOTAL)		39400	41000	23600	37400	25800	40100	61800	47200	45000	86300
	SULFATE	400000*	64300	32600	36600	68600	32900	40100	68600	49600	46200	62300
VOLATILE ORGANICS (ug/liter)	1,1-DICHLOROETHANE	5	-	-	-	-	-	-	-	-	-	-
	1,1-DICHLOROETHENE	6	-	-	-	-	-	-	-	-	-	-
	1,2-DICHLOROETHANE	0.5	-	-	-	-	-	-	-	-	-	-
	CHLOROFORM	100	2.4	-	-	-	-	-	-	-	-	-
	METHYLENE CHLORIDE	5*	-	-	-	-	-	-	-	-	-	-
SEMIVOLATILE ORGANICS (ug/liter)	BIS(2-ETHYLHEXYL)PHTHALATE	4	-	2.8	3	2.7	5.3	10.1	-	3.3	4.6	3
CHLORINATED PESTICIDES AND PCBS (ug/liter)	DIELDRIN		-	-	-	-	-	-	-	-	-	-
	ENDRIN	0.2	-	-	-	-	-	-	-	-	-	-
	GAMMA-BHC	4	-	-	-	-	-	-	-	-	-	-

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F = measured in the field.
MCL = Maximum Contaminant Level (primary), Title 22, Division 44, Chapter 15.
* = proposed USEPA MCL.
# = USEPA MCL.
UCD-XX = monitoring well.

Note: Monitoring wells UCD-1 and UCD-4 were dry and could not be sampled.

TABLE 6.1C Summary of Non-Radiological Detections in Groundwater, August 1992 (cont.)

	SAMPLE DATE QA	MCL	UCD-24 08/06/92
	ANALYTE		
GENERAL CHEMICAL PARAMETERS	ALKALINITY TOTAL(AS CACO3) (mg/liter)		500
	CHEMICAL OXYGEN DEMAND (mg/liter)		3.22
	EC-F ((umhos/cm)		1326
	TEMPERATURE (degrees C)		20.8
	TOTAL DISSOLVED SOLIDS (mg/liter)		943
	TURBIDITY (NTU)		27
	TURBIDITY-F (NTU)		46
	pH-F		7 44
METALS (ug/liter)	BARIUM (TOTAL)	1000	150
	BERYLLIUM (TOTAL)	1	-
	CHROMIUM (TOTAL)	50	70
	CHROMIUM, HEXAVALENT (+6)		60
	NICKEL (TOTAL)	100*	-
	SILVER (TOTAL)	50	-
ANIONS AND CATIONS (ug/liter)	CALCIUM (TOTAL)		42400
	CHLORIDE		23900
	MAGNESIUM (TOTAL)		110000
	NITROGEN, NITRATE (AS N)	10000	13000
	PHOSPHATE, TOTAL (AS P)		190
	POTASSIUM (TOTAL)		1210
	SODIUM (TOTAL)		72600
	SULFATE	400000*	69700
VOLATILE ORGANICS (ug/liter)	CHLOROFORM	100	-
	METHYLENE CHLORIDE	5*	-
	TOLUENE	1000#	-
	TRICHLOROETHENE	5	-
	TRICHLOROFLUOROMETHANE	150	-
SEMIVOLATILE ORGANICS (ug/liter)	BIS(2-ETHYLHEXYL)PHTHALATE	4	-

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T or TB = trip blank, analyzed for volatile organics only.
F = measured in the field.
MCL = Maximum Contaminant Level (primary), Title 22, Division 44, Chapter 15.
* = proposed USEPA MCL.
# = USEPA MCL.
UCD-XX = monitoring well.

Note: Monitoring wells UCD-1 and UCD-4 were dry and could not be sampled.

TABLE 6.1D Summary of Non-Radiological Detections in Groundwater, November 1992

	SAMPLE DATE QA	MCL	TB-73 11/17/92 T	TB-74 11/17/92 T	TB-75 11/18/92 T	TB-76 11/18/92 T	TB-77 11/18/92 T	UCD-01 11/23/92	UCD-07 11/24/92	UCD-10 11/23/92
	ANALYTE									
GENERAL CHEMICAL PARAMETERS	ALKALINITY TOTAL (AS CACO3) (mg/liter)		-	-	-	-	-	51311	35711	63511
	CHEMICAL OXYGEN DEMAND (mg/liter)		-	-	-	-	-	-	-	8.22
	EC-F ((umhos/cm)		-	-	-	-	-	1339	732	1780
	TEMPERATURE (degrees C)		-	-	-	-	-	16.1	15.8	18.5
	TOTAL DISSOLVED SOLIDS (mg/liter)		-	-	-	-	-	878	475	1300
	TURBIDITY (NTU)		-	-	-	-	-	407	0.74	3.57
	TURBIDITY-F (NTU)		-	-	-	-	-	200	4.25	2.23
	pH-F		-	-	-	-	-	7.03	7.64	7.5
METALS (ug/liter)	ANTIMONY (TOTAL)	5*	-	-	-	-	-	10	10	-
	BARIUM (TOTAL)	50	-	-	-	-	-	200	150	20
	CHROMIUM (TOTAL)	50	-	-	-	-	-	70	30	80
	CHROMIUM, HEXAVALENT (+6)		-	-	-	-	-	50	30	60
	COPPER (TOTAL)	1300*	-	-	-	-	-	-	-	-
	MOLYBDENUM (TOTAL)		-	-	-	-	-	-	-	-
	NICKEL (TOTAL)	100*	-	-	-	-	-	-	-	-
	SELENIUM (TOTAL)	10	-	-	-	-	-	-	-	-
	SILVER (TOTAL)	50	-	-	-	-	-	10	-	-
	VANADIUM (TOTAL)		-	-	-	-	-	10	-	10
	ZINC (TOTAL)		-	-	-	-	-	10	10	20
ANIONS AND CATIONS (ug/liter)	CALCIUM (TOTAL)		-	-	-	-	-	64400	26900	38400
	CHLORIDE		-	-	-	-	-	10000	20000	25000
	MAGNESIUM (TOTAL)		-	-	-	-	-	110000	61300	118000
	NITROGEN, NITRATE (AS N)	10000	-	-	-	-	-	11300	8490	21800
	PHOSPHATE, TOTAL (AS P) - H		-	-	-	-	-	134	150	180
	POTASSIUM (TOTAL)		-	-	-	-	-	1100	1100	1800
	SODIUM (TOTAL)		-	-	-	-	-	38100	35900	151000
	SULFATE	400000*	-	-	-	-	-	31000	34000	300000
VOLATILE ORGANICS (ug/liter)	1,1-DICHLOROETHANE	5	-	-	-	-	-	-	-	-
	1,1-DICHLOROETHENE	6	-	-	-	-	-	-	-	-
	1,2-DICHLOROETHANE	0.5	-	-	-	-	-	-	-	-
	CHLOROFORM	100	-	-	-	-	-	-	-	-
	METHYLENE CHLORIDE	5*	3.4	3	3.6	3.5	2.9	-	-	-
	TOLUENE	1000#	-	-	-	-	14	-	-	-
SEMIVOLATILE ORGANICS (ug/liter)	BIS(2-ETHYLHEXYL)PHTHALATE	4	-	-	-	-	-	-	5.38	5.04
	DI-N-BUTYLPHTHALATE		-	-	-	-	-	-	-	-
CHLORINATED PESTICIDES AND PCBS (ug/liter)	DIELDRIN		-	-	-	-	-	-	-	-
	ENDOSULFAN I		-	-	-	-	-	-	-	-
	ENDRIN	0.2	-	-	-	-	-	-	-	-
	GAMMA-BHC	4	-	-	-	-	-	-	-	-
RADIOCHEMICAL ANALYSES (pCi/liter)	CARBON-14		-	-	-	-	-	-	-	-
	GROSS ALPHA	15	-	-	-	-	-	4	-	3
	GROSS BETA	50	-	-	-	-	-	21	-	8
	STRONTIUM-90	8	-	-	-	-	-	-	-	1.2
	TRITIUM	20000*	-	-	-	-	-	-	-	-

