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U.S. Department of Energy
Oakland Operations Office, Oakland, California

**FINAL
ANNUAL SITE ENVIRONMENTAL REPORT
CALENDAR YEAR 1996**

for the

Laboratory for Energy-Related Health Research (LEHR)
University of California at Davis, California

Submitted to:

United States Department of Energy
Oakland Operations Office
1301 Clay Street
Oakland, California 95612-5208

Prepared by:

Weiss Associates
5500 Shellmound Street
Emeryville, California 94608

September, 1997
Rev. 0

DOE Oakland Operations Contract DE-AC03-96SF20686

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Department of Energy

Oakland Operations Office
1301 Clay Street
Oakland, California 94612-5208

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Distribution:

SUBJECT: 1996 Site Environmental Report (SER) for the Laboratory for Energy-Related Health Research (LEHR)

This report, prepared by Weiss Associates (WA) for the U.S. Department of Energy, Oakland Operations Office (DOE/OAK), provides a comprehensive summary of the environmental protection activities at the Laboratory for Energy-Related Health Research (LEHR) for Calendar Year 1996. Site Environmental Reports (SERs) are prepared annually for all DOE sites with significant environmental activities, and distributed to relevant external regulatory agencies and other interested organizations or individuals.

To the best of my knowledge, this report accurately summarizes the results of the 1996 environmental monitoring and restoration program at LEHR. This assurance can be made based on DOE/OAK and WA review of the SER, and quality assurance protocols applied to monitoring and data analyses at LEHR.

A reader survey form is provided with the SER to provide comments or suggestions for future versions of the report. Your response is appreciated. Questions or comments regarding this report may also be made directly to DOE/OAK, by contacting Steve Black of the Environment, Safety, and Health Division at (510) 637-1595, or by mail to the address above.

Sincerely,

A handwritten signature in cursive script, appearing to read "James T. Davis".

For

James T. Davis
Associate Manager for
Environmental Management

ENVIRONMENTAL REPORT READER SURVEY

To Our Readers:

Each annual Environmental Report publishes the results of environmental monitoring at the Former Laboratory for Energy-Related Health Research (LEHR) and documents our compliance with environmental regulations. In providing this information, our goal is to give our readership — whether they be regulators, scientists, or the public — a clear accounting of the range of environmental activities we undertake, the methods we employ, and the degree of accuracy of our results.

It is important that the information we provide is easily understood, is of interest, and communicates the Department of Energy's effort to protect human health and the environment. We would like to know from you, our readers, whether we are successful in these goals. Your comments are welcome.

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CERTIFICATION OF ACCURACY FOR:
ANNUAL SITE ENVIRONMENTAL REPORT, 1996, FOR LEHR

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: Robert O. Devany Date: 9-17-97
Robert O. Devany, Project Manager

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SUMMARY

This Annual Site Environmental Report for the Laboratory for Energy-Related Health Research (LEHR) Site (the Site) includes 1996 environmental monitoring data for Site air, soil, ground water, surface water, storm water and ambient radiation. DOE operation of LEHR as a functioning research location ceased in 1989, after the completion of three decades of research on the health effects of low-level radiation exposure (primarily strontium-90 and radium-226), using beagles to simulate effects on human health. During 1996, the U.S. Department of Energy (DOE) conducted activities at the Site in support of Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Environmental remediation and the decontamination and decommissioning (D&D) of Site buildings. Extensive environmental data were collected in 1996 to evaluate appropriate remedial actions for the Site.

Environmental monitoring for the Site in 1996 was conducted according to the Site Environmental Monitoring and Surveillance Plan (DOE, 1990a), the Site Water Monitoring Plan (DOE, 1992b), the CERCLA RI/FS Work Plan (DOE, 1994b), and the respective D&D Work Plans for confirmatory air effluent sampling. This annual report presents environmental data for each of these activities. Some of the data are still preliminary and unvalidated since some of the studies are ongoing and final reports have not yet been issued. Because data quality objectives required under CERCLA are more extensive than those required for the Site Environmental Monitoring and Surveillance Plan, the procedures for collection of air, soil, water, and biota data were incorporated into the CERCLA environmental restoration process. A revised Site Environmental Monitoring and Surveillance Plan to define appropriate requirements for collection of this information will be completed in 1997.

Progress of Site Environmental Restoration and Overview of 1996 Monitoring Results

Site restoration activities are conducted with close coordination between the U.S. Environmental Protection Agency (EPA), the DOE, the University of California at Davis (UC Davis), and the involved state agencies including the Department of Toxic Substance Control (DTSC), the Central Valley Regional Water Quality Control Board (CVRWQCB), and the Department of Health Services (DHS). DOE and UC Davis are currently finalizing a Memorandum of Agreement to divide responsibility for Site operable units.

During 1996, considerable progress was made toward characterization of the Site burial locations, including the trenches, pits, and landfills. The radium-226 and strontium-90 treatment systems and dog pen areas were also further characterized during 1996. Extensive soil sampling was conducted during these investigations. Soil data were compared to background information to determine which contaminants of concern exceed background. Contaminants found to be above guidelines were primarily a few pesticides, metals, radionuclides and volatile organic compounds (VOCs). The results of these investigations are summarized below:

- **Southwest Disposal Trenches.** Cesium-137, strontium-90, radium-226, gross alpha, gross beta, tritium, lead-214, thorium-234, uranium-235, actinium-228, carbon-14, thallium-208, potassium-40 and bismuth-214 were detected above background in soil samples. The highest radionuclide activities (16,700 pCi/g strontium-90 and 34,700 pCi/g gross beta) were detected in excavated sludge, which was subsequently removed from the trench and disposed of offsite. Metals were detected in most samples. VOCs and semi-volatile organic compounds (SVOCs) were detected in one wood sample in concentrations up to 1.17 mg/kg, and 34,000 mg/kg respectively, and pesticides were detected at less than 2 mg/kg in many samples.
- **DOE Disposal Box.** Approximately 3,000 cubic feet of material was excavated and disposed offsite. Following excavation, tritium and bismuth-14 were the only radionuclides detected above background at 280 pCi/g and 0.74 pCi/g, respectively. Samples from this area were not analyzed for nonradiological compounds in 1996.
- **Radium-226 and Strontium-90 Treatment Area.** Strontium-90, radium-226, lead-212, lead-214, actinium-228, carbon-14, thallium-208, and bismuth-214 were all detected at activities above background, in activities up to 16 pCi/g. No VOCs or pesticides were detected. Chromium, copper and zinc were detected above background levels in several samples in concentrations up to 207 mg/kg, and SVOCs were detected at 247 mg/kg in one sample.
- **Western and Eastern Dog Pens.** The dog pens, the dog pen pedestals and some surface soil were removed from the Site in 1996. Following this removal, surface soil samples were collected to evaluate residual soil activities. Lead-212, lead-214, actinium-228, carbon-14, thallium-208 and bismuth-214 were detected at activities exceeding background at a maximum of 16 pCi/g. Chlordane was detected at up to 15 mg/kg in fifteen samples. No other nonradiological analyses were conducted.
- **Domestic Septic Systems.** Soil samples were collected from near or beneath Septic tanks No. 1 and No. 7. Carbon-14 detected at 2.1 pCi/g, exceeded background in one sample collected near Tank No. 1.

In August of 1995, a baseline air monitoring investigation began. This investigation continued until fall of 1996. Neither radiological nor nonradiological parameters were reported above background levels.

The 1996 water monitoring continued the extensive program applied in previous years. One extraction well and four new monitoring wells were installed in late 1996. The results of the water monitoring program are similar to previous years, and are summarized below.

- **Ground Water.** Twelve radionuclides were detected in Site wells above the minimum detectable activity (MDA). Tritium was detected in seven wells at up to 17,000 pCi/L, below the MCL of 20,000 pCi/L. Carbon-14 was detected in three wells at up to 7,180 pCi/L, no MCL has been established for carbon-14. All other radionuclides were only slightly above the MDA and do not appear to

represent elevated ground water activity levels. Fourteen VOCs were detected at more than 10 µg/L, five SVOCs were detected at up to 48 µg/L, two pesticides (dieldrin and endrin) were detected at up to 0.027 µg/L, no PCBs and sixteen metals were detected in Site wells. Hexavalent chromium was detected at up to 392 µg/L, exceeding the 50 µg/L MCL for total chromium. Chloroform was detected in fourteen wells at up to 6,700 µg/L (UCD1-12). Nitrogen exceeded the MCL in several Site wells.

- **Surface Water.** Eight radionuclides were detected in surface water. Only gross alpha, gross beta and plutonium-241 exceeded 1 pCi/L, and none of the detected radionuclides exceeded their MCL. All radionuclides were only slightly above the MDA and do not appear to represent elevated surface water activity levels. Six VOCs, one SVOC, twelve metals and no pesticides or PCBs were detected in surface water samples. None of these compounds exceeded their MCL.
- **Storm Water.** No radionuclides were detected above the MDA in storm water samples. Acetone and three phthalate compounds were detected at up to 16 ug/L, and alpha-chlordane and gamma-chlordane were detected at up to 0.012 ug/L. Thirteen metals were detected at less than 4.0 mg/L.

The 1996 sampling results confirm previous findings that elevated levels of chloroform, tritium, chromium and nitrate are present in Site ground water. Chromium and nitrate occur in regional ground water, and do not appear to be attributable to Site activities.

Assessment of Radiological Impact of LEHR Environmental Restoration Project

The radiological data collected at the Site in 1996 generally indicate such low activities that they are not detectable above natural background levels. Exceptions were carbon-14 and tritium in a few on-Site wells, and several radionuclides (primarily radium-226 and strontium-90) in some soil samples from waste burial locations, the waste treatment systems area, and the dog pens. Background levels of radiation were reported in air monitoring samples, and ambient radiation was slightly above background in only one of the locations monitored. Release point air monitoring during building D&D activities also found no release of contamination above allowable levels.

1. INTRODUCTION

This Annual Site Environmental Report describes environmental activities for the Department of Energy's (DOE's) Environmental Restoration/Waste Management (ER/WM) Project at the Laboratory for Energy-Related Health Research (LEHR). The report provides information about the Site and its environmental monitoring operation throughout calendar year 1996. Environmental data for the year are summarized for both radiological and nonradiological monitoring. This report also describes activities conducted during 1996 in support of the Site environmental restoration efforts, and information about the impact of these activities on the public and the environment.

1.1 History

The Atomic Energy Commission (AEC) first sponsored radiological studies on laboratory animals at UC Davis in the early 1950s. Initially situated on the main campus, LEHR was established in 1958 at its present location (Figure 1-1) by the AEC. Research at LEHR through the mid-1980s focused on the health effects from chronic exposures to radionuclides, primarily strontium-90 and radium-226, using beagles to simulate radiation effects on humans. Other related research was conducted at the Site concurrent with these long-term studies. In the early 1970s, a cobalt-60 irradiator facility was constructed on the Site to study the effects in beagles of chronic exposure to gamma radiation.

A campus landfill, used from the 1940s until the mid-1960s, is located in the southeast corner of the current Site, and extends a few tens of feet beyond the east border of the Site. Also at LEHR are several low-level radioactive waste burial areas. Campus and LEHR research waste were buried in these areas until 1974, in compliance with regulations in effect at the time.

In 1988, pursuant to a Memorandum of Agreement (MOA) between the U.S. Department of Energy 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 UC Davis after remediation is complete.

1.1.1 Environmental Restoration

The environmental restoration of the DOE impacted areas of the Site is managed by the U.S. Department of Energy Oakland Operations Office (DOE-OAK). From October 1989 through February 1990, an interim contract with UC Davis was implemented to succeed the maintenance and operational program and begin Site restoration. In March 1990, DOE selected Battelle's Environmental Management Operations (EMO) to provide LEHR ER/WM project management.

Battelle subsequently contracted with various organizations, including UC Davis, to perform specific services required by the project. In 1996 ER/WM project management was transferred to Weiss Associates (WA) of Emeryville, California.

In May 1994, the U.S. EPA added the Site to the National Priorities List. The Site Remedial Investigation and Feasibility Study (RI/FS) workplan has been developed to ensure that investigation and remediation is conducted in accordance with regulatory requirements. Remedial Project Managers meetings were held monthly during 1996 to evaluate the progress of remediation and identify actions needed to facilitate the process. A draft Federal Facility Agreement has been prepared and is being discussed with the U.S. EPA and state agencies. This Agreement will be finalized after development of a revised Memorandum of Agreement between UC Davis and DOE.

In order to encourage community involvement and oversight of progress achieved in the LEHR environmental restoration, the Davis South Campus Superfund Oversight Committee was formed in 1995 through the assistance of an EPA-awarded Technical Assistance Grant. This grant has enabled the group to hire a technical advisor to help interpret and comment on Site-related information.

Primary restoration/remediation activities include: soil and ground water characterization, building assessment, D&D of above-ground structures, waste management, chemical and radiological risk assessment, and remediation of DOE-contaminated trenches, soil, and underground tanks. Project management, health and safety, and quality assurance are components of all actions undertaken.

1.2 Site Description

The 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 1-1). The Site is presently occupied by the UC Davis Institute of Toxicology and Environmental Health (ITEH). Research at ITEH is directed towards toxicology, epidemiology, radiation biology, and radiochemistry.

The Site consists of 15 buildings, including a main administration and office building, two animal hospitals, a laboratory and support buildings, and cargo containers for waste storage facilities. Historical use of specific facilities and/or areas on the Site has left an environmental impact, which is being investigated and remediated. Former facilities include: radioactive fluid waste treatment systems, indoor/outdoor cobalt-60 beam irradiator, a radioactive waste burial ground, the animal hospitals, and outdoor dog pens. Potential environmental impacts from the inactive campus landfill units and numerous inactive campus low-level radioactive disposal Sites (trenches and holes), used by UC Davis and DOE to dispose waste, are also being evaluated for remediation. Figure 1-2 shows areas that have potentially impacted the environment at the Site.

Known and potentially impacted areas of the Site are divided into six operable units (OUs) comprised of similar contaminant sources (Table 1-1 and Figure 1-3). Soil sampling was performed in these OUs in 1995 to characterize environmental impacts, guide further investigation, and provide

information to support informed risk management decisions in planning remedial action. These data are discussed briefly in the 1995 Annual Site Environmental Report (DOE, 1996). In 1996, additional sampling was performed in OUs 1-4 to determine whether potential sources in these areas pose an unacceptable threat to ground water. Sampling was also conducted in 1995 and 1996 to determine local background levels of constituents of concern to compare to data acquired from the OUs. Preliminary background values have been established for radionuclides, metals, and some other parameters as presented in the Draft Final Final Site Characterization Summary Report (Weiss Associates, 1997a). These preliminary background values are currently under revision and will be presented in the Risk Evaluation (WA, 1997b).

Table 1-1. Summary of Operable Units at the Site

Operable Unit	Investigative Area	Description
OU-1	Southwest Trenches	Disposal trenches and chemical dispensing area in the southwest corner of the Site.
OU-1	DOE Disposal Box	Subsurface disposal area defined by metal matting located between the two sets of dog pens.
OU-1	Southern Solid Waste Trenches	Trenches located along the south side of the Western Dog Pens.
OU-1	Eastern Solid Waste Trenches	Trenches located between Landfills Nos. 1 and 2.
OU-1	49 Waste Holes	Pits located along the south side of the Eastern Dog Pens.
OU-2	Radium Treatment System	Radium-226 treatment tank and the associated leach field and dry wells.
OU-2	Strontium Treatment System	Strontium-90 treatment tanks and associated leach system.
OU-3	Dog Pens Area	Western set of dog pens, including the southern portion of the area currently occupied by the Cellular Biology Lab. The Eastern Dog Pens and North Chemical Dispensing Area are also included.
OU-4	Domestic Septic Systems	Seven domestic septic tanks at LEHR.
OU-5	Landfill Disposal Units	Three UC Davis landfill units.
OU-6	Ground Water	Ground water beneath LEHR.
OU-6	Surface Water	Surface water (includes Putah Creek and storm water runoff).

1.3 Population Data

1.3.1 Site Population

Currently, the Site is shared by the University and the DOE to support ongoing research and remediation objectives, respectively. UC Davis' ITEH consists of several facilities on the Site where research is conducted. ITEH activities involve approximately 200 university researchers and support

staff. ITEH researchers and student assistants have varying schedules and are not all present at the Site at the same time.

The LEHR ER/WM Project is currently managed and staffed by WA. WA also employs subcontractors responsible for specific aspects of the project. Total LEHR ER/WM Project on-Site personnel currently includes six full-time workers and one part-time student. These numbers will change as on-Site work progresses on scheduled remediation and waste management projects.

1.3.2 Local Population

The Site is located in a rural area in northeast Solano County just outside of Davis. UC Davis has a student population of approximately 22,000 and employs approximately 15,000 full-time faculty and staff. The current population of Davis is approximately 53,000 and the current total population of Yolo County is about 150,000. The more densely populated and metropolitan Sacramento area is approximately 12 miles east of the Site. The current population of Sacramento County is about 1,150,000, and approximately 396,000 people live in the City of Sacramento.

1.4 Environmental Setting

The Site is bordered on the south by the northern levee of the South Fork of Putah Creek. The Site lies outside the 100-year floodplain, which is bounded on the north by the Putah Creek levee.

1.4.1 Land Use

The land within a one-mile radius of the 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.

1.4.2 Meteorology/Air Quality

The local climate 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. In summer, the average temperature is 73.0 °F and the average daily maximum temperature is 92.3 °F. The mean annual precipitation is 17.0 inches, most of which occurs between October and April (DOE, 1996).

The Site is located in the Sacramento Valley Air Basin, which has a very high air pollution potential when weather conditions do not favor adequate dispersion. Extensive agricultural, industrial and urban development, combined with topographic and meteorological conditions that often reduce atmospheric dispersion, can allow pollutants to reach relatively high levels at times during the year.

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 (DOE, 1994a).

1.4.3 Topography

The regional topography is typical of the relatively flat Sacramento Valley (Figure 1-1). 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 2 feet, with the lowest portion in the area of the former Cobalt-60 irradiation field (DOE, 1992b).

1.4.4 Hydrogeology

The major ground water 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 & Moore, 1993).

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 beneath the valley. No regionally-identified confining units exist in the Sacramento Valley.

The first regional aquifer beneath the Site has been divided into two hydrogeologic units, based on differences in composition. The uppermost unit, extending from ground surface to a depth of about 80 feet, has been identified as hydrostratigraphic unit one (HSU-1). It consists predominantly of fine-grained alluvial-fan sediments composed of clayey silt, sandy silt, and silty fine sand with thin beds or lenses of sand and/or gravel.

The deeper part of the first aquifer, ranging from about 80 feet below ground surface down to 125 feet, is known as hydrostratigraphic unit two (HSU-2). This unit consists of relatively coarse-grained alluvial-fan sediments, including sand, gravel and cobble-sized sediments. This unit is laterally continuous on a regional scale and represents the first major aquifer underlying the Davis area. This lateral continuity is an important distinction between the first and the second HSU. Within HSU-1, the ground water gradient is primarily vertical and its recharge is primarily dependent upon HSU-2 (DOE, 1996).

1.4.5 Water Supply and Quality

Ground water in the vicinity of the Site is used for agricultural and domestic supply. Regional ground water quality has been impacted by nitrates, probably from agricultural sources, and by hexavalent chromium, probably from natural sources (Dames and Moore, 1997).

Local ground water is recharged by streams and rivers, and direct infiltration from precipitation and irrigation. At the Site, recharge rates are highest immediately after precipitation events that cause a rise in the level of nearby Putah Creek. Within a day after a heavy precipitation event, continuous water level measuring equipment located in monitoring wells near the creek show a significant increase, (DOE, 1996).

1.4.6 Sanitary Sewer Systems

The Site 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 CVRWQCB.

1.4.7 Storm Drainage System

Storm water runoff at the Site is controlled through an underground drainage system that feeds into two collection points on the Site. According to facility drawings, storm water from the paved area in the west part of the Site is collected in catch-basins and discharged to Putah Creek. Drainage around the southern buildings in the western area is collected in a storm water drainage system and routed to the Site storm water lift station and subsequently pumped to an outfall along the west side of the Old Davis Road, where it is discharged to Putah Creek. Storm water that falls along the eastern and non-paved southern portions of the Site percolates into the soil, except for a section of the former Cobalt-60 field where dog pens were once located, where drainage is connected to the sanitary sewer. Water ponds during heavy rains in some areas on the Site.

1.4.8 Biological Resources

A number of sensitive biological resources were identified as having a potential for occurrence in the vicinity of the project Site. These species include: the Giant Garter Snake, the Northern Harrier, the Coopers Hawk, the California Horned Lark, the Great Egret, and the Burrowing Owl (Table 2-3).

1.4.9 Historical and Archeological Resources

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

2. COMPLIANCE SUMMARY

This compliance summary provides an overview of primary environmental regulatory compliance status for 1996 activities conducted at LEHR. DOE-funded work at the Site centered on environmental restoration and waste management. Investigation activities for soil and ground water characterization were the primary focus for the year. Decontamination and decommissioning of above ground structures continued at a low level in 1996, and with the exception of a few waste storage areas required for remediation, was completed in 1996.

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

In 1995 a streamlined CERCLA process was initiated at the Site. The streamlined processes encourages an interactive remedial decision-making framework, wherein data are evaluated and clean-up actions are implemented in an ongoing process. Remedial Investigation activities conducted to further characterize Site water, soil, and air were the primary focus of 1996 CERCLA compliance actions. These activities include the completion of a Limited Field Investigation (LFI), quarterly ground water monitoring, and ongoing air monitoring. Characterization efforts have been planned and implemented to assist in developing sufficient information for a health risk evaluation as well as to support expeditious completion of necessary remedial actions. No CERCLA, RCRA or other violations, fines, or penalties were issued in 1996.

Progress of the Site restoration has been coordinated, directed and reviewed at monthly meetings of the Remedial Project Managers (RPMs) responsible for the Site. The RPMs include representatives from the U.S.EPA, state agencies including the Department of Toxic Substances Control (DTSC), the CVRWQCB, and the Department of Health Services (DHS), and the Site project managers (DOE and UC Davis).

Community input and involvement has been encouraged under CERCLA. In April of 1995, the Community Relations Plan for the Site was published. Additionally, through the assistance of an EPA-awarded Technical Assistance Grant, the Davis South Campus Superfund Oversight Committee (DSCSOC) was formed. Representatives from this group provide input at the monthly RPM meetings.

A Memorandum of Agreement is being developed between DOE and UC Davis to divide responsibility for Site operable units according to historical information regarding use and operation. This agreement will aid the CERCLA mandated development of agreements for the accomplishment of remedial actions. A draft Memorandum of Agreement has been completed and final negotiations are in progress.

2.2 Resource Conservation and Recovery Act (RCRA)

2.2.1 Site Treatment Plan for RCRA-regulated/Mixed Waste

The Federal Facilities Compliance Act of 1992 waives sovereign immunity for federal facilities for fines and penalties under the provisions of RCRA's hazardous and solid waste management requirements. It requires that a Site Treatment Plan be prepared for each Site within DOE that generates or stores mixed waste. After completion of the California Environmental Quality Act (CEQA) Initial Study and public comment a final Site Treatment Plan was approved and issued in October 1995. No modifications were made to this plan in 1996.

2.2.2 Part A Permit

In 1989, UC Davis as operator, and DOE as owner, submitted a Part A permit application to EPA for the storage of mixed waste generated during the DOE-funded research work. Since the original application was submitted, no formal action, such as notification of interim status, has been taken by the EPA or DTSC. However, contact with DTSC has indicated that the Site is considered to be under interim status while the application is in process.

Subsequent to filing the Part A Permit application for the storage of RCRA waste on-Site, the waste identified on the application has been characterized, packaged, and shipped off-Site for disposal. If hazardous wastes are discovered, they will be managed in accordance with applicable state and RCRA regulations. The interim status is expected to be maintained until fiscal year 1998, when the facility will be closed.

2.3 National Environmental Policy Act (NEPA)

No NEPA documentation was processed or required in 1996.

2.4 California Environmental Quality Act (CEQA)

No CEQA documentation was processed or required in 1996.

2.5 Clean Air Act

The LEHR Environmental Monitoring and Surveillance Plan (DOE, 1992) does not currently require source monitoring of airborne effluent streams because the Site does not have airborne effluent streams that require monitoring. The Site is subject to Yolo-Solano Air Quality Management District (YSAQMD) regulations. Currently, there are no sources on the Site that are subject to permits required by YSAQMD. Future plans for development of ground water treatment

systems for the Site will need to incorporate evaluations for air pollution control permits that may be needed, in conjunction with the UC Davis campus Operating Permit required pursuant to Title V of the 1990 Clean Air Act Amendments.

Although the Site has no permitted airborne effluent streams for DOE-funded activities, a number of potential diffuse sources exist, primarily due to the presence of the former dog pens, landfills and burial pits. Verification of compliance with clean air regulations is accomplished at the Site through several different methods. These methods include computer modeling for estimating potential fugitive wind-blown dust emissions from diffuse sources, and localized air monitoring during excavation or remediation of buildings. Site ambient air monitoring has been conducted as a one-year baseline air sampling investigation. This investigation is expected to determine at what level normal Site activities and waste burial locations contribute to local airborne effluent.

As the various environmental restoration activities progress at the Site, the need for air monitoring is continually evaluated. The potential is recognized for some of the previously fixed radioactive contamination buried in landfills to become exposed during tests and excavation. Prior to the start of each phase of the project, an analysis is performed to determine required controls to reduce potential emissions and to evaluate air monitoring requirements. Monitoring data are collected during the activity to verify that controls are maintained and requirements are met.

2.5.1 National Emission Standards for Hazardous Air Pollutants (NESHAPs)

The Site complies with 40 CFR Part 61 Subpart H - *National Emissions Standards for Hazardous Air Pollutants (NESHAPs) for Emissions of Radionuclides from DOE Facilities*. During 1995 and 1996, D&D activities resulted in the removal of the Imhoff building, the only remaining point on-Site with the potential for small releases of radionuclide emissions. The NESHAPs requirements primarily target point source/stack emissions. However a Memorandum of Understanding between the DOE and the EPA (DOE, 1995) applies the same criteria to potential diffuse area sources that are required of point sources. The NESHAPs regulations require that radionuclides emissions not exceed levels that would result in an effective dose equivalent (EDE) of 10 mrem/yr. To demonstrate compliance, an EDE may be calculated for the facility by applying models to estimate radionuclide air activities, or measurement of radionuclide air activities at critical receptor locations may be used as an alternative to air dispersion calculations.

Calculations were performed to determine the potential or estimated dose from Site sources to members of the public. These calculations were based on Site residual surface soil contamination (diffuse sources). No significant remediation activities resulting in elevated fugitive emissions were undertaken during the year. Estimated contributions to the annual Site effective dose equivalent from nonpoint source emissions (surface soils) are shown in Table 4-9, and are well below the NESHAPs limit. The potential radionuclide diffuse area sources at the Site are further discussed in section 4.5.

In Table 2-1 we compare detected radionuclide activities to calculated levels as described in 40 CFR Part 61 – Appendix E. The Appendix E levels are radionuclide concentrations which would result in an exposure of 10 mrem/yr under conservative exposure conditions. Site activities are below these levels for all air monitoring stations except the remote background station located off-Site. (See Figures 4-1 and 4-2 for air monitoring locations). Table 2-1 shows the 40 CFR level and

the average and maximum activities detected at each air monitoring station. The detected levels exceed the 40 CFR levels only at the off-Site monitoring station. These data indicate that radionuclides in on-Site air do not exceed the 40 CFR levels, and that small detectable levels are likely associated with background sources.

In preparation for the 1996 Radionuclide Air Emission Annual Report (under Subpart H of 40 CFR Part 61) an analysis of potential diffuse airborne radiological effluent sources on the Site is currently underway. The results of this dose assessment are presented in the 1996 Radionuclide Air Emission Annual Report (Weiss, 1997f), and are summarized in Section 4.5 of this report. Modeling completed in 1995, using an EPA computer code, CAP88-PC, Version 1, indicated that the maximum annual credible dose equivalent to a member of the public from residual contamination on the Site is less than 0.001 mrem. These calculations were based on the residual material contamination measured during Phase-II Site Characterization for Site areas including the strontium-90 leach field, the radium-226 seepage system, the southwest chemical dispensing area, and the dog pen areas.

2.6 National Pollution Discharge Elimination System

Some surface water from the Site is directed to the UC Davis Wastewater Treatment Plant. Wastewater from this plant is discharged to the south fork of Putah Creek. This discharge is permitted by UC Davis under NPDES Permit #CA0077895 (EPA) and Waste Discharge Requirements (WDR) Order No. 92-040 (California RWQCB, Central Valley Region).

Table 2-1. Comparison of Detected Concentrations in Air at the Site with 40 CFR 61 Subpart H (Section 40 CFR 61.93(5) (iv) Levels¹.

40CFR61 App. E Levels (Ci/m ³)	Air Monitoring Station-2		Air Monitoring Station-3		Air Monitoring Station-5		Air Monitoring Station-6 (offsite)	
	Average	Maximum	Average	Maximum	Average	Maximum	Average	Maximum
Gamma-Spectroscopy								
Actinium-228	3.70E-12	3.80E-04	1.70E-04	1.00E-03	-8.20E-04	-6.80E-04	5.00E-05	2.70E-04
Beryllium-7	2.30E-11	9.30E-02	8.50E-02	9.70E-02	9.10E-02	1.00E-01	8.90E-02	1.10E-01
Bismuth-214	1.40E-10	8.20E-04	2.40E-04	4.40E-04	2.20E-05	2.50E-04	-1.70E-04	3.40E-04
Cesium-134	2.70E-14	1.90E-05	-2.60E-05	5.30E-05	-5.50E-05	7.80E-05	-3.30E-05	1.30E-05
Cesium-137	1.90E-14	1.10E-04	3.40E-05	1.20E-04	-1.50E-04	3.90E-05	2.60E-04	3.10E-04
Cobalt-57	1.30E-12	1.00E-04	-4.40E-05	1.80E-05	-1.20E-05	7.80E-05	-6.00E-06	3.70E-05
Cobalt-60	1.70E-14	-4.20E-05	-1.40E-04	-8.60E-05	-3.20E-05	1.00E-04	-7.00E-05	6.00E-05
Lead-212	6.30E-12	4.50E-04	1.70E-04	4.60E-04	3.90E-05	1.70E-04	1.70E-04	2.70E-04
Lead-214	1.20E-10	4.50E-04	2.70E-04	5.60E-04	-3.40E-04	7.80E-05	-2.50E-05	1.00E-04
Potassium-40	2.70E-14	5.90E-03	1.50E-03	3.30E-03	3.70E-03	5.00E-03	2.20E-03	3.40E-03
Thallium-208		5.90E-06	4.40E-05	2.90E-04	-1.70E-04	-5.20E-05	2.80E-05	2.10E-04
Thorium-234		1.40E-03	-5.50E-04	-3.50E-04	-1.90E-04	1.30E-03	-4.60E-06	1.80E-04
Uranium-235		-6.10E-04	5.30E-04	1.00E-03	-9.60E-05	5.70E-04	-1.40E-04	7.10E-05
Thorium Isotopic								
Thorium-228	3.10E-15	1.00E-04	5.60E-05	6.00E-05	5.90E-05	7.30E-05	6.90E-05	1.00E-04
Thorium-230	3.40E-15	6.90E-05	4.60E-05	5.40E-05	3.30E-05	4.20E-05	4.10E-05	4.70E-05
Thorium-232	6.20E-16	7.90E-05	5.90E-05	7.30E-05	4.30E-05	5.40E-05	4.90E-05	6.50E-05
Uranium Isotopic								
Uranium-233/234	7.10E-15	2.20E-04	1.70E-04	2.80E-04	1.20E-04	1.70E-04	1.50E-04	2.30E-04
Uranium-238	8.30E-15	6.80E-05	3.60E-05	5.50E-05	2.00E-05	3.00E-05	4.90E-05	1.30E-04
Uranium-235	7.10E-15	1.60E-04	1.00E-04	1.30E-04	7.80E-05	1.40E-04	1.00E-04	2.10E-04
Radium-22								
Radium-226	3.30E-15	2.10E-04	1.60E-04	1.80E-04	1.70E-04	2.70E-04	1.50E-04	3.10E-04
Str-89,90								
Strontium-89,90	1.90E-14	3.80E-04	5.40E-05	7.30E-05	8.90E-05	1.60E-04	2.00E-02	6.10E-02

¹ From Table 3.1.2 of Baseline Investigation of Radionuclide and Non-Radionuclide Contaminants in Ambient Air at the Laboratory for Energy Related Health Research (LEHR) at Davis, California (August 1995 - August 1996); G. W. Patton & A. T. Cooper, Jr, December 1996

2.7 Clean Water Act

The Site discharges its sanitary waste to the UC Davis Wastewater Treatment Plant. The plant is subject to the conditions set forth in the NPDES permit CA0077895 and Waste Discharge Requirements (WDR) Order No. 92-040, granted by the RWQCB. DOE operations at the Site include no underground or above ground tanks that are subject to any county, state, or federal permit requirements.

Storm water runoff monitoring at the Site began in the fall of 1994. Storm water samples are collected twice a year; once at the beginning of the rainy season after the first storm of the season, and once near the end of the season. Grab samples were collected from four locations at the Site in 1996. Storm water sample locations are shown on Figure 2-1. Although the Site does not fall under the industrial categories subject to the State General Storm Water Permit requirements, the storm water sampling program meets the State General Permit requirements, and is performed in accordance with the Site Water Monitoring Plan.

2.8 Safe Drinking Water Act/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 planned remedial actions.

DOE operations at the Site were discontinued in 1989. Therefore, current water monitoring activities focus primarily on environmental surveillance activities for non-operational facilities as defined in DOE Order 5400.1. Ground water and surface water monitoring is accomplished under the Site Water Monitoring Plan (Dames and Moore, 1994). Quarterly monitoring of ground water and surface water has been conducted since November 1990. Concerns that ground water may be affected by previously utilized waste burial Sites are being investigated as part of the CERCLA restoration effort.

DOE and UC Davis are working closely with the U.S.EPA, DTSC, and RWQCB to determine the extent of contamination and the remedial action(s) to be taken. In April 1997, UC Davis completed an Engineering Evaluation/Cost Analysis (EE/CA) Ground Water Interim Removal Action, (Dames and Moore, 1997) to assess ground water plume mitigation and containment options.

2.9 Emergency Planning and Community Right to Know Act (EPCRA)

The Site has in place a Contingency Plan and General Emergency Response Procedures for Site Remediation Work (UC Davis, 1994), as required under 40 CFR Part 265. This plan has been distributed to the campus fire department, local medical centers and hospitals, and is required reading for all on-Site workers, including employees of the Institute for Toxicology and Environmental

Health (ITEH). As part of compliance with EPCRA, UC Davis Environmental Health and Safety has also prepared the required emergency and hazardous chemical inventory for all hazardous substances that require Material Safety Data Sheets that are present on University property, including the Site. Compliance with reporting requirements of this regulation is summarized for the Site in Table 2-2.

Table 2-2. Compliance with Hazardous Material Reporting Under EPCRA

EPCRA 302-303: Planning Notification	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Not Required
EPCRA 304: EHS Release Notification	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Not Required
EPCRA 311-312: MSDS/Chemical Inv.	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	<input type="checkbox"/> Not Required
EPCRA 313: TRI Reporting	<input type="checkbox"/> Yes	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Not Required

2.10 Toxic Substances Control Act: 40 CFR 763 (TSCA); and Demolition/Renovation Involving Asbestos: NESHAPs Subpart M, 40 CFR 61.14

No asbestos removal was conducted in 1996.

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

Herbicides were used on the Site in 1996 by UC Davis Agricultural Services Department personnel to control weeds for fire suppression. Registered pesticides were applied following applicable campus and local regulations.

2.12 Endangered Species Act (ESA)

A number of sensitive biological resources with a potential for occurrence in the vicinity of the project Site (along Putah Creek) have been identified. These resources may need to be considered during future planning if remedial activities are determined to have a potential impact on these species. Table 2-3 presents a list of special status species known to exist at or near Putah Creek. These species, and other potential receptors of concern are discussed in more detail in a risk evaluation currently being performed and scheduled for release later in 1997.