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# = USEPA MCL.
UCD-XX = monitoring well.

Note: Monitoring wells UCD-1 and UCD-4 were dry and could not be sampled.

TABLE 6.1D Summary of Non-Radiological Detections in Groundwater, November 1992 (cont.)

	SAMPLE DATE QA	MCL	UCD-11 11/18/92	UCD-12 11/23/92	UCD-13 11/24/92	UCD-14 11/24/92	UCD-15 11/23/92	UCD-16 11/18/92	UCD-17 11/18/92	UCD-18 11/18/92
	ANALYTE									
GENERAL CHEMICAL PARAMETERS	ALKALINITY TOTAL(AS CACO3) (mg/liter)		515	829H	480H	303H	322H	353H	331H	397H
	CHEMICAL OXYGEN DEMAND (mg/liter)		-	4.60	-	-	-	-	-	-
	EC-F ((umhos/cm)		1160	2270	1402	836	671	734	678	800
	TEMPERATURE (degrees C)		17.8	17.3	15.8	15.8	17.2	18.2	17.9	18.1
	TOTAL DISSOLVED SOLIDS (mg/liter)		781	1700	1020	474	420	460	430	407
	TURBIDITY (NTU)		1.2	15.2	7.55	0.4	0.273	0.09	0.08	4.2
	TURBIDITY-F (NTU)		2.93	4.25	3.21	6.09	1.89	0.5	1.9	9.32
	pH-F		7.42	7.28	7.18	7.58	7.67	7.64	7.64	7.55
METALS (ug/liter)	ANTIMONY (TOTAL)	5*	10	-	-	10	-	-	-	-
	BARIUM (TOTAL)	50	170	380	220	190	140	160	130	120
	CHROMIUM (TOTAL)	50	340	240	120	50	20	40	20	30
	CHROMIUM, HEXAVALENT (+6)		310	190	110	30	10	30	20	20
	COPPER (TOTAL)	1300*	-	-	-	-	-	20	-	-
	MOLYBDENUM (TOTAL)		-	-	-	-	-	10	10	10
	NICKEL (TOTAL)	100*	10	30	20	-	10	20	20	50
	SELENIUM (TOTAL)	10	10	-	-	-	-	-	-	-
	SILVER (TOTAL)	50	-	10	-	-	10	-	-	-
	VANADIUM (TOTAL)		10	20	10	-	-	20	10	20
	ZINC (TOTAL)		10	20	10	10	10	20	10	10
ANIONS AND CATIONS (ug/liter)	CALCIUM (TOTAL)		33900	73000	53400	33600	28010	27700	26600	26600
	CHLORIDE		45000	364000	35000	31000	18000	17000	16000	28000
	MAGNESIUM (TOTAL)		101000	261000	187000	94900	60400	68800	65700	88200
	NITROGEN, NITRATE (AS N)	10000	24400	9490	16200	5830	1960	3220	2600	8240
	PHOSPHATE, TOTAL (AS P) - H		210	177	220	160	150	170	150	220
	POTASSIUM (TOTAL)		1030	4000	3100	1100	700	1130	440	690
	SODIUM (TOTAL)		72900	108000	54100	40800	27900	42600	21500	38800
	SULFATE	400000*	39000	101000	71000	47000	32000	35000	31000	32000
VOLATILE ORGANICS (ug/liter)	1,1-DICHLOROETHANE	5	-	6.8	-	-	-	-	-	-
	1,1-DICHLOROETHENE	6	-	6.7	-	-	-	-	-	-
	1,2-DICHLOROETHANE	0.5	-	8	-	-	-	-	-	-
	CHLOROFORM	100	-	7900	-	3.3	-	-	-	-
	METHYLENE CHLORIDE	5*	-	-	-	-	-	-	-	-
	TOLUENE	1000#	-	-	-	-	-	-	-	-
SEMIVOLATILE ORGANICS (ug/liter)	BIS(2-ETHYLHEXYL)PHTHALATE	4	-	5.92	4.22	22.4	-	3.56	3.51	3.2
	DI-N-BUTYLPHTHALATE		-	-	-	-	-	-	-	-
CHLORINATED PESTICIDES AND PCBS (ug/liter)	DIELDRIN		-	-	0.085	-	-	-	-	-
	ENDOSULFAN I		-	-	0.018	-	-	-	-	-
	ENDRIN	0.2	-	-	0.04	-	-	-	-	-
	GAMMA-BHC	4	-	-	0.011	-	-	-	-	-
RADIOCHEMICAL ANALYSES (pCi/liter)	CARBON-14		-	-	1784	-	-	-	-	-
	GROSS ALPHA	15	-	5	-	-	-	-	-	-
	GROSS BETA	50	-	9	4	-	-	-	-	-
	STRONTIUM-90	8	-	1	-	-	0.9	-	-	-
	TRITIUM	20000*	-	-	29838	1204	-	1200	-	614

- – denotes either not detected or not analyzed.
D = duplicate sample.
T or TB = trip blank, analyzed for volatile organics only.
F = measured in the field.
MCL = Maximum Contaminant Level (primary), Title 22, Division 44, Chapter 15.
* = proposed USEPA MCL.
# = USEPA MCL.
UCD-XX = monitoring well.

Note: Monitoring wells UCD-1 and UCD-4 were dry and could not be sampled

TABLE 6.1D Summary of Non-Radiological Detections in Groundwater, November 1992 (cont.)