Table 2-3. Special Status Species Near Putah Creek

SPECIES	STATUS	
	Federal	State
Burrowing owl	MB	SSC
California horned lark	MB	SSC
Coopers hawk	MB	SSC
Giant garter snake	T	T
Golden eagle	MB	SSC
Great blue heron	MB	SSC
Great egret	MB	SSC
Loggerhead shrike	MB	SSC
Long-billed curlew	MB	SSC
Merlin	MB	SSC
Northern harrier	MB	SSC
Sharp-shinned hawk	MB	SSC
Short-eared owl	MB	SSC
Tricolored blackbird	MB	SSC
Western pond turtle	SC	SSC
White-tailed kite	MB	SSC

Notes:

LISTING STATUS CODES:

T = Threatened

SC = Species of Concern

SSC = California Natural Diversity Database Species of Special Concern

MB = Migratory non-game birds of management concern

(Source: California Natural Diversity Database, California Department of Fish and Game, 1996.)

Since the Site is in an area that contains critical wildlife habitat, activities undertaken during the LEHR environmental restoration will be coordinated with the U.S. Fish and Wildlife Service and the California Department of Fish and Game. A CEQA Preliminary Study for Site Characterization of the UC Davis Landfill was prepared for the University of California, Davis in February, 1990. This study identified the investigation techniques to be used during the characterization of the UC Davis Landfill at the Site, and discussed potential environmental impacts from those methods. The study concluded, "Although minor impacts were disclosed in the Environmental Checklist process, all impacts were temporary, consistent with existing land use and less than significant." The investigation techniques defined in the RI/FS Workplan (Dames and Moore, 1994) for soil characterization are similar to those described in the above mentioned study, and therefore it is expected that associated environmental impacts will be temporary and not significant.

2.13 National Historic Preservation Act (NHPA)

All areas affected by current remediation 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 Ground Water Characterization of

the Site (DOE, 1992a). No evidence of cultural resources, historical or agriculturally sensitive areas was encountered.

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

The Site is not on a floodplain, nor is any portion of it designated as a wetland.

2.15 Current Issues and Actions--Noteworthy Practices

2.15.1 Waste Volume Reduction and Cost Savings

This initiative, first employed in fiscal year 1993, continues to enable the Site to utilize off-Site commercial supercompaction facilities to reduce D&D waste by very significant amounts. Whenever possible, waste generated by the 1996 D&D in was reduced by shredding, crushing, and other size-reducing procedures. This resulted in a cost reduction and also helped to conserve valuable landfill space.

2.16 Summary of Permits

There were no permit violations involving Site operations in 1996. The following permits are related to operations at LEHR:

1. ***NPDES Permit #CA0077895 (EPA) and WDR Order No. 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 and storage of radioactive materials on campus property, including the Site.
3. ***EPA RCRA Permit #CAD982469702:*** Part A Permit application for storage of mixed waste (interim status).
4. ***Drilling permits:*** Obtained as necessary from the Solano County Department of Environmental Health for the specific purpose of installing new borings or monitoring.

3. ENVIRONMENTAL PROGRAM INFORMATION

Each year DOE monitors the environment at the Site through comprehensive air, water and soil sampling. This section describes the environmental monitoring program, and summarizes 1996 environmental site activities. The results of this monitoring program are discussed in Section 4.

3.1 Summary of Environmental Protection Program

The environmental protection program at LEHR consists of ongoing programs that include monitoring for compliance and any other relevant environmental protection requirements. Overall program requirements are defined in DOE Order 5400.1, as well as applicable federal, state, and local environmental regulations. This program shall consist of, but is not limited to, those actions needed for compliance with the following areas:

- Remedial actions involving cleanup of past actions under CERCLA;
- Ground water, surface water, soil, sediment, air, and biota monitoring defined by the Site investigation, the Water Monitoring Plan, and the Environmental Monitoring Plan;
- Documentation under NEPA and CEQA;
- Reports to DOE, including the Annual Site Environmental Report and other reports required by DOE Orders;
- Hazardous waste management, including waste minimization, storage, segregation, characterization, designation, and disposal;
- Hazardous materials inventory and usage and other reports and information as requested or required by regulatory agencies; and,
- EPA permit requirements for storage of mixed waste if it is found during remediation.

3.2 Notification of Environmental Occurrences and Reporting

Requirements for 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 reportable quantities.

The WA Project Manager is responsible for reporting environmental occurrences under DOE Orders 5484.1 and 232.1-1. These reports are submitted to DOE for review, analysis, and inclusion in annual summary reports. The reports are transmitted to DOE System Safety and Development

Center and DOE 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 ER/WM Project Site office.

3.3 General Planning and Reporting

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, Weiss Associates. This ensures comprehensiveness of the environmental monitoring program at LEHR ER/WM Project. The following summary reports have been, or will be prepared for 1996:

- **Annual Site Environmental Report.** This document presents a summary of environmental data, characterizes Site environmental management performance, confirms compliance with environmental standards and requirements, and highlights significant program efforts.
- **Annual Water Monitoring Report.** This report provides a summary and analysis of ground water, surface water, and storm water data collected each year for the Site. The objective of this report is to assess the quality of data collected and to quantify the hydrologic and chemical trends observed in order to meet the surveillance and monitoring requirements for the Site as expressed in DOE Order 5400.1.
- Other environmental status reports as required.

The Environmental Protection Implementation Plan was not updated in 1996. Most of the requirements contained in this report are met by other documents, and thus it is no longer required (Marik, 1996).

3.4 Environmental Monitoring Programs

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

3.4.1 Environmental Monitoring and Surveillance Plan

The environmental monitoring program for the LEHR ER/WM Project is described in the Environmental Monitoring and Surveillance Plan, (DOE, 1992b) developed in accordance with DOE Order 5400.1. The plan provides guidelines for the measurement and documentation of environmental releases (should they occur). A revised Environmental Monitoring and Surveillance Plan will be completed in 1997. Data collected are evaluated to determine the effects of DOE operations at LEHR on the environment, both on-Site and off-Site. The program supports environmental compliance requirements and promotes goals of the Site environmental management

policy. Because remedial action at the Site is now under the CERCLA requirements, water, soil, and biota are being investigated within the streamlined CERCLA process.

3.5 Summary of Environmental Monitoring Performed

3.5.1 Effluent Monitoring

Storm water runoff and airborne emissions during D&D activities are the only effluent streams monitored by the Site Environmental Monitoring and Surveillance Program. Active liquid effluent discharges to the environment were curtailed in the 1980s at the end of the LEHR research activities. There are now no active radiological or hazardous liquid effluent discharges to the environment from DOE-sponsored activities at the Site. An analysis of potential airborne effluent sources (leach field, chemical dispensing areas, dog pen soils, Imhoff D&D, etc.), based on data collected prior to 1995, determined that current point and diffuse sources at the Site would result in an effective dose equivalent of below 0.06 mrem to any member of the public (DOE, 1995).

3.5.2 Environmental Surveillance

3.5.2.1 Surface and Ground Water Monitoring

The Site Water Monitoring Plan (DOE, 1994a) has been developed to meet the requirements of DOE's General Environmental Protection Program as defined in DOE Order 5400.1 as well as applicable state and federal regulations. Water monitoring is conducted as part of the Site environmental restoration program.

Monitoring points have been identified in order to evaluate water quality and lateral and vertical extent of impact at the Site. The program is guided by data needs for risk analysis and Site remediation alternatives. The scope of the program is designed for modification when required to meet objectives (as approved by regulatory oversight agencies) as the CERCLA process and environmental restoration activities progress. This also provides flexibility necessary to obtain temporal and spatial information regarding chemical and radiologic constituents.

In 1997 the water monitoring program will be transferred to UC Davis. UC Davis will perform all ground water and surface water monitoring, and will monitor storm water runoff from the UC Davis areas of the Site. DOE will continue to monitor storm water runoff from the DOE areas only.

3.5.2.2 Air Monitoring

Currently, air monitoring is not performed as part of the LEHR ER/WM Project Environmental Monitoring and Surveillance Program except during D&D or other activities which might affect air quality. A baseline air monitoring investigation has been conducted under CERCLA.

The one-year baseline air monitoring program began in August 1995, and included both radiologic and nonradiologic parameters for substances previously detected in Site soil, ground water, and surface water. The locations for air monitoring were based on historical records of Site activities, planned investigation activities, and soil and water monitoring data. Wind direction characteristics at the Site were also considered in determining the most appropriate air sampling station locations. In support of the air monitoring program, a meteorological station was constructed on-Site. Although the one-year baseline program was completed in August 1996, monitoring of selected radionuclides is ongoing, as discussed in Section 4.1.

3.5.2.3 Soil and Biota Monitoring

As planning progressed to develop a Site plan for the remedial investigation, it was determined that the soil and vegetation sampling required in the Site Environmental Monitoring and Surveillance Plan did not include sufficient sampling locations and did not require data quality levels adequate for CERCLA requirements. Therefore, the soil and biota sampling for the Site are now included in the streamlined CERCLA process.

3.6 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 hazardous Site work, he or she must complete the 40-hour OSHA "Hazardous Waste Operations Training." In addition, prior to working on Site, pollution prevention information is provided 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.

3.7 Decontamination and Decommissioning

In 1996, D&D was completed at Room 201 of Animal Hospital No. 1 and the Cobalt-60 building. All D&D activities were conducted using approved workplans. Scoping, characterization, and final radiological surveys were performed for all buildings in accordance with nuclear regulations guidelines.

Results of all final status surveys indicate that the building surfaces in D&D areas are within the established limits for surface contamination and that the buildings are ready for reuse by the University of California.

3.8 Waste Minimization

The Site Waste Minimization Plan (PNNL, 1995) reflects the commitment of DOE and the Site contractor to reduce the quantity and toxicity of waste generated at the Site during restoration activities. The plan is designed to 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.

The plan requires that waste assessments be made for all project activities prior to initiation. Economically practicable waste reduction and minimization techniques, including waste abatement, recycling, good housekeeping, and treatment are discussed. Methods to promote awareness and recognition of the waste minimization effort are also included. The plan is designed to eliminate or minimize pollutant releases to all environmental media.

4. ENVIRONMENTAL RADIOLOGICAL PROGRAM INFORMATION

With the cessation of research at LEHR and the subsequent D&D work, there are currently no permanent point source of radiological emissions to the environment. The environmental radiological monitoring program for the Site is normally conducted under the guidance of the Site Environmental Monitoring and Surveillance Plan. However, sampling of Site air, soil, water and vegetation will continue to be conducted under various CERCLA program plans.

During 1996, radiological data were collected on and near the Site for various environmental media including air, soil, sediment, ground water, surface water, and storm water. Ambient radiation monitoring was conducted Site-wide, and effluent air monitoring was conducted during D&D activities.

4.1 Radiological Air Monitoring

4.1.1 Site Baseline Air Sampling

Between August 1995 and August 1996, a one-year baseline air sampling investigation was completed as part of the Site remedial investigation. Atmospheric releases of pollutants from the Site to the surrounding region are a potential source of human exposure. For that reason, radioactive and nonradioactive materials in air are monitored at a number of locations on and around the Site. The influence of LEHR emissions on local pollutant concentrations was evaluated by comparing air concentrations measured at a distant location within the region to concentrations measured at the Site perimeter. This section discusses sample collection techniques and analytical methods of the LEHR air surveillance program.

The analytical results of the one-year baseline air sampling investigation were presented in PNNL's Baseline Air Monitoring Report (Patton, 1996). PNNL extended sampling activities in August 1996 to monitor potential air emissions during LFI activities, and then elected to maintain the LEHR air monitoring program pending transfer of program oversight to Weiss Associates. Weiss Associates has elected to continue several elements of the monitoring program to provide additional information.

The program includes three on-Site sampling stations, one background station, and one meteorological station. See Figures 4-1 and 4-2 for sample locations. The goals of the program are to:

- Document background air concentrations for contaminants of concern;

- Support a quantitative risk assessment;
- Detect, characterize and report unplanned releases;
- Verify effluent treatment and control programs;
- Identify potential environmental problems and evaluate the need for remedial actions;
- Allow assessment of airborne impacts during remedial actions;
- Establish local meteorological conditions at the Site; and,
- Verify compliance with applicable federal, state, and local regulations and DOE Orders.

The on-Site meteorological station provides measurements of wind speed, wind direction, and temperature. Hourly-average measurements are recorded with an automated data acquisition system. Other meteorological data are collected from the UC Davis climatological data center, located approximately 1 mile northwest of the Site.

The approach for radionuclide monitoring in air includes continuous air monitoring for tritium and for particle-associated radionuclides. Radionuclides to be analyzed in air samples were selected on the basis of: (1) their detection in Site soil or ground water in typical above-background activities; (2) past Site history and use; and (3) their relative importance in terms of potential dose to man and the environment. Radionuclides from several categories were selected for measurement:

- Gamma-emitting radionuclides (cobalt-60, cesium-137 and radium-226);
- Uranium-238 and thorium-232 decay chain radionuclides (includes radium-226 and radon-222);
- Beta-emitting radionuclides (tritium and strontium-90);
- Radon-222 to assess possible impacts from the decay of radium-226 wastes; and,
- Gross alpha, gross beta, and gamma.

Table 4-1 provides the radiological sample collection schedule for the air monitoring stations.

Table 4-1. Air Monitoring Parameters and Collection Schedule for Radiological Constituents

<u>Analyte</u>	<u>Sampling Period</u>	<u>Limit of Detection (pCi/sample)¹</u>
Alpha	2-Week	0.3
Beta	2-Week	0.3
Tritium	4-Week	0.2
Gamma	Quarterly	1.0-5.0
Strontium	Quarterly	0.3
Uranium	Quarterly	0.3
Thorium	Quarterly	0.04
Radium	Quarterly	1.0

Note: ¹ from DOE, 1994b.

Airborne radionuclides are sampled by a network of four continuously operating samplers: three on the Site perimeter (AM-2, AM-3, & AM-5; Figure 4-1) and one at a distant location (Figure 4-2). Perimeter samplers were located around the Site, with emphasis on the prevailing downwind directions to the north and south of the Site. The distant location was at the LTRAS Site, located approximately 10 km northwest of the Site and provided background data from an area essentially unaffected by Site operations.

Samples were collected according to the above schedule, established before the monitoring year began, until December of 1996. Airborne particles were sampled at each of these locations by continuously drawing air through a high-efficiency glass-fiber filter, with a typical sample volume of 850 m³. The filters were collected every 2 weeks, shipped to the analytical laboratory, and stored for at least 7 days prior to analysis. The storage period was necessary to allow for the decay of short-lived, naturally occurring radionuclides (e.g., radon gas decay products) that would otherwise obscure detection of longer-lived radionuclides potentially present from LEHR emissions. The filters were then analyzed for total beta and total alpha radioactivity.

For most radionuclides, the amount of radioactive material collected on the filter during the two-week period was too small to be readily measured. The sensitivity and accuracy of sample analysis was increased by combining biweekly samples at each location into quarterly compoSite samples. The quarterly compoSite samples were analyzed for numerous specific gamma-emitting radionuclides, isotopic uranium, isotopic thorium, radium, and strontium-90. Radon was sampled at four locations using passive alpha-track air sampling cartridges. These cartridges were exchanged quarterly.

Atmospheric water vapor was collected for tritium analysis at four locations by continuously passing air through cartridges containing a silica gel, which were exchanged every four weeks. The typical air sampling volume was 7-9 m³. The collected water was distilled from the silica gel and analyzed for its tritium content (as tritiated water vapor, HTO) using liquid scintillation counting.

Based upon the results of the one-year baseline air sampling investigation (shown in Table 2-1) and the requirements to conduct environmental surveillance DOE Orders 5400.1 and 5400.5 and DOE/EH-0173T - Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance (DOE, 1991), WA has implemented a reduced air monitoring program which includes:

- 1) Continuous monitoring at the three on-Site stations (AM-2, AM-3, & AM-5) and the background station for alpha & beta activities, with the filters collected for semi-annual compoSite analysis for gamma-emitting radionuclides;
- 2) Quarterly radon sampling of the three on-Site stations and the background station; and,
- 3) Continued collection of meteorological data at the on-Site meteorological station.

Samples will be compoSited semi-annually for gamma-emitting radionuclides, rather than annually as recommended in DOE/EH-0173T. Semi-annual sampling was selected to differentiate between possible winter/summer variations in emissions rates. This reduced program has eliminated continuous sampling for tritium and quarterly monitoring for nonradiological compounds (chlordane, PM-10, metals, VOCs).

The air monitoring plan originally called for collection of only one year of baseline data, PNNL's Baseline Air Monitoring Report results demonstrate compliance with all applicable Federal regulations and DOE Orders, and earlier modeling estimates have consistently indicated that the non-point source radionuclide emissions are insignificant. Additional project-specific environmental surveillance will be implemented in conjunction with any future remedial activities.

4.1.2 Radiological Results for Baseline Air Monitoring Program

The analytical results of the one-year baseline air sampling are summarized below and are discussed in detail in PNNL's Baseline Air Monitoring Report (Patton, 1996). Air sampling data collected since August 1996 are currently being reviewed for WA's semi-annual Air Monitoring Memorandum to DOE, to be completed in August, 1997.

Both the average and maximum activities of total alpha radiation collected during the one-year baseline air sampling investigation were similar for Site perimeter locations and the distant location, indicating that the observed levels were predominantly the result of natural sources and worldwide fallout. The highest average air activities for a Site location was at AM-2 (0.0017 ± 0.0004 pCi/m³; (result ± 2 sigma counting error)), which was not statistically different from the average activity at the distant location (0.0017 ± 0.0005 pCi/m³) (Patton, 1996).

Total beta radiation activities in ambient air collected during the one-year baseline air sampling investigation peaked during the winter. The highest average total beta activity at a Site perimeter location (AM-3, 0.030 ± 0.012 pCi/m³) was similar to the distant location (0.027 ± 0.010 pCi/m³), indicating that the observed levels were predominantly a result of natural sources and worldwide fallout. No statistical differences were observed between the average total beta activities measured at the Site perimeter locations compared to the distant location.

Quarterly compoSite air samples collected during the one-year baseline air sampling investigation were analyzed for gamma-emitting radionuclides. Radionuclides with at least one sample result above the counting error were beryllium-7, potassium-40, cesium-137, lead-212, bismuth-214, and lead-214. Beryllium-7 and potassium-40 are naturally occurring and were found at similar activities at the Site and the distant location. All other gamma-emitting radionuclides were detected in only one or two samples out of 12. All gamma-emitting radionuclides were well below the DOE Derived Concentration Guides (DCGs) specified in DOE Order 5400.5, "Radiation Protection of the Public and the Environment." The DCG values represent the activity of a radionuclide in air that an individual could continuously inhale at average annual rates without receiving an effective dose equivalent of greater than 100 mrem/yr. Site ambient air concentrations should be less than 1/10 of the DCG value to comply with NESHAPs 10 mrem/yr standard.

This indicates that detectable levels of gamma-emitting radionuclides at the Site do not exceed 40 CFR Part 61 Subpart H Standards, and that small detectable levels are likely associated with background sources. All measured activities for isotopic thorium, uranium, radium, and strontium collected during the one-year baseline air sampling investigation were also well below the DOE DCGs. These data are shown in detail in Patton, 1996.

Tritium activities in air collected during the one-year baseline air sampling investigation for both Site perimeter and the distant location were below the detection limit for all but one sample (3.3 ± 3.1 pCi/m³). This value is less than 1/10th of the DOE DCG of 100,000 pCi/m³.

Only one of 24 radon samples collected at the Site collected during the one-year baseline air sampling investigation was above the detection limit (0.9 pCi/L at AM-2, on 4/16/96); however, the activity of radon in the duplicate sample at this location was below the detection limit (<0.3 pCi/m³). The distant location (AM-6) had detectable activities of radon for four of eight samples, with a maximum activity of 2.1 pCi/L. All measured radon air activities and detection limits were below the DOE DCG of 3.0 pCi/L, although the highest onsite and offsite activities exceeded the NESHAPs limit of 0.3 pCi/L. Since radon activity is higher offsite, radon in the vicinity of the Site is probably associated with background sources.

4.1.3 Air Sampling for D&D Activities

Air sampling was conducted to monitor the effectiveness of engineering controls that were designed to prevent environmental release of radionuclides during D&D activities in 1996. Analysis of sample data indicated that emissions generated by the activities was significantly below allowable release limits for all radionuclides. Results for most samples showed levels below background for the radionuclides monitored.

4.2 Radiological Monitoring for Soil

Soil sampling in support of the on-going CERCLA remediation was performed in several areas in 1996. The soil sampling methods consisted of soil borings and grab samples. In soil boring, a hollow stem auger is drilled to various depths, producing cylindrical soil cores from which appropriate samples are removed and prepared for analysis. Grab samples are obtained by shovel or trowel from the soil surface or from soil unearthed during activities such as trenching, and then prepared for analysis. Soil samples are shipped to a contract laboratory to undergo the requested suite of analysis. Full descriptions of the soil sampling methods, procedures for sample preparation and shipment, requested analyses and minimum detectable activity limits, along with the associated quality assurance/control requirements, are contained in the LFI Workplan (IT Corp., 1996) and the RI/FS Workplan (DOE, 1994b).

During the summer of 1996, surface soil samples were collected from the Dog Pens Area following the removal of the pens. Sampling was also conducted in the Southwest Trenches and Radium/Strontium (Ra/Sr) Treatment Areas, the two other potential contaminant source areas used by DOE. Waste from, and associated with, the DOE Disposal Box was removed in September and October 1996 as part of a CERCLA Time Critical Removal Action. Soil samples were also taken at this time to assess whether the goals of the removal action were met. Results of these field investigations, including analytical values from vadose zone soil analyses, are presented in the Draft Final Final Site Characterization Report (Weiss Associates, 1997) and the DOE Disposal Box Closure Report (IT Corp., 1997). The following section summarizes 1996 field activities and important analytical results for radiological compounds for the DOE source areas at the Site.

4.2.1 Southwest Trenches Area

The Southwest Trenches Area is located on the southwest corner of the LEHR facility (Figure 1-2) and is part of OU-1. The disposal trenches in the area are reported to have received primarily LEHR-generated low-level radioactive waste, fecal material, and laboratory wastes. It was also reported that a resin column from the Imhoff system was buried in one of the trenches. The Southwest Trenches Area also contained a chemical dispensing area where chemicals were reportedly stored in an open wooden structure.

Although the locations and dimensions of the trenches are not known with certainty, they were reportedly about 120 ft long, 2 ft wide, 8-to-10 ft deep, and oriented in a north-south direction. Trenches 15, 16, and 17 were reportedly used between September 1963 and November 1965 (PNNL, 1995). Additional burial areas are likely present in the Southwest Trenches Area, based on a ground-penetrating radar survey conducted in 1994.

Sampling was conducted in the Southwest Trenches Area as part of the 1996 LFI. Maximum activities of radioactive compounds detected in soil or waste samples from the area are summarized in Table 4-2. The waste encountered consisted of gravel, fecal matter, syringes, bone, wood and pipes. Of the compounds listed in the table, strontium-90, gross beta, and tritium were the radionuclides most frequently detected above background. Generally, the most elevated radiological activities were observed within and immediately below the waste disposal zones. Much of the non-gravel/non-soil waste encountered was removed from the trenches and packaged for off-Site disposal (Weiss Associates, 1997a).

Table 4-2. Summary of Maximum Activities of Radionuclides Exceeding Background, Southwest Trenches Area

Radionuclide	Max. Activity (pCi/g)	MDA (pCi/g)	Error (+/-)	Background ¹ (pCi/g)	Sample No.	Matrix
Cesium-137	23	0.074	2	0.71	S-350	Soil ²
Strontium-90	16,700	10	840	0.52	S-340	Sludge ²
Radium-226	2.2	1.5	1	1.50	S-338	Gravel
Gross Alpha	16.7	6.5	6	16.1	S-357	Soil
Gross Beta	34,700	5.4	1700	18.6	S-340	Sludge ²
Tritium	91.1	3.5	8	0.03	S-347	Gravel
Lead-214	1.9	0.14	0	0.83	S-356	Soil
Thorium-234	39.5	18	8	1.65	S-362	Wood ²
Uranium-235	2.6	5.1	3	0.15	S-362	Wood ²
Actinium-228	1.6	4.7	3	0.76	S-362	Wood ²
Carbon-14	117	11	14	1.82	S-339	Bone ²
Thallium-208	0.6	2.1	1	0.23	S-340	Sludge ²
Potassium-40	16.7	0.53	2	14.4	S-473	Soil
Bismuth-214	1.56	0.099	0	0.62	S-471	Soil

Notes:

¹ = Data cited in WA 1997a. Additional data will be collected in fall 1997.

² = Removed from trenches and packaged for off-Site disposal.

4.2.2 DOE Disposal Box

As part of a CERCLA Time Critical Removal Action, approximately 3,000 cubic feet of low-level radioactive waste, including gravel and laboratory hardware, was excavated from an on-Site trench known as the "DOE Box" (Figure 1-2). The material was characterized, packaged, and shipped to the DOE Hanford facility for disposal. Post-removal sampling was conducted to determine if removal action objectives were achieved.

Thirteen samples were collected from the "DOE Box" waste matrix and surrounding soil prior to excavation. The analytical results for these samples are reported in the DOE Disposal Box Area Closure Report (IT Corp., 1997); and are discussed briefly in the 1995 Annual Site Environmental Report (DOE, 1996). Nine additional soil samples were taken from the bottom and sidewalls of the excavation and analyzed for radionuclides (IT Corp., 1997). Maximum radionuclide activities for these nine samples are presented in Table 4-3. As shown, only tritium and bismuth-214 were reported above background. Background has not been established for Radium-223, lead-210, and bismuth-212. Activities for all the other radionuclides were below background values.

Table 4-3. Summary of Maximum Activities of Radionuclides Compared to Background, DOE Disposal Box Excavation

Radionuclide	Max. Activity (pCi/g)	MDA (pCi/g)	Error (+/-)	Background ¹ (pCi/g)	Sample No.	Matrix	Depth (ft bgs)
Cesium-137*	0.014	0.031	0	0.075	S-504	soil	8
Strontium-90	0.28	0.55	0	0.52	S-503	soil	10
Radium-223*	-0.03	0.57	0	NA	S-505	soil	10
Radium-226	1.13	0.26	0	1.50	S-509	soil	8.5
Radium-226*	1.41	0.93	1	1.50	S-506	soil	8
Gross Alpha	13.5	6.8	6	16.1	S-503	soil	10
Gross Beta	17.8	5.5	4	18.6	S-508	soil	10.5
Tritium (pCi/L)	280	200	150	139	S-511	soil	8
Lead-210*	2.4	11	8	NA	S-503	soil	10
Lead-212*	0.76	0.087	0	0.81	S-507	soil	10
Lead-214*	0.75	0.098	0	0.83	S-506	soil	8
Thorium-234*	0.91	1.2	0	1.65	S-506	soil	8
Uranium-235*	0.12	0.2	0	0.15	S-511	soil	8
Actinium-228*	0.7	0.21	0	0.76	S-508	soil	10.5
Carbon-14	0.27	1.1	1	1.82	S-506	soil	8
Thallium-208*	0.224	0.057	0	0.23	S-506	soil	8
Potassium-40*	12.1	0.61	2	14.4	S-506	soil	8
Cobalt-60*	0.011	0.051	0	0.023	S-506	soil	8
Bismuth-212*	0.57	0.37	0	NA	S-510	soil	10.5
Bismuth-214*	0.74	0.11	0	0.62	S-506	soil	8

Notes:

¹ = Preliminary data cited in WA 1997a, currently being revised.

* = gamma scan

N/A = Not applicable

4.2.3 Radium/Strontium Treatment Systems Area

The Radium and Strontium Treatment Systems are located between Animal Hospital Numbers 1 and 2 (AH-1 and AH-2) in the western portion of the LEHR facility (Figure 1-2) and together comprise OU-2. These systems were used to treat radiological liquid wastes generated from animal experiments.

The Radium/Strontium Treatment System Area was investigated and characterized in the LFI (Weiss Associates, 1997a). Investigation included sampling soil during excavation of five exploratory trenches and drilling of five soil borings, sampling surface soils from locations at the western edge of the LEHR facility along Old Davis Road, and conducting geophysical logging of one soil boring. Additional information regarding the investigation is presented in the Draft Final Site Characterization Report (Weiss Associates, 1997a).

Maximum activities of radioactive compounds detected in soil samples from the Ra/Sr Treatment Area are summarized in Table 4-4. All radionuclide maximum activities reported from OU-2 were discovered in the Radium Treatment System. Reported activities of radionuclides in the Strontium Treatment system were only slightly above background. The maximum activity values for gross alpha, gross beta, lead-212, lead-214, carbon-14, thallium-208, and Bi-214 were found in samples taken from boreholes adjacent to the Radium Dry Wells. The maximum activity values for radium-226 and actinium-228 were found in samples taken from locations associated with the Radium Leach Line, while the maximum activity value for tritium was found in a sample taken near the Radium Distribution Box. During quality assurance verification of the LFI data it was found that strontium-90 activities for some samples were erroneously high. These data are discussed in Section 7.

Analysis of the distribution of radionuclides in the soil of the Radium/Strontium Treatment System Area indicate that the Strontium (Imhoff) Treatment System operations did not significantly impact surrounding soil. Significant radium/strontium contamination associated with the Ra Treatment System is generally confined to, or immediately adjacent to, the leach lines and dry wells.

Table 4-4. Summary of Maximum Activities of Radionuclides Exceeding Background in Soil Radium/Strontium Treatment Systems

Radionuclide	Max. Activity (pCi/g)	MDA (pCi/g)	Error (+/-)	Background ¹ (pCi/g)	Sample No.
Gross Alpha	46	6.4	10	16.1	S-437/S-422
Gross Beta	39.7	5.4	6	18.6	S-437
Tritium (pCi/L)	230	230	160	139	S-427
Lead-212*	0.9	0.087	0	0.81	S-460/S-454
Lead-214*	7.7	0.13	1	0.83	S-437
Actinium-228*	0.89	0.21	0	0.76	S-456
Carbon-14	16	37	22	1.82	S-458
Thallium-208*	0.253	0.064	0	0.23	S-460
Bismuth-214*	6.52	0.17	1	0.62	S-437

Notes:

¹ = Preliminary data cited in WA 1997a. Additional data will be collected in fall 1997.

* = gamma scan

4.2.4 Dog Pens Area

The Dog Pens Area (OU-3) is located near the center of the LEHR facility (Figure 4-3). From June through August 1996, the 256 Western and 96 Eastern dog pens, dog pen pedestals, and some soil were removed. During removal of the pens, alpha and beta/gamma scans were conducted on the pedestals in the 352 dog pens. Maximum allowable total residual surface contamination levels specified in the surface radioactivity guidelines from DOE Order 5400.5 are 300 dpm/100² cm for alpha scans, and 3,000 dpm/100² cm for beta scans. Of the 352 alpha scans, 22 samples were above

this 300 dpm/100cm² maximum. Of the 352 beta/gamma scans, 49 samples were above this 3,000 dpm/100cm² maximum (Weiss Associates, 1997a).

Following the removal of the dog pen pedestals, 12 surface soil samples were collected for health and safety purposes from locations that had been previously identified as having alpha and beta/gamma scans above the allowable residual levels. An additional set of 12 samples was collected from areas where alpha and beta/gamma scans indicated background readings. All 24 samples were submitted for radionuclide analysis. Only strontium-90 and radium-226 were detected above background in the 12 samples collected from areas of high alpha and beta/gamma scans, whereas only strontium-90 and cesium-137 were detected above background in the 12 samples from areas of low alpha and beta/gamma scans. The maximum activities reported for strontium-90 were 3.25 pCi/g and 5.66 pCi/g in the areas of high and low scans, respectively. Additional maximum activities include radium-226 at 1.9 pCi/g and cesium-137 at 0.096 pCi/g. Based on the 24 samples, it appears that the radioactivities in the soil do not correlate with the radioactivities in the associated pedestals. In addition, radioactivities in the soil are significantly less than those indicated by the surface radiation survey of the pedestals (Weiss Associates, 1997a). These data were semi-quantitative in nature, and were not collected in accordance with strict QAPP procedures. Maximum detections of radionuclides in soil from all OU-3 investigations to date are presented in Table 4-5.

Table 4-5. Summary of Maximum Activities of Radionuclides in Soil Exceeding Background, Dog Pens Area and North Chemical Dispensing Area

Analyte	Maximum Activity (pCi/g)	Background ¹ (pCi/g)	Location	Depth (ft)	Date
Gross Beta	28.00	18.6	SB-11	N/A	Oct-87
Actinium-228	0.83	0.76	SBL-8	20.75	Dec-94
Bismuth-212	2.21	0.62	SB-17	0.8	Mar-90
Carbon-14	16.40	1.82	SBL-8	10.8	Dec-94
Cesium-137	0.20	0.075	PS-K27	10.0	Oct-90
Cobalt-60	0.05	0.023	SBL-2	5.75	Dec-94
Lead-214	1.04	0.83	SBL-16	1.8	Mar-90
Potassium-40	20.2	14.4	UCD-20	0	Oct-90
Radium-226	5.11	1.50	SBL-5	5.8	Dec-94
Strontium-90	5.66	0.52	S-371	N/A	July 96
Thorium-232	1.4	0.78	UCD-23	20	Oct-90
Tritium (pCi/L)	260.00	139	SBL-8	5.75	Dec-94

Notes:

¹ = Preliminary data cited in WA 1997a. Additional data will be collected in fall 1997.

4.2.5 Domestic Septic Systems

OU-4 comprises seven sanitary septic tanks (Figures 1-2 and 4-3) that once served the LEHR office and laboratory buildings. As part of the 1996 LFI (Weiss Associates, 1997a), two of the seven septic tanks were investigated. These tanks are Tank No. 1, located on the west side of the Administration Building, and Tank No. 7, located on the north side of the Co-60 Building (Figure 1-2).

Septic Tank No. 1 is a concrete vertical cylindrical tank that is 6 ft tall and has a diameter of 5 ft (approximately 800 gallons), with the top of the tank 1.5 ft below ground surface (bgs). Four soil samples were collected during the excavation around the tank at various depths (7.5 ft, 10 ft, and two at 13 ft bgs).

Septic Tank No. 7 is a concrete tank with the long axis of the tank oriented north-south. The size of the tank was not confirmed. Three soil samples were collected immediately below the tank at various depths (7 ft to 9.5 ft, and 12 ft bgs).

No radionuclides were detected above background in soil samples collected near Septic Tank No. 7. Only the activity for C-14 reported for one sample exceeded background activity in soil samples collected near Septic Tank No. 1. C-14 was detected in sample S-431 at 2.1 pCi/g and the preliminary background level is 1.8 pCi/g.

4.3 Radiological Monitoring in Site Water

Water monitoring for the Site during 1996 included quarterly ground water monitoring of Site wells, quarterly surface water monitoring, and biannual storm water monitoring. Ground water, surface water, and storm water samples were analyzed for selected radiological parameters. Table 4-6 presents information on the analytical parameters and methods.

Table 4-6. Water Monitoring Parameters and Analytic Methods for Radiological Constituents

Analyte Fraction	Analytical Parameter	Method Reference
Radiological	tritium	U.S.EPA 906.0
	strontium-90	U.S.EPA 905.0
	gross alpha	U.S.EPA 9310
	gross beta	U.S.EPA 9310
	gamma emitters	U.S.EPA 901.1
	carbon-14	U.S.EPA C-01 M
	radium-226	U.S.EPA 903.1
	americium-241	U.S.EPA LAS 108
	plutonium-241	U.S.EPA LAS 178

The 1996 water monitoring program continued the basic program from 1995, with minor modifications. Table 4-7 shows the ground water monitoring schedule.