	SAMPLE DATE QA	MCL	UCD-19 11/17/92	UCD-20 11/17/92	UCD-21 11/17/92	UCD-22 11/18/92	UCD-22B 11/18/92 D	UCD-23 11/18/92	UCD-23D 11/18/92 D	UCD-24 11/17/92
	ANALYTE									
GENERAL CHEMICAL PARAMETERS	ALKALINITY TOTAL (AS CACO3) (mg/liter)		757H	478	622	415	415	472	471	497
	CHEMICAL OXYGEN DEMAND (mg/liter)		-	-	-	3.11	1.04	-	2.07	-
	EC-F ((umhos/cm)		1112	961	1533	957	-	988	-	1390
	TEMPERATURE (degrees C)		18.2	19	19.7	18.9	-	18.3	-	19.2
	TOTAL DISSOLVED SOLIDS (mg/liter)		823	617	925	543	534	560	595	850
	TURBIDITY (NTU)		0.67	1.34	1.4	1.13	1.3	0.88	0.95	0.45
	TURBIDITY-F (NTU)		2.51	1.8	1.09	2.52	-	1.71	-	2.52
	pH-F		7.54	7.8	7.38	7.5	-	7.6	-	7.29
METALS (ug/liter)	ANTIMONY (TOTAL)	5*	-	-	-	-	-	-	-	-
	BARIUM (TOTAL)	50	80	100	140	50	50	80	70	170
	CHROMIUM (TOTAL)	50	280	70	80	20	20	110	30	60
	CHROMIUM, HEXAVALENT (+6)		290	60	60	10	-	20	20	50
	COPPER (TOTAL)	1300*	-	-	-	-	-	-	-	-
	MOLYBDENUM (TOTAL)		10	10	-	-	-	70	-	-
	NICKEL (TOTAL)	100*	10	10	10	50	40	390	120	10
	SELENIUM (TOTAL)	10	-	-	-	-	-	-	-	-
	SILVER (TOTAL)	50	-	-	-	-	-	-	-	-
	VANADIUM (TOTAL)		20	20	20	10	-	20	20	20
	ZINC (TOTAL)		30	20	20	10	10	20	10	20
ANIONS AND CATIONS (ug/liter)	CALCIUM (TOTAL)		41700	29100	43000	24300	24200	30800	30500	37800
	CHLORIDE		11000	8000	22000	34000	32000	29000	28000	21000
	MAGNESIUM (TOTAL)		113000	78800	109000	62700	62300	61900	88800	101000
	NITROGEN, NITRATE (AS N)	10000	11300	19600	4470	6550	6680	7550	7680	5100
	PHOSPHATE, TOTAL (AS P) - H		220	180	170	160	160	190	200	180
	POTASSIUM (TOTAL)		790	990	1200	1020	1010	980	930	870
	SODIUM (TOTAL)		66900	44400	84900	70100	68400	40800	39600	69700
	SULFATE	400000*	58000	39000	42000	30000	36000	26000	25000	49000
VOLATILE ORGANICS (ug/liter)	1,1-DICHLOROETHANE	5	-	-	-	-	-	-	-	-
	1,1-DICHLOROETHENE	6	-	-	-	-	-	-	-	-
	1,2-DICHLOROETHANE	0.5	-	-	-	-	-	-	-	-
	CHLOROFORM	100	-	-	1.8	-	-	-	-	-
	METHYLENE CHLORIDE	5*	2.7	2.7	4.7	-	-	-	-	4.4
	TOLUENE	1000#	-	-	-	-	-	-	-	-
SEMIVOLATILE ORGANICS (ug/liter)	BIS(2-ETHYLHEXYL)PHTHALATE	4	-	-	-	-	3.32	16.3	-	2.6
	DI-N-BUTYLPHTHALATE		-	-	-	9.76	7.07	14.4	10	-
CHLORINATED PESTICIDES AND PCBS (ug/liter)	DIELDRIN		-	-	-	-	-	-	-	-
	ENDOSULFAN I		-	-	-	-	-	-	-	-
	ENDRIN	0.2	-	-	-	-	-	-	-	-
	GAMMA-BHC	4	-	-	-	-	-	-	-	-
RADIOCHEMICAL ANALYSES (pCi/liter)	CARBON-14		-	-	-	-	-	-	-	-
	GROSS ALPHA	15	-	-	-	6	10	-	4	-
	GROSS BETA	50	-	-	-	12	18	-	7	-
	STRONTIUM-90	8	-	-	-	-	-	-	-	-
	TRITIUM	20000*	-	-	509	-	-	-	-	-

- = denotes either not detected or not analyzed.
D = duplicate sample.
T or TB = trip blank, analyzed for volatile organics only.
F = measured in the field.
MCL = Maximum Contaminant Level (primary), Title 22, Division 44, Chapter 15.
* = proposed USEPA MCL.
# = USEPA MCL.
UCD-XX = monitoring well.

Note: Monitoring wells UCD-1 and UCD-4 were dry and could not be sampled.

TABLE 6.2A Summary of Non-Radiological Detections in Surface Water, February 1992

	SAMPLE DATE QA	MCL	PCD-01 02/26/92	PCU-01 02/26/92	STPO 02/26/92	STPO-B 02/26/92 D	TB-23 02/26/92 T	TB-24 02/26/92 T
	ANALYTE							
GENERAL CHEMICAL PARAMETERS	ALKALINITY TOTAL(AS CACO3) (mg/liter)		140	133	155	170	-	-
	CHEMICAL OXYGEN DEMAND (mg/liter)		10.4	10.8	20.2	25.3	-	-
	EC-F ((umhos/cm)		518	333	1111	1111	-	-
	TEMPERATURE (degrees C)		19.7	14.4	23.6	23.6	-	-
	TOTAL DISSOLVED SOLIDS (mg/liter)		296	210	625	622	-	-
	TURBIDITY (NTU)		77.3	110	2.58	2.53	-	-
	TURBIDITY-F (NTU)		200	200	3.18	3.18	-	-
	pH-F		7.89	8.4	7.26	7.26	-	-
METALS	BARIUM (TOTAL)	1000	60	60	-	-	-	-
(ug/liter)	THALLIUM (TOTAL)	2*	-	50	60	-	-	-
	ZINC (TOTAL)		-	-	30	40	-	-
ANIONS AND CATIONS	CALCIUM (TOTAL)		20100	21400	19200	19300	-	-
(ug/liter)	CHLORIDE		48900	11700	181000	178000	-	-
	MAGNESIUM (TOTAL)		18600	19000	21700	21600	-	-
	NITROGEN, NITRATE (AS N)	10000	2340	300	8750	8490	-	-
	PHOSPHATE, TOTAL (AS P)		900	-	4700	4700	-	-
	POTASSIUM (TOTAL)		4900	2800	11900	11700	-	-
	SODIUM (TOTAL)		41100	15200	103000	126000	-	-
	SULFATE	400000*	26600	24400	41000	40800	-	-
VOLATILE ORGANICS	CHLOROFORM	100	-	-	4.7	5.1	-	-
(ug/liter)	METHYLENE CHLORIDE	5*	3	-	4.1	4.9	6.8	14.5
SEMIVOLATILE ORGANICS	2-CHLOROPHENOL		-	-	-	4.6	-	-
(ug/liter)	BIS(2-ETHYLHEXYL)PHTHALATE	4	3.1	-	2.7	3.3	-	-
	DI-N-BUTYLPHTHALATE		-	-	-	4.1	-	-
CHLORINATED PESTICIDES	4,4'-DDD		0.023	0.014	0.051	0.048	-	-
AND PCBS (ug/liter)	ALDRIN	0.05c	0.008	-	-	-	-	-
	ALPHA-BHC	0.7c	-	-	-	0.004	-	-
	ENDRIN	0.2	-	-	-	0.056	-	-
	GAMMA-BHC	4	-	0.004	-	-	-	-