Table 4-7. Ground Water Radiological Monitoring Parameters and Schedule

Well	Gamma Spec.	Tritium	Carbon -14	Strontium -90	Radium -226	Plutonium -241	Americium -241	Gross beta	Gross alpha
UCD1-4	Q	Q	*	Q	Q	*	*	Q	Q
UCD1-10	A	A	*	*	*	*	*	A	A
UCD1-11	A	A	*	*	*	*	*	A	A
UCD1-12	Q	Q	Q	Q	Q	*	*	Q	Q
UCD1-13	Q	Q	Q	Q	Q	*	*	Q	Q
UCD1-18	A	A	A	*	*	*	*	A	A
UCD1-19	A	A	*	*	*	*	*	A	A
UCD1-20	S	S	S	S	S	*	*	S	S
UCD1-21	A	A	A	A	A	A	A	A	A
UCD1-22	S	S	S	S	S	S	S	S	S
UCD1-23	S	S	S	S	S	*	*	S	S
UCD1-24	A	A	A	A	A	*	*	A	A
UCD1-25	Q	Q	Q	Q	Q	Q	Q	Q	Q
UCD1-34	Q	Q	Q	Q	Q	Q	Q	Q	Q
UCD2-17	A	A	A	*	*	*	*	A	A
UCD2-7	S	S	S	S	S	*	*	S	S
UCD2-14	Q	Q	Q	Q	Q	Q	Q	Q	Q
UCD2-15	Q	Q	*	Q	Q	*	*	S	S
UCD2-16	S	S	*	S	S	*	*	S	S
UCD2-35	Q	Q	Q	Q	Q	Q	Q	Q	Q
UCD2-36	Q	Q	Q	Q	Q	Q	Q	Q	Q
UCD1/2-27	Q	Q	Q	Q	Q	Q	Q	Q	Q

Notes:

- A = Annual sampling (February)
- S = Semi-annual sampling (February and August)
- Q = Quarterly sampling (February, May, August, and November)
- * = Sample not analyzed for constituent

4.3.1 Reporting Format for Radiological Results

Radiological results for 1996 ground water from wells installed before 1996, surface water and storm water samples are provided in Appendix A. Selected analytical results for ground water from wells installed in 1996 are shown in Table 6-10. The vast majority of these results were close to or below the Minimum Detectable Activity (MDA) for the laboratory analysis methods. Many of the results are therefore reported either as negative numbers (measured sample activity below laboratory background) or with a high uncertainty associated with the result. It is helpful to understand the following information concerning the reporting format since this format is unique to radiological analyses.

Radionuclide results reported in Appendix A show the calculated activity of the sample and the counting error. The counting error represents the total statistical uncertainty resulting from measuring all random processes involved in the analytical procedures used. Individual errors associated with these processes are used to estimate the total uncertainty. The uncertainty value is reported as a two-sigma (two standard deviations) error for each sample analysis result. This uncertainty, therefore, approximates a 95% confidence interval about the reported value. The significance of the radionuclide results can be evaluated by comparing the reported value with the reported uncertainty. It should be noted, that despite being statistically detectable on the basis of total uncertainty, a given sample result may not be significant in terms of health risk, presence of Site contamination, or regional background concentrations.

Uranium-238 and thorium-232 are naturally occurring radionuclides found in most soils, including soils at the Site. Uranium-238 decays into daughter products (progeny) such as thorium-234, radium-226, radon-222, bismuth-214, and lead-210. Thorium-232 progeny include radium-228, radon-220, lead-212, bismuth-212 and lead-208. Because these parent radionuclides are found in soils and groundwater, their progeny are also expected to be found in soil and ground water analyses results.

4.3.2 Ground Water Monitoring--Radiochemical Analyses

Quarterly ground water samples were collected in February, May-June, August-September and November 1996. All well locations are shown on Figure 2-1. Table 4-7 identifies the sampling schedule for radiochemical analytes for each monitoring well. This schedule was first implemented in the summer 1995 quarter.

Results of the radiochemical analyses indicated that tritium and carbon-14 are present above background levels in ground water in wells UCD1-13 and UCD2-14. Carbon-14 was also detected above the MDA in wells UCD1-12 and UCD1-23, and cobalt-60 was detected at 4.0 pCi/L in well UCD1-24. Bismuth-212, bismuth-214, lead-214, radium-226, strontium-89,90, americium-241, gross alpha, gross beta, and plutonium-241 were all detected slightly above their MDAs. Maximum tritium activities detected in HSU-1 and HSU-2 in 1996 are shown in Figures 4-3 and 4-4.

Analytical results detected radionuclides in ground water samples are summarized in Appendix A, Table A-1. This appendix provides data for all wells installed before 1996 for radiological constituents that were above the MDA. If a particular constituent did not have a positive detection during 1996 for any ground water samples collected, it was not included in the tables. For a more detailed description of the program, refer to the 1996 Annual Water Monitoring Report (Weiss Associates, 1997d) and/or the Site Water Monitoring Plan (Dames and Moore, 1994). Analytic results for wells installed in 1996 are shown in Table 6-1.

4.3.3 Surface Water--Radiochemical Analyses

Surface water samples were collected quarterly from three locations along Putah Creek: PCU, PCD and STPO (Figure 2-1).

A review of all surface water data collected during 1996 indicated no evidence of radiological contamination that could be attributed to the Site. Carbon-14, americium-241, gross beta, and radium-226 were detected at PCD at slightly above the MDA, americium-241, plutonium-241 and strontium-89,90 were detected at PCU and americium-241, gross alpha, gross beta, plutonium-241, radium-226 and stontium-89,90 were detected at STPO. None of these detections except gross alpha, gross beta and plutonium-241 at STPO exceeded 1 pCi/L, and none exceeded an MCL. These data indicate that surface water activities are similar to those found in 1995.

A summary of reported analytical results for detected radionuclide constituents in surface water samples is presented in Appendix A, Table A-2. For a more detailed description of Site surface water monitoring in Putah Creek, refer to the 1996 Annual Water Monitoring Report (Weiss Associates, 1997d) and/or the Site Water Monitoring Plan (Dames & Moore, 1994).

4.3.4 Radiological Monitoring for Storm Water

Storm water samples are collected twice a year; once at the beginning of the rainy season after the first storm of the season, and once near the end of the season. Grab samples were collected from four locations at the Site in 1996. Storm water sample locations are shown on Figure 2-1.

Spring storm water samples were collected in March from location LS-1 (the lift station) located on the western side of the Site. One grab water sample and one duplicate sample were collected from this location in 1996.

Fall storm water samples were collected in October after the first storm of the season. Grab water samples were collected from LS-1, and storm drain SD-1. A duplicate sample was collected from SD-1. Eastern landfill runoff samples could not be collected at locations LF-1 and LF-3 in October due to insufficient rainfall. Storm water samples were collected from LF-1 and LF-3 in December when adequate water was present. The analytical results of the December samples have not yet been validated and are not included in this report.

There was no detectable radionuclide activity in the storm water samples collected during 1996. Appendix B provides results for all nonradiological constituents detected. Dosimeter readings for each location are shown in Table 4-8.

4.4 Ambient Radiation Monitoring

Perimeter fence lines, radioactive waste storage areas, and various work areas around the Site are monitored by Thermoluminescent Dosimeters (TLDs). Several of the TLDs are placed to measure natural background radiation, and others are control dosimeters used to ensure continued accuracy of the TLD group during transport to off-Site processing. Dosimeter readings for each location are shown in Table 4-8.

4.4.1 Overview of 1996 Ambient Radiation Monitoring Results

One of the four TLD locations that monitored the DOE occupied section of a radioactive waste storage building had readings slightly above background levels. This area was the Geriatrics I radioactive storage area. The TLD on the east side of the building (GeriE in Table 4-8) had readings slightly above background levels. These elevated readings are attributable to radioactive laboratory sources and standards, which are stored close to the TLD location. The highest reading for this storage location was a total of 12 mR/yr, after correcting for Site background and Radiation Detection Company (RDC) control readings.

Calculations were performed to determine the maximum potential exposure an individual might have received in the vicinity of this storage location. Geriatrics I is situated in an area of the Site where employees spend very little time and where visitors are rarely present. Assuming an occasional occupancy factor of 30 minutes per day, 12 mR/yr yields a calculated dose of 0.19 mrem at the TLD location. Thirty minutes a day is probably much higher than the actual average occupancy for this locations, which is not adjacent to sidewalks or passageways.

Since people are unlikely to actually stand at the TLD location, the calculated dose can be adjusted by assuming a one meter distance from the TLD. At one meter distance the dose is reduced to less than 1.0×10^{-5} mrem/yr. This calculated dose is well below the maximum 100 mrem/yr allowed by the LEHR Radiological Control Manual (IT, 1997b).

Table 4-8. 1996 Quarterly Ambient Radiation Monitoring Results

Badge Location Name	TLD Location Number	First Qtr. 1/1-3/31 m/R	Second Qtr. 4/1-6/30 m/R	Third Qtr. 7/1-9/30 m/R	Fourth Qtr. 10/1-12/31 m/R	Annual Total 1996 m/R	Total Dose at Location (mSV*/yr)
RDC Bkg.	Mfr. Site	21	21	n/a	n/a	42**	0.42**
Contr 1	TLD-3	0	0	14	14	28	0.28
EH&S	TLD-36	0	0	14	14	28	0.28
NWcorn	TLD-1	1	0	2	4	7	0.07
NEcorn	TLD-2	0	0	3	4	7	0.07
NCC	TLD-4	0	0	0	2	2	0.02
MWSS	TLD-6	0	0	0	3	3	0.03
Co-60#1	TLD-7	1	1	2	5	9	0.09
Co-60#2	TLD-8	2	1	2	3	8	0.08
Co-60#3	TLD-9	2	1	2	4	9	0.09
Co-60#4	TLD-11	1	1	2	5	9	0.09
Co-60#5	TLD-12	0	0	1	3	4	0.04
Co-60#6	TLD-13	0	0	1	3	4	0.04
GeriSo	TLD-14	2	0	0	1	3	0.03
GeriE	TLD-15	6	2	1	3	12	0.12
GeriNo	TLD-16	2	0	0	2	4	0.04
GeriW	TLD-17	3	0	0	2	5	0.05
Pen Fen	TLD-18	0	0	0	3	3	0.03
Lev Fen	TLD-19	0	0	2	5	7	0.07
SWcorn	TLD-20	1	1	2	3	7	0.07
ITfenc	TLD-21	1	0	0	3	4	0.04
AH-2Dr	TLD-23	0	0	0	1	1	0.01
LiftSt.	TLD-24	0	0	1	3	4	0.04
FenImh	TLD-25	0	0	0	3	3	0.03
AH-1Dr	TLD-26	1	0	1	6	8	0.08
Imhoff	TLD-29	0	0	0	2	2	0.02
Equine	TLD-35	2	1	2	4	9	0.09

* First and second quarter exposure rates have Radiation Detection Co. background in m/R subtracted out.
 ** Third and fourth quarter exposure rates have on-Site control background in m/R subtracted out.

4.5 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 Site residual surface soil contamination (diffuse sources). No significant remediation activities resulting in elevated fugitive emissions were undertaken during the year. Estimated contributions to the annual Site effective dose equivalent from

nonpoint source emissions (surface soils) are shown in Table 4-9, and are well below the NESHAPs limit.

Table 4-9. Estimated Annual Maximum Effective Dose Equivalent

Maximum Individual Dose ¹	EPA and DOE Standard	Site Natural Background ²
1.8 x 10 ⁻³ mrem/year (1.8 x 10 ⁻⁵ mSv/year)	10 mrem/year (0.1 mSv/year)	98 mrem (0.98 mSv)

Notes:

¹ = Maximum effective dose equivalent from 1996 NESHAPs report. Data are calculated, not measured; therefore, they represent potential or estimated rather than actual doses.

² = DOE, 1992a

[1 Sievert (Sv) = 100 Roentgen equivalent man (rem)]

The Site nonpoint or diffuse sources (areas with known or potential radionuclide contamination resulting from past DOE activities at the Site), include the strontium-90 leach field, the radium-226 seepage system, the southwest trenches area, the north chemical dispensing area, eastern and western dog pen areas, inactive landfill units and storm water runoff system. Of these nonpoint sources, four have been determined to have radioactive material contamination in near-surface soils (0 to 3 ft below ground surface) that could potentially lead to airborne radioactive material emissions. Those sources are the radium-226 seepage system, the strontium-90 leach field, the southwest trenches area, and the eastern and western dog pen areas. Emission estimates from these sources are discussed below.

4.5.1 Nonpoint/Diffuse Source Emission

As noted above, there are currently no remaining point sources of radionuclide emissions at the LEHR facility. Potential fugitive/area sources of radionuclide emissions were modeled using the EPA atmospheric dispersion/radiation dose calculation computer code, CAP88-PC version 1.0. The total estimated contribution to the Effective Dose Equivalent (EDE) from the four nonpoint source areas was estimated to be 1.8 x 10⁻³ mrem/year (Table 4-10).

The radium-226 seepage system and the strontium-90 leach field were located between Animal Hospital Numbers 1 and 2 (H-219 and H-218) in the western portion of the LEHR facility. The radium-226 seepage system consisted of four septic tanks, three pits and a leach line. The system was used to dispose of the excrement from dogs that were part of the radium-226 injection studies. The radium-226 seepage system lies beneath a paved area. The strontium-90 leach field consisted of two leach fields used to disperse low-level contaminated liquid effluent from an Imhoff treatment process. The soils above the strontium-90 leach fields are partially covered by pavement and the Site structures. These two areas of potential surface soil contamination (Ra and Sr leach systems) are contiguous and are treated as a single potential diffuse source of radionuclide emissions.

The southwest trenches area is located on the southwest corner of the LEHR facility. The disposal trenches in the area are reported to have received primarily LEHR-generated low-level radioactive waste, fecal material, and laboratory wastes. Sampling was conducted in the southwest

trenches area as part of the 1996 LFI. The results of the Site characterization detected near-background radionuclide activities in area surface soil samples.

The eastern and western dog pen areas were used to house the dogs that participated in the strontium-90 and radium-226 studies. Radioactive contamination was deposited in the area through urine. Patches of low-level radioactive contamination has been detected in the sub-surface soils of these areas.

Compliance with the NESHAP requirements for diffuse, non-point source emissions was assessed using the EPA atmospheric dispersion/radiation dose calculation computer code, CAP88-PC version 1.0. Conservative radionuclide emission rates were estimated using maximum soil activities measured above background for each potential area source and applying the U.S. EPA recommended particulate resuspension rate model to calculate the fugitive dust emission rates (Cowherd, 1985). The estimated radionuclide emission rates are shown in Table 4-10.

Table 4-10. Nonpoint/Diffuse Source Estimated Radiological Releases

Nonpoint Source Radionuclide	Annual Quantity ¹ (Ci/yr)	Annual Quantity ¹ (Bq/yr)
Americium-241	7.0×10^{-11}	2.6×10^0
Bismuth-212	7.6×10^{-9}	2.8×10^2
Bismuth-214	7.3×10^{-9}	2.7×10^2
Carbon-14	1.3×10^{-7}	4.7×10^3
Cesium-137	3.7×10^{-8}	1.4×10^3
Cobalt-60	3.3×10^{-10}	1.2×10^1
Lead-210	3.6×10^{-8}	1.3×10^3
Lead-212	7.5×10^{-9}	2.8×10^2
Plutonium-241	2.5×10^{-9}	9.4×10^1
Radium-223	4.2×10^{-9}	1.6×10^2
Radium-226	2.2×10^{-8}	8.2×10^2
Strontium-90	8.4×10^{-8}	3.1×10^3
Thallium-208	2.1×10^{-9}	7.7×10^1
Thorium-234	1.2×10^{-8}	4.5×10^2
Tritium	1.4×10^{-7}	5.2×10^3
Uranium-235	1.8×10^{-9}	6.8×10^1

Notes:

¹ = Annual quantities are based on conservative radionuclide emission rates calculated using maximum soil activities measured above background for each potential area source and applying the U.S. EPA recommended particulate resuspension rate model to calculate the fugitive dust emission rates (Cowherd, 1985).

[1 Curie (Ci) = 3.7×10^{10} Becquerels (Bq)]

The CAP88-PC computer code was then used to calculate the EDE to individual receptors at various distances and from each of the four potential LEHR facility radionuclide emission sources. The estimated EDE to a Maximally Exposed Individual (MEI) at the LEHR facility was determined by summing the contributions from all four potential LEHR facility radionuclide emission sources using the CAP88-PC model output. Based upon the combined source exposures, the MEI assumed

for the LEHR facility is located onsite in the Medical Clinic Building (H-215). The results of the assessment are shown in Table 4-11.

Table 4-11. Estimated Dose Equivalent to OnSite Maximally Exposed Individual from Site Nonpoint/Diffuse Sources

Nonpoint Source	Dose Equivalent ¹	Percent of NESHAPs
Ra/Sr Leach System	6.3 x 10 ⁻⁵ mrem/yr	<0.001
Southwest trenches Area	6.6 x 10 ⁻⁴ mrem/yr	<0.007
Western dog pen area	1.1 x 10 ⁻³ mrem/yr	<0.011
Eastern dog pen area	8.3 x 10 ⁻⁶ mrem/yr	<0.0001
Total Combined Contribution	1.8 x 10 ⁻³ mrem/yr	<0.02

Notes:

¹ = Maximum effective dose equivalent from 1996 NESHAPs report. Data are calculated, not measured. Therefore, they represent potential or estimated rather than actual doses.

[1 Sievert (Sv) = 100 Roentgen equivalent man (rem)]

The CAP88-PC computer code was also used to calculate the collective population dose to receptors within 10 km from the LEHR facility resulting from each of the four potential LEHR facility radionuclide emission sources. The collective population dose is calculated as the average radiation dose to an individual in a specified area, multiplied by the number of individuals in that area. The CAP88-PC computer code was run with the same population data file used in the 1995 LEHR facility NESHAP report. This population file includes receptors only to a distance of 10 km, rather than 80 km as specified in DOE Guidance. This was done to avoid including the large number of receptors in the Sacramento area whose exposure to radionuclides resulting from the LEHR facility are negligible, but whose population numbers would have a large effect on population run results. This approach is appropriate for calculating the collective population dose for the primarily rural LEHR facility surroundings. The results of the CAP88-PC population runs based upon the combined source exposures are shown in Table 4-12.

Table 4-12. Summary of Estimated Collective Population Dose Resulting from Radionuclide Emissions from Each Fugitive Dust Emission Source

Location	OffSite Maximally Exposed Individual		Collective Population Dose (person-rem/yr)
	(mrem/yr)	Distance	
Ra/Sr Leach Systems Area	4.5×10^{-6}	250 m North	1.5×10^{-5}
Southwest Trenches Area	1.2×10^{-5}	250 m North	4.0×10^{-5}
Western Dog Pens Area	3.7×10^{-5}	250 m North	1.2×10^{-4}
Eastern Dog Pens Area	3.3×10^{-6}	250 m North	1.1×10^{-5}
Total Site	5.6×10^{-5}		1.8×10^{-4}

Notes:

¹ = Maximum offsite effective dose equivalent from 1996 Draft Final NESHAPs report. (Data are calculated, not measured. Therefore, they represent potential or estimated rather than actual doses.)

² = Distance and direction from source area centered from source area centered to MEI receptor location.

[1 Sievert (Sv) = 100 Roentgen equivalent man (rem)]

5. ENVIRONMENTAL NONRADIOLOGICAL PROGRAM INFORMATION

DOE activities at the Site in 1996 primarily focused on the LFI and D&D work. Significant progress was made during the year toward the characterization of Site air, soil, and water to meet the remaining data requirements for an evaluation of removal action options. This section provides an overview of 1996 nonradiological results for Site air, soil and water and describes significant results and trends. A more detailed discussion of investigations and findings is presented in the reports referenced in each section.

5.1 Nonradiological Air Monitoring

5.1.1 Site Baseline Air Sampling Program

Nonradiological parameters for the air sampling program include (1) selected metals that were reported in soil as potentially above regional background levels as listed in the RI/FS workplan, (2) the pesticide chlordane, which was stored and used at the Site and has been found in soil samples, and (3) the volatile organic compounds (VOCs) chloroform and methylene chloride that have been found in both Site soil and water. In addition, air samples are analyzed for total respirable particulates, defined as those particulates with an aerodynamic diameter less than 10 micrometers (PM₁₀). Baseline PM₁₀ information will be used to evaluate potential increases in fugitive dust emissions during remedial actions.

Samples for chlordane compounds, metals, volatile organic compounds, and airborne dust as PM₁₀ analyses were collected at the sampling locations used for the radiological samples. On- and off-Site air monitoring locations are shown in Figures 4-1 and 4-2. These samples were collected in August 1995, September 1995, October 1995, January 1996, April 1996, July 1996, and October 1996. All nonradiological samples were collected over 24-hour sampling periods. The analytical results of the October 1996 sampling event were not included in the Baseline Air Monitoring Report (Patton, 1996) and will be included in the semi-annual Air Monitoring Memorandum, to be completed in June, 1997.

Air samples for chlordane analysis were collected using EPA Method TO-4 (EPA 1988), which uses high-volume air samplers equipped with glass-fiber filters and polyurethane-foam adsorbent traps. Typical air sampling volumes were approximately 200 m³. Air samples were analyzed by capillary gas chromatography with either electron capture detection or mass selective detection. Samples were collected using primary and secondary adsorbent traps; the secondary trap was used at one location during each sampling event to monitor vapor penetration (breakthrough) beyond the primary trap.

Air samples for VOC analysis were collected using EPA Method TO-14 (EPA 1988), which uses stainless steel air sampling canisters. Air samples were analyzed by capillary gas chromatography with mass selective detection. The samples were collected over a 24-hour period by using evacuated canisters equipped with flowrate controllers. The two primary compounds of interest were methylene chloride (dichloromethane) and chloroform (trichloromethane), although a total of 40 VOCs were included in the analysis.

Air samples for metals and PM₁₀ airborne dust analyses were collected using a particle size selective inlet and sampling methods outlined in 40 CFR part 50. The typical sample size was approximately 1600 m³ collected over 24 hours. Air samples were analyzed for PM₁₀ dust loading for beryllium, chromium, copper, molybdenum, stibnite and selenium which are contaminants of concern identified in the RI/FS workplan.

5.1.2 Results of Nonradiological Air Monitoring

The analytical results for samples analyzed for nonradiological pollutants are summarized below and are presented in detail in PNNL's Baseline Air Monitoring Report (Patton, 1996). Additional project-specific environmental surveillance will be implemented in conjunction with any future remedial activities.

PM₁₀ dust concentrations exceeded the air quality standard of 150 ug/m³ on October 4, 1995 at AM-2 (390 ug/m³) and AM-3 (240 ug/m³), with a PM₁₀ activity of 20 ug/m³ at the distant station. All other PM₁₀ activities were below the 150 ug/m³ standard. The October 4, 1995 sampling event was characterized by very strong winds with field staff directly observing the resuspension of dust from the livestock area 20-m north of station AM-2 onto the Site. Thus the elevated PM₁₀ activities appear to be largely influenced by non-LEHR sources of airborne particulates.

Detectable concentrations of metals were found in ambient air at both the LEHR and distant stations. Air concentrations were corrected by subtracting the average analytical blank contribution from the individual sample results.

Antimony and selenium show similar average concentrations for the distant and perimeter locations, with no statistical differences between the LEHR stations and the distant location. Antimony had poor analytical recoveries for spiked samples and a standard reference material; thus antimony concentrations may be underestimated. Average copper concentrations were somewhat higher at LEHR stations compared to the distant station; however, PNNL concluded the differences were not statistically significant. Copper was also detected in the blank samples; however, the blank concentrations were small compared to the actual sample concentrations.

Beryllium was only detected in three samples at the Site and no detectable concentrations were measured at the distant location. The maximum beryllium concentration was 0.00021 ug/m³ (AM-2 on October 4, 1996). This concentration was associated with the strong northerly winds and high PM₁₀ concentrations reported on that date. This maximum concentration did not exceed the NESHAPs emission standard of 0.01 ug/m³ (40 CFR 61.32).

The maximum molybdenum air concentration was 0.00032 ug/m^3 (AM-2 on October 4, 1996). The maximum concentration was associated with the strong northerly winds and high PM_{10} concentrations reported on that date. Molybdenum was detected in the blank samples at concentrations similar to the environmental samples. No NESHAPs standard has been set for molybdenum, and no Preliminary Remediation Goal (PRG) has been established. However, the average air concentrations of molybdenum were similar at the Site stations and the distant location, indicating that Site levels do not exceed local background.

Chromium was detected in all air samples, with average air concentrations numerically greater at the AM-2 and AM-3 locations compared to the distant station (AM-6); however, the differences were not statistically significant. The highest chromium concentration was 0.054 ug/m^3 at AM-2 on October 4, 1995, which was associated with the strong northerly winds and high PM_{10} concentrations reported on that date. The chromium air concentrations reported were corrected by subtracting the average blank value from each individual sample. Chromium samples had reasonable spike recovery values of $84\% \pm 16\%$ ($n = 4$); however, analysis of National Institute of Standards and Testing (NIST) Standard 1648 Urban Dust had low recoveries of $21\% \pm 5.8\%$. The low recoveries for the Urban Dust Standard may result from the different digestion method used for the LEHR samples (nitric acid digestion) compared to a more rigorous digestion method used for certifying the standard. Because of the high chromium concentration in the blank samples and the low recoveries for the NIST Urban Dust standard, the chromium data are suspect. Any additional air sampling for chromium should use either a different air filter media or a longer sampling interval to minimize the effect of the blank.

Alpha-chlordane, gamma-chlordane, heptachlor, and trans-nonachlor were detected in most samples. Cis-nonachlor and heptachlor epoxide were only occasionally detected, with no location reporting more than one detectable concentration for the six sampling events. The average air concentrations of chlordane components were numerically greater at the AM-2 location compared to the distant station (AM-6); however, the differences were not statistically significant. Average air concentrations at AM-3 and AM-4 were similar to the distant station, with no statistical differences compared to the distant station. All measured LEHR air concentrations for chlordane components were below the available PRG values.

The air concentrations for the majority of VOCs were below the detection limits. Toluene was the most frequently detected VOC with a maximum air concentration of 280 ug/m^3 at AM-2 on 10/4/95. All other concentrations of toluene were less than 7 ug/m^3 , with similar concentrations at the LEHR stations and the distant station. Dichlorodifluoromethane (Freon 12) was found in six samples with similar concentrations at the LEHR stations and the distant station. 1,1,1-trichloroethane was found in three samples at the Site with a maximum concentration of 15 ug/m^3 at AM-2 on 8/8/96. Chlorobenzene was detected in one sample with a concentration of 8.0 ug/m^3 at AM-2 on 10/4/95. Because of the low number of samples with detectable concentrations it was not possible to make a statistical comparison between the LEHR perimeter and the distant location.

5.2 Nonradiological Soil Monitoring

As mentioned in Section 4, soil sampling was conducted at the Site during the summer of 1996. Areas investigated include the Southwest Trenches, Radium/Strontium Treatment Systems, Western Dog Pens, and the DOE Disposal Box. Results of these field investigations, including analytical values from vadose zone soil samples, are presented in the Draft Final Final Site Characterization Summary Report (Weiss Associates, 1997a) and the DOE Disposal Box Closure Report (IT Corp., 1997). The following section summarizes 1996 field activities and important analytical results for nonradiological compounds from the DOE source areas at the Site.

5.2.1 Southwest Trenches Area

As part of the 1996 LFI of the DOE areas at the Site, soil and waste sampling was conducted in the Southwest Trenches Area. This section presents analytical results for non-radioactive compounds for samples taken in the Southwest Trenches Area.

Maximum reported concentrations above background of nonradiological compounds detected in the Southwest Trenches Area are provided in Table 5-1. Many metals were detected at concentrations above background; however, the reported concentrations of these metals were generally only slightly above background. Ethylbenzene and xylenes were only detected in a single wood sample at relatively low concentrations. No VOCs were detected in soil samples from the Southwest Trenches Area. SVOCs were detected in only one soil sample and two solid waste samples collected from the Southwest Trenches Area. The maximum concentration of Total SVOCs reported from the area was found in a wood sample and consisted mainly of PAHs and furans. Samples of soil collected immediately below the wood sample contained no detectable SVOCs. The elevated concentrations of PAHs associated with this sample may be attributed to wood preservatives. PCB-1260 was detected in one solid waste sample collected from the area. Additionally, organochlorine pesticides (listed in Table 5-1) were detected in trace concentrations in soil samples collected from throughout the Southwest Trenches Area. Easily gatherable and/or large item wastes were bagged as low-level radioactive waste, and packaged for off-Site disposal. Most other material was returned to the trenches.

Thirteen soil samples and two solid waste samples, collected within or beneath disposal trenches, contained nitrate at concentrations exceeding background. Although the maximum nitrate concentration detected was 390 mg/kg (S-357), nitrate concentrations above background were generally between 50 mg/kg to 100 mg/kg. Sixteen soil samples and three solid waste samples contained sulfate at concentrations exceeding background. Although the maximum sulfate concentration detected was 1,700 mg/kg (S-331), sulfate concentrations above background were generally less than 200 mg/kg. Two soil samples and three solid waste samples contained chloride at concentrations exceeding background. Although the maximum chloride concentration detected was 470 mg/kg (S-331), chloride concentrations above background were generally less than 50 mg/kg. Formaldehyde was detected at 1.6 mg/kg in one soil sample, only slightly above the 1 mg/kg detection limit.

Table 5-1. Summary of Maximum Nonradionuclide Concentrations Exceeding Background, Southwest Trenches Area

Parameter	Maximum Concentration (mg/kg)	Background ¹ (mg/kg)	Sample No.	Matrix	Depth (ft bgs)
Metals					
Antimony	1.3	0.74	S-340	Sludge ²	6.5
Cadmium	7.1	0.46	S-340	Sludge ²	6.5
Chromium VI	0.22	0.155	S-350	Gravel ²	0.5-1
Chromium	250	207.49	S-349	Soil	4
Copper	880	56.165	S-340	Sludge ²	6.5
Iron	46,000	44,081	S-352	Soil	3.5
Lead	49	10.753	S-340	Sludge ²	6.5
Manganese	940	773.234	S-481	Soil	30
Mercury	5.2	0.907	S-483	Soil	3
Molybdenum	5.9	2.0	S-340	Sludge ²	6.5
Nickel	420	365.81	S-495	Soil	3-4.5
Selenium	1.5	1.33	S-340	Sludge ²	6.5
Silver	2.7	0.52	S-340	Sludge ²	6.5
Vanadium	82	78.109	S-481	Soil	30
Zinc	730	90.206	S-340	Sludge ²	6.5
VOCs					
Ethyl Benzene	0.38	N/A	S-362	Wood ²	12
Xylenes	1.17	N/A	S-362	Wood ²	12
SVOCs					
Total SVOCs	34,000	N/A	S-362	Wood ²	12
Pesticides					
Alpha chlordane	1.7	N/A	S-484	Soil	3.5
Gamma chlordane	1.9	N/A	S-484	Soil	3.5
DDD	0.26	N/A	S-484	Soil	3.5
DDE	0.014	N/A	S-378	Soil	2.5
Heptachlor	0.10	N/A	S-486	Soil	3
Endosulfan I	0.011	N/A	S-485	Soil	3
Endosulfan-SO ₄	0.011	N/A	S-485	Soil	3
PCB-1260	1.0	N/A	S-340	Sludge ²	6.5
Dieldrin	0.07	N/A	S-484	Soil	3
DDT	0.0037	N/A	S-490	Soil	4
Methoxychlor	0.0011	N/A	S-490	Soil	4
Other					
Nitrate	390	29.1	S-357	Soil	14.4
Sulfate	1,700	39.4	S-331	Soil	2
Chloride	470	24.8	S-331	Soil	2
Formaldehyde	1.6	N/A	S-348	Soil	3

Notes:

¹ = Preliminary data cited in WA 1997a, currently being revised.

² = Waste removed for packaging and off-Site disposal

N/A = Not applicable

5.2.2 DOE Disposal Box

The DOE Disposal Box, (Figure 1-2) part of OU-1, was removed from the Site during 1995, and is discussed in Section 4 of this report. The analytical results of thirteen soil and waste samples taken to characterize the waste for disposal are presented in the DOE Disposal Box Area Closure Report (IT Corp., 1997) and discussed in the 1995 Annual Site Environmental Report (US DOE, 1996). The analyses of this waste matrix did not detect the presence of hazardous chemicals (Mitchell, 1996 as reported in IT Corp., 1997), and therefore, the additional nine soil samples collected from the limits of the excavation in 1996 were not analyzed for nonradiological compounds.

5.2.3 Radium/Strontium Treatment Systems Area

A description of the Radium/Strontium Treatment Systems Area is presented in Section 4 of this report. As part of the 1996 LFI at the Site, soil sampling was conducted in this area. This section presents analytical results for non-radioactive compounds for samples taken in the Radium/Strontium Treatment Systems Area.

Maximum concentrations of non-radioactive compounds detected in soil samples from the area are summarized in Table 5-2. No VOCs, pesticides, or PCBs were detected in any of the soil samples collected from the Radium/Strontium Treatment Systems Area. Only one soil sample (SB-3), taken from a depth of 8.5 ft in a soil boring adjacent to the Radium Leach Line, contained SVOCs (247 mg/kg).

Metals detected above background in the Radium Treatment System include chromium, copper, and zinc. The maximum concentrations for chromium and zinc were found in samples from boreholes associated with the Radium Leach Line, while the maximum concentration for copper was found in a sample from a borehole associated with one of the Radium Dry Wells. Maximum concentrations of nitrate and sulfate were detected in the area of the Radium Treatment System, while the maximum concentration of chloride in the area was found near the Strontium (Imhoff) Treatment System.

Analysis of the distribution of nonradionuclides in the soil of the Radium/Strontium Treatment System Area indicate that the Strontium (Imhoff) Treatment System operations did not significantly impact surrounding soil. Based on the water quality in nearby monitoring well UCD1-22, there is no significant impact to ground water from soil in this area of the Site (Weiss Associates, 1997a).

Table 5-2. Summary of Maximum Nonradionuclide Concentrations Exceeding Background, Radium/Strontium Treatment Systems Area

Parameter	Maximum Concentration (mg/kg)	Background ¹ (mg/kg)	Sample No.	Matrix	Depth (ft bgs)
Metals					
Chromium	280	207	S-447	Soil	8.5
Copper	160	56.1	S-462	Soil	24
Zinc	360	90.2	S-456	Soil	26
SVOCs					
Total SVOCs	247	N/A	S-447	Soil	8.5
Other					
Nitrate	110	29.1	S-440	Soil	7
Sulfate	150	39.4	S-435/S-453	Soil	9/13
Chloride	29	24.8	S-390	Soil	7

Notes:

¹ = Preliminary data cited in WA 1997a, currently being revised

N/A = Not applicable

5.2.4 Dog Pens Area

A description of the Dog Pen Areas is presented in Section 4.2.4 of this report. Soil sampling was conducted as part of the removal of the pens in 1996. This section presents analytical results for non-radioactive compounds for samples taken in the Dog Pens Area.

As previously mentioned, 24 soil samples were taken in the Dog Pens Area in 1996 for health and safety purposes. Half of these samples were taken from areas of relatively high alpha and beta/gamma scans, while the other half of these samples were taken from areas of relatively low alpha and beta/gamma scans. Fifteen of the 24 samples were analyzed for chlordane, all of which contained chlordane. Because analysis of nonradiological compounds was limited to chlordane in 1996, Table 5-3 lists the maximum concentrations of various compounds observed to date during this and previous investigations. The maximum concentration of chlordane detected in the Dog Pens Area in 1996 was 15 mg/kg (Table 5-3). These data were semi-qualitative in nature and were not collected in accordance with strict QAPP procedures.

Table 5-3. Summary of Maximum Concentrations of Non-Radionuclides in Previous Investigations, Dog Pens and North Chemical Dispensing Area

Analyte	Maximum Concentration/ Activity (mg/kg)	Background ¹	Depth (ft)	Date
Metals				
Antimony	21.5	0.74	50	Oct-90
Beryllium	5.1	0.76	1.5	Feb-90
Cadmium	26.7	0.46	0	Oct-90
Cobalt	31.5	31.3	0	Oct-90
Copper	69.5	56.2	40	Oct-90
Chromium	262	207	3.0	Dec-94
Chromium VI	3.98	0.16	35.0	Oct-90
Lead	73.1	10.8	40	Oct-90
Manganese	1010	773	5.8	Dec-94
Molybdenum	13.7	2.0	10	Oct-90
Thallium	6.18	1.36	60	Oct-90
Zinc	397	90.21	0	Oct-90
VOCs				
Methylene Chloride	0.120	N/A	35	Dec-94
SVOCs				
Heptachlor	0.0066	N/A	0.0	Dec-94
Acetone	0.032	N/A	5	Dec-94
Bis (2-Ethylhexyl) phthalate	0.065	N/A	5	Dec-94
Di-n-Butylphthalate	0.160	N/A	5.0	Dec-94
Diethyl Phthalate	1.2	N/A	10.0/60.0	Oct-90
Pesticides				
Chlordane	15	N/A	0	Jul-96
4,4-DDE	0.0013	N/A	0	Dec-94
Other				
TPH as Diesel	27.00	N/A	0	Dec-94
Nitrate	168.00	29.1	1.5	Feb-90
Sulfate	97	39.4	5	Dec-94

Notes:

¹ = Preliminary data cited in WA 1997a, currently being revised.

N/A = Not applicable

5.2.5 Domestic Septic Systems

Soil sampling was conducted in 1996 at two septic tanks (Nos. 1 and 7). All nonradiological compounds detected above background concentrations are presented in Table 5-4. Copper was the only non-radionuclide detected in soil samples collected near Septic Tank No. 1, however the concentration did not exceed background. Nitrate, copper, zinc, chloride, and sulfate were detected

slightly above background in soil samples collected near Septic Tank No. 7. Formaldehyde was detected slightly above background in the deepest sample taken (12 ft) beneath this tank.

Table 5-4. Summary of Nonradionuclide Concentrations Exceeding Background, Domestic Septic Systems

Analyte	Maximum Concentration (mg/kg)	Background ¹	Location	Depth (ft)	Date
Metals					
Copper	60	56.2	Tank No. 7	7	S-428
Zinc	110	90.2	Tank No. 7	12	S-430
Other					
Nitrate	120	29.1	Tank No. 7	9.5	S-429
Chloride	100	24.8	Tank No. 7	12	S-430
Sulfate	65	39.4	Tank No. 7	12	S-430
Formaldehyde	2.2	N/A	Tank No. 7	12	S-430

Notes:

¹ = Preliminary data cited in WA 1997a, currently being revised.

N/A = Not applicable

5.3 Water Monitoring for Nonradiological Constituents

Water monitoring for the Site during 1996 included collection of ground water, surface water, and storm water samples.

Quarterly ground water and surface water sampling has been conducted since 1990 for an extensive list of analytes. In 1995 the sampling and analytical schedule was modified based on a review of historical data compiled since quarterly sampling began in the fall of 1990 and approved by the RPMs. Table 5-5 presents the nonradiological analyte collection schedule. Depending on its importance in a particular sampling location, each analyte remaining in the program will be analyzed quarterly (as before), or one or two times a year. The new system allows for modifications when unexpected conditions arise. With this flexibility, a significant cost savings has been realized, with no loss of program integrity. In 1997 ground water and surface water sampling will be conducted and reported by UC Davis. DOE will sample only storm water runoff from the Site.

5.3.1 Ground Water Monitoring for Nonradiological Analytes

Quarterly ground water samples were collected in February, May-June, August-September and November 1996. All well locations are shown in Figure 2-1. The sampling frequency and requested analytes followed the schedule specified in the Water Monitoring Plan (Table 5-5).

Table 5-5. Nonradiological Analyte Analysis/Schedule

Well	VOCs	SVOCs	Metals	Nitrate	Chromium (hexavalent)	TDS	Pesticides & PCBs
UCD1-18	A	A	A	S	S	A	A
UCD1-1	*	*	*	S	S	*	*
UCD1-4	Q	A	A	Q	Q	Q	Q
UCD1-10	Q	A	A	Q	Q	Q	A
UCD1-11	A	*	A	S	S	A	A
UCD1-12	Q	A	A	Q	Q	Q	Q
UCD1-13	Q	A	A	A	Q	Q	Q
UCD1-19	A	*	A	A	Q	A	A
UCD1-20	A	A	A	A	S	A	A
UCD1-21	A	*	A	A	A	A	*
UCD1-22	*	*	*	*	*	S	*
UCD1-23	A	*	A	*	A	A	*
UCD1-24	A	*	A	A	A	A	A
UCD1-25	Q	Q	Q	Q	Q	Q	Q
UCD1-34	Q	Q	Q	Q	Q	Q	Q
UCD2-17	A	A	A	S	S	A	A
UCD2-7A	*	A	S	S		A	A
UCD2-14	Q	A	Q	Q	Q	Q	Q
UCD2-15	Q	A	A	Q	Q	Q	Q
UCD2-16	S	*	Q	S	Q	Q	*
UCD2-35	Q	Q	Q	Q	Q	Q	Q
UCD2-36	Q	Q	Q	Q	Q	Q	Q
UCD1/2-27	Q	Q	Q	Q	Q	Q	Q

Notes:
 A = Annual sampling (February)
 S = Semi-annual sampling (February and August)
 Q = Quarterly sampling (February, May, August, and November)
 * = Sample not analyzed for constituent

Observed trends in 1996 analytical results were not significantly different than previous years for the majority of wells. Fourteen VOCs were reported, including chloroform, at more than 10 µg/L in four locations. Figures 5-1 and 5-2 show the chloroform distribution in HSU-1 and HSU-2, respectively. Five semi-volatile organic compounds were detected at concentrations of up to 48 µg/L. Two pesticides (dieldrin and endrin) were reported at up to 0.027 µg/L. No PCBs were detected. Metals found in Site ground water include antimony, arsenic, barium, chromium, hexavalent chromium, cobalt, copper, iron, lead, magnesium, molybdenum, nickel, selenium, vanadium, and zinc. Nitrogen concentrations are above the MCL in many HSU-1 wells, but only one HSU-2 well, and total dissolved solids and turbidity exceeded the MCL in most wells.

Table 5-6. Water Monitoring Parameters and Analytical Methods

Analyte Fraction	Analytical Parameter	Method Reference
Volatile Organic Compounds	Target Compound List	CLP SOW OLC 02.0
Semi-Volatile Organic Compounds	Target Compound List	CLP SOW OLM 01.8
Pesticides and PCBs	Target Compound List	CLP SOW OLM 01.8
Metals	antimony	ILC SOW 2.0
	arsenic	ILC SOW 2.0
	barium	ILC SOW 2.0
	beryllium	ILC SOW 2.0
	cadmium	ILC SOW 2.0
	cobalt	ILC SOW 2.0
	copper	ILC SOW 2.0
	iron	ILC SOW 2.0
	lead	ILC SOW 2.0
	mercury	ILC SOW 2.0
	molybdenum	ILC SOW 2.0
	silver	ILC SOW 2.0
	thallium	ILC SOW 2.0
	vanadium	ILC SOW 2.0
	zinc	ILC SOW 2.0
Miscellaneous organics	formaldehyde	Modified NIOSH 3500 or SW 846 - 8315
Miscellaneous inorganics	total organic carbon	415.2 (9060)
	alkalinity, as CaCO ₃	U.S.EPA 310.1
	chemical oxygen demand	U.S.EPA 410.1
	ammonia	U.S.EPA 350.1 (350.2)
	total Kjeldahl nitrogen (TKN)	U.S.EPA 351.2
	turbidity	U.S.EPA 180.1
	total dissolved solids	U.S.EPA 160.1
	anions	U.S.EPA
	cations	U.S.EPA
	Field parameters	pH
electrical conductivity (EC)		SOP 2.0
turbidity		SOP 2.0
redox potential (Eh)		SOP 2.0
water level		SOP 2.0

CLP = Contract Laboratory Program
 ILC = Inorganic Low Concentration
 NIOSH = National Institute of Safety and Health
 OLC = Organic Low Concentration

OLM = Organic Low Medium Concentration
 SOW = Statement of Work
 SOP = Standard Operating Procedure

5.3.2 National Pollutant Discharge Elimination System (NPDES) Data

The Site discharges its sanitary waste to the UC Davis Wastewater Treatment Plant, which is permitted according to NPDES requirements. Purge water generated during well sampling is tested

prior to discharge to ensure that no hazardous compounds are released. Current DOE activities do not contribute to hazardous discharges.

5.3.3 Surface Water Monitoring for Nonradiological Analytes

The South Fork of Putah Creek, separated from the Site by a levee, is the only year-round surface water adjacent to the Site. Analysis of conditions in Putah Creek indicate that much of the flow during late summer and fall through the reach adjacent to the Site is derived from the outfall from the UC Davis wastewater treatment plant. This analysis was based on visual observations, wastewater treatment plant flow data, and the South Fork of Putah Creek stream gauge data. Results of numerical modeling and the ground water gradient information suggest that the creek acts as a recharge source to the local ground water in the first HSU.

Surface water samples were collected quarterly during 1996 from PCU, PCD and STPO (Figure 2-1). The parameters for which surface water samples were analyzed are shown in Table 5-7, and Appendix B summaries data collected during 1996.

Six VOCs were reported in surface water samples collected during 1996. These were acetone, bromodichloromethane, bromoform, chloroform, dibromochloromethane, and methylene chloride. One or more of the trihalomethane group (chloroform, bromodichloromethane, dibromochloromethane, and bromoform) were detected well below the MCL of 100 µg/L at STPO and downstream at PCD. The use of chlorine disinfectants in the UC Davis wastewater treatment plant is the apparent source of these constituents. Methylene chloride was detected at STPO and PCD at up to 3.5 µg/L, less than the MCL of 5 µg/L. While this is a common laboratory reagent and has been found in blank samples, it is generally detected in STPO and PCD samples and never in upstream PCU samples, indicating that it is probably introduced to the creek at location STPO. No VOCs were found in surface water samples in concentrations exceeding their MCL in 1996.

The only semivolatile organic compounds detected was bis(2-ethylhexyl)phthalate detected in all sample locations in 1996. This compound was also detected in blank samples, and the surface water detections may be partially due to lab procedures.

No pesticides or PCBs were detected in 1996 surface water samples. Each quarterly surface water sample was analyzed for 16 metals and hexavalent chromium. None of the metals detected in 1996 exceeded the MCL.

Nitrate concentrations for surface water samples were below the MCL of 10 mg/L (for nitrate as nitrogen) in all 1996 samples. Reported concentrations of nitrate in STPO were higher than in the upstream or downstream samples. This trend is also apparent in 1994 and 1995 samples.

Table 5-7. Nonradiological Parameters for 1996 Surface Water Samples

Field Parameters	Laboratory Parameters	
pH	Volatile Organic Compounds	Total Chromium
Electrical Conductivity	Semi-Volatile Organic Compounds	Hexavalent Chromium
Turbidity	Pesticides and PCBs	Nitrate
Eh	Metals	Ammonia
Approximate Flow Rate	Antimony, Arsenic,	TKN
(obtained from the Solano	Barium, Beryllium, Cadmium,	Alkalinity
Country Irrigation District)	Cobalt, Copper, Iron,	Cations
Temperature	Lead, Mercury,	Anions
	Molybdenum, Nickel,	Total Dissolved Solids
	Selenium, Silver,	Turbidity
	Thallium, Vanadium, and	Total Organic Carbon
	Zinc	Chemical Oxygen Demand
		Formaldehyde

5.3.4 Storm Water Monitoring for Nonradiological Analytes

Storm water samples are collected twice a year; once at the beginning of the rainy season after the first storm of the season, and once near the end of the season. Grab samples were collected from four locations at the Site in 1996 (Figure 2-1). Nonradiological analytes are listed in Table 5-8, and sample results are summarized in Appendix B.

Acetone was detected in storm water samples at up to 16 µg/L and three phthalate compounds were detected at up to 6.4 µg/L. Alpha-chlordane and gamma-chlordane were detected at up to 0.012 µg/L. No other organic compounds were detected in any of the samples.

Metals were detected in all samples at concentrations below the MCLs. A more complete discussion of the possible impact of storm water runoff to Putah Creek will be included in a risk evaluation currently in progress and scheduled for release later in 1997.

Table 5-8 Nonradiological Analytes for Storm Water Runoff Samples

Field Parameters	Laboratory Parameters	
pH	Volatile Organic Compounds	Total Chromium
Electrical Conductivity	Semi-Volatile Organic Compounds	Hexavalent Chromium
Temperature	Pesticides and PCBs	Nitrate
Turbidity	Metals	Ammonia
Eh	Antimony, Arsenic,	Alkalinity
	Barium, Beryllium, Cadmium,	Cations
	Cobalt, Copper, Iron,	Anions
	Lead, Mercury,	Turbidity
	Molybdenum, Nickel,	Total Dissolved Solids
	Selenium, Silver,	Total Suspended Solids
	Thallium, Vanadium, and	Total Organic Carbon
	Zinc	Total Oil and Grease
		Formaldehyde

6. GROUND WATER PROTECTION PROGRAM

Ground water monitoring has been conducted quarterly for the LEHR ER/WM Project since November 1990. The quarterly monitoring program began as a component of the Phase II Site Characterization (Dames & Moore 1993). In 1993, the program evolved to include the development of a Site Water Monitoring Plan, designed to meet the requirements of DOE's General Environmental Protection Program in DOE Order 5400.1.

Water monitoring is conducted in conjunction with the CERCLA process as part of the DOE-sponsored environmental restoration program underway at the LEHR ER/WM Site. Since LEHR has not been an operational Site since 1989, the current water monitoring program focuses primarily on environmental surveillance activities for non-operational facilities. Figure 2-1 shows the location of ground water monitoring wells for the Site.

The objectives of the ground water monitoring program are to characterize baseline ground water conditions at the Site, to further evaluate impacts of previous LEHR facility operations on ground water in the area, to provide data to support future Site activities (risk assessment and remedial actions), and to comply with applicable federal, state and local regulations.

6.1 Hydrology

The hydrogeology of the Sacramento Valley is comprised of both unconfined and confined aquifers in the flat or gently sloping sedimentary deposits in the upper 3,000 feet beneath the valley. No regionally identified confining units are known to exist in the Sacramento Valley. Ground water is recharged through leakage from streams and rivers, as well as from direct precipitation and irrigation (DOE, 1992b).

Ground water is encountered beneath the Site at depths ranging seasonally from about 20 to 70 feet below ground surface. The water levels are usually highest in early spring and lowest in summer. Based on analysis of subsurface stratigraphy, the uppermost aquifer has been separated for investigation purposes into two hydrostratigraphic units (HSUs). An hydraulic connection does exist between these two layers, as evidenced by comparison of hydrographs. Water levels in both HSUs show the characteristic rise during fall and winter, and the same decline during spring and summer. However, the two HSUs are distinctly different water-bearing zones, with different characteristics. Deeper HSUs have not been investigated below the LEHR ER/WM Site, although they are known to exist on a regional basis (DOE, 1994b).

The direction of ground water flow in HSU-1 is generally toward the northeast, although local temporary changes in flow direction and gradient occasionally occur. Local horizontal ground water gradients across the Site in the first HSU vary from approximately 0.0004 to 0.0016 vertical

feet per horizontal foot. Figures 6-1 to 6-4 present contour maps of ground water elevations in the first HSU during the four quarters of 1996.

In the second HSU, ground water flow is predominantly toward the east/northeast. Both the direction of flow and the lateral gradient are more consistent than in the first HSU. Horizontal gradients in HSU-2 range from 0.0004 to 0.0015 ft/ft. Generally, gradients are lower in winter and fall, while higher gradients occur in spring and summer.

The vertical hydraulic gradient between HSU-1 and HSU-2 appears to shift seasonally; a downward gradient is observed during the summer months in adjacent well pairs, changing to upwards in several wells during the rainy season. HSU-2 is pumped for agricultural supply during the summer months. During this period, while little or no natural surface recharge is occurring, the vertical gradient appears to be upward or neutral across most of the Site. Wells UCD1-34 and UCD2-35, located near Putah Creek, do not show an upward gradient during the rainy season, possibly due to hydraulic connection to the creek. Refer to Figures 6-5 to 6-8 for contour maps of ground water elevations in the second HSU for all four quarters of 1996.

6.2 Aquifer Parameter Estimates

Tests have been performed to estimate aquifer parameters at the Site. In 1996 Dames and Moore, under the direction of UC Davis performed a spinner test and pumping tests on well EW2-1 (Figure 2-1). Extraction well EW2-1 and four observation wells (UCD1-28, UCD2-29, UCD2-30 and UCD2-31) were installed in 1996. HSU-2 hydraulic conductivity estimates ranged from 749 to 1,210 ft/day and transmissivity estimates ranged from 32,950 to 52,340 ft²/day. Storativity was estimated at 0.0005 to 0.0067. The results and methodology of these tests is described in greater detail in the UC Davis Engineering Evaluation/Cost Analysis (Dames and Moore, 1997).

6.3 Uses of Ground Water in Vicinity

Local ground water is utilized for both drinking and agricultural purposes. The major ground water 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 (DOE, 1995). The first HSU and is not used for drinking or irrigating purposes. In the general area near the Site, a number of domestic and irrigation wells draw from the second HSU.

6.4 Potential Sources of Ground Water Pollution

Studies of potential sources of ground water pollution have not determined the extent of the environmental impact of Site sources, although additional data are being collected and analyzed. A number of locations onsite are considered "waste management areas," where a variety of potential wastes were handled and/or buried during former Site operations. Impact from these areas has been evaluated during previous investigations and may be further evaluated during future investigations

and/or remedial actions. Most impacts to ground water that have been identified are localized on the Site near waste burial locations and are within the first HSU, which is not used for drinking water. The primary waste management areas include: the Imhoff treatment system, the radium-226 treatment system, domestic septic tanks (reported to have received project effluent), chemical dispensing areas, waste burial trenches, landfill units, dog pen areas, and dry wells for storm water (storm water may have carried wastes from other management areas).

6.5 Vadose Zone Transport Modeling

One-dimensional contaminant transport modeling was performed in late 1996/early 1997 to assess potential ground water impact resulting from downward migration of contaminants through the unsaturated sediments beneath the LEHR facility. The scope of the modeling project was limited to DOE areas of concern at the Site. The model results provide guidance for estimating Site soil clean-up levels and evaluating planned removal actions, as well as input to the risk evaluation currently in progress.

Five indicator compounds were selected to represent Site contaminants of concern. These modeled compounds include nitrate, radium-226, strontium-90, chlordane, and hexavalent chromium. The results of the modeling indicate that observed levels of strontium-90, radium-226, and chlordane in soil should not impact ground water above either the 95% Upper Threshold Limit (UTL) approximations of background or Maximum Contaminant Levels (MCLs). The results also indicate that maximum observed concentrations of hexavalent chromium in shallow soil may exceed the 95% UTL, but should not impact ground water above the total chromium MCL (50 µg/L).

The model results indicate that concentrations of nitrate above preliminary background values may impact ground water above both the nitrate as nitrogen MCL (10 mg/L) and the 95% UTL. Based on conservative assumptions in the modeling procedure, peak concentrations predicted by these models are conservative estimates and, therefore, should represent an upper limit of concentrations that may impact ground water. For additional information regarding the modeling procedures or model results, refer to the Draft Final Final One-Dimensional Vadose Zone Modeling Report (Weiss Associates, 1997c).

6.6 LEHR ER/WM Project Site Ground Water Monitoring Well Installation

A total of 33 ground water monitoring wells and one extraction well have been installed at the Site (Figure 2-1). During the Phase I investigation, nine wells (UCD1-1 through UCD1-9) were installed. A short time later, during the Solid Waste Assessment Test investigation of the Old UC Davis Landfill at the LEHR ER/WM Project Site, five ground water monitoring wells (UCD1-10 through UCD2-14) were installed. Ten monitoring wells (UCD2-15 through UCD1-24) were added during the Phase II Site Characterization. Monitoring well UCD1-2 was abandoned by DOE in 1990 because it was installed through the UC Davis Landfill Disposal Unit No. 2. During 1995 five additional monitoring wells were installed, including two wells in HSU-1 (UCD1-25 and UCD1-34) and two wells in HSU-2 (UCD2-26 and UCD2-35). A Westbay Well (UCD1/2-27), which was constructed to sample water from seven discrete intervals in both HSU-1 and HSU-2, was also

installed. In 1996 an extraction well (EW2-1) and four monitoring wells (UCD1-28, UCD2-29 through UCD2-31) were installed in the northeast area of the Site.

6.6.1 Hydropunch Investigation

Hydropunch sampling occurred in several phases in 1994 and 1995. A hydropunch is a sampling tool that can be used to collect ground water samples from multiple intervals in a single borehole. Hydropunch screening investigations began downgradient of the Site to evaluate the downgradient and lateral extent of impacts in the first and second HSUs. Hydropunch sampling focused on tracking the extent of chloroform in ground, but samples were also analyzed for nitrate, tritium and hexavalent chromium. In addition to providing information on impacts regarding Site constituents of concern, the information obtained from hydropunch samples was used to determine the locations to install additional perimeter monitoring wells.

In the Fall of 1996 UC Davis performed additional hydropunch sampling downgradient of the Site. These samples confirmed that chloroform is present off-Site downgradient, and indicate that the chloroform plume extends at least 1,500 ft, but less than 2,500 ft, to the east of the Site.

6.6.2 Off-Site Neighbor Well Sampling

Sampling of private wells to the south, north, and east of the Site has been conducted since 1989. Because the wells are not uniform in dimension or construction, limited comparisons can be made between these wells and Site ground water data. The offsite neighbor well sampling program has provided information about the quality of water in private domestic and irrigation wells regarding the primary Site constituents of concern: VOCs, tritium, hexavalent chromium, nitrate as nitrogen, gross alpha and gross beta. Private wells sampled in 1996 are shown in Figure 6-9.

In 1996, UC Davis sampled selected irrigation and domestic wells to the east of the Site four times. Hexavalent chromium and nitrate as nitrogen were detected above or near the MCL in many of the wells. These compounds are present in regional ground water, and no direct link to the Site is evident. Gross Alpha and Gross Beta activities occasionally exceeded the MDA, but did not exceed the MCL and no identifiable trend is apparent.

Analyses for VOCs were added to all wells in the off-Site well monitoring program in the fall 1995 to provide additional information regarding the extent of chloroform that may be affecting the neighbors' wells. In 1996, chloroform was detected in two off-Site wells, with the maximum concentration of 38 µg/L reported in well NIW in March. Low concentrations (less than the reporting limit) of 1,2-dichloroethane, 1,1-dichloroethane and 1,1-dichloroethene were also detected in well NIW in December 1996. Trimethyl silanol was detected at 0.8 µg/L in well NDW in December. Low concentrations of toluene and methylene chloride were reported in some samples, however these compounds were also detected in associated blanks.

6.7 Summary of Trends in Analytical Results 1990-1996

This section summarizes trends observed in the ground water monitoring program from 1990 through 1996. The discussions below pertain to the wells, which have been regularly monitored since 1990. Trends have not yet been established for the 10 wells installed in 1995 and 1996.

6.7.1 Volatiles/Semivolatiles

Chloroform has been routinely detected at low levels in five Site wells and at consistently higher levels in UCD1-12. During 1996, concentrations of chloroform in UCD1-12 ranged from 5,200 to 6,700 $\mu\text{g/L}$. Chloroform concentrations in this well appear to be decreasing with time from a maximum of 24,000 $\mu\text{g/L}$ in 1990. UCD1-12 is located downgradient from Landfill No. 2, indicating an apparent chloroform source in that area. 1,1-dichloroethene, 1,1-dichloroethane, and 1,2-dichloroethane are also consistently detected in ground water samples collected from UCD1-12 in concentrations exceeding drinking water standards.

Figures 6-10 through 6-14 present graphs of chloroform concentrations in UCD1-12, UCD1-13, UCD2-14, UCD1-21 and UCD1-24 over time. Of the new wells installed in 1995 and 1996, chloroform was detected in UCD1-25, UCD2-26, UCD2-29, UCD2-30, UCD2-31, EW2-1 and in most zones of UCD1/2-27. Figures 5-1 and 5-2 present chloroform concentration contours for HSU-1 and HSU-2, based on 1996 monitoring well data.

Semivolatile phthalates and phenol have been sporadically reported in ground water at the Site at maximum concentrations of 48 $\mu\text{g/L}$. No temporal trends are apparent from the analytical data.

6.7.2 Pesticides

A few organochlorine pesticides have occasionally been found in Site wells, and have also been reported in low concentrations in storm water and in surface water. Two pesticides (endrin and dieldrin) were detected in well UCD1-13 in the spring of 1996 at concentrations less than 0.03 $\mu\text{g/L}$. No temporal trends are apparent from the analytical data.

6.7.3 Metals

A number of metals have been regularly reported in ground water samples, both upgradient and downgradient of the Site. No trends indicating a change in concentration over time have been noted for any of these metals. Metals typically detected at LEHR are summarized below:

- Antimony has been detected at least once in all 18 wells, at low levels near the detection limit, and below the 6 $\mu\text{g/L}$ MCL.

- Arsenic has consistently been detected in most wells since summer quarter 1993, when the detection limit was lowered to 2.0 µg/L. The annual mean arsenic concentrations range from 2.3 to 3.3 µg/L. The MCL for arsenic is 50 µg/L.
- Barium has consistently been detected in most wells and the annual mean concentrations vary from 28 to 336 µg/L. The MCL for barium is 1,000 µg/L.
- Total chromium and hexavalent chromium have been detected in most wells, and several wells have typically exceeded the MCL for total chromium (50 µg/L). The highest annual mean hexavalent chromium concentrations of 171 to 362 µg/L are typically reported in wells UCD1-11, UCD1-12, UCD1-19 and UCD1-25.
- Cobalt, copper and molybdenum have been detected occasionally in several wells at levels similar to those found in background wells. No MCL has been established for cobalt or molybdenum. The secondary MCL for copper is 1,000 µg/L.
- Mercury has been detected sporadically in wells across the Site and has not exceeded the 2 µg/L MCL.
- Nickel has been detected in varying concentrations in all wells. UCD1-18 and UCD1-23 reported annual mean concentrations of 17 and 56.9 µg/L in 1996, while the annual mean concentration in other wells ranges from 1.8 to 18.4 µg/L. The MCL for nickel is 100 µg/L.
- Selenium has consistently been detected in UCD1-10, UCD1-11, UCD1-12 and UCD1-19, with an annual mean concentration of 3.4 to 26.0 µg/L in 1996. Selenium has been detected sporadically in 11 other wells. The MCL for selenium is 50 µg/L.
- Vanadium and zinc have consistently been detected in all wells, and on-Site concentrations appear consistent with background wells. No MCL has been established for Vanadium. The secondary MCL for zinc is 5 µg/L.
- Lead has been detected in several wells including UCD1-13, UCD1-18, UCD1-19, UCD1-25, UCD2-7, and UCD2-27 at up to 3.3 µg/L in 1996. The MCL for lead is 50 µg/L.

6.7.4 Nitrate

Nitrate is present in ground water throughout the Site, although the concentration varies. Nitrate concentrations in 11 of 18 wells typically exceed the MCL of 10 mg/L for nitrate as N. The highest nitrate concentrations are generally reported in wells UCD1-10, UCD1-11, UCD1-12, UCD1-19, UCD1-21 and UCD1-24, which have mean concentrations ranging from 24.5 to 80.0 mg/L. Figures 6-15 through 6-19 present the historical nitrate concentrations of these wells. These data do not show any discernable trends, with the exception of UCD1-10, which increased from approximately 15,000 µg/L in 1990-1991 to approximately 35,000 µg/L in 1993-1996. Nitrate concentrations appear to be elevated in background wells and throughout the region (Dames and Moore, 1997).

6.7.5 Radioisotopes

Statistical evaluations of gross alpha, gross beta, and gamma radioactivity suggest that ground water samples collected at the Site do not have elevated alpha, beta, or gamma activity with regard to upgradient conditions (DOE, 1996). Measurements for strontium-90 show sporadic and generally low activity levels. During 1996, there were a few detections of plutonium-241 and americium-241 in on-Site wells. However, these results were all near the MDA and probably do not represent elevated activities. Careful monitoring of these parameters will be continued.

Tritium activity below or near MCL levels has been reported in ground water samples collected from Site wells UCD1-13 and UCD2-14. Figures 6-20 and 6-21 present graphs of tritium activities in UCD1-13 and UCD2-14. Review of these data indicate that the tritium activity in UCD1-13 may be decreasing, and that tritium in UCD2-14 may decrease in the fall and winter months. Figures 4-3 and 4-4 present tritium activity contours for HSU-1 and HSU-2, based on 1996 monitoring well data. Since the analysis for carbon-14 was added in 1991, consistent detections of carbon-14 activity have also been reported in UCD1-13 and UCD2-14.

6.7.6 New Wells

One extraction well (EW2-1) and four observation wells (UCD1-28, UCD2-29, UCD2-30 and UCD2-31) were installed in 1996 (Figure 2-1). These wells were sampled for a limited suite of analytes: VOC's, nitrate, TDS, hexavalent chromium and tritium. Preliminary data for detected constituents are shown in Table 6-1. No tritium was detected in any of these wells.

Table 6-1. Compounds Detected in Monitoring Wells Installed in 1996

Compound (units)	Well ID				
	UCD1-28	UCD2-29	UCD2-30	UCD2-31	EW2-1
Chloroform (µg/L)	---	140	89	22	87
Nitrate as NO ₃ (mg/L)	38	6.1	5.6	2.8	25.8
TDS (mg/L)	950	440	440	350	380
Hexavalent Chromium (µg/L)	550	14	15	12	---

Notes:

--- = none detected

Data from Dames and Moore, 1997, and D. Zuber, 1997.

These data confirm hydropunch sampling results, which indicate that chloroform in ground water extends beyond the northeastern boundary of the Site.

7. QUALITY ASSURANCE

Quality assurance (QA) is a key element of the environmental protection program for the Site. A Quality Assurance Project Plan (QAPP) (Weiss Associates, 1997d) that describes the requirements for all quality-related work on the LEHR project has been prepared and reviewed by DOE, and is currently being finalized. Within the planning for each phase of the LEHR ER/WM Project (Site characterization, investigation, D&D actions, etc.) this QAPP and other quality-assuring documents, such as Standard Operating Procedures (SOPs) and task-specific workplans are followed. The purpose of the QAPP and these other documents is to identify the specifications and methods employed to establish technical accuracy and precision, validity of measurements and statistics, and to provide a sound basis for management decisions that will be based on environmental information collected for the Site. The QAPP for the LEHR ER/WM Project was prepared in accordance with EPA QAMS-005/80 and NQA-1 specifications. It also incorporates the guidance of DOE Order 5700.6C and the General Environmental Protection Program as defined in DOE Order 5400.1, to ensure that DOE quality and environmental goals are met.

Environmental samples discussed in this report were collected, analyzed and reviewed according to the QAPP and other relevant SOPs and/or task-specific workplans. To assure quality, quality control (QC) is built into all aspects of environmental sampling. Included in the QAPP and related documents are sections identifying QC for sample collection requirements and specific quality assurance objectives for the measurement data. QC 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 sample quality, these are carefully controlled. To ensure the comparability of analytical data, all samples are analyzed by EPA-approved methods when available. When analytic results are received, they are reviewed by the contractor according to the defined data quality objectives and data review procedures.

Virtually all of the 1996 environmental sample data for Site air, soil and water were collected under the strict quality assurance requirements of the CERCLA process. Most of these data have been carefully reviewed and validated as required under the QAPP, with the exception of the soil data collected in the dog pens area which were qualitative in nature, and did not follow strict QAPP QA/QC procedures. These unvalidated data are discussed in this report, but the data are still considered preliminary at the time of publication of this report.

Most of the 1996 Site air, soil and water monitoring data have been, or will be, presented in separate reports (e.g. the 1996 Annual Water Monitoring Report and the Site Characterization Summary Report). The individual review and validation process for each data set is presented in these reports, and will not be discussed in detail here.

7.1 Field Quality Assurance

Quality assurance for field sampling is accomplished by the use of field replicates, decontamination rinseates, trip blanks and field blanks, as appropriate for the type of sample collected. For each round of sampling, replicate samples are collected from a selected sample point at the same time as the original sample to check for consistency in the sampling process. The replicate sample is labeled with a coded sample number and serves as a check on the precision of the sampling and analytical procedures. Decontamination rinseates are analyzed whenever the potential exists for cross-contamination from sampling equipment. Trip blanks are sent with each shipment of water samples requiring analysis for volatiles. Field blanks are collected to check for contamination during the water sampling process. Calibration records for each field instrument are maintained in the contractor QA files.

7.2 Laboratory Quality Assurance

Contracted laboratories providing analytical services for the LEHR ER/WM Project activities are evaluated by UC Davis and/or WA 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 analyzing environmental samples. Laboratories must submit their analytical procedure for review if it differs from standard procedures (such as EPA). Each contracted laboratory is required to have acceptable accreditation through participation in DOE Emission Measurement Laboratory (EML) Interlaboratory Comparison Program, the National Volunteer Laboratory Assurance Plan (NVLAP), or similar approved programs. For nonradiological analyses, laboratories participate in the EPA's Interlaboratory Comparison Program. LEHR RI/FS analytical laboratory comparison results from the EML Interlaboratory Comparison Program are available for review at the Site.

7.3 Quality Assurance Program Audit and Surveillance Activities

Contracted laboratories that perform environmental analyses for the project are subject to periodic audits of their QA program to assure compliance with project standards. One surveillance of field activities and one laboratory audit were conducted in late 1995 by the LEHR QA Representative and a LEHR Technical Representative to verify compliance with the appropriate requirements. Both of these activities were performed in accordance with PNNL Quality Instruction QP-05, Revision O, "Supplier and Hanford Contractor Audits."

All findings and observations identified during the audit were addressed in a timely manner in early 1996, and these audits are considered closed.

7.4 Summary of Quality Control Data Validation

The overall quality assurance objective is to collect and analyze environmental samples from the Site in a manner that ensures that technical data are accurate and representative, are able to withstand scientific and legal scrutiny, and are useful for evaluating Site conditions and remedial actions. The criteria used to specify QA goals are precision, accuracy, representativeness, completeness, and comparability (PARCC) for evaluation of quality control data. An evaluation of the PARCC parameters is accomplished through data validation. The Table 7-1 summarizes the components that are used to monitor and evaluate the quality of LEHR environmental data.

Table 7-1. Components of QC Program in Support of Data Quality Objectives

Data Quality Objective	QC Component	Evaluation Criteria
Precision	<ul style="list-style-type: none"> • Field duplicate • Matrix spike • Matrix spike duplicate 	Relative percent difference
Accuracy	<ul style="list-style-type: none"> • Matrix spike • Matrix spike duplicate • Surrogate spikes 	Percent recovery
Representativeness	<ul style="list-style-type: none"> • Trip blanks • Field duplicated • Method blanks 	Qualitative degree of confidence
Completeness	<ul style="list-style-type: none"> • Holding time • Valid data points 	Percent valid data
Comparability	<ul style="list-style-type: none"> • Analytical methods • Field duplicates 	Qualitative degree of confidence

A significant data quality concern was identified during review of 1996 soil data. Strontium-90 results for eight LFI soil/waste samples were identified as anomalous, based on activities significantly exceeding the gross beta activities for the same samples. Five of these samples were from one laboratory sample batch, while the other three were from three different sample batches. For the five samples from the same batch, the laboratory was able to recover the sample precipitate and determine that a barium-133 tracer that had been added to the sample had not been completely removed prior to the strontium-90 analysis, thereby producing significant gamma radiation that was measured as beta activity and was erroneously reported as strontium-90. Although the laboratory was unable to recover the other three samples, they determined that the three batches these samples represent were prepared the same way as the other batch, and that they may have contained some barium-133 at the time of the strontium-90 analyses.

Because the 90-day required laboratory storage time had passed by the time this problem was discovered, the laboratory had disposed all the LFI samples shipped to them in summer 1996. However, split samples in the possession of the DHS were available for seven of the eight

samples with suspect strontium-90 results, as well as a number of other samples from the same four laboratory batches. Thirty samples were selected for strontium-90 reanalysis, and were shipped to the laboratory in early May 1997. Results of these reanalyses will be discussed in the Final Site Characterization Summary Report to be issued later this year.

In addition, the analytic laboratory has implemented corrective actions to ensure that barium-133 contamination of strontium-90 samples will not occur in the future. For all future analyses the laboratory will analyze separate sample aliquots for radium-226 and strontium-90, rather than performing these analyses sequentially using the same aliquot. The laboratory will also confirm that the gross beta activity equals or exceeds the strontium-90 activity for each sample, thereby verifying that the strontium-90 result is reasonable.