TABLE 6.2B Summary of Non-Radiological Detections in Surface Water, May 1992

	SAMPLE DATE QA	MCL	PCD-01 05/18/92	PCU-01 05/18/92	PCU-B 05/18/92 D	STPO 05/18/92
	ANALYTE					
GENERAL CHEMICAL PARAMETERS	ALKALINITY TOTAL(AS CACO3) (mg/liter)		200	219	227	174
	CHEMICAL OXYGEN DEMAND (mg/liter)		10	5	-	-
	EC-F ((umhos/cm)		728	487	487	953
	TEMPERATURE (degrees C)		27.7	22.4	22.4	24.7
	TOTAL DISSOLVED SOLIDS (mg/liter)		507	400	354	619
	TURBIDITY (NTU)		13.5	30.5	30.7	2.75
	TURBIDITY-F (NTU)		16.21	42.2	42.2	4.97
	pH-F		8.29	8.89	8.89	7.22
METALS (ug/liter)	BARIUM (TOTAL)	1000	70	80	90	30
	CHROMIUM (TOTAL)	50	10	-	30	-
	CHROMIUM, HEXAVALENT (+6)		-	10	-	-
	COBALT (TOTAL)		-	-	10	-
	MERCURY (TOTAL)	2	-	0.4	0.9	-
	MOLYBDENUM (TOTAL)		-	-	10	-
	NICKEL (TOTAL)	100*	-	-	10	-
	VANADIUM (TOTAL)		20	-	10	10
	ZINC (TOTAL)		10	30	30	40
ANIONS AND CATIONS (ug/liter)	CALCIUM (TOTAL)		21000	18700	18800	14300
	CHLORIDE		92900	18800	18400	147000
	MAGNESIUM (TOTAL)		28200	36100	35600	20700
	NITROGEN, NITRATE (AS N)	10000	3510	-	-	11100
	PHOSPHATE, TOTAL (AS P)		1100	220	280	2500
	POTASSIUM (TOTAL)		6140	1890	1880	8370
	SODIUM (TOTAL)		88400	22100	22600	131000
	SULFATE	400000*	44100	29400	31300	54800
VOLATILE ORGANICS (ug/liter)	BROMODICHLOROMETHANE	100	-	-	-	13
	CHLOROFORM	100	4.7	-	-	33
	DIBROMOCHLOROMETHANE	100	-	-	-	4.8
SEMIVOLATILE ORGANICS (ug/liter)	BIS(2-ETHYLHEXYL)PHTHALATE	4	3.1	3	4.2	5.6
CHLORINATED PESTICIDES AND PCBS (ug/liter)	ALPHA-BHC	0.7c	0.014	-	-	-

TABLE 6.2C Summary of Non-Radiological Detections in Surface Water, August 1992

	SAMPLE DATE QA	MCL	PCD-01 08/11/92	PCU-01 08/11/92	STPO 08/11/92	STPO-B 08/11/92 D	TB-27 08/11/92 T	TB-28 08/11/92 T
	ANALYTE							
GENERAL CHEMICAL PARAMETERS	ALKALINITY TOTAL(AS CACO3) (mg/liter)		194	190	224	224	-	-
	EC-F ((umhos/cm)		1390	840	770	770	-	-
	TEMPERATURE (degrees C)		25.8	20.8	28.8	28.8	-	-
	TOTAL DISSOLVED SOLIDS (mg/liter)		562	572	575	571	-	-
	TURBIDITY (NTU)		8.6	8.05	1.82	2.22	-	-
	TURBIDITY-F (NTU)		-200	30.4	8.01	8.01	-	-
	pH-F		7.79	7.75	7.52	7.52	-	-
METALS (ug/liter)	ANTIMONY (TOTAL)	5	10	10	-	-	-	-
	BARIUM (TOTAL)	1000	50	50	30	30	-	-
	BERYLLIUM (TOTAL)	1	1	1	-	1	-	-
	CADMIUM (TOTAL)	10	2	2	2	2	-	-
	CHROMIUM (TOTAL)	50	10	30	100	10	-	-
	CHROMIUM, HEXAVALENT (+6)		42H	43H	45H	39H	-	-
	NICKEL (TOTAL)	100*	-	50	-	-	-	-
	ZINC (TOTAL)		-	-	30	-	-	-
ANIONS AND CATIONS (ug/liter)	CALCIUM (TOTAL)		16100	15100	16200	16300	-	-
	CHLORIDE		139000	160000	148000	130000	-	-
	MAGNESIUM (TOTAL)		22000	21400	22000	22000	-	-
	NITROGEN, NITRATE (AS N)	10000	3960	5980	5720	5720	-	-
	PHOSPHATE, TOTAL (AS P)		1490	1730	2220	2230	-	-
	POTASSIUM (TOTAL)		7900	7200	56900	7800	-	-
	SODIUM (TOTAL)		143000	147000	139000	140000	-	-
	SULFATE	400000*	68800	61900	52500	52200	-	-
VOLATILE ORGANICS (ug/liter)	BROMODICHLOROMETHANE	100	2.8	7.1	1.3	1.2	-	-
	CHLOROFORM	100	8.9	19	5.5	5.2	-	-
	DIBROMOCHLOROMETHANE	100	1.1	2.7	-	-	-	-
	METHYLENE CHLORIDE	5*	-	-	5.2	5	-	1.3
	TOLUENE	1000#	-	-	-	-	4	5.9
SEMIVOLATILE ORGANICS (ug/liter)	BIS(2-ETHYLHEXYL)PHTHALATE	4	-	4.5	-	2.8	-	-
	BIS(2-ISOPROPYL)ETHER		3.8	-	5.7	-	-	-
CHLORINATED PESTICIDES AND PCBS (ug/liter)	ALPHA-BHC	7c	0.01	0.055	0.031	0.017	-	-
	DELTA-BHC		-	-	0.048	0.048	-	-
	GAMMA-BHC	4	-	-	0.052	0.045	-	-

TABLE 6.2D Summary of Non-Radiological Detections in Surface Water, November 1992

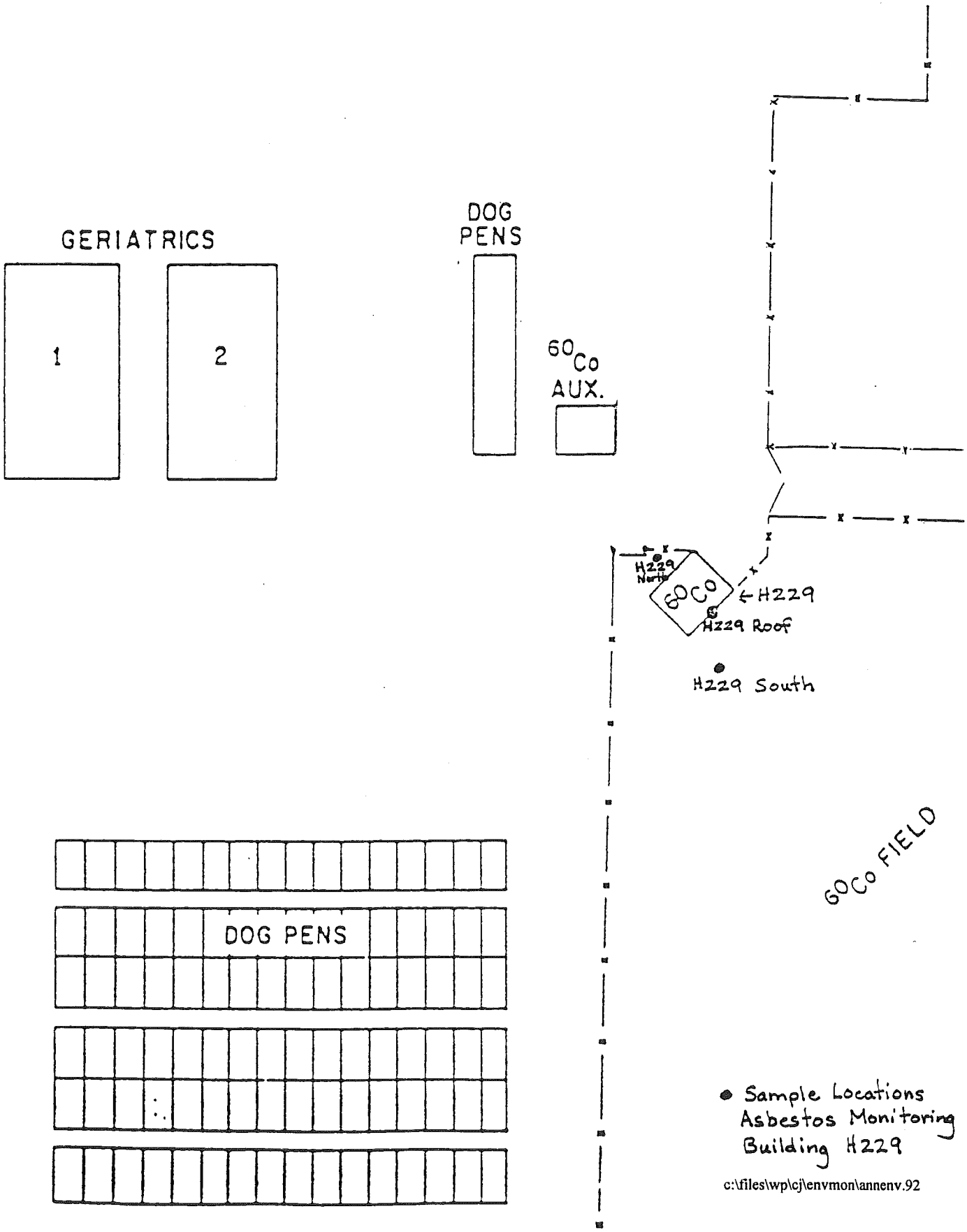
	SAMPLE DATE QA	MCL	PCD-01 11/19/92	PCU-01 11/19/92	STPO 11/19/92	STPO-B 11/19/92 D
	ANALYTE					
GENERAL CHEMICAL PARAMETERS	ALKALINITY TOTAL(AS CACO3) (mg/liter)		180	185	216	216
	CHEMICAL OXYGEN DEMAND (mg/liter)		20.2	16.6	27.5	16.6
	EC-F (umhos/cm)		394	987	1042	-
	TEMPERATURE (degrees C)		14.1	14.1	20.8	-
	TOTAL DISSOLVED SOLIDS (mg/liter)		593	582	515	568
	TURBIDITY (NTU)		18.1	3.89	3.45	3.05
	TURBIDITY-F (NTU)		17.3	4.2	4.99	-
	pH-F		7.89	7.5	7.48	-
METALS (ug/liter)	ANTIMONY (TOTAL)	5*	10	10	-	10
	BARIUM (TOTAL)	50	30	30	20	20
	CHROMIUM (TOTAL)	50	-	20	10	-
	CHROMIUM, HEXAVALENT (+6)		-	10	10	10
	LEAD (TOTAL)	50	10	-	-	-
	ZINC (TOTAL)		20	30	30	40
ANIONS AND CATIONS (ug/liter)	CALCIUM (TOTAL)		14400	14100	13700	13700
	CHLORIDE		195000	147000	124000	110000
	MAGNESIUM (TOTAL)		22900	23900	23700	22900
	NITROGEN, NITRATE (AS N)	10000	4090	3960	2200	2780
	PHOSPHATE, TOTAL (AS P)		3440H	4070H	4780H	4410H
	POTASSIUM (TOTAL)		11200	16300	15000	15400
	SODIUM (TOTAL)		132000	136000	136000	131000
	SULFATE	400000*	78000	50000	65000	55000
VOLATILE ORGANICS (ug/liter)	CHLOROFORM	100	4.7	3.6	5.8	6
SEMIVOLATILE ORGANICS (ug/liter)	BIS(2-ETHYLHEXYL)PHTHALATE	4	12.6	4.98	13.3	8.96
	DI-N-BUTYLPHTHALATE		-	3.41	-	4.9
CHLORINATED PESTICIDES AND PCBS (ug/liter)	4,4'-DDD		0.093	-	-	-
	ALPHA-BHC	0.7c	0.008	0.032	0.011	0.042
	BETA-BHC	0.3c	0.008	-	-	-
	DELTA-BHC		-	0.055	0.055	0.35
	DIELDRIN		0.043	-	-	-
	ENDOSULFAN I		0.029	0.029	-	0.055
	ENDRIN ALDEHYDE		0.041	-	-	-
	GAMMA-BHC	4	0.019	-	-	-
	HEPTACHLOR	0.01	0.032	0.029	-	-
RADIOCHEMICAL ANALYSES (pCi/liter)	GROSS ALPHA	15	3	8	12	9
	GROSS BETA	50	34	29	37	43
	STRONTIUM-90	8	-	0.9	-	-
	TRITIUM	20000*	351	-	1724	-