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9. ACKNOWLEDGMENTS

The following LEHR Project personnel worked on the 1996 Annual Site Environmental Report:

Name and Position	Responsibility
Michael Dresen LEHR Program Manager, WA	Senior guidance and review, and quality assurance
Robert Devany LEHR Project Manager, WA	Project management, guidance and review.
Salem Attiga Principal, EMS	Senior review
Mary Stallard LEHR Quality Assurance, WA	Technical guidance and review, and quality assurance
Alison Watts Senior Staff Geologist, WA	Project coordination, report writing
John Pekala Senior Staff Geologist, WA	Report writing
Malieka Bundy Database Technician, WA	Database management
Keith Commiskey Graphics, WA	Graphics
Elizabeth Carrier Project Administrator	Word processing and report coordination
Craig Adams Production Personnel, WA	Graphics and report production

FIGURES

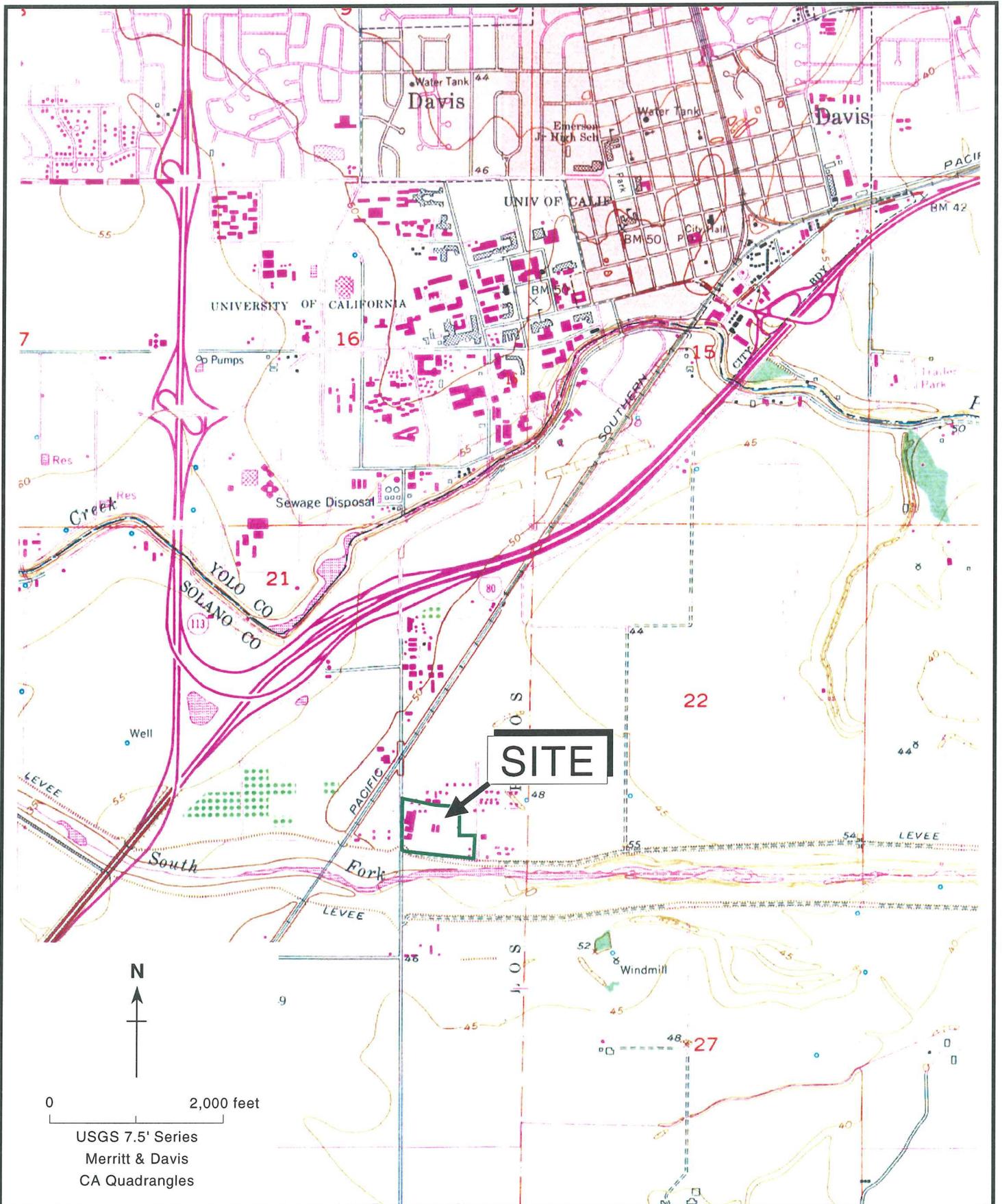


Figure 1. LEHR Site and UC Davis Location Map.

Weiss Associates

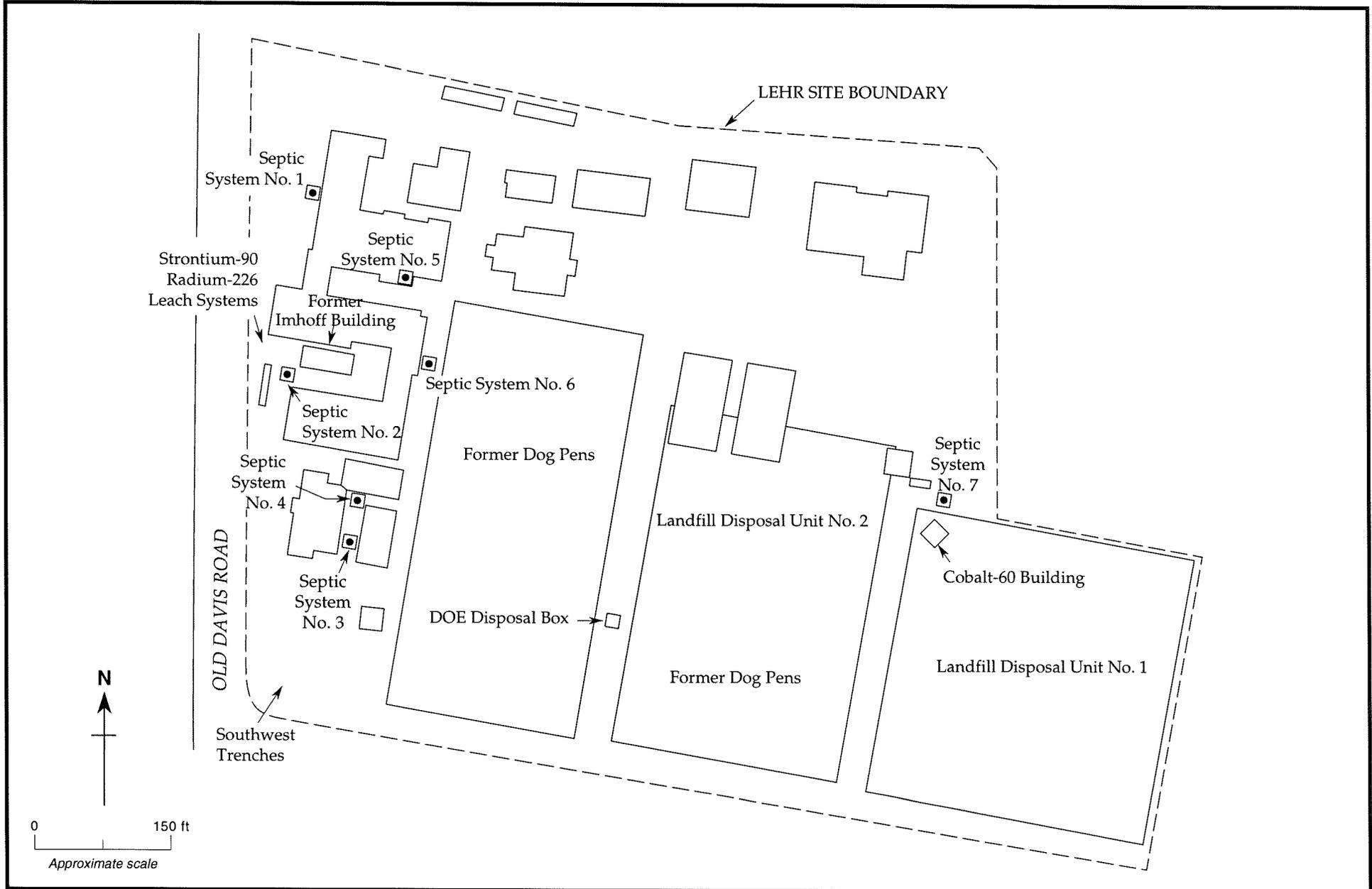


Figure 1-2. Site Features That May Have Impacted the Environment.

Weiss Associates

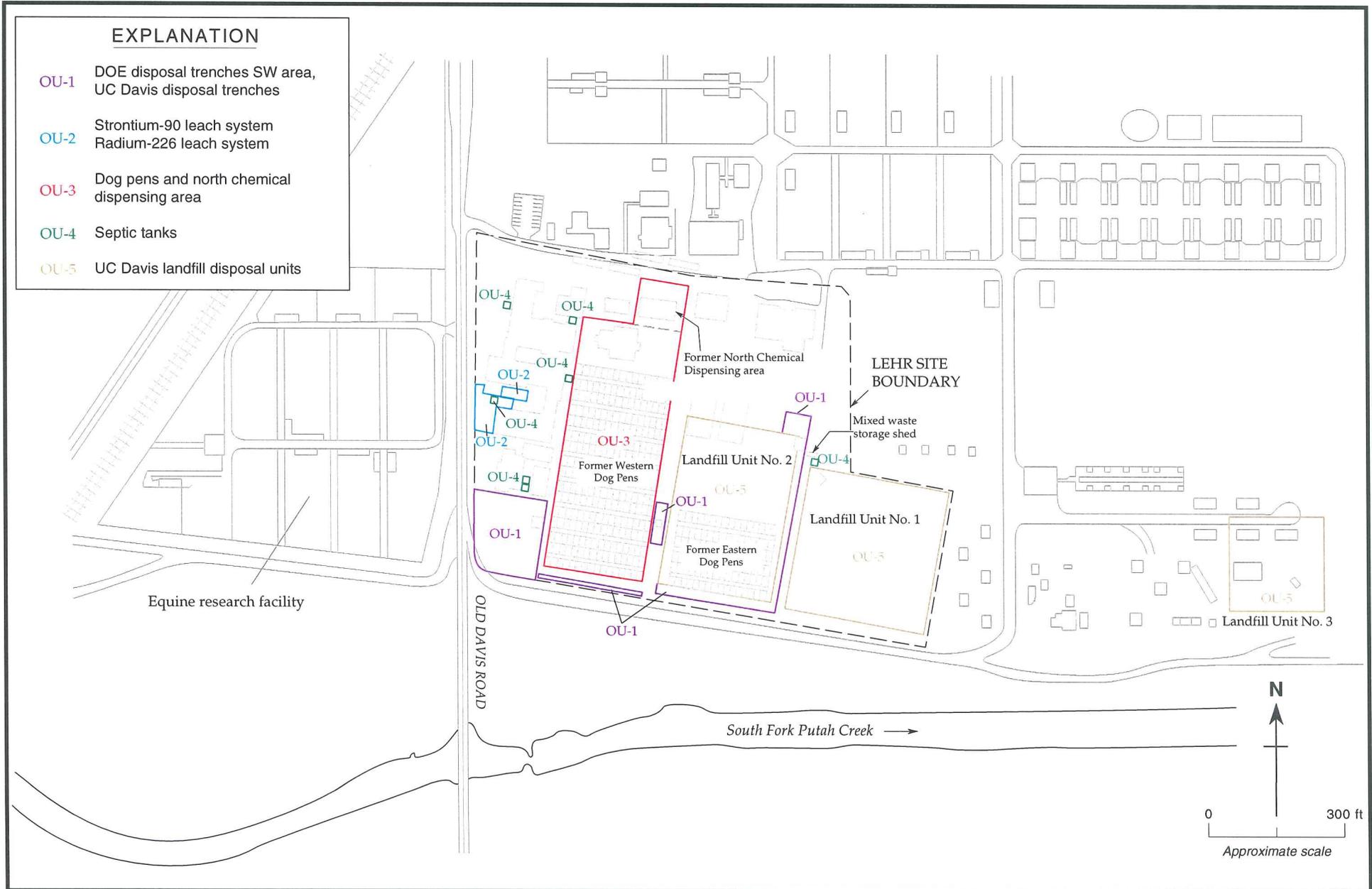


Figure 1-3. LEHR Operable Unit Locations.

Weiss Associates

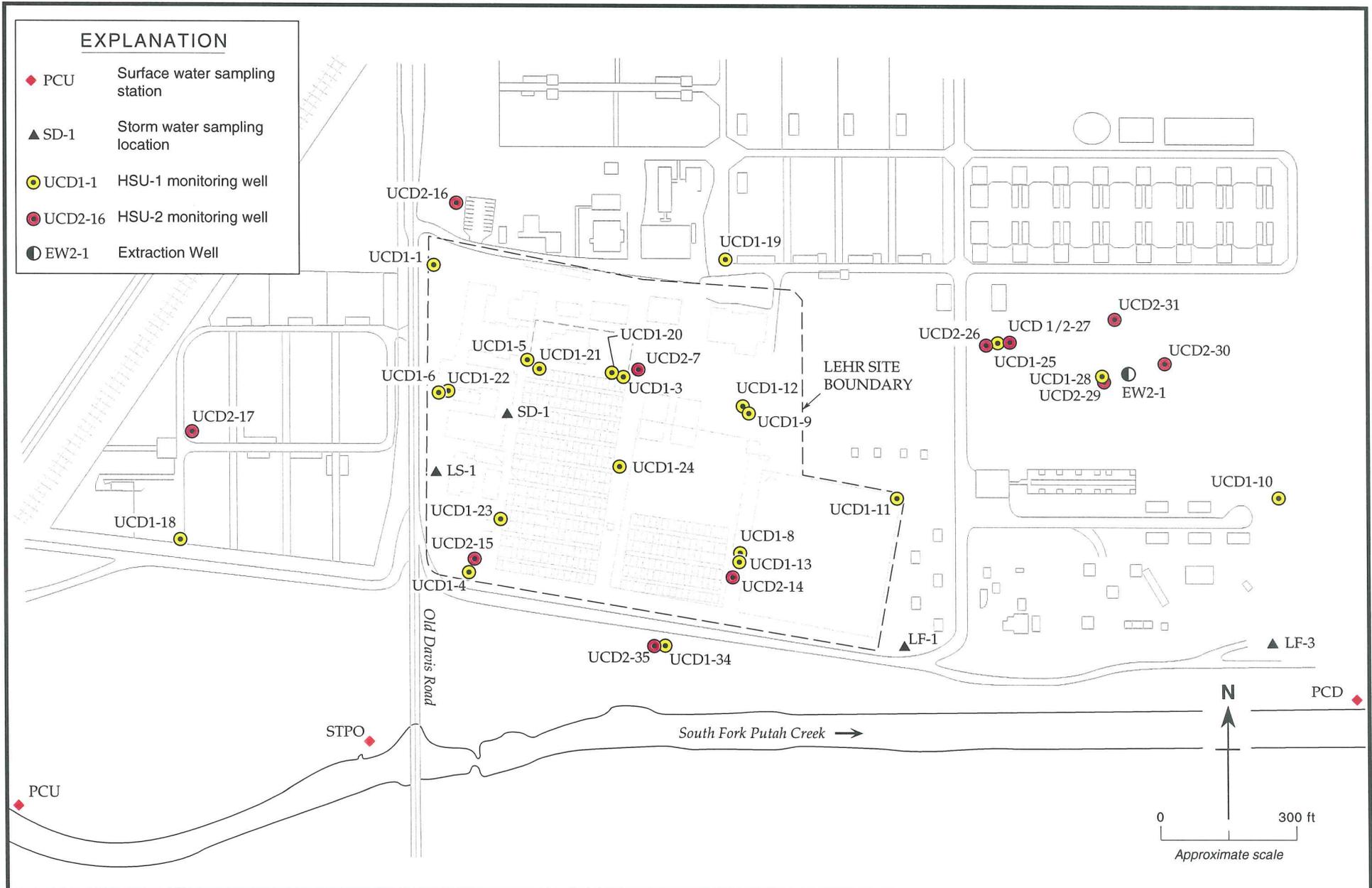


Figure 2-1. Monitoring Well, Storm Water and Surface Water Monitoring Locations.

Weiss Associates

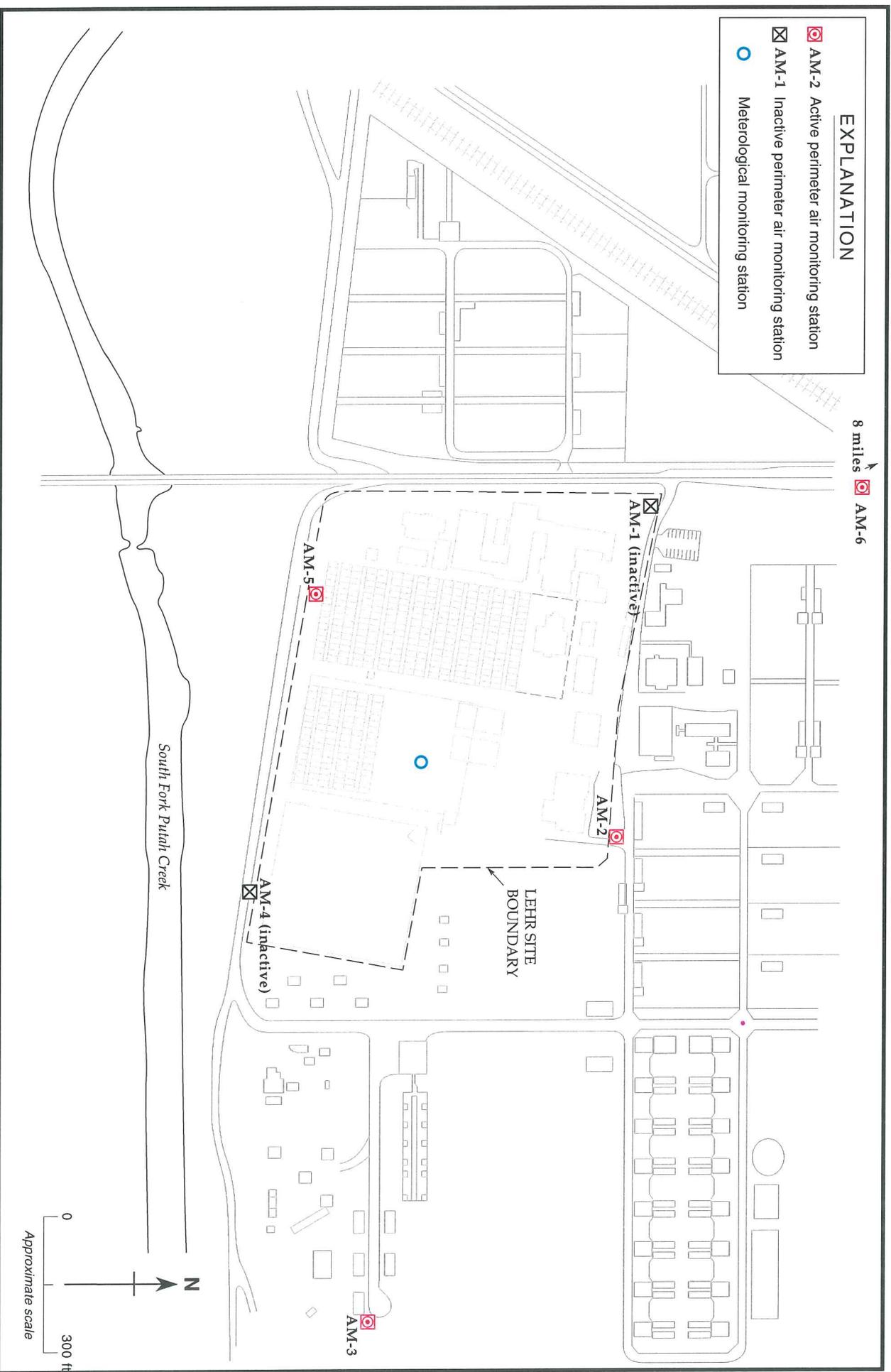


Figure 4-1. Onsite Air Sampling Stations.

la10-006.ai

Weiss Associates

09/16/97

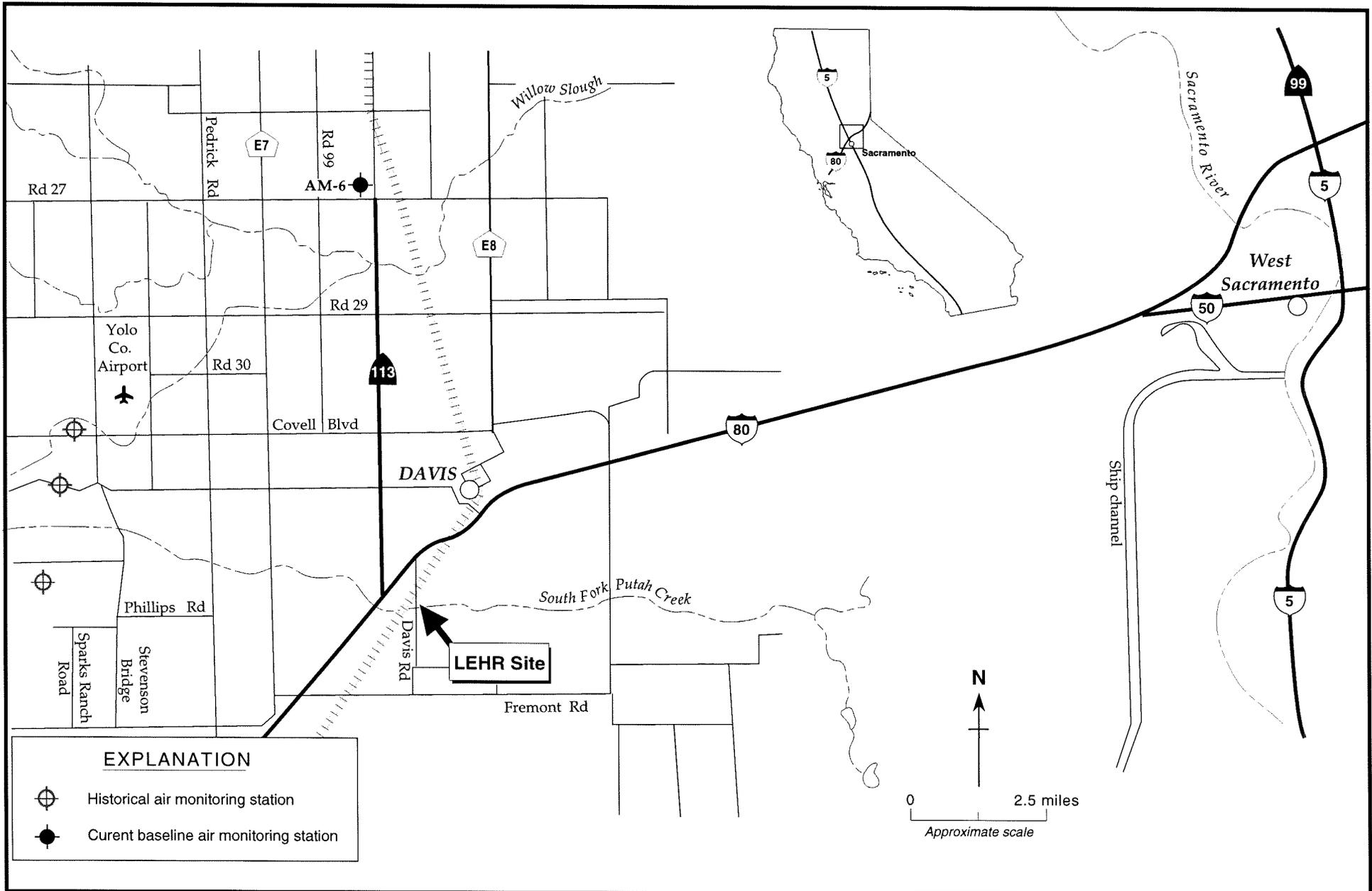


Figure 4-2. Offsite Air Monitoring Stations.

Weiss Associates

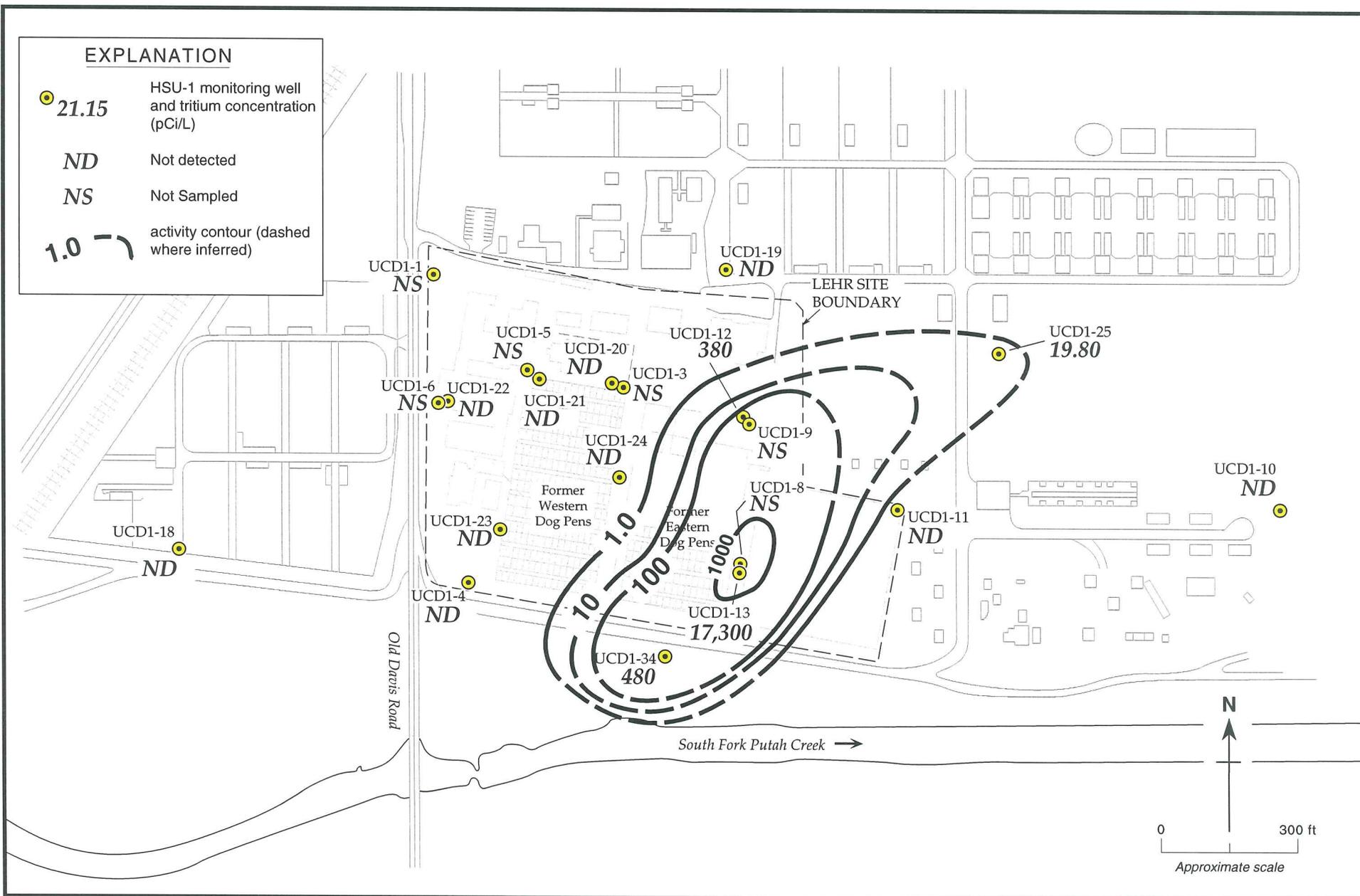


Figure 4-3. Concentration Contour Plot - Maximum 1996 Tritium Concentration in HSU-1.

Weiss Associates

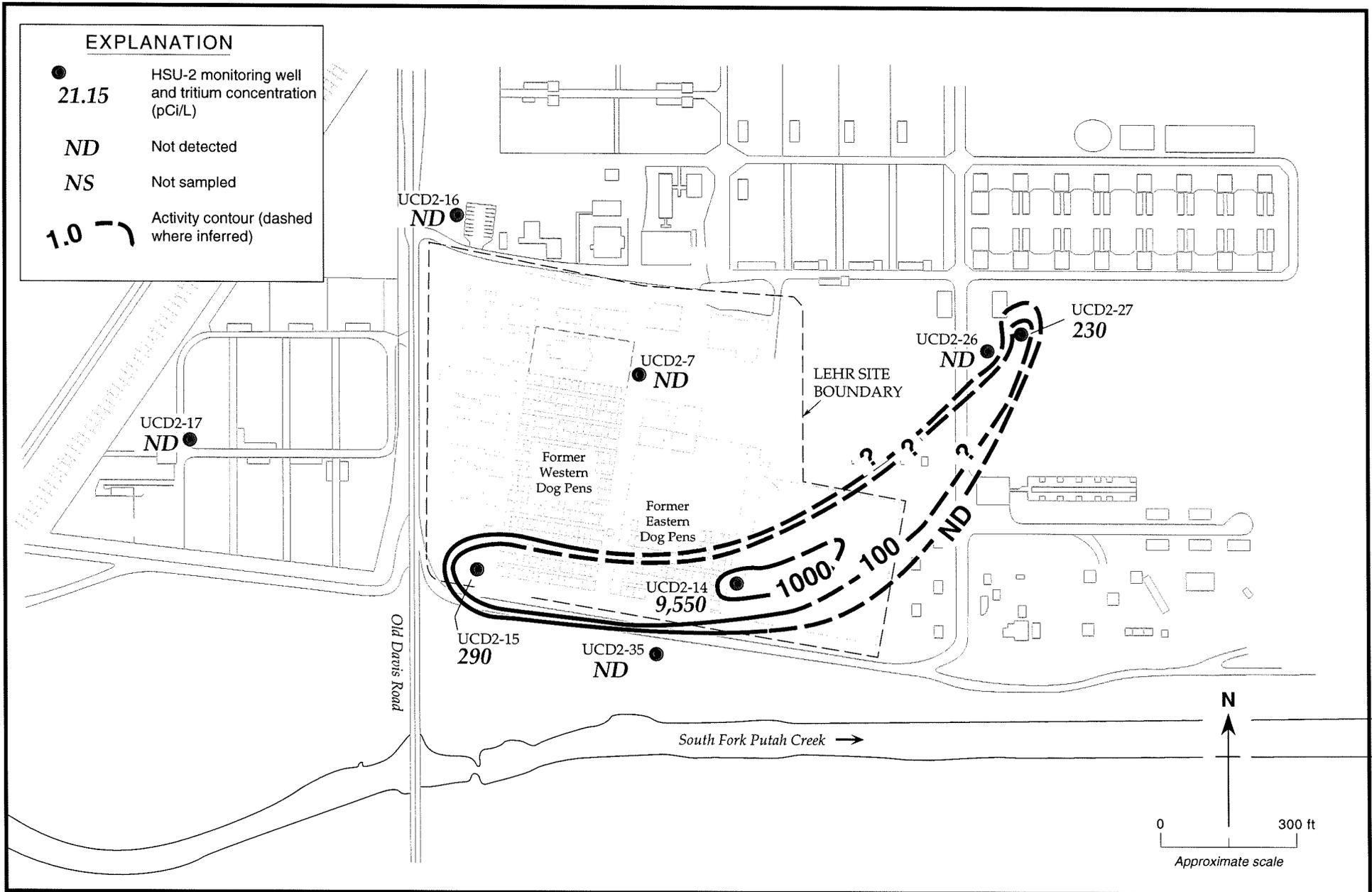


Figure 4-4. Maximum 1996 Tritium Concentration in HSU-2.

Weiss Associates

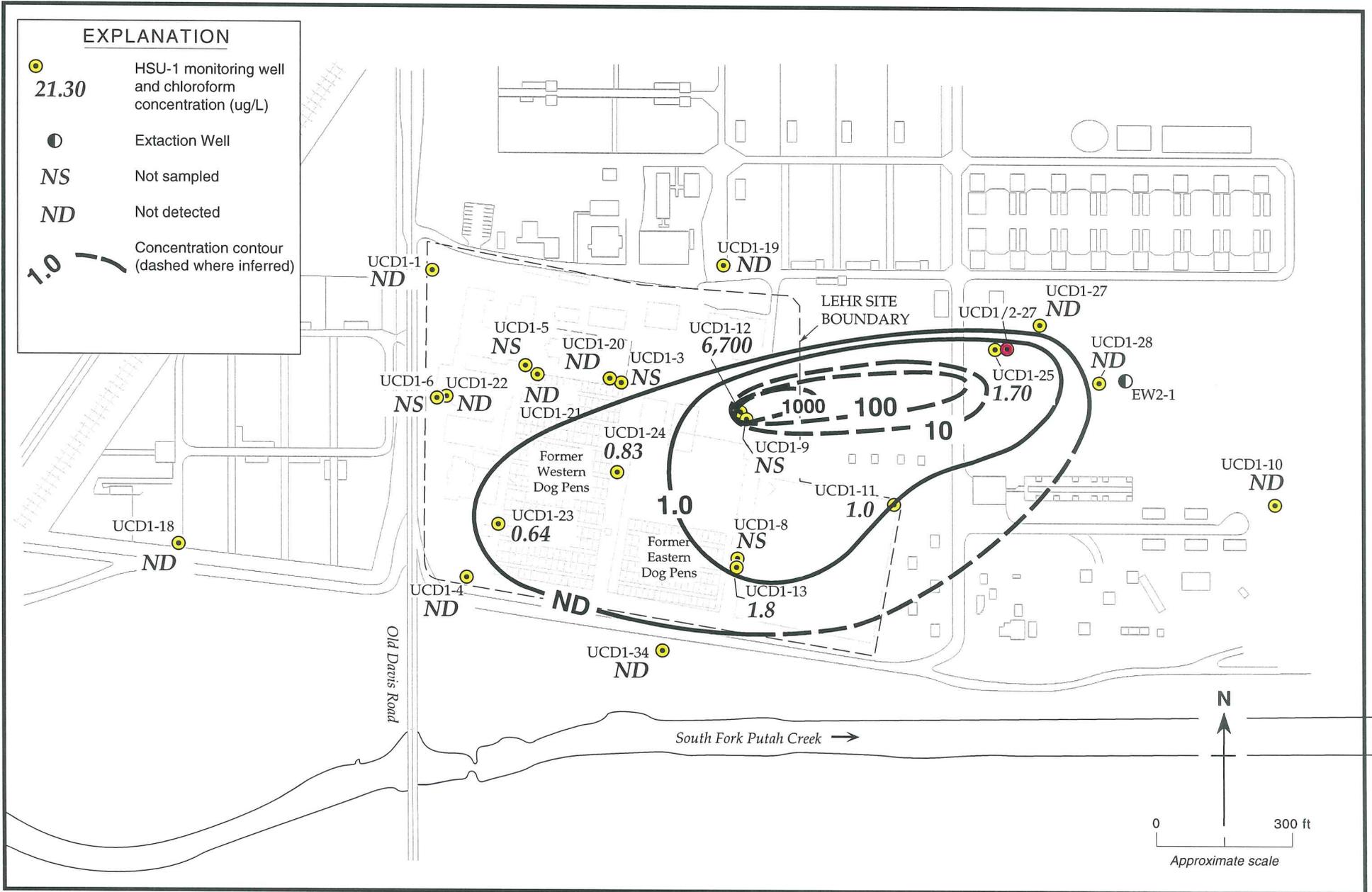


Figure 5-1. Maximum 1996 Chloroform Concentration in HSU-1.

Weiss Associates

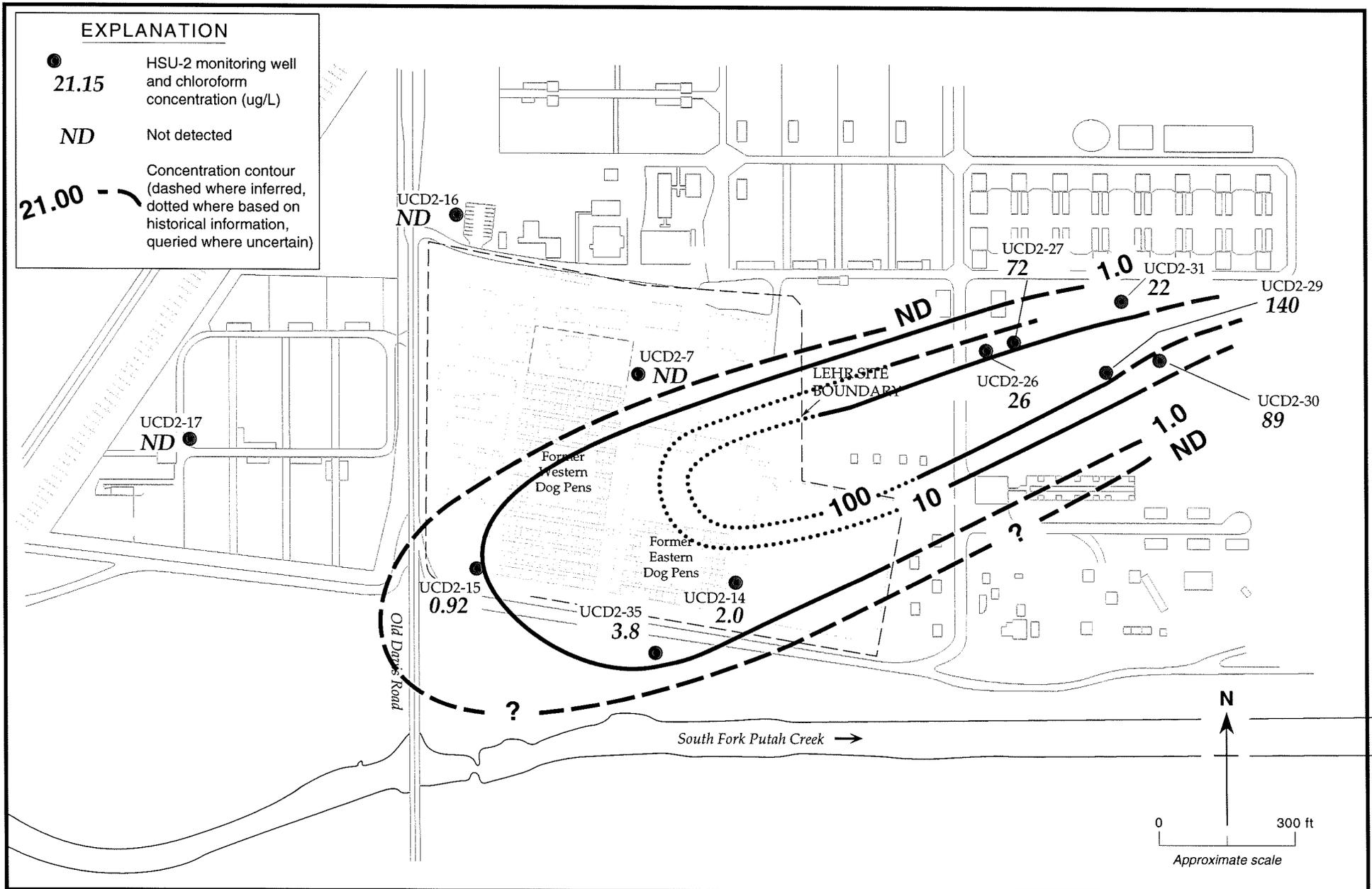


Figure 5-2. Maximum 1996 Chloroform Concentration in HSU-2.

Weiss Associates

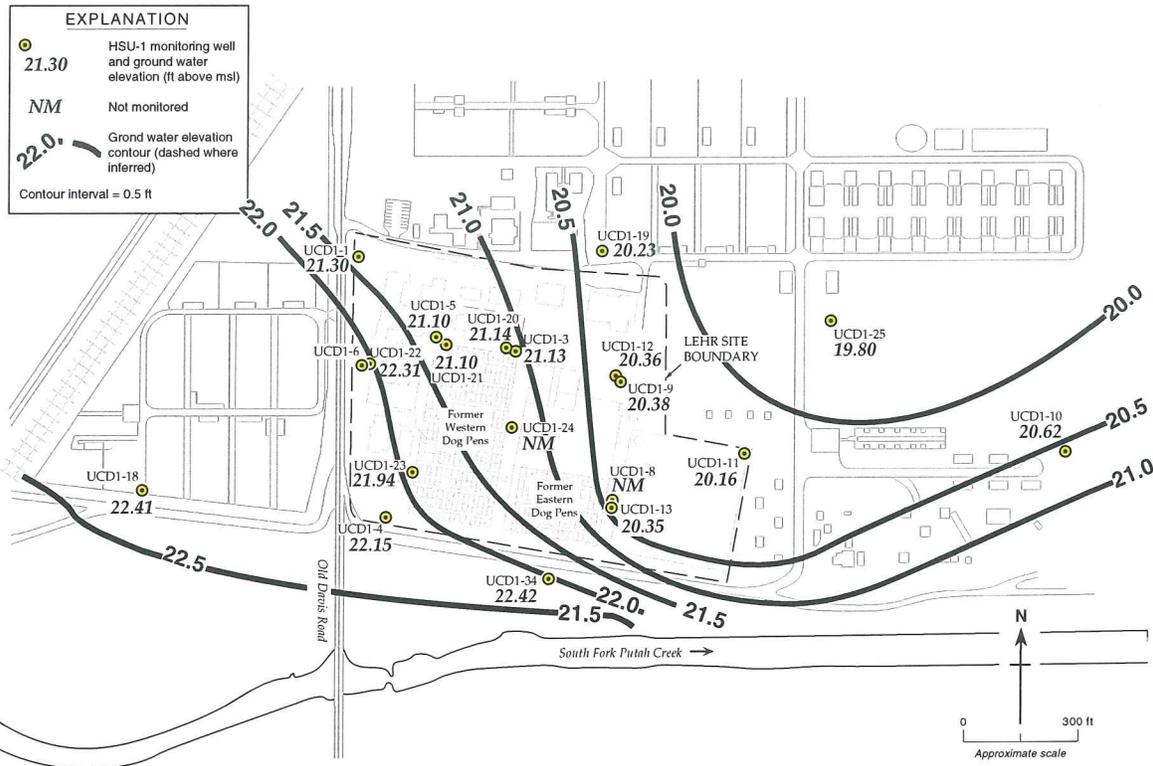


Figure 6-1. Ground Water Elevation Contours for HSU-1, February 12, 1996.
 (Data and contours from Pacific Northwest National Laboratory, May 1996).

LA1K-001.ai

03/13/97

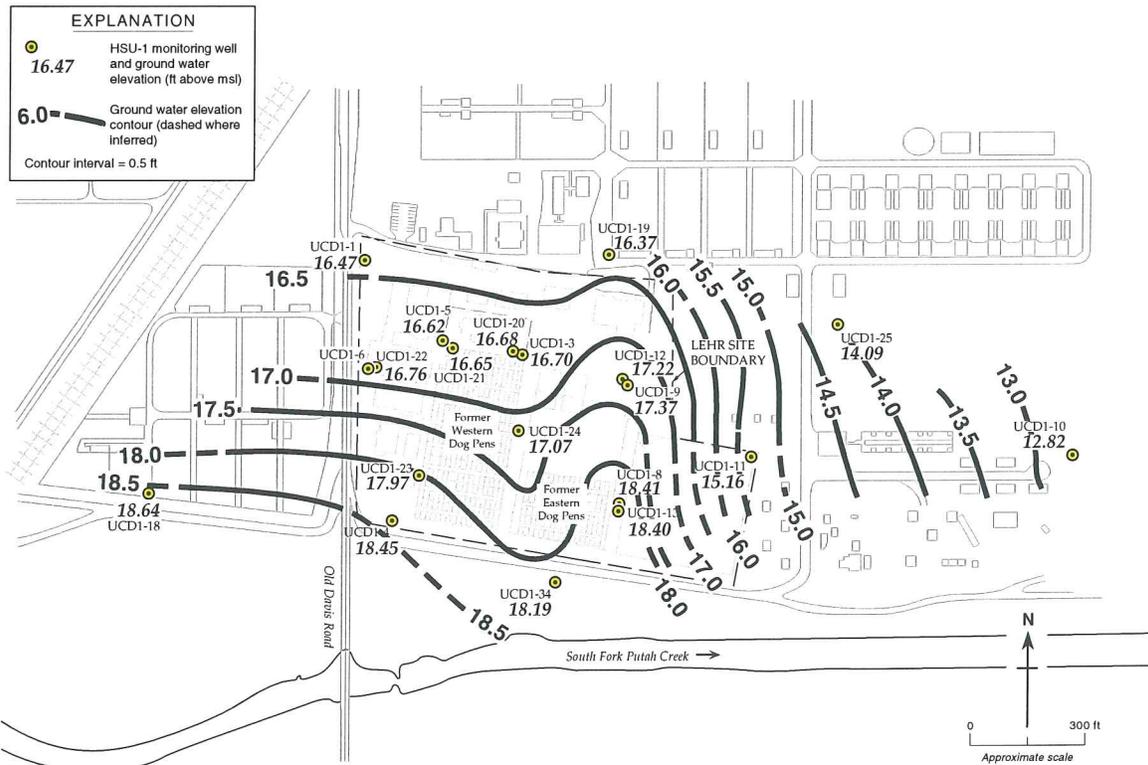


Figure 6-2. Ground Water Elevation Contours for HSU-1, May 13, 1996.
 (Data and contours from Pacific Northwest National Laboratory, August 1996).

LA1K-002.ai

03/12/97

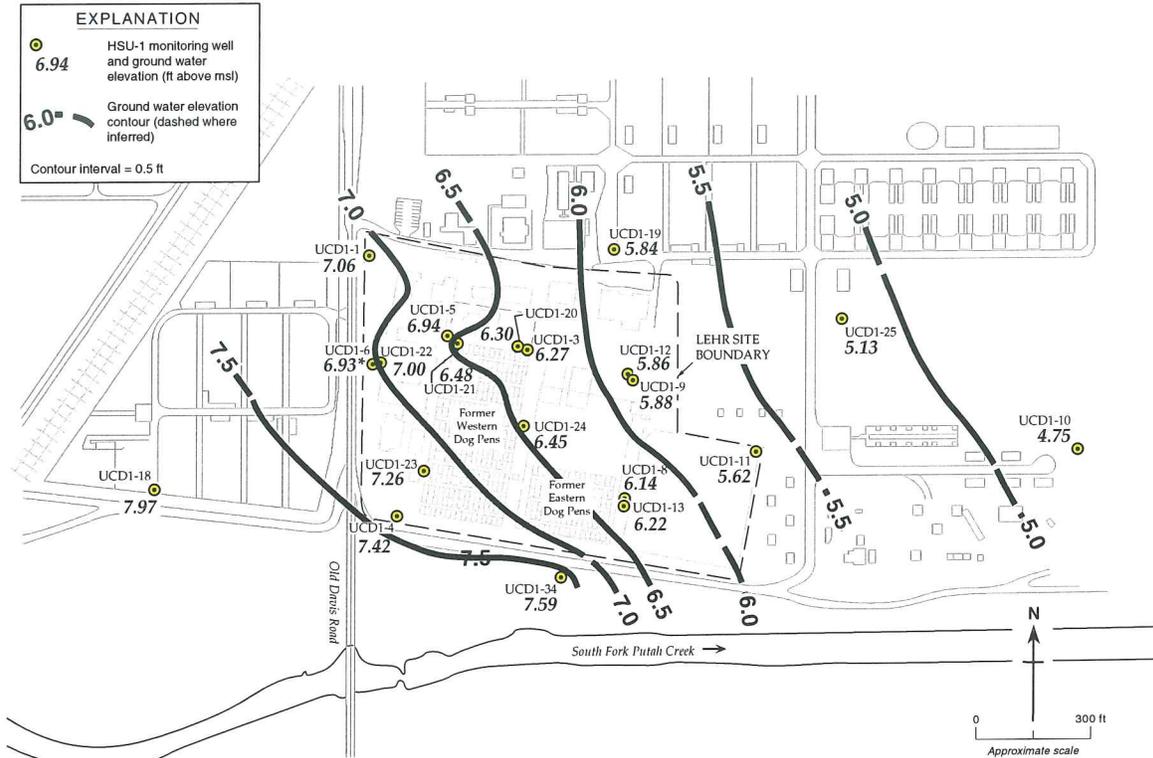


Figure 6-3. Ground Water Elevation Contours for HSU-1, August 27, 1996.

L801-036.ai

03/13/97

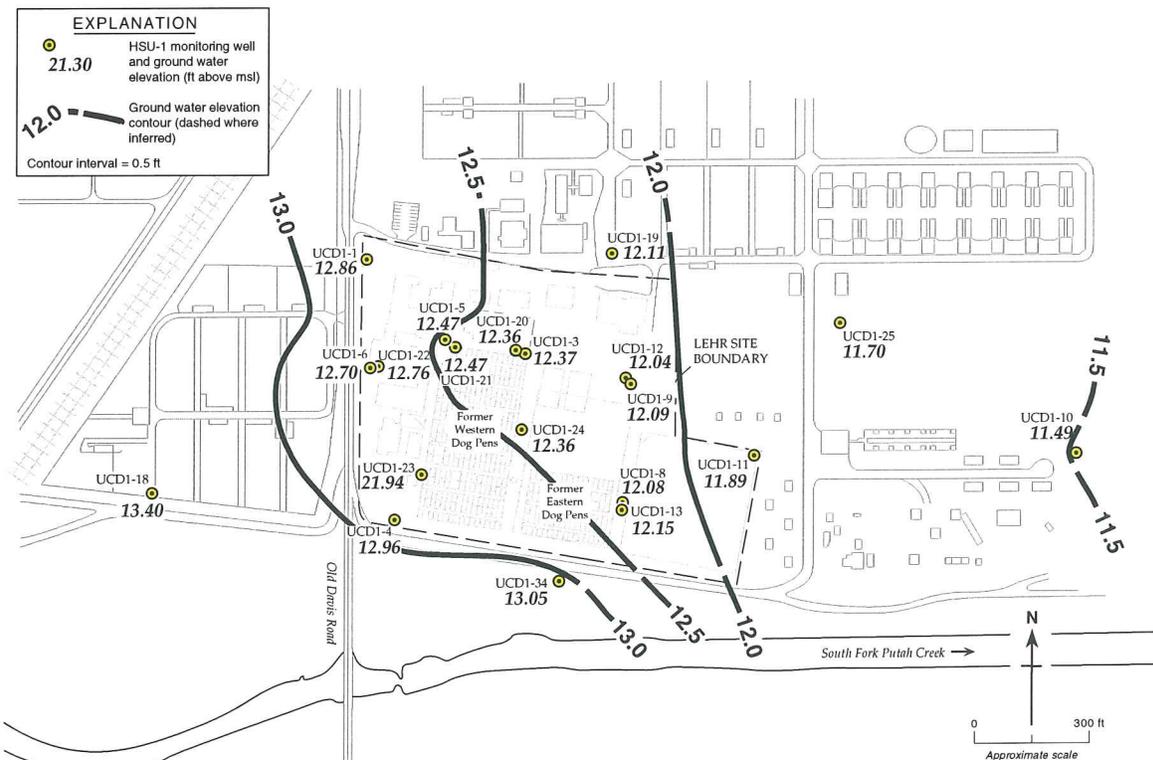


Figure 6-4. Groundwater Elevation Contours for HSU-1, November 12, 1996.

LA1K-005.ai

03/13/97

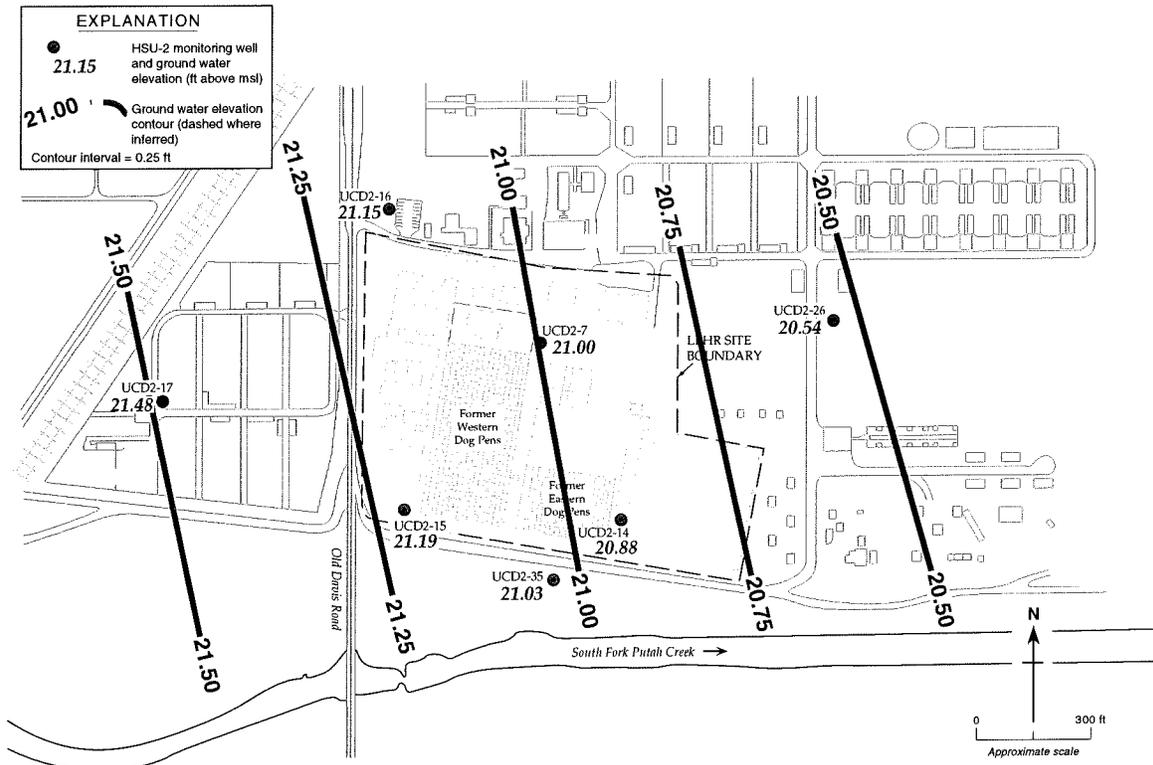


Figure 6-5. Ground Water Elevation Contours for HSU-2, February 12, 1996.
 (Data and contours from Pacific Northwest National Laboratory, May 1996).

LA1K-003.ai

03/13/97

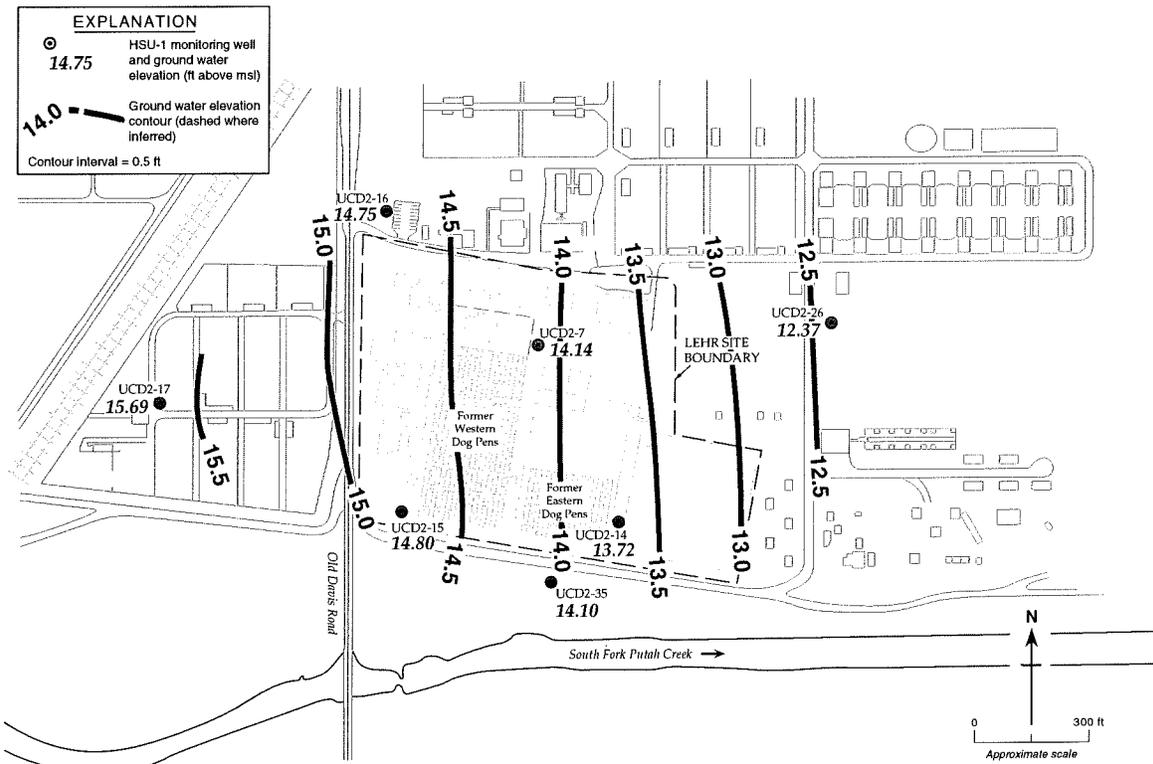


Figure 6-6. Ground Water Elevation Contours for HSU-2, May 13, 1996, LEHR Site.
 (Data and contours from Pacific Northwest National Laboratory, August 1996).

LA1K-004.ai

03/13/97

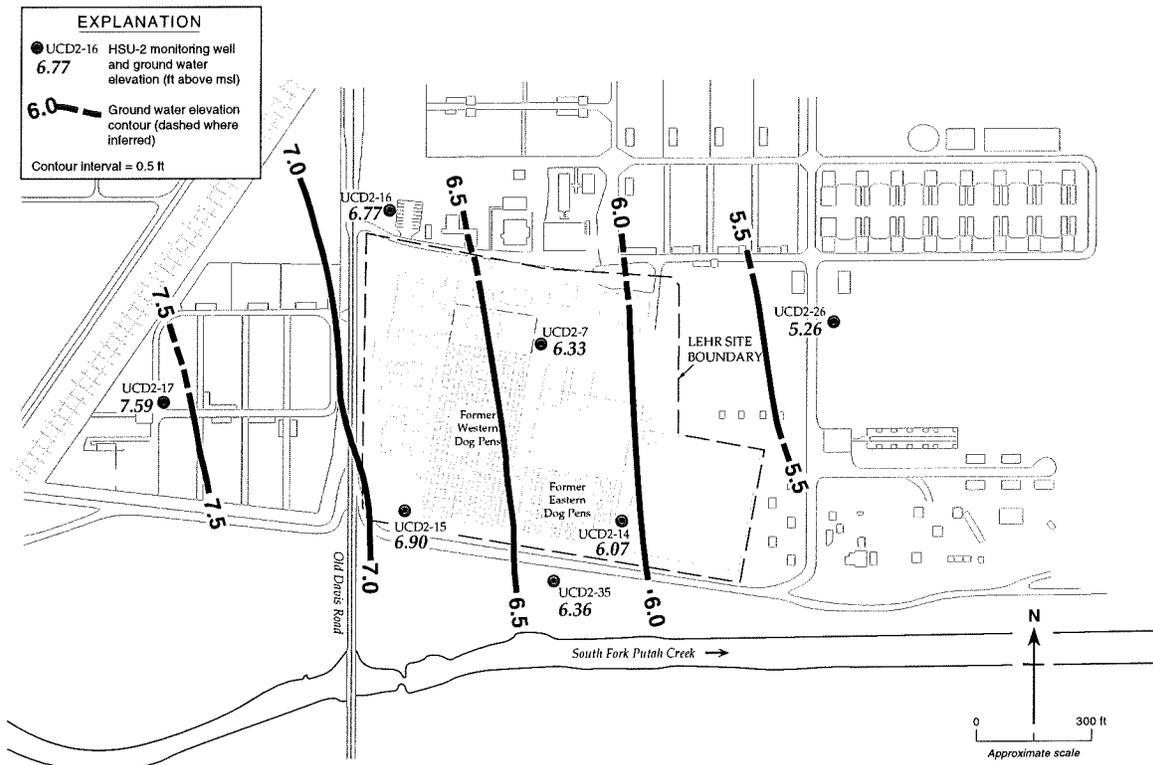


Figure 6-7. Ground Water Elevation Contours for HSU-2, August 27, 1996.

L801-063.ai

03/12/97

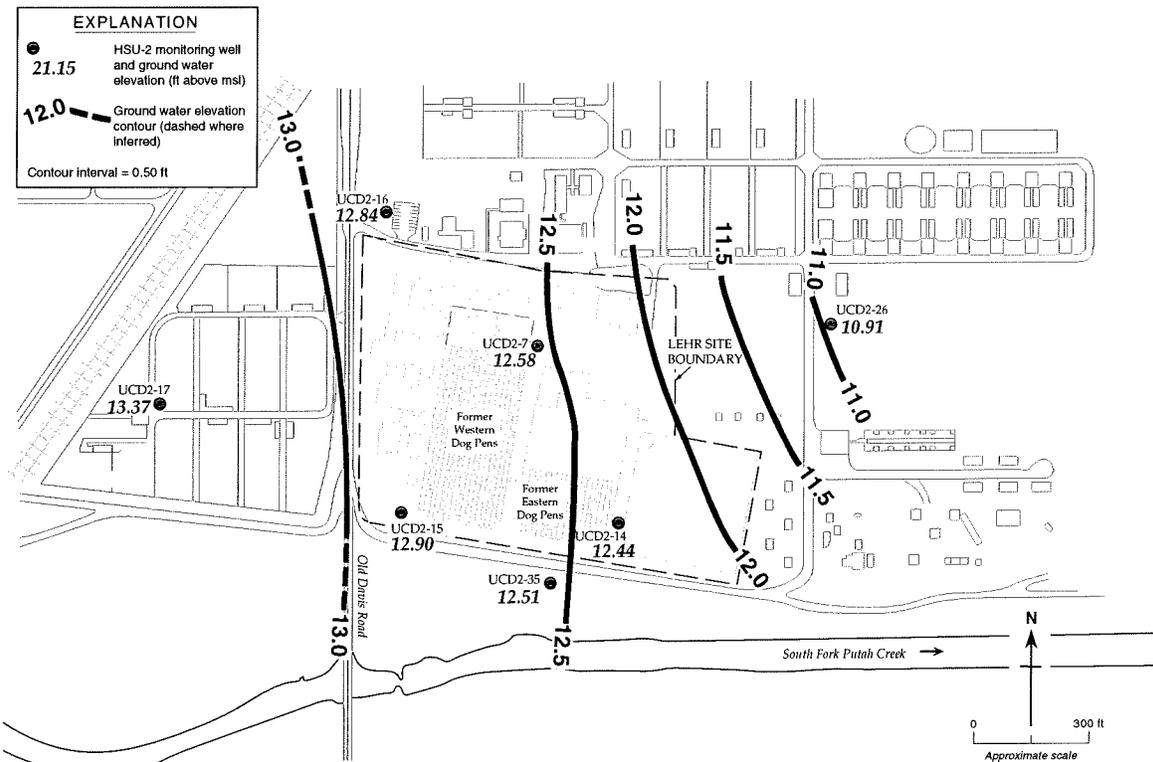


Figure 6-8. Groundwater Elevation Contours for HSU-2, November 12, 1996.

LA1K-006.ai

03/13/97

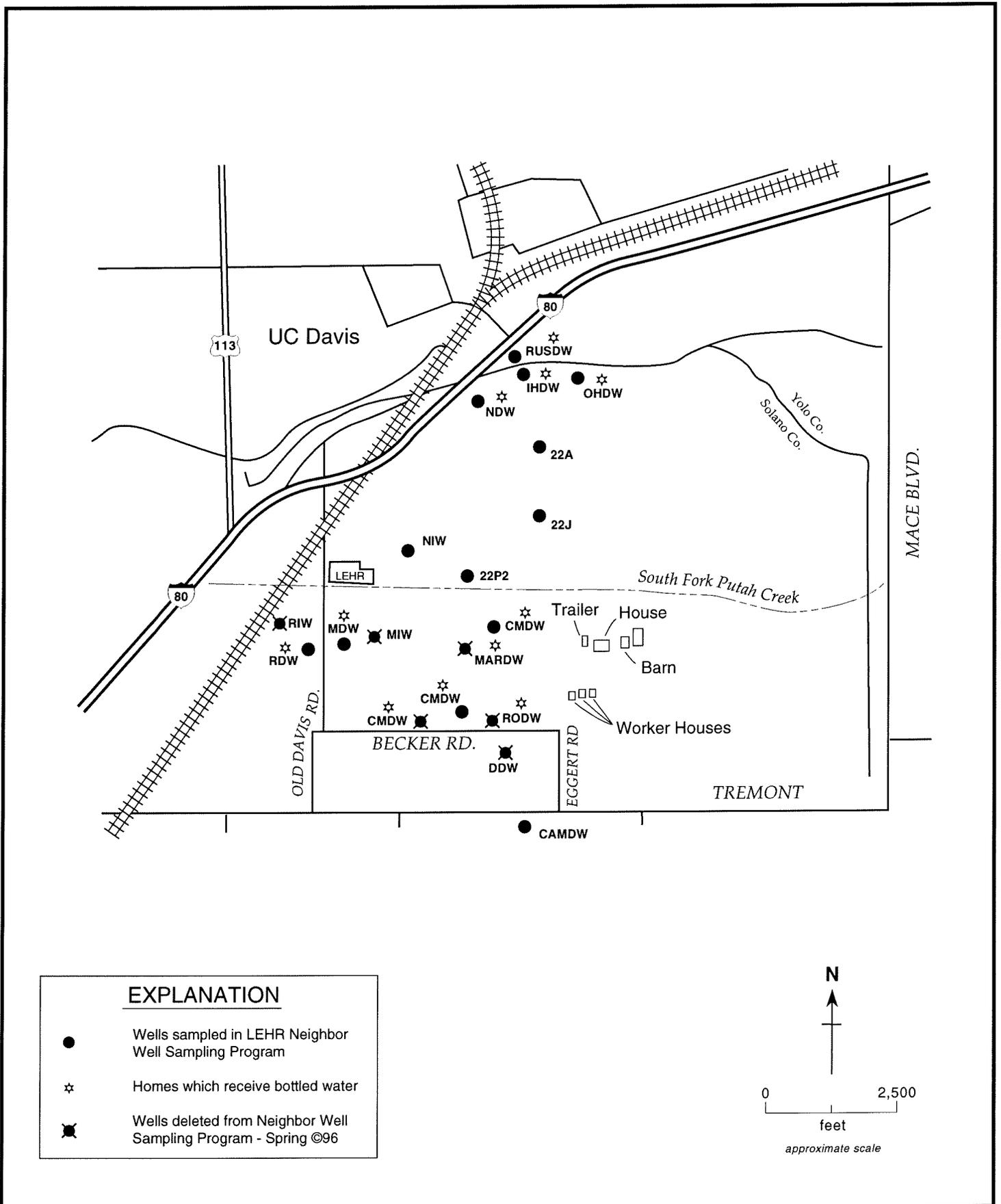
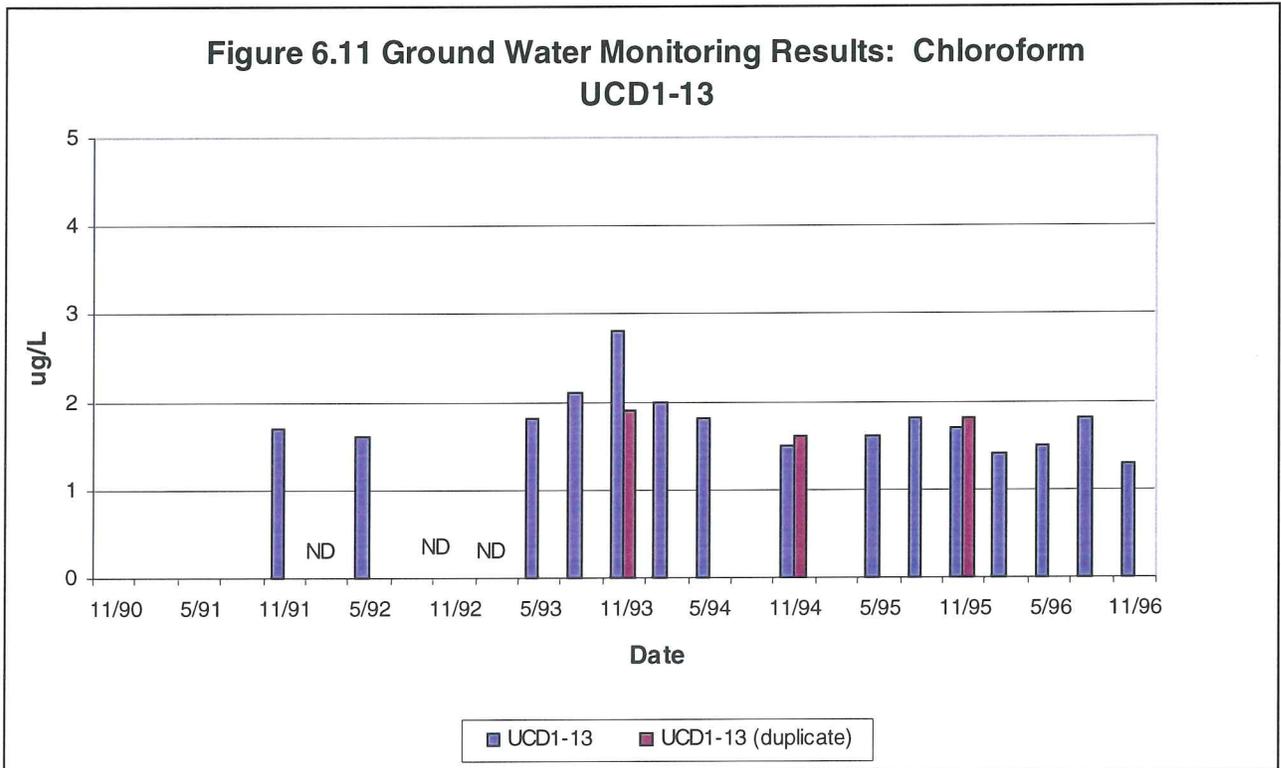
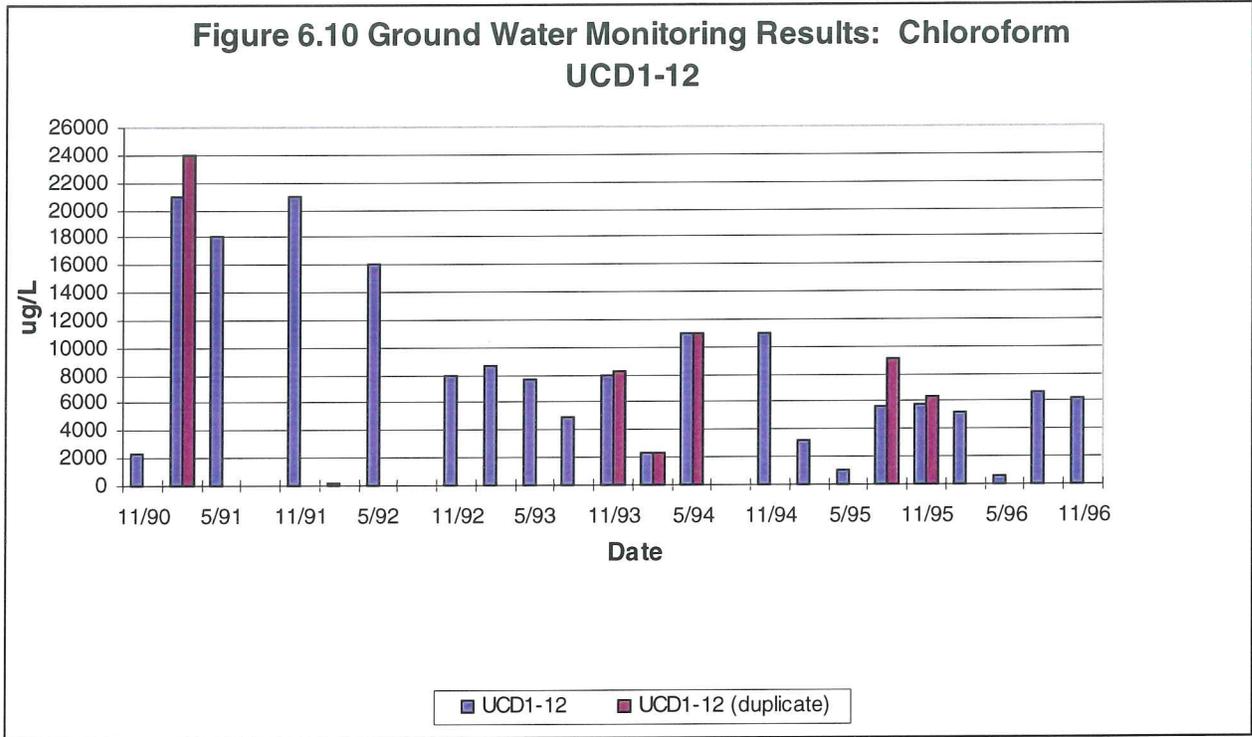
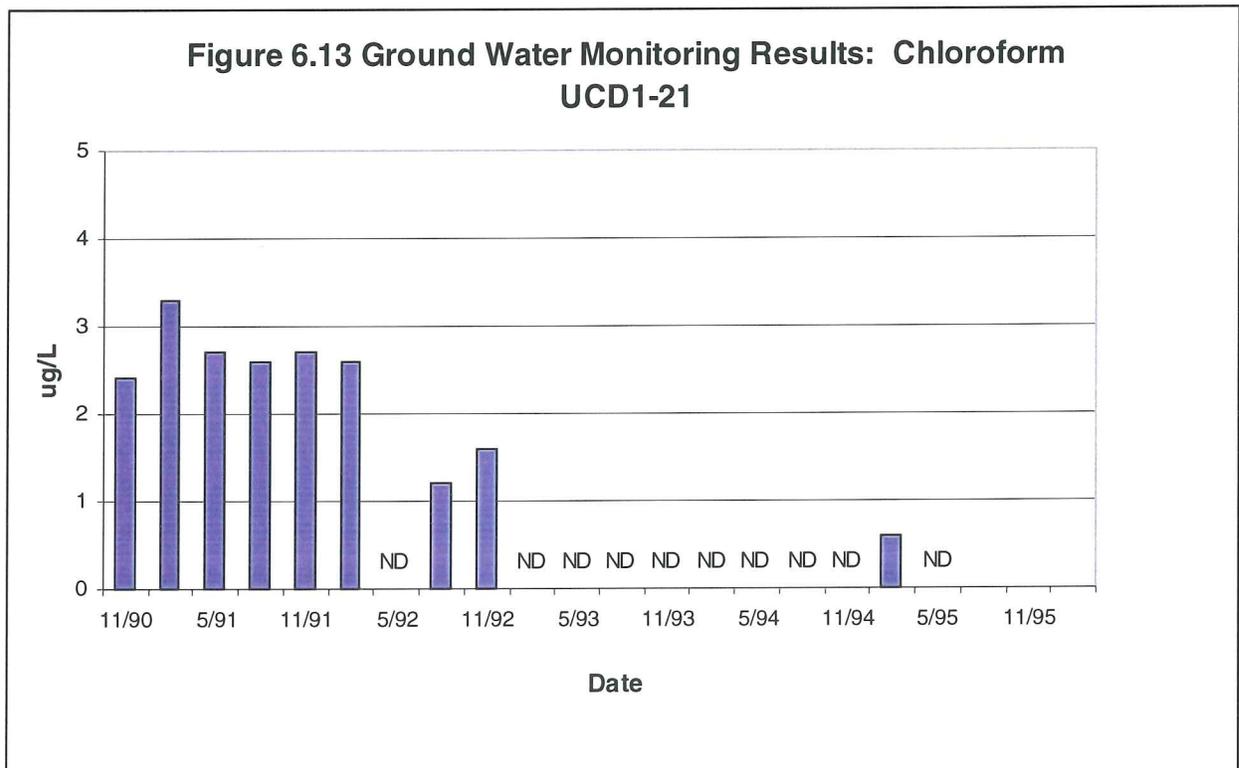
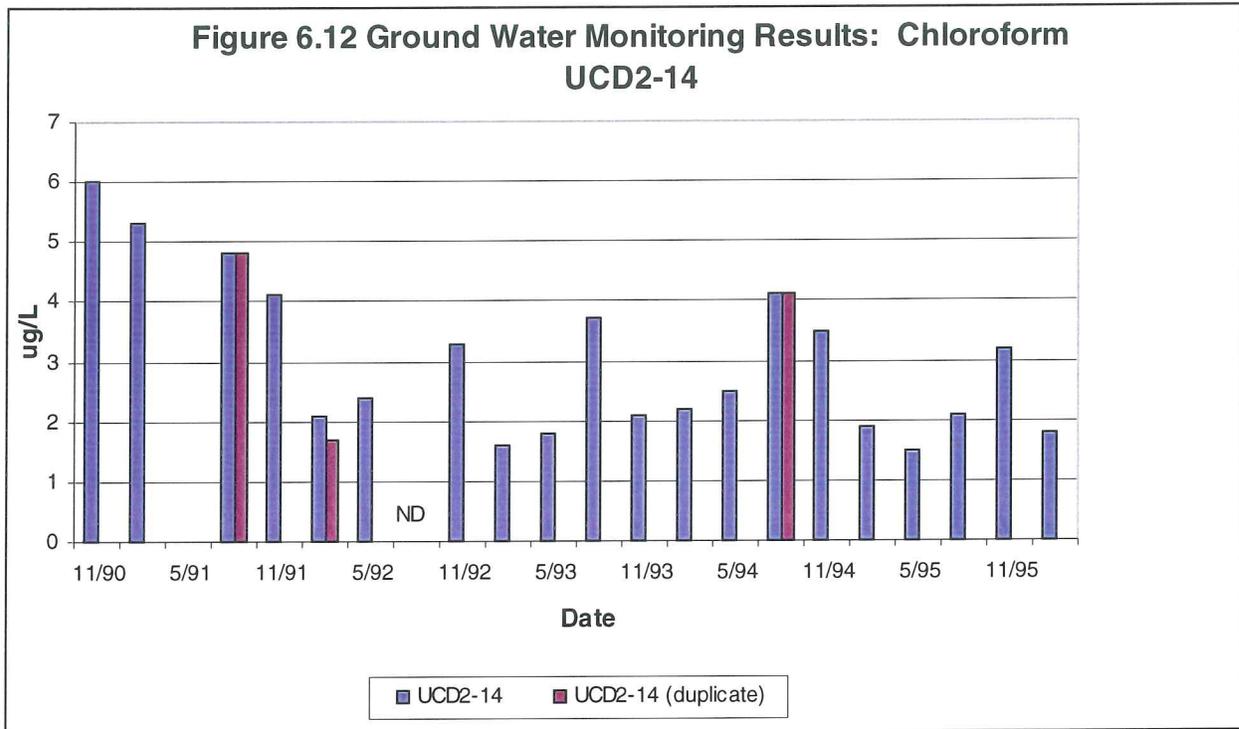
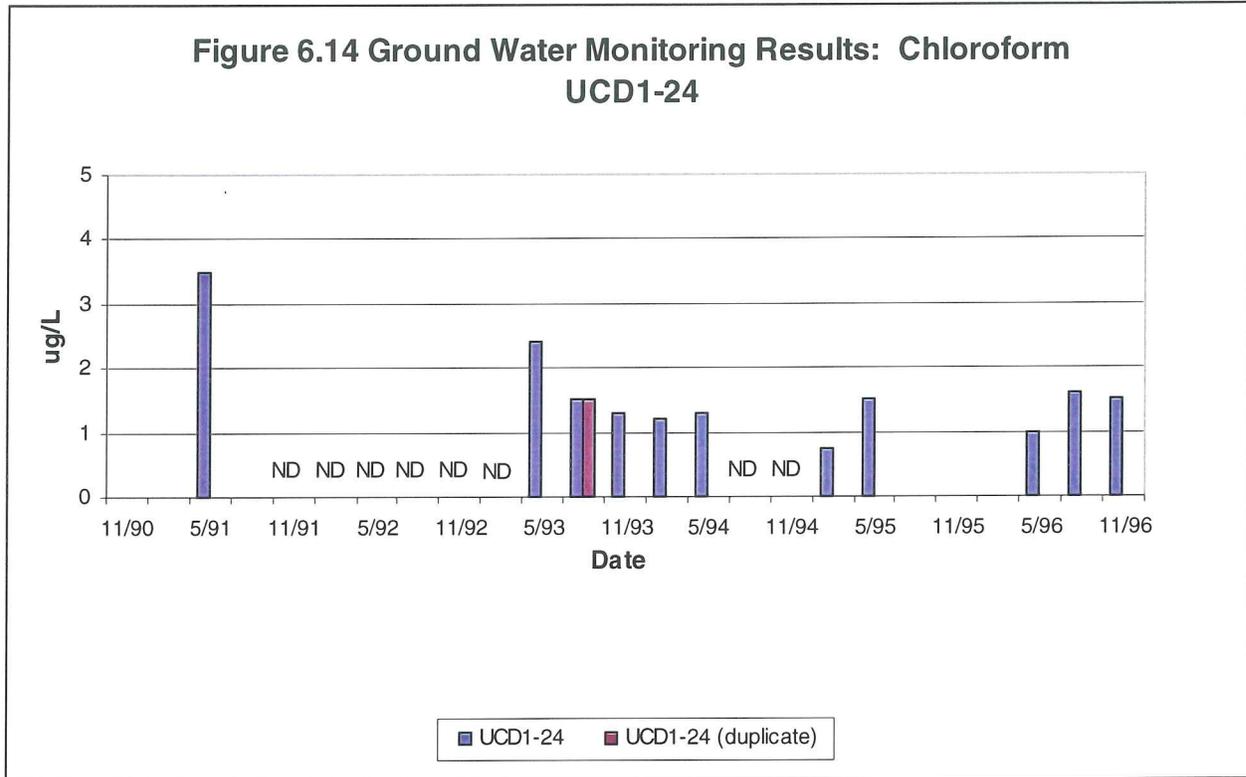