TABLE 6.3 Asbestos Air Monitoring For External Ambient Air

Date	Sample Location	Analysis	Total Structures	Structures/cc	Detection Limit
9-28-92	AH-1 West Stack	TEM	0	0.00000	0.00500
9-28-92	AH-1 East Stack	TEM	0	0.00000	0.00500
9-28-92	AH-1 NE Corner	TEM	0	0.00000	0.00500
9-28-92	AH-2 Stack	TEM	0	0.00000	0.00500
9-28-92	AH-2 Stack	PCM	11.0	0.00400	0.00200
9-28-92	AH-2 SW Corner	TEM	0	0.00000	0.00500
11-11-92	H-229 North	TEM	27,378	0.01014	0.00253
11-11-92	H-229 South	TEM	0	0.00000	0.00285
11-11-92	H-229 Roof	TEM	6,844	0.00207	0.00207
12-03-92	AH-1 West Stack	TEM	0	0.00000	0.00500
12-10-92	AH-1 Stack	TEM	0	0.00000	0.00500
12-22-92	AH-2 Stack	TEM	0	0.00000	0.00500

TEM = Transmission Electron Microscopy
PCM = Phase Contrast Microscopy

FIGURE 6.1 Sampling Locations For Asbestos Air Monitoring, Building H-229



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7.0 GROUNDWATER PROTECTION PROGRAM

As of April 1993, a draft comprehensive Water Monitoring Plan has been developed to comply with the General Environmental Protection Program conducted by the DOE, and with federal and state requirements, including those defined by the California Regional Water Quality Control Board (RWQCB) and the Department of Toxic Substances Control (DTSC). Because DOE operations at the LEHR site ceased in 1988, this Water Monitoring Plan focuses primarily on environmental surveillance activities for non-operational facilities as defined in DOE Order 5400.1. Quarterly monitoring of groundwater and surface water, which constitutes a surveillance activity, has been conducted since November 1990 within the Phase II Site Characterization Study and is ongoing.

7.1 Quarterly Groundwater Monitoring Program

Groundwater monitoring began in November 1990 and has included quarterly sample collection, field measurements, and laboratory analysis. Although there are currently 23 existing wells, 5 of these are frequently dry, and monitoring is usually conducted at the remaining 18 well locations. Figure 5.2 displays the locations of site monitoring wells. Wells included in the quarterly monitoring (Table 7.1) are: UCD-1, UCD-4, UCD-7, UCD-10, UCD-11, UCD-12, UCD-13, UCD-14, UCD-15, UCD-16, UCD-17, UCD-18, UCD-19, UCD-20, UCD-21, UCD-22, UCD-23, and UCD-24.

A list of parameters currently analyzed in the groundwater samples is provided in Table 7.2. This table also defines the method used for each type of analysis, and results from the Phase II Characterization Study.

7.2 Summary of Trends Identified in Overall Monitoring Results

Some general findings have been drawn from the data collected to this point, as summarized in the Phase II Site Characterization Report. Groundwater beneath the site has been impacted by nitrate, volatile organic compounds, radionuclides and hexavalent chromium. Sporadic detections of trace amounts of chlorinated pesticides and several phthalates have been reported in groundwater samples from wells at the LEHR site and upgradient wells. Since groundwater from the LEHR site does not flow into adjacent surface water, additional tests are necessary to determine the significance of these constituents with respect to LEHR.

TABLE 7.1 Summary Of Monitoring Wells PHASE II SITE CHARACTERIZATION LEHR ENVIRONMENTAL RESTORATION

Well Name	Total Depth	Screened Interval	HSU	Investigation	Date Completed
UCD-1	56.5	46.5 - 56.5	First	Wahler Associates 1989	10/09/87
UCD-3	49.0	39.0 - 49.0	First	Wahler Associates 1989	10/23/87
UCD-4	57.2	45 - 55	First	Wahler Associates 1989	10/14/87
UCD-5	48.0	38.0 - 48.0	First	Wahler Associates 1989	10/22/87
UCD-6	50.0	40 - 50	First	Wahler Associates 1989	10/21/87
UCD-7	90	80 - 90	Second	Wahler Associates 1989	11/05/87
UCD-8	53.5	43.5 - 53.5	First	Wahler Associates 1989	11/03/87
UCD-9	50.0	70.0 - 50.0	First	Wahler Associates 1989	11/04/87
UCD-10	70.0	54 - 69	First	Dames & Moore SWAT, 1990	10/11/89
UCD-11	66.5	50 - 65	First	Dames & Moore SWAT, 1990	10/17/89
UCD-12	65.0	49.5 - 64.5	First	Dames & Moore SWAT, 1990	10/19/89
UCD-13	65.0	50 - 65	First	Dames & Moore SWAT, 1990	10/26/89
UCD-14	85	75 - 85	Second	Dames & Moore SWAT, 1990	11/15/89
UCD-15	120.5	91 - 116	Second	Dames & Moore, DOE Phase II	03/28/90
UCD-16	122	92 - 117	Second	Dames & Moore, DOE Phase II	04/04/90
UCD-17	143	88 - 113	Second	Dames & Moore, DOE Phase II	04/10/90
UCD-18	70	54 - 69	First	Dames & Moore, DOE Phase II	10/04/90
UCD-19	74.5	71.5 - 56.5	First	Dames & Moore, DOE Phase II	10/01/90
UCD-20	73	57 - 72	First	Dames & Moore, DOE Phase II	10/09/90
UCD-21	73	57 - 72	First	Dames & Moore, DOE Phase II	10/11/90
UCD-22	73	57 - 72	First	Dames & Moore, DOE Phase II	10/25/90
UCD-23	73	56.5 - 71.5	First	Dames & Moore, DOE Phase II	10/17/90
UCD-24	73	57 - 72	First	Dames & Moore, DOE Phase II	10/22/90

HSU = Hydrostratigraphic Unit
SWAT = Solid Waste Assessment Test

Source: Phase II Site Characterization, LEHR Environmental Restoration, Draft Report, April 1992 (Dames & Moore)

TABLE 7.2 Detections In Groundwater
PHASE II SITE CHARACTERIZATION
NOVEMBER 1990 - NOVEMBER 1991