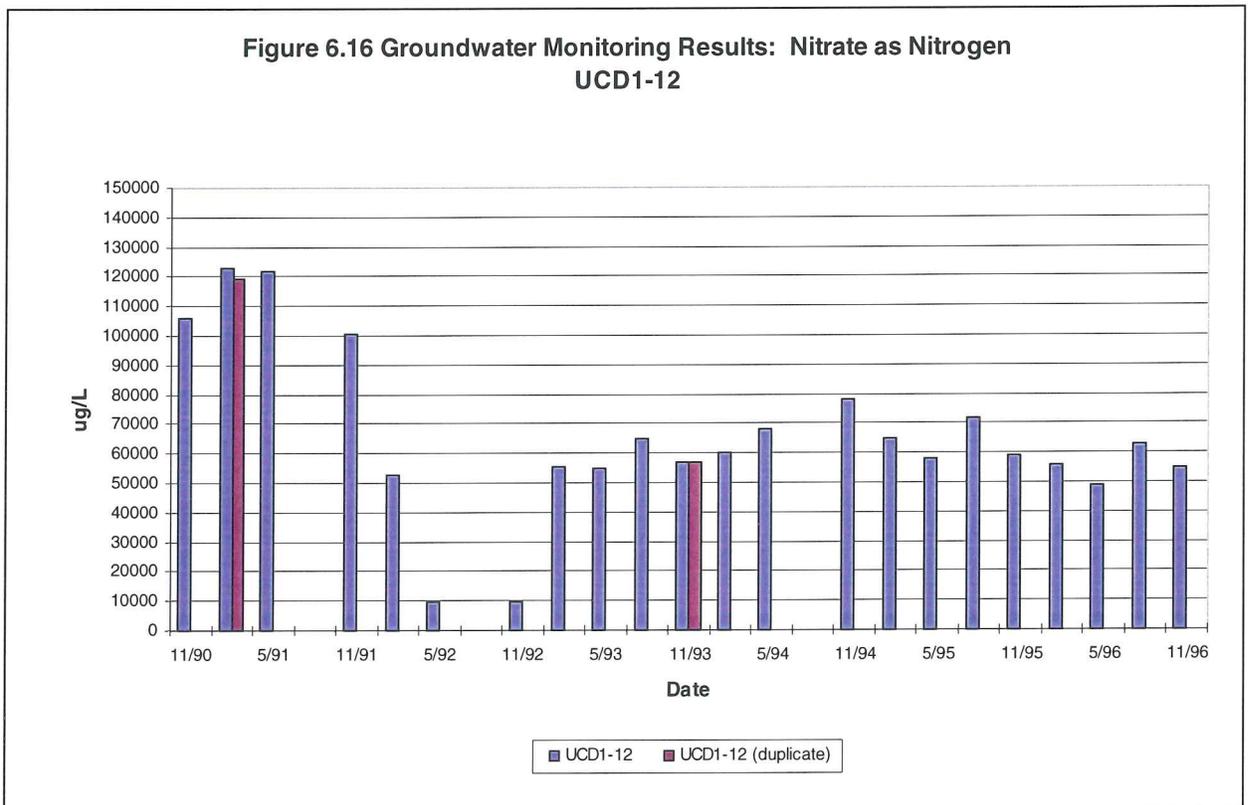
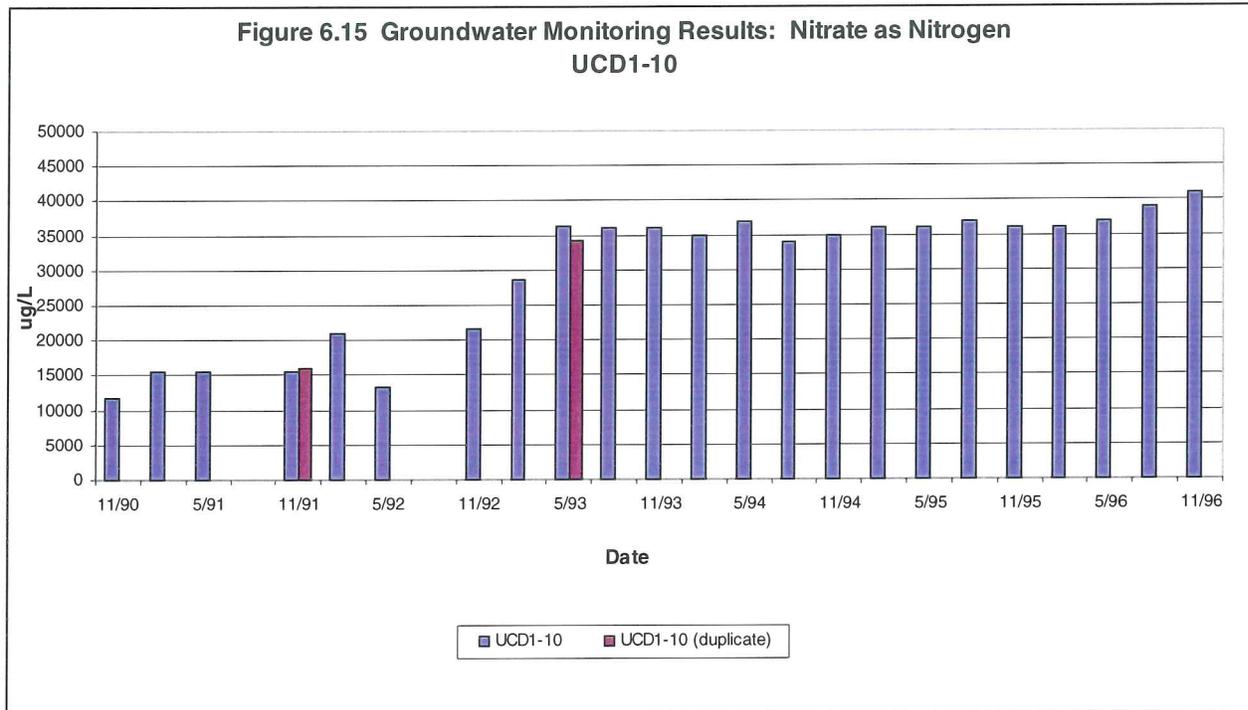
Figure 6-9. Neighbor Well Sampling Program Locations near the LEHR Site.

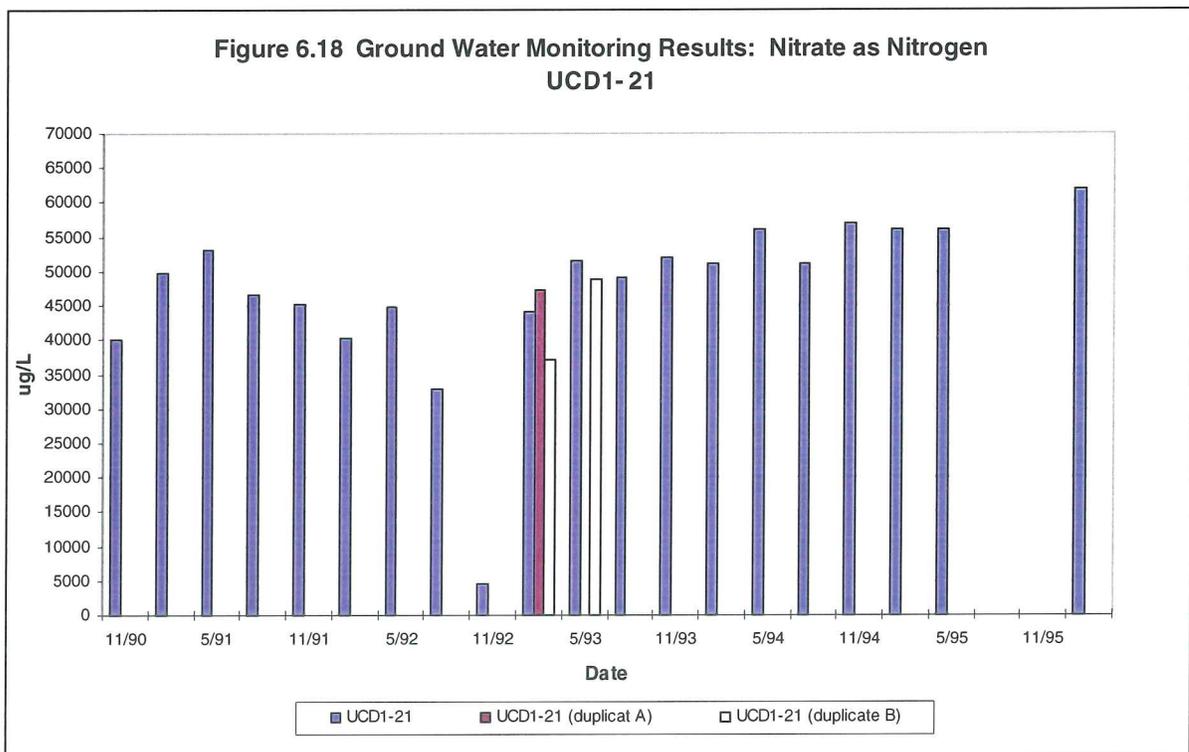
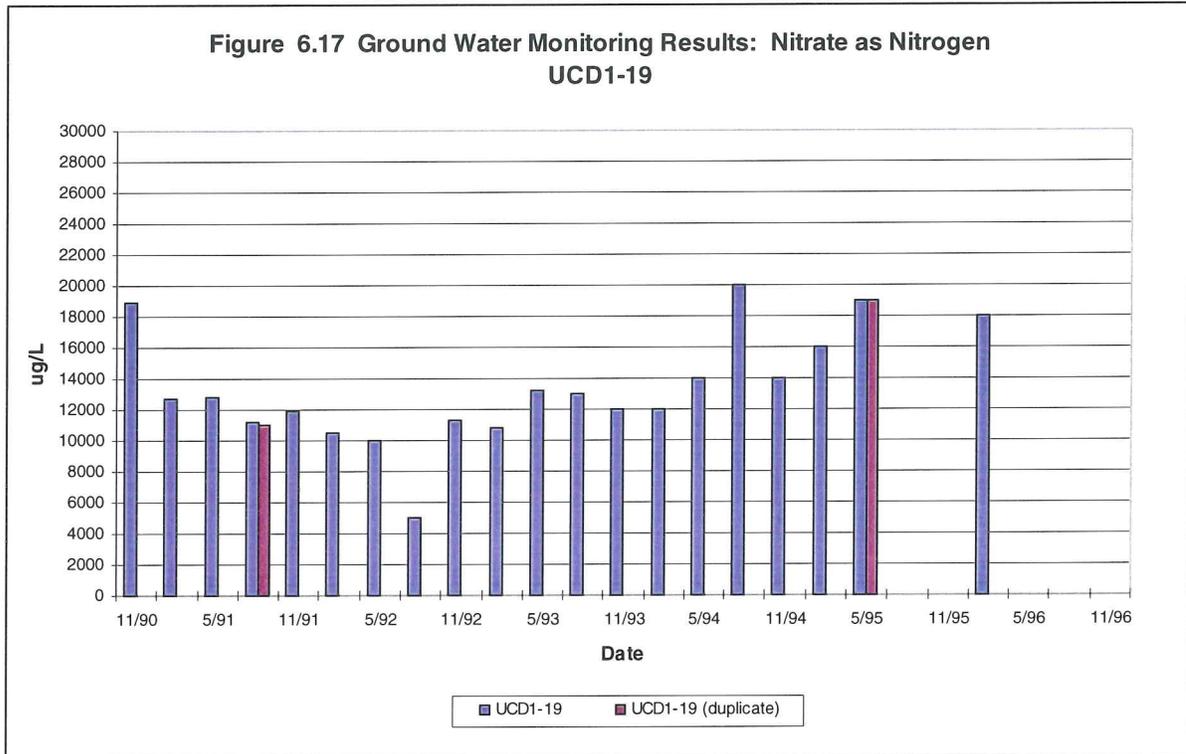
Weiss Associates

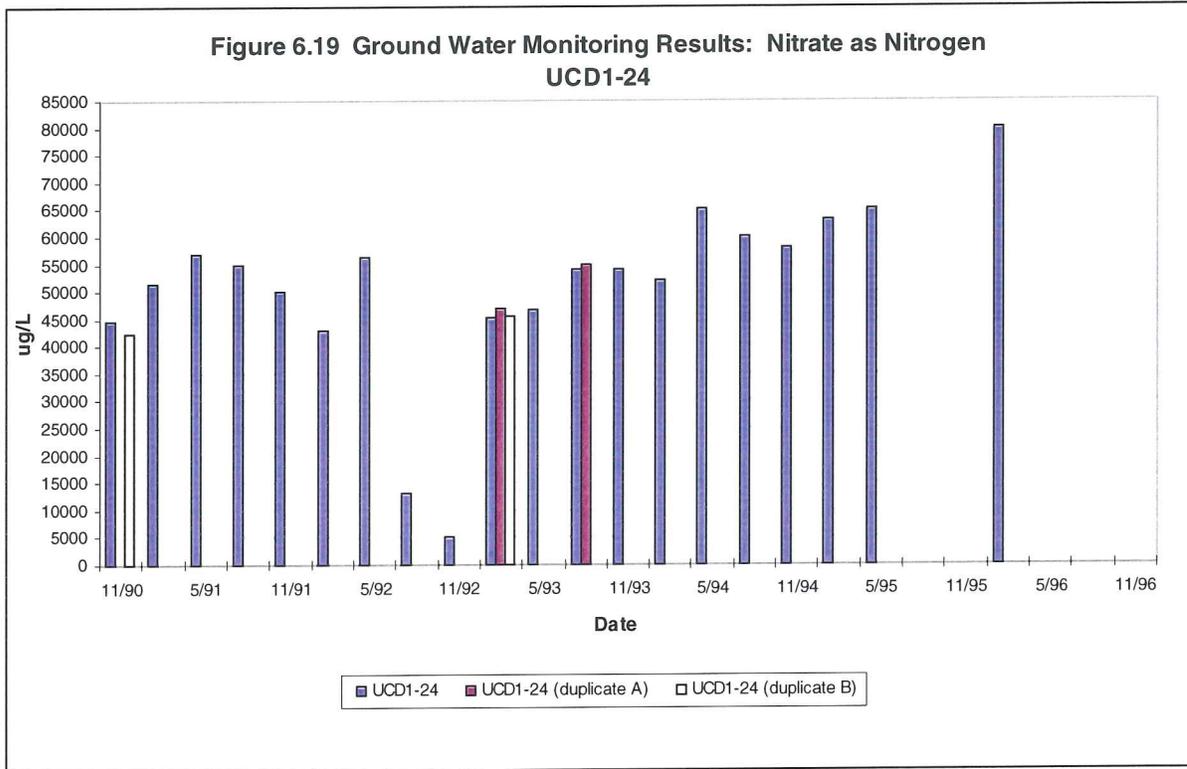


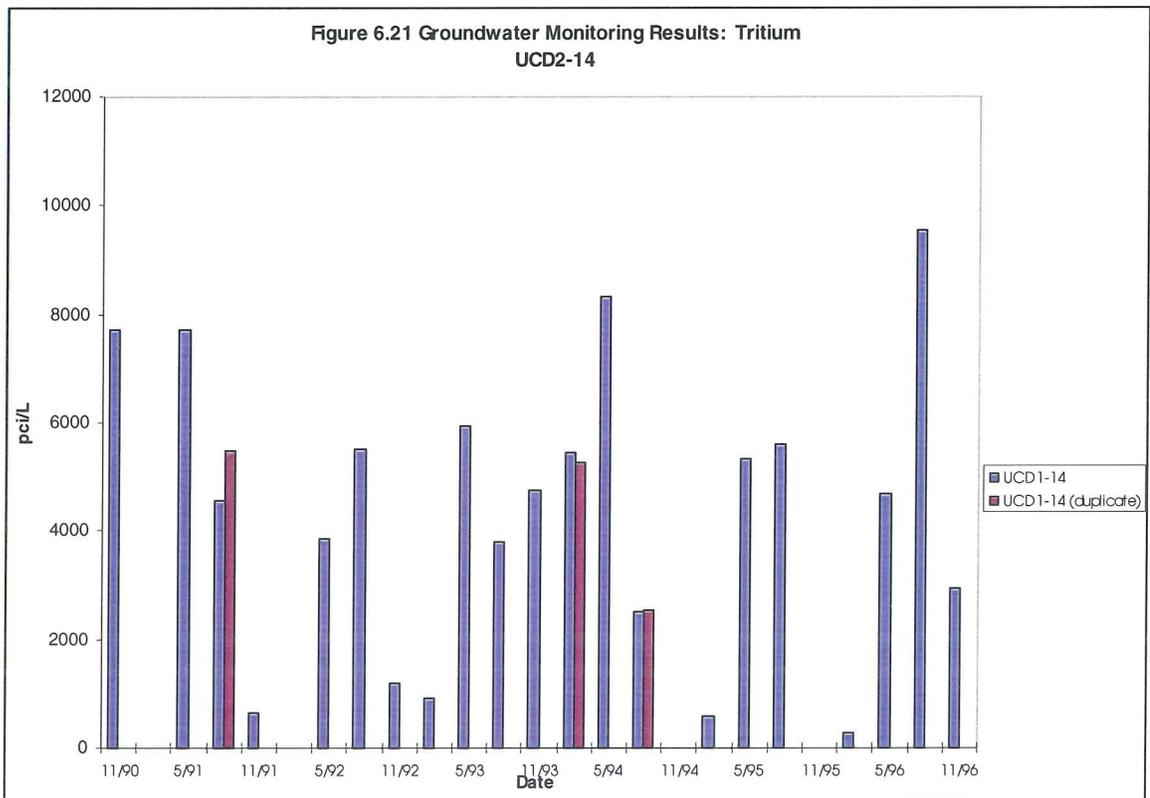
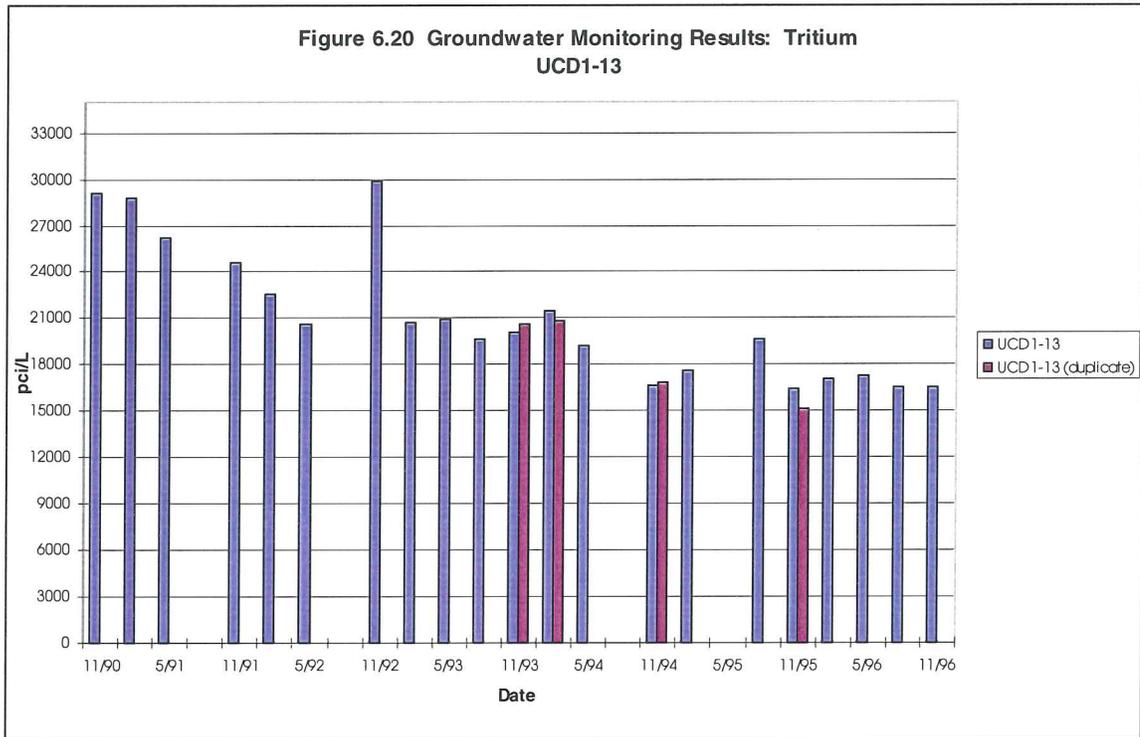












APPENDIX A

RADIOLOGICAL RESULTS FOR WATER - 1996

Table A-1
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Radiological Results

Location			UCD1- 4			UCD1-10			UCD1-11			UCD1-12			
Units	MCL		Value	Uncertainty	MDA	Value	Uncertainty	MDA	Value	Uncertainty	MDA	Value	Uncertainty	MDA	
Bismuth-214*															
Winter	pCi/L	-	---	---	---	---	---	---	17.4	6.4	7.7	---	---	---	
Summer	pCi/L	-	---	---	---	---	---	---	---	---	---	43	18	19	
Fall	pCi/L	-	18.4	Jz	8.4	11	---	---	---	---	---	24	Jz	17	22
Carbon-14															
Winter	pCi/L	-	---	---	---	---	---	---	---	---	---	169	95	110	
Spring	pCi/L	-	---	---	---	---	---	---	---	---	---	240	100	110	
Summer	pCi/L	-	---	---	---	---	---	---	---	---	---	235	71	89	
Fall	pCi/L	-	---	---	---	---	---	---	---	---	---	215	68	86	
Lead-214*															
Winter	pCi/L	-	---	---	---	21	12	16	10.4	5.5	7.9	---	---	---	
Summer	pCi/L	-	---	---	---	---	---	---	---	---	---	25	14	20	
Fall	pCi/L	-	16.6		6.8	9.3	---	---	---	---	---	---	---	---	
Radium-226															
Winter	pCi/L	5	0.7	0.26	0.23	---	---	---	---	---	---	---	---	---	
Spring	pCi/L	5	0.2	0.13	0.17	---	---	---	---	---	---	---	---	---	
Summer	pCi/L	5	---	---	---	---	---	---	---	---	---	0.18	0.11	0.13	
Strontium-89,90															
Fall	pCi/L	8	0.7	Jx	0.18	0.25	---	---	---	---	---	0.99	0.21	0.27	
Tritium															
Fall	pCi/L	20,000	---	---	---	---	---	---	---	---	---	380	Jm	160	210

See tables in Appendix C for explanation of data qualifiers.

All units = pCi/L

MCL = California Maximum Contaminant Level (Primary), Title 22, Division 4, Chapter 15.

MDA = Minimal Detectable Activity.

* = Gamma scan.

- = No MCL

--- = Parameter not analyzed or no value less than the MDA.

Table A-1
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Radiological Results

Location			UCD1-13			UCD1-20			UCD1-21			UCD1-22			
Units	MCL		Value	Uncertainty	MDA	Value	Uncertainty	MDA	Value	Uncertainty	MDA	Value	Uncertainty	MDA	
Americium-241															
Winter	pCi/L	-	---	---	---	---	---	---	0.036	0.041	0.033	---	---	---	
Summer	pCi/L	-	---	---	---	---	---	---	---	---	---	0.036	0.031	0.028	
Bismuth-214*															
Fall	pCi/L	-	16.3	Jz]	7.9	10	---	---	---	---	---	---	---	---	
Carbon-14															
Winter	pCi/L	-	1,342		75	21	---	---	---	---	---	---	---	---	
Spring	pCi/L	-	1,870		190	110	---	---	---	---	---	---	---	---	
Summer	pCi/L	-	7,180		560	210	---	---	---	---	---	---	---	---	
Fall	pCi/L	-	2,010		180	86	---	---	---	---	---	---	---	---	
Lead-214*															
Fall	pCi/L	-	15.6		6.8	9.5	---	---	---	---	---	---	---	---	
Radium-226															
Summer	pCi/L	5	0.24		0.12	0.13	0.97	0.22	0.14	---	---	---	0.21	0.11	0.13
Strontium-89,90															
Fall	pCi/L	8	0.57		0.19	0.28	---	---	---	---	---	---	---	---	
Tritium															
Winter	pCi/L	20,000	17,100		1,100	270	---	---	---	---	---	---	---	---	
Spring	pCi/L	20,000	17,300		1,000	240	---	---	---	---	---	---	---	---	
Summer	pCi/L	20,000	16,500		1,200	220	---	---	---	---	---	---	---	---	
Fall	pCi/L	20,000	16,500	Jm]	1,100	200	---	---	---	---	---	---	---	---	

See tables in Appendix C for explanation of data qualifiers.

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* = Gamma scan.

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Table A-1
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Radiological Results

Location			UCD1-23			UCD1-24			UCD1-25			UCD1-25 Duplicate		
Units	MCL		Value	Uncertainty	MDA	Value	Uncertainty	MDA	Value	Uncertainty	MDA	Value	Uncertainty	MDA
Americium-241														
Spring	pCi/L	-	---	---	---	---	---	---	0.032	0.028	0.018	---	---	---
Bismuth-212*														
Summer	pCi/L	-	---	---	---	---	---	---	---	---	---	60	54	53
Bismuth-214*														
Spring	pCi/L	-	---	---	---	---	---	---	11.5	6.2	8	---	---	---
Summer	pCi/L	-	---	---	---	---	---	---	---	---	---	21	17	20
Carbon-14														
Winter	pCi/L	-	270	100	110	---	---	---	---	---	---	---	---	---
Summer	pCi/L	-	209	69	89	---	---	---	---	---	---	---	---	---
Cobalt-60*														
Winter	pCi/L	-	---	---	---	4	3.8	3.1	---	---	---	---	---	---
Gross Alpha														
Spring	pCi/L	15	---	---	---	---	---	---	13.8	C	8	9.6	---	---
Gross Beta														
Spring	pCi/L	50	---	---	---	---	---	---	11.6	C	6.1	9.3	---	---
Lead-214*														
Spring	pCi/L	-	---	---	---	---	---	---	10	5.5	7.9	---	---	---
Radium-226														
Winter	pCi/L	5	---	---	---	---	---	---	0.57	0.23	0.23	---	---	---
Summer	pCi/L	5	---	---	---	---	---	---	0.23	0.15	0.19	0.19	0.13	0.15

See tables in Appendix C for explanation of data qualifiers.