Group	Parameter	Method	Number Detected	Number Sampled	Lowest Detection	Highest Detection
Volatiles (μg/liter)	1,1-Dichloroethane	624	3	94	23.0	27.0
	1,1-Dichloroethene		3	94	3.9	53.8
	1,2-Dichloroethane		3	94	15.5	20.0
	Bromodichloromethane		1	94	2.4	2.4
	Chloroform		21	94	1.6	24000.0
	Methylene Chloride		3	94	2.9	3.9
	Trichloroethene		1	94	3.1	3.1
Semivolatiles (μg/liter)	Benzyl Butyl Phthalate	625	3	93	5.0	13.4
	Bis(2-ethylhexyl)phthalate		16	93	3.1	33.3
	Di-n-butylphthalate		1	93	7.6	7.6
Organochlorine Pesticides and PCBs (μg/liter)	4,4'-DDE	608	3	94	0.006	0.008
	Aldrin		2	94	0.004	0.006
	Alpha-BHC		5	94	0.003	0.020
	Beta-BHC		2	94	0.007	0.012
	Delta-BHC		1	94	0.129	0.129
	Dieldrin		6	94	0.004	0.030
	Endrin		2	94	0.010	0.020
	Endrin Aldehyde		1	94	0.028	0.028
	Gamma-BHC		4	94	0.004	0.044
	Heptachlor		10	94	0.004	0.020
Metals (μg/liter)	Antimony (Total)	204.2	53	93	2.0	340.0
	Barium (Total)	200.7	81	93	30.0	560.0
	Beryllium (Total)	200.7	24	93	1.0	6.0
	Cadmium (Total)	213.2	16	93	1.0	7.0
	Chromium (Total)	200.7	58	93	11.0	377.0
	Chromium, Hexavalent (+6)	218.4	87	93	10.0	400.0
	Copper (Total)	200.7	3	93	30.0	30.0
	Lead (Total)	239.2	8	93	1.0	3.0
	Mercury (Total)	245.1	2	93	0.4	0.5
	Molybdenum (Total)	200.7	34	93	30.0	260.0

Group	Parameter	Method	Number Detected	Number Sampled	Lowest Detection	Highest Detection
	Selenium (Total)	270.2	10	93	10.0	31.0
	Nickel (Total)	200.7	5	93	30.0	50.0
	Thallium (Total)	279.2	75	93	2.0	280.0
	Zinc (Total)	200.7	11	93	30.0	40.0
Anions and Cations (μg/liter)	Calcium (Total)	200.7	92	93	15000.0	103000.0
	Chloride	300.0	93	93	11300.0	455000.0
	Magnesium (Total)	200.7	93	93	500.0	320000.0
	Nitrate (as N)	300.0	93	93	1000.0	123000.0
	Phosphate, total (as P)	300.0	78	93	100.0	1000.0
	Potassium (Total)	200.7	89	93	400.0	5600.0
	Sodium (Total)	200.7	93	93	10400.0	166000.0
	Sulfate	300.0	93	93	8110.0	489000.0
General Chemical Parameters (mg/liter)	Alkalinity (as CACO3)	310.1	90	93	25.5	885.0
	Chemical Oxygen Demand	410.1	87	93	0.0	269.0
	Total Dissolved Solids	160.1	93	93	392.0	9190.0
	Turbidity (reported in ntu)	180.1	93	93	0.0	1370.0
Radiochemicals (pCi/liter)	Carbon-14	Environmental Radioassay Procedures	5	17	662.0	1815.0
	Gamma Spectral Analysis		1	93	11.0	11.0
	Gross alpha	9310	28	93	3.0	27.0
	Gross beta		47	93	3.0	62.0
	Strontium-90	Environmental Radioassay Procedures	7	93	0.8	5.7
	Tritium	D-04	17	94	652.0	29066.0

7.3 Summary of Hydrology

The 1992 Phase II Site Characterization Report provides an overview of site hydrogeology. Groundwater is encountered beneath the site at depths of 45 to 70 feet. Previous studies divided groundwater into the "water table zone" and the "deeper aquifer zone"; the Phase II Report refers to these as the "first hydrostatigraphic unit" (HSU) and the "second HSU", respectively. Comparison of data from wells monitored in the two HSUs suggest a hydraulic connection between the two zones.

The geohydrology of the Sacramento Valley is characterized by both unconfined and confined aquifers in the near flat-lying of gently sloping sedimentary deposits in the upper 3,000 feet of section beneath the valley. No regionally identified confining units exist in the Sacramento Valley.

7.3.1 Groundwater Elevations and Gradients

Groundwater elevations beneath the site vary from 5 feet above to 20 feet below mean sea level throughout the year. Water elevations are usually at their highest in early spring and at their lowest in late summer. Generally, groundwater flow direction is predominantly toward the northeast. There are temporary local changes in flow gradient and direction which have been noted as well.

7.3.2 Groundwater Flow Rates

The average flow velocity estimated for the first HSU is 1.6 ft/yr. The average value estimated for the second HSU is 71 ft/yr. Actual flow rates may vary in subsurface sediments due to buried channels or coarser grained sediments that may provide pathways for flow.

7.4 Potential Sources of Groundwater Pollution

Studies completed to date have not determined the extent of the environmental impact of site sources. Additional data collection and further analysis of the hydrogeologic information already obtained are in progress. This effort will assist in defining whether the old landfill, burial trenches, or other areas are sources of groundwater pollution. Previous studies have addressed various aspects of this issue, and these studies will provide a basis for further research.

7.5 Uses of Groundwater in Vicinity

Local groundwater is utilized for both drinking water and agricultural purposes. The major groundwater sources for both public and private water supplies in the Sacramento Valley are the unconsolidated deposits of Pliocene and Pleistocene age, and the older alluvium (Dames and Moore, 1992).

8.0 QUALITY ASSURANCE

The General Environmental Protection Program, as defined in DOE Order 5400.1, requires that site Quality Assurance (QA) programs be established in compliance with DOE Order 5700.6C for each element of the Environmental Monitoring and Surveillance Program. Requirements for quality assurance plans for the LEHR Environmental Monitoring and Surveillance Program are defined in the UC Davis LEHR Work Element Quality Assurance Plan (WEQAP), the Dames and Moore Quality Assurance Plan, and other UC Davis ER Project internal operating procedures. The UC Davis WEQAP identifies controlling documents, such as DOE orders, responsible organizations, policies, standards and procedures that implement the requirements of the controlling documents. The WEQAP and all quality assurance plans for the LEHR site are prepared in accordance with EPA QAM-005 and NQA-1 specifications.

All samples are collected, analyzed and reviewed according to approved quality assurance plans. To ensure quality assurance, quality control (QC) is built into all aspects of the sampling project. Quality control samples are run with each sample batch at the laboratory to validate the method of analysis and the proficiency of the technician. Because holding times are an important factor in the quality of the sample, these are controlled within acceptable limits. To ensure the comparability of the analytical data with previous and future data, all samples are analyzed by EPA-approved methods when available, including QA/QC procedures.

8.1 Field Quality Assurance

QA of field sampling procedures is checked by using field duplicates, decontamination rinsates, trip blanks and field blanks. Duplicates are collected to check for consistent sampling. For each round of sampling, "blind" duplicate samples, amounting to a number which is 10% of the samples, are collected from a selected sample point at the same time as the original sample. The duplicate samples are labeled with a fictitious sample number and sent to the laboratory with the other samples. The QA duplicate serves as a check on the precision of the sampling and analytical procedures. Decontamination rinsates are analyzed to check for cross-contamination from sampling equipment. Trip blanks are sent with each shipment of volatiles to check for volatile contamination from other samples during shipment. Field blanks are collected to check for contamination during the sampling process.

8.2 Laboratory Quality Assurance

Laboratories providing services to the Environmental Monitoring Program on the LEHR site are evaluated by UC Davis, Dames and Moore and ESO to assure compliance with the QA program requirements. Laboratory quality assurance is analyzed externally by the submission of split samples, spiked samples, and blanks to the laboratories performing analysis for environmental samples.

In addition, laboratories performing analyses for the environmental monitoring program at LEHR are subject to periodic audits of their QA program to assure compliance with project standards. One such audit, a Quality Assurance Program Audit, was performed at the

Page 5 kwds.

laboratory, Controls for Environmental Pollution, Inc. (CEP) in April of 1992. The scope of this audit included all contractual quality-related requirements pertaining to services performed in support of the LEHR Project. The audit determined that CEP operated in an efficient manner and that its staff were familiar with their QA and technical responsibilities.

8.3 Data Quality Objectives

The objective of analytical data is to evaluate and determine the nature and extent of radiological and chemical contamination at the LEHR site. Based on this evaluation, additional data will be obtained as required for site remediation. The overall completeness objective of the data is to validate greater than 90% of the total number of required analyses. Because so many parameters are required for the analysis of site soil and groundwater, the following table (Table 8.1) describes the limits of detection accuracy and precision required for the evaluation of this data.

TABLE 8.1 Data Quality Objectives For Soil And Groundwater Samples

ANALYTE	MATRIX	METHOD	MINIMUM REPORTING LIMIT	ACCEPTABLE ACCURACY LIMIT	ACCEPTABLE PRECISION RANGE
Copper	Water	200.7	0.001 mg/l	73-123	0-7.1
	Solid	6010	0.10 ug/g		
Lead	Water	239.2	0.001 mg/l	57-142	0-19.8
	Solid	7421	0.10 ug/g		
Mercury	Water	245.1	0.0004 mg/l	66-133	0-16
	Solid	7471	0.04 ug/g		
Molybdenum	Water	200.7	0.001 mg/l	75-125	0-25
	Solid	6010	0.10 ug/g		
Nickel	Water	200.7	0.014 mg/l	67-123	0-5.3
	Solid	6010	1.00 ug/g		
Selenium	Water	270.2	0.01 mg/l	70-110	0-27
	Solid	7740	1.00 ug/g		
Silver	Water	200.7	0.01 mg/l	75-125	0-25
	Solid	6010	1.00 ug/g		
Thallium	Water	279.2	0.01 mg/l	75-125	0-25
	Solid	7841	1.00 ug/g		
Vanadium	Water	200.7	0.01 mg/l	75-125	0-25
	Solid	6010	1.00 ug/g		
Zinc	Water	200.7	0.01 mg/l	92-107	0-4.1
	Solid	6010	1.00 ug/g		
Strontium 90	Water	*	0.5 pCi/l	86-105	0-8.0
	Solid	*	0.05 pCi/g		

TABLE 8.1 Data Quality Objectives For Soil And Groundwater Samples (cont.)

ANALYTE	MATRIX	METHOD	MINIMUM REPORTING LIMIT	ACCEPTABLE ACCURACY LIMIT	ACCEPTABLE PRECISION RANGE
Gross Alpha	Water	900.0	2.0 pCi/l	93-103	0-5.0
	Solid	9310	0.3 pCi/g		
Gross Beta	Water	900.0	3.0 pCi/l	93-103	0-5.0
	Solid	9310	0.1 pCi/g		
Tritium	Water	(1)	500 pCi/l	76-114	0-8.0
	Solid	(1)	0.05 pCi/g		
Volatile Organic	Water	624	See Method	See Method	See Method
	Solid	8240	See Method		
BNA Organic	Water	625	See Method	See Method	See Method
	Solid	8270	See Method		
Pest/PCBs	Water	608	See Method	34-93 (2) 30-105 (3)	0-29 (2) 0-13 (3)
	Solid	8080	See Method	30-52 (4)	0-32 (4)
Petroleum Hydrocarbon	Water	GC/MS	10 ug/l	In Development	In Development
	Solid	GC/MS	333 ug/kg		
Chlordane	Water	608	0.014 ug/l	In Development	In Development
	Solid	608	0.47 ug/kg	21-53	0-43
Formaldehyde	Water	HEAD SPACE GC/MS	5.0%	In Development	In Development
	Solid	HEAD SPACE GC/MS	12.5%		

Notes:

(1) Radiochemistry Procedures for Environmental Samples. EPA.

(2) Endrin

(3) Lindane

(4) Methoxychlor

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ATTACHMENT 1: ENVIRONMENTAL MANAGEMENT POLICY

The Environmental Protection Program at LEHR reflects DOE and the Environmental Services Operations' (ESO) policy and practice to conduct LEHR ER operations in a safe and environmentally sound manner.

The environmental protection program is developed to ensure that:

1) ER project activities are conducted in a safe and environmentally sound manner.

2) The ER project complies with applicable Federal, state and local regulations, and

3) The ER project staff are proactive in preventing environmental problems.

4) Generation of waste is minimized.

In addition, this program ensures that ER operations are proactive in preventing environmental problems. This policy is achieved through awareness, education, and commitment on the part of all ER project staff.

VERIFICATION DOCUMENTS

Department of Energy
San Francisco Operations Office
1301 Clay Street
Oakland, California 94612-5208

SEP 28 1993

LEHR
RECEIVED
OCT 1 1993

Dr. Salem Attiga
Laboratory for Energy-Related
Health Research
University of California
Old Davis Road
Davis, California 95616-8615

Subject: Approval of the 1992 Site Environmental Report for the Laboratory for Energy-Related Health Research

Dear Dr. Attiga:

This is to notify you that the 1992 Site Environmental Report (SER) for the Laboratory for Energy-Related Health Research (LEHR) is approved for public release. This approval is based on EH-22 guidance for the preparation and approval of 1992 SERs which delegated approval authority from EH-1 to the Heads of Field Elements beginning this year. My approval for release is based on DOE-SF review of the SER and LEHR's certification of the validity and accuracy of the monitoring data in the report.

Please provide the Environment and Safety Support Division (ESS) ten copies of the final report. Should your staff have any questions, please have them contact Steve Black of ESS at (510) 637-1595.

Sincerely,

Terry A. Vaeth
Acting Manager

Certification of Accuracy for:

Annual Site Environmental Report of LEHR, 1992

I certify that the information submitted herein is true, accurate, and complete, based on my familiarity with the information and my inquiry of those individuals immediately responsible for obtaining the information.

Signature: _____ Date: Aug 25, 1993

Dawn Mitchell
LEHR Project

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