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Table A-1
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Radiological Results

Location			UCD1-27Z3			UCD1-34			UCD1-34 Duplicate			UCD2-7		
Units	MCL		Value	Uncertainty	MDA	Value	Uncertainty	MDA	Value	Uncertainty	MDA	Value	Uncertainty	MDA
Americium-241														
Winter	pCi/L	-	0.035	0.028	0.016	---	---	---	---	---	---	---	---	---
Spring	pCi/L	-	---	---	---	0.038	0.031	0.027	0.057	0.039	0.031	---	---	---
Fall	pCi/L	-	0.027	0.027	0.019	0.033	0.031	0.028	---	---	---	---	---	---
Bismuth-214*														
Spring	pCi/L	-	11.2	7.7	11	---	---	---	---	---	---	---	---	---
Summer	pCi/L	-	103	27	25	---	---	---	---	---	---	---	---	---
Gross Alpha														
Spring	pCi/L	15	1.26	0.81	1.1	---	---	---	---	---	---	---	---	---
Gross Beta														
Spring	pCi/L	50	---	---	---	4.6	1C	2.8	4.3	---	---	---	---	---
Summer	pCi/L	50	35.4	1C	5.6	6.1	---	---	---	---	---	---	---	---
Lead-214*														
Spring	pCi/L	-	10.5	6.7	10	---	---	---	---	---	---	---	---	---
Summer	pCi/L	-	90	21	25	---	---	---	---	---	---	---	---	---
Plutonium-241														
Fall	pCi/L	-	---	---	---	---	---	---	4.4	3	3.4	---	---	---
Radium-226														
Winter	pCi/L	5	0.39	0.22	0.28	---	---	---	---	---	---	---	---	---
Spring	pCi/L	5	0.22	0.13	0.17	0.19	0.13	0.16	---	---	---	---	---	---
Summer	pCi/L	5	0.21	0.13	0.13	0.58	0.21	0.19	---	---	---	0.25	0.14	0.17
Strontium-89,90														
Fall	pCi/L	8	---	---	---	0.49	0.19	0.28	0.57	0.18	0.26	---	---	---

See tables in Appendix C for explanation of data qualifiers.

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Table A-1
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Radiological Results

Location	Units		UCD1-27Z3			UCD1-34			UCD1-34 Duplicate			UCD2- 7			
		MCL	Value	Uncertainty	MDA	Value	Uncertainty	MDA	Value	Uncertainty	MDA	Value	Uncertainty	MDA	
Tritium															
Fall	pCi/L	20,000	---	---	---	---	---	---	460	Jm]	170	210	---	---	---

See tables in Appendix C for explanation of data qualifiers.

All units = pCi/L

MCL = California Maximum Contaminant Level (Primary), Title 22, Division 4, Chapter 15.

MDA = Minimal Detectable Activity.

* = Gamma scan.

- = No MCL

--- = Parameter not analyzed or no value less than the MDA.

Table A-1
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Radiological Results

Location			UCD2-14			UCD2-15			UCD2-26			UCD2-26 Duplicate		
Units	MCL		Value	Uncertainty	MDA	Value	Uncertainty	MDA	Value	Uncertainty	MDA	Value	Uncertainty	MDA
Americium-241														
Spring	pCi/L	-	0.046	0.036	0.021	---	---	---	---	---	---	---	---	---
Summer	pCi/L	-	---	---	---	---	---	---	0.035	0.03	0.028	---	---	---
Fall	pCi/L	-	0.028	0.028	0.019	---	---	---	0.026	0.029	0.023	---	---	---
Bismuth-214*														
Summer	pCi/L	-	---	---	---	44	10	9.9	---	---	---	---	---	---
Carbon-14														
Spring	pCi/L	-	500	120	110	---	---	---	---	---	---	---	---	---
Summer	pCi/L	-	2,030	270	220	---	---	---	---	---	---	---	---	---
Fall	pCi/L	-	375	81	86	---	---	---	---	---	---	---	---	---
Gross Beta														
Fall	pCi/L	50	---	---	---	8.2	3.4	5.1	---	---	---	---	---	---
Lead-214*														
Spring	pCi/L	-	---	---	---	8.5	5.2	7.6	---	---	---	---	---	---
Summer	pCi/L	-	---	---	---	31.2	8.1	9.8	---	---	---	---	---	---
Radium-226														
Winter	pCi/L	5	---	---	---	2.4	0.49	0.29	---	---	---	---	---	---
Spring	pCi/L	5	0.34	0.17	0.2	0.17	0.12	0.15	0.32	0.17	0.2	---	---	---
Summer	pCi/L	5	0.22	0.13	0.16	---	---	---	---	---	---	0.6	0.21	0.19
Radium-226*														
Winter	pCi/L	-	---	---	---	0.51	0.27	0.3	---	---	---	---	---	---

See tables in Appendix C for explanation of data qualifiers.

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MDA = Minimal Detectable Activity.

* = Gamma scan.

- = No MCL

--- = Parameter not analyzed or no value less than the MDA.

Table A-1
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Radiological Results

Location			UCD2-14			UCD2-15			UCD2-26			UCD2-26 Duplicate		
Units	MCL		Value	Uncertainty	MDA	Value	Uncertainty	MDA	Value	Uncertainty	MDA	Value	Uncertainty	MDA
Strontium-89,90														
Spring	pCi/L	8	---	---	---	---	---	---	0.57	0.34	0.54	---	---	---
Fall	pCi/L	8	0.47	0.18	0.27	0.39	Jx	0.18	0.29	---	---	---	---	---
Tritium														
Winter	pCi/L	20,000	270	210	240	---	---	---	---	---	---	---	---	---
Spring	pCi/L	20,000	4,690	480	240	---	---	---	---	---	---	---	---	---
Summer	pCi/L	20,000	9,550	780	230	---	---	---	---	---	---	---	---	---
Fall	pCi/L	20,000	2,950	Jm	370	210	290	Jm	150	210	---	---	---	---

See tables in Appendix C for explanation of data qualifiers.

All units = pCi/L

MCL = California Maximum Contaminant Level (Primary), Title 22, Division 4, Chapter 15.

MDA = Minimal Detectable Activity.

* = Gamma scan.

- = No MCL

--- = Parameter not analyzed or no value less than the MDA.

Table A-1
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Radiological Results

Location			UCD2-27Z4			UCD2-27Z5			UCD2-27Z6			UCD2-27Z7			
Units	MCL		Value	Uncertainty	MDA										
Americium-241															
Spring	pCi/L	-	---	---	---	---	---	---	0.052	0.039	0.032	---	---	---	
Summer	pCi/L	-	0.028	0.027	0.019	0.032	0.026	0.023	0.014	0.016	0.013	0.029	0.026	0.024	
Bismuth-214*															
Winter	pCi/L	-	---	---	---	9	5.9	7.9	---	---	---	---	---	---	
Spring	pCi/L	-	---	---	---	10	7.2	9.5	---	---	---	---	---	---	
Fall	pCi/L	-	12.1	Jz]	7.3	10	---	---	---	---	---	---	---	---	
Carbon-14															
Fall	pCi/L	-	---	---	---	---	---	---	---	---	---	78	48	72	
Gross Alpha															
Summer	pCi/L	15	---	---	---	---	---	---	---	---	---	31.2	C	8.1	6
Gross Beta															
Summer	pCi/L	50	6.2	C	2.9	4.4	---	---	---	---	---	7	C	3.7	5.6
Lead-214*															
Winter	pCi/L	-	---	---	---	10.1	5.6	8	---	---	---	---	---	---	
Summer	pCi/L	-	23	---	15	21	---	---	---	---	---	---	---	---	
Radium-226															
Winter	pCi/L	5	---	---	---	0.39	0.21	0.24	---	---	---	---	---	---	
Spring	pCi/L	5	---	---	---	0.22	0.12	0.15	0.32	0.14	0.15	---	---	---	
Summer	pCi/L	5	---	---	---	0.37	0.17	0.14	0.44	0.21	0.19	---	---	---	
Fall	pCi/L	5	0.26	---	0.15	0.19	---	---	---	---	---	0.85	0.24	0.17	

See tables in Appendix C for explanation of data qualifiers.

All units = pCi/L

MCL = California Maximum Contaminant Level (Primary), Title 22, Division 4, Chapter 15.

MDA = Minimal Detectable Activity.

* = Gamma scan.

- = No MCL

--- = Parameter not analyzed or no value less than the MDA.

Table A-1
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Radiological Results

Location			UCD2-27Z4			UCD2-27Z5			UCD2-27Z6			UCD2-27Z7		
Units	MCL		Value	Uncertainty	MDA	Value	Uncertainty	MDA	Value	Uncertainty	MDA	Value	Uncertainty	MDA
Strontium-89,90														
Spring	pCi/L	8	---	---	---	1.15	0.33	0.46	---	---	---	---	---	---
Fall	pCi/L	8	0.48	0.2	0.3	---	---	---	---	---	---	---	---	---
Tritium														
Fall	pCi/L	20,000	230	Jm]	140	210	---	---	---	---	---	---	---	---

See tables in Appendix C for explanation of data qualifiers.

All units = pCi/L

MCL = California Maximum Contaminant Level (Primary), Title 22, Division 4, Chapter 15.

MDA = Minimal Detectable Activity.

* = Gamma scan.

- = No MCL

--- = Parameter not analyzed or no value less than the MDA.

Table A-1
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Radiological Results

Location			UCD2-35			UCD2-35 Duplicate		
	Units	MCL						
			Value	Uncertainty	MDA	Value	Uncertainty	MDA
Americium-241								
Spring	pCi/L	-	---	---	---	0.065	0.047	0.038
Fall	pCi/L	-	0.041	0.033	0.019	---	---	---
Bismuth-214*								
Spring	pCi/L	-	72	12	8.7	35	16	17
Gross Beta								
Fall	pCi/L	50	11.4 C	3.4	4.7	---	---	---
Lead-214*								
Spring	pCi/L	-	65.1	9.2	8.2	29	13	17
Radium-226								
Fall	pCi/L	5	0.25	0.15	0.18	0.27	0.14	0.15
Strontium-89,90								
Fall	pCi/L	8	0.9	0.2	0.26	0.9	0.21	0.28
Tritium								
Fall	pCi/L	20,000	---	---	---	1,620 m	270	190

See tables in Appendix C for explanation of data qualifiers.

All units = pCi/L

MCL = California Maximum Contaminant Level (Primary), Title 22, Division 4, Chapter 15.

MDA = Minimal Detectable Activity.

* = Gamma scan.

- = No MCL

--- = Parameter not analyzed or no value less than the MDA.

Table A-2
LEHR Environmental Restoration
Summary of Detected Constituents in Surface Water and Stormwater Samples - 1996
Radiological Results

Location			PCD			PCD Duplicate			PCU			PCU Duplicate		
Units	MCL		Value	Uncertainty	MDA	Value	Uncertainty	MDA	Value	Uncertainty	MDA	Value	Uncertainty	MDA
Americium-241														
Spring	pCi/L	-	0.051	0.038	0.02	---	---	---	0.039	F 0.035	0.035	---	---	---
Fall	pCi/L	-	---	---	---	---	---	---	0.032	0.029	0.018	---	---	---
Carbon-14														
Fall	pCi/L	-	80	48	70	---	---	---	---	---	---	---	---	---
Gross Beta														
Winter	pCi/L	50	6.1	C 3	4.6	---	---	---	---	---	---	---	---	---
Plutonium-241														
Spring	pCi/L	-	---	---	---	---	---	---	7.2	3.3	3.6	---	---	---
Radium-226														
Spring	pCi/L	5	0.142	0.098	0.13	0.15	0.11	0.14	---	---	---	---	---	---
Summer	pCi/L	5	---	---	---	---	---	---	---	---	---	0.42	0.28	0.31
Strontium-89,90														
Spring	pCi/L	8	---	---	---	---	---	---	1.18	0.38	0.55	---	---	---

See tables in Appendix C for explanation of data qualifiers.

All units = pCi/L

MCL = California Maximum Contaminant Level (Primary), Title 22, Division 4, Chapter 15.

MDA = Minimal Detectable Activity.

* = Gamma scan.

- = No MCL

--- = Parameter not analyzed or no value less than the MDA.

Table A-2
LEHR Environmental Restoration
Summary of Detected Constituents in Surface Water and Stormwater Samples - 1996
Radiological Results

Location			STPO			STPO Duplicate		
Units	MCL		Value	Uncertainty	MDA	Value	Uncertainty	MDA
Americium-241								
Winter	pCi/L	-	0.037	0.042	0.034	0.046	0.034	0.018
Fall	pCi/L	-	0.052	0.043	0.041	0.022	0.024	0.019
Gross Alpha								
Winter	pCi/L	15	7.7 C	5.1	6.9	---	---	---
Gross Beta								
Winter	pCi/L	50	21.7 C	4.6	5.6	15.3 C	4.2	5.7
Spring	pCi/L	50	11.5 C	3.6	4.9	---	---	---
Summer	pCi/L	50	10.6 C	4.5	6.7	---	---	---
Fall	pCi/L	50	19.8 C	4.6	6	20.5 C	4.6	5.9
Plutonium-241								
Spring	pCi/L	-	6.7	2.9	2.8	---	---	---
Radium-226								
Winter	pCi/L	5	---	---	---	0.29	0.21	0.24
Fall	pCi/L	5	0.14	0.12	0.073	0.27	0.15	0.13
Strontium-89,90								
Spring	pCi/L	8	0.88	0.4	0.61	---	---	---
Fall	pCi/L	8	---	---	---	0.35	0.15	0.23

See tables in Appendix C for explanation of data qualifiers.

All units = pCi/L

MCL = California Maximum Contaminant Level (Primary), Title 22, Division 4, Chapter 15.

MDA = Minimal Detectable Activity.

* = Gamma scan.

- = No MCL

--- = Parameter not analyzed or no value less than the MDA.

APPENDIX B

NONRADIOLOGICAL RESULTS FOR WATER - 1996

Table B-1
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Volatile Organics by CLP

Location				UCD1- 1	UCD1- 4	UCD1-10	UCD1-11	UCD1-12	UCD1-13
	UNITS	DL	MCL						
1,1,2-Trichloroethane									
Winter	ug/L	1	5	-	-	-	-	1.1	-
Spring	ug/L	1	5	-	-	-	-	1.4	-
Summer	ug/L	1	5	-	-	-	-	2.8	-
Fall	ug/L	1	5	-	-	-	-	2.3	-
1,1-Dichloroethane									
Winter	ug/L	1	5	-	-	-	-	5.3	-
Spring	ug/L	1	5	-	-	-	-	6.1	-
Summer	ug/L	1	5	-	-	-	-	7	-
Fall	ug/L	1	5	-	-	-	-	5.6	-
1,1-Dichloroethene									
Winter	ug/L	1	6	-	-	-	-	13	-
Spring	ug/L	1	6	-	-	-	-	11	-
Summer	ug/L	1	6	-	-	-	-	12	-
Fall	ug/L	1	6	-	-	-	-	11	-

See tables in Appendix C for explanation of data qualifiers.

- = Parameter not analyzed or not detected.

--- = No MCL.

< = Constituent below detection limit. Detection limits may vary depending on interference by other sample constituents.

DL= Detection Limit; Contract Required Quantitation Detection Limit.

F = Field data.

S = Secondary Drinking Water Standard.

MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-1
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Volatile Organics by CLP

Location				UCD1- 1	UCD1- 4	UCD1-10	UCD1-11	UCD1-12	UCD1-13
	UNITS	DL	MCL						
1,2-Dichloroethane									
Winter	ug/L	1	0.5	-	-	-	-	2.9	-
Spring	ug/L	1	0.5	-	-	-	-	3.1	-
Summer	ug/L	1	0.5	-	-	-	-	4.9	-
Fall	ug/L	1	0.5	-	-	-	-	3.6	-
1,2-Dichloropropane									
Spring	ug/L	1	5	-	-	-	-	0.43	IJ
Summer	ug/L	1	5	-	-	-	-	0.5	IJ
Fall	ug/L	1	5	-	-	-	-	0.6	IJ
Acetone									
Spring	ug/L	5	---	-	-	4.2	JclJ	4.2	-
Fall	ug/L	5	---	-	-	-	-	12	Jcl
Bromodichloromethane									
Winter	ug/L	1	100a	-	-	-	-	0.6	IJ
Spring	ug/L	1	100a	-	-	-	-	0.64	IJ
Summer	ug/L	1	100a	-	-	-	-	0.8	IJ
Fall	ug/L	1	100a	-	-	-	-	1.2	-

See tables in Appendix C for explanation of data qualifiers.

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--- = No MCL.

< = Constituent below detection limit. Detection limits may vary depending on interference by other sample constituents.

DL= Detection Limit; Contract Required Quantitation Detection Limit.

F = Field data.

S = Secondary Drinking Water Standard.

MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-1
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Volatile Organics by CLP

Location				UCD1- 1	UCD1- 4	UCD1-10	UCD1-11	UCD1-12	UCD1-13
	UNITS	DL	MCL						
Chloroform									
Winter	ug/L	1	100a	-	-	-	-	5,200	1.4
Spring	ug/L	1	100a	-	-	-	-	-	1.5
Summer	ug/L	1	100a	-	-	-	-	6,700	ID 1.8
Fall	ug/L	1	100a	-	-	-	-	6,200	1.3 UzIB
Methylene Chloride									
Spring	ug/L	1	5#	-	0.35 JyIJ	-	-	0.25 IJ	-
Summer	ug/L	1	5#	-	-	-	-	0.3 IJ	-
Fall	ug/L	1	5#	-	-	-	-	0.9 IJ	-
trans-1,2-Dichloroethene									
Fall	ug/L	1	10	-	-	-	-	0.2 IJ	-
Trichloroethene									
Spring	ug/L	1	5	-	-	-	-	-	0.24 IJ
Summer	ug/L	1	5	-	-	-	-	-	0.2 IJ
Fall	ug/L	1	5	-	-	-	-	-	0.3 IJ

See tables in Appendix C for explanation of data qualifiers.

- = Parameter not analyzed or not detected.

--- = No MCL.

< = Constituent below detection limit. Detection limits may vary depending on interference by other sample constituents.

DL= Detection Limit; Contract Required Quantitation Detection Limit.

F = Field data.

S = Secondary Drinking Water Standard.

MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-1
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Volatile Organics by CLP

Location				UCD1-18	UCD1-19	UCD1-20	UCD1-21	UCD1-22	UCD1-23
	UNITS	DL	MCL						
Chloroform									
Winter	ug/L	1	100a	-	-	-	-	-	0.64 IJ

See tables in Appendix C for explanation of data qualifiers.

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--- = No MCL.

< = Constituent below detection limit. Detection limits may vary depending on interference by other sample constituents.

DL= Detection Limit; Contract Required Quantitation Detection Limit.

F = Field data.

S = Secondary Drinking Water Standard.

MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-1
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Volatile Organics by CLP

Location	UNITS	DL	MCL	UCD1-24	UCD1-25	UCD1-25 Duplicate	UCD1-27Z3	UCD1-34	UCD1-34 Duplicate
Carbon Disulfide									
Winter	ug/L	1	---	-	-	-	- IJ	-	-
Chloroform									
Winter	ug/L	1	100a	0.83 IJ	-	0.58 IJ	0.58	-	-
Spring	ug/L	1	100a	-	1	-	-	-	-
Summer	ug/L	1	100a	-	1.6	1.7	1.7	-	-
Fall	ug/L	1	100a	-	1.5	-	-	-	-
Methylene Chloride									
Spring	ug/L	1	5#	-	-	-	- IJ	-	-
Toluene									
Spring	ug/L	1	150	-	-	-	- IJ	-	-

See tables in Appendix C for explanation of data qualifiers.

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< = Constituent below detection limit. Detection limits may vary depending on interference by other sample constituents.

DL= Detection Limit; Contract Required Quantitation Detection Limit.

F = Field data.

S = Secondary Drinking Water Standard.

MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-1
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Volatile Organics by CLP

Location				UCD2- 7	UCD2-14	UCD2-15	UCD2-16	UCD2-17	UCD2-26
	UNITS	DL	MCL						
Acetone									
Spring	ug/L	5	---	-	-	4.8 JziBJ	4.8	-	-
Chloroform									
Winter	ug/L	1	100a	-	1.8	-	-	-	12
Spring	ug/L	1	100a	-	1.8	0.92 IJ	0.92	-	26 ID
Summer	ug/L	1	100a	-	2	-	-	-	8.8
Fall	ug/L	1	100a	-	1.9 UzIB	-	-	-	6
Chloromethane									
Spring	ug/L	1	---	-	-	0.38 IJ	0.38	-	-
Methylene Chloride									
Winter	ug/L	1	5#	-	-	-	- IJ	-	-
Spring	ug/L	1	5#	-	-	0.36 JyIJ	0.36	-	-

See tables in Appendix C for explanation of data qualifiers.

- = Parameter not analyzed or not detected.

--- = No MCL.

< = Constituent below detection limit. Detection limits may vary depending on interference by other sample constituents.

DL= Detection Limit; Contract Required Quantitation Detection Limit.

F = Field data.

S = Secondary Drinking Water Standard.

MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-1
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Volatile Organics by CLP

Location				UCD2-26 Duplicate	UCD2-27Z4	UCD2-27Z5	UCD2-27Z6	UCD2-27Z7	UCD2-27Z7 Duplicate
	UNITS	DL	MCL						
1,1-Dichloroethene									
Spring	ug/L	1	6	-	0.3	IJ	-	-	-
Fall	ug/L	1	6	-	-	-	0.3	IJ	0.3
Acetone									
Spring	ug/L	5	---	-	4	JzIBJ	-	-	-
Summer	ug/L	5	---	-	-	-	6.5	UzIJB	6.5
Chloroform									
Winter	ug/L	1	100a	-	-	-	67	-	-
Spring	ug/L	1	100a	-	22	ID	25	25	0.96
Summer	ug/L	1	100a	11	11	-	27	IE	27
Fall	ug/L	1	100a	-	11	Uxl	72	Uxl	72
Methylene Chloride									
Spring	ug/L	1	5#	-	0.61	IJ	0.47	IJ	0.47
Summer	ug/L	1	5#	-	-	-	0.4	UzIJB	0.4
Fall	ug/L	1	5#	-	1.1	UxlJ	-	-	-

See tables in Appendix C for explanation of data qualifiers.

- = Parameter not analyzed or not detected.

--- = No MCL.

< = Constituent below detection limit. Detection limits may vary depending on interference by other sample constituents.

DL= Detection Limit; Contract Required Quantitation Detection Limit.

F = Field data.

S = Secondary Drinking Water Standard.

MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-1
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Volatile Organics by CLP

Location	UNITS	DL	MCL	UCD2-35	UCD2-35 Duplicate
Acetone					
Winter	ug/L	5	---	4	JclJ
Spring	ug/L	5	---	-	4.3 JziBJ
Chloroform					
Winter	ug/L	1	100a	3.8	-

See tables in Appendix C for explanation of data qualifiers.

- = Parameter not analyzed or not detected.

--- = No MCL.

< = Constituent below detection limit. Detection limits may vary depending on interference by other sample constituents.

DL= Detection Limit; Contract Required Quantitation Detection Limit.

F = Field data.

S = Secondary Drinking Water Standard.

MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-2
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Semivolatile Organics by CLP

Location				UCD1- 1	UCD1- 4	UCD1-10	UCD1-11	UCD1-12	UCD1-13
	UNITS	DL	MCL						
Bis(2-Ethylhexyl)phthalate									
Winter	ug/L	10	---	-	-	-	-	6.3 U	5 U

See tables in Appendix C for explanation of data qualifiers.

- = Parameter not analyzed or not detected.

--- = No MCL.

< = Constituent below detection limit. Detection limits may vary depending on interference by other sample constituents.

DL= Detection Limit; Contract Required Quantitation Detection Limit.

F = Field data.

S = Secondary Drinking Water Standard.

MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-2
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Semivolatile Organics by CLP

Location	UNITS DL MCL			UCD1-24	UCD1-25	UCD1-25 Duplicate	UCD1-27Z3	UCD1-34	UCD1-34 Duplicate		
	ug/L	10	---								
4-Methylphenol											
Winter	ug/L	10	---	-	-	-	IJ	-	-		
Bis(2-Ethylhexyl)phthalate											
Winter	ug/L	10	---	-	-	-	IJ	-	-		
Spring	ug/L	10	---	-	2.4	IJ	JzIJB	0.94	IJ	19	
Summer	ug/L	10	---	-	-	-	IJ	-	-		
Fall	ug/L	10	---	-	-	-	IJ	3.5	UzIJB	-	
Di-n-Butylphthalate											
Spring	ug/L	10	---	-	-	-	JqI	0.82	JqIJ	1.2	JqIJ
Summer	ug/L	10	---	-	-	-	IJB	-	-	-	
Phenol											
Winter	ug/L	10	---	-	-	-	IJ	-	-		
Spring	ug/L	10	---	-	-	-	JqIJ	-	-		

See tables in Appendix C for explanation of data qualifiers.

- = Parameter not analyzed or not detected.

--- = No MCL.

< = Constituent below detection limit. Detection limits may vary depending on interference by other sample constituents.

DL= Detection Limit; Contract Required Quantitation Detection Limit.

F = Field data.

S = Secondary Drinking Water Standard.

MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-2
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Semivolatile Organics by CLP

Location				UCD2- 7	UCD2-14	UCD2-15	UCD2-16	UCD2-17	UCD2-26
	UNITS	DL	MCL						
Bis(2-Ethylhexyl)phthalate									
Winter	ug/L	10	---	-	1.5	IJ	-	-	-
Spring	ug/L	10	---	-	-	0.92	JxIJ	0.92	0.68
Summer	ug/L	10	---	-	-	-	-	-	1.7
									IJ
									UziJB

See tables in Appendix C for explanation of data qualifiers.

- = Parameter not analyzed or not detected.

--- = No MCL.

< = Constituent below detection limit. Detection limits may vary depending on interference by other sample constituents.

DL= Detection Limit; Contract Required Quantitation Detection Limit.

F = Field data.

S = Secondary Drinking Water Standard.

MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-2
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Semivolatile Organics by CLP

Location	UNITS DL MCL			UCD2-26 Duplicate	UCD2-27Z4	UCD2-27Z5	UCD2-27Z6	UCD2-27Z7	UCD2-27Z7 Duplicate
Bis(2-Ethylhexyl)phthalate									
Winter	ug/L	10	---	-	-	28	28	-	-
Spring	ug/L	10	---	-	8.2 JzlJB	35 JzIB	35 JzlJB	6.8 JzlJB	-
Summer	ug/L	10	---	1.8 UzIJB	0.78 IJ	0.96 IJ	0.96 IJ	48 Jsl	-
Fall	ug/L	10	---	-	0.7 UzIJB	-	-	-	-
Di-n-Butylphthalate									
Spring	ug/L	10	---	-	0.71 JqIJ	2.5 IJ	2.5 JqIJ	-	-
Summer	ug/L	10	---	-	-	-	- IJB	5.2 JslJB	-
Diethyl Phthalate									
Summer	ug/L	10	---	-	-	-	-	2.2 JslJ	-
Phenol									
Spring	ug/L	10	---	-	-	0.73 IJ	0.73	-	-

See tables in Appendix C for explanation of data qualifiers.

- = Parameter not analyzed or not detected.

--- = No MCL.

< = Constituent below detection limit. Detection limits may vary depending on interference by other sample constituents.

DL= Detection Limit; Contract Required Quantitation Detection Limit.

F = Field data.

S = Secondary Drinking Water Standard.

MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-2
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Semivolatile Organics by CLP

Location				UCD2-35	UCD2-35 Duplicate	
	UNITS	DL	MCL			
Bis(2-Ethylhexyl)phthalate						
Spring	ug/L	10	---	-		2.4 JxIJ
Fall	ug/L	10	---	33 IB	1.3	UzIJB

See tables in Appendix C for explanation of data qualifiers.

- = Parameter not analyzed or not detected.

--- = No MCL.

< = Constituent below detection limit. Detection limits may vary depending on interference by other sample constituents.

DL= Detection Limit; Contract Required Quantitation Detection Limit.

F = Field data.

S = Secondary Drinking Water Standard.

MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-3
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Pesticides and PCBs by CLP

Location				UCD1- 1	UCD1- 4	UCD1-10	UCD1-11	UCD1-12	UCD1-13
	UNITS	DL	MCL						
Dieldrin Spring	ug/L	-	---	-	-	-	-	-	0.027 Jcl
Endrin Spring	ug/L	-	2	-	-	-	-	-	0.009 J

See tables in Appendix C for explanation of data qualifiers.

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DL= Detection Limit; Contract Required Quantitation Detection Limit.

F = Field data.

S = Secondary Drinking Water Standard.

MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-5
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Cations/Anions by CLP

Location	UNITS	DL	MCL	UCD1- 1	UCD1- 4	UCD1-10	UCD1-11	UCD1-12	UCD1-13		
Calcium											
Winter	mg/L	2	---	-	37.6	47.6	47.6	74.4	74.4		
Magnesium											
Winter	mg/L	2	---	-	70.6	189	189	236	194		
Nitrogen, Nitrate (as N)											
Winter	mg/L	0.1	10.0	17	2.7	36	36	56	ID	18	ID
Spring	mg/L	0.1	10.0	-	4.8	37	37	49		-	
Summer	mg/L	0.1	10.0	16	3.4	39	IH	39		63	
Fall	mg/L	0.1	10.0	-	3	41		41		55	
Potassium											
Winter	mg/L	2	---	-	-	-	-	1.94	IB	0.851	IB
Sodium											
Winter	mg/L	2	---	-	28.7	187	187	100		60.7	

See tables in Appendix C for explanation of data qualifiers.

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DL= Detection Limit; Contract Required Quantitation Detection Limit.

F = Field data.

S = Secondary Drinking Water Standard.

MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-5
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Cations/Anions by CLP

Location	UNITS DL MCL			UCD1-18	UCD1-19	UCD1-20	UCD1-21	UCD1-22	UCD1-23
Calcium Winter	mg/L	2	---	53.5	59	25	25	-	48
Magnesium Winter	mg/L	2	---	140	175	59.8	59.8	-	112
Nitrogen, Nitrate (as N) Winter	mg/L	0.1	10.0	27	18	6	6	ID	-
Summer	mg/L	0.1	10.0	26	-	-	-	-	-
Potassium Winter	mg/L	2	---	-	0.837	IB	-	-	1.39
									IB
Sodium Winter	mg/L	2	---	50.8	72.4	41.2	41.2	-	44.9

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DL= Detection Limit; Contract Required Quantitation Detection Limit.

F = Field data.

S = Secondary Drinking Water Standard.

MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-5
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Cations/Anions by CLP

Location	UNITS	DL	MCL	UCD1-24	UCD1-25	UCD1-25 Duplicate	UCD1-27Z3	UCD1-34	UCD1-34 Duplicate
Alkalinity, Total (as CaCO3)									
Winter	mg/L	-	---	-	790	770	770	320	-
Spring	mg/L	-	---	-	700	-	-	350	340
Summer	mg/L	-	---	-	640	660	660	360	-
Fall	mg/L	-	---	-	700	-	-	350	340
Ammonia Nitrogen									
Winter	mg/L	-	---	-	-	0.049 IB	0.049	0.064	-
Spring	mg/L	-	---	-	0.089 Jel*	-	-	0.15 I*	0.11 Jel*
Summer	mg/L	-	---	-	-	-	-	-	-
Fall	mg/L	-	---	-	0.049 JdINB	-	- JdIN	0.048 IB	0.055
Calcium									
Winter	mg/L	2	---	54.8	51.8	50.8	50.8	34.9	-
Spring	mg/L	2	---	-	47.9	-	- Jcl	36.7	35.8
Summer	mg/L	2	---	-	43.3	40.7	40.7	36.7	-
Fall	mg/L	2	---	-	42.2	-	-	32.9	32.8

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1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-5
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Cations/Anions by CLP

Location	UNITS DL MCL			UCD1-24	UCD1-25	UCD1-25 Duplicate	UCD1-27Z3	UCD1-34	UCD1-34 Duplicate
Phosphate, Total (as P)									
Winter	mg/L	-	---	-	0.12	0.12	0.12	0.19	-
Spring	mg/L	-	---	-	0.12	-	-	0.2	0.18
Summer	mg/L	-	---	-	0.15	0.14	0.14	0.21	-
Fall	mg/L	-	---	-	0.098	-	-	0.17	0.16
Potassium									
Winter	mg/L	2	---	0.628 IB	1 IB	1.33 IB	1.33	0.865 IB	-
Spring	mg/L	2	---	-	-	-	JclB	-	-
Sodium									
Winter	mg/L	2	---	79.1	86.8	85.1	85.1	56.8	-
Spring	mg/L	2	---	-	82.1	-	-	52.6	51.6
Summer	mg/L	-	---	-	78.4	73.8	73.8	63.4	-
Fall	mg/L	-	---	-	74.5	-	-	56.5	56.2
Sulfate									
Winter	mg/L	1	250-600s	-	41	41	41	33	-
Spring	mg/L	1	250-600s	-	39	-	-	25	25
Summer	mg/L	1	250-600s	-	37	38	38	18	-
Fall	mg/L	1	250-600s	-	40	Jhl	-	Jhl	22

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1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

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Table B-5
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Cations/Anions by CLP

Location				UCD1-24	UCD1-25	UCD1-25 Duplicate	UCD1-27Z3	UCD1-34	UCD1-34 Duplicate
	UNITS	DL	MCL						
Total Kjeldahl Nitrogen									
Spring	mg/L	0.5	---	-	-	-	-	-	9.7
Summer	mg/L	0.5	---	-	0.23	1*	0.61	0.61	1*
Fall	mg/L	0.5	---	-	2	-	-	Uxl	-

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S = Secondary Drinking Water Standard.

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1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-5
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Cations/Anions by CLP

Location				UCD2- 7	UCD2-14	UCD2-15	UCD2-16	UCD2-17	UCD2-26
	UNITS	DL	MCL						
Alkalinity, Total (as CaCO3)									
Winter	mg/L	-	---	-	-	-	-	-	320
Spring	mg/L	-	---	-	-	11	IB	11	320
Summer	mg/L	-	---	-	-	-	-	-	340
Fall	mg/L	-	---	-	-	-	-	-	340
Ammonia Nitrogen									
Winter	mg/L	-	---	-	-	-	-	-	0.26
Spring	mg/L	-	---	-	-	0.09	Jel*	0.09	0.11 Jel*
Fall	mg/L	-	---	-	-	-	-	-	0.14 JdIN
Calcium									
Winter	mg/L	2	---	35.1	35	32.2		32.2	34.6
Spring	mg/L	2	---	-	47.7 Jcl	0.0699	IB	0.0699 Jcl	-
Summer	mg/L	2	---	-	59.5	-	-	-	-
Fall	mg/L	2	---	-	42.1	-	-	-	35.9
Chloride									
Winter	mg/L	1	250-600s	-	-	-	-	-	20
Spring	mg/L	1	250-600s	-	-	0.041	IB	0.041	21
Summer	mg/L	1	250-600s	-	-	-	-	-	21
Fall	mg/L	1	250-600s	-	-	-	-	-	21 Jhl

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1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

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Table B-5
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Cations/Anions by CLP

Location	UNITS DL MCL			UCD2- 7	UCD2-14	UCD2-15	UCD2-16	UCD2-17	UCD2-26
Magnesium									
Winter	mg/L	2	---	69.6	77.8	56.1	56.1	59.7	61.3
Spring	mg/L	2	---	-	118 Jcl	-	- Jcl	-	61.1
Summer	mg/L	-	---	-	152	-	-	-	67.1
Fall	mg/L	-	---	-	101	-	-	-	63.1
Nitrogen, Nitrate (as N)									
Winter	mg/L	0.1	10.0	10	2.5	1.7	1.7	1.8	2.5
Spring	mg/L	0.1	10.0	-	7.4	1.7	1.7	-	3.4
Summer	mg/L	0.1	10.0	10	11	1.6	1.6	2	4.9
Fall	mg/L	0.1	10.0	-	5.2 Jhl	1.5	1.5	-	4.5 Jhl
Phosphate, Total (as P)									
Winter	mg/L	-	---	-	-	-	-	-	0.18
Spring	mg/L	-	---	-	-	0.006 IB	0.006	-	0.2
Summer	mg/L	-	---	-	-	-	-	-	0.21
Fall	mg/L	-	---	-	-	-	-	-	0.16
Potassium									
Winter	mg/L	2	---	-	0.809 IB	0.697 IB	0.697	0.502 IB	1.2 IB
Fall	mg/L	-	---	-	-	-	-	-	1.53 IB

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S = Secondary Drinking Water Standard.

MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-5
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Cations/Anions by CLP

Location				UCD2- 7	UCD2-14	UCD2-15	UCD2-16	UCD2-17	UCD2-26	
	UNITS	DL	MCL							
Sodium										
Winter	mg/L	2	---	48.3	39	27.1		27.1	30.2	34.4
Spring	mg/L	2	---	-	44	0.405	IB	0.405	-	39.4
Summer	mg/L	-	---	-	49.4	-		-	-	37.5
Fall	mg/L	-	---	-	42.7	-		-	-	35
Sulfate										
Winter	mg/L	1	250-600s	-	-	-		-	-	37
Spring	mg/L	1	250-600s	-	-	0.12	IB	0.12	-	37
Summer	mg/L	1	250-600s	-	-	-		-	-	36
Fall	mg/L	1	250-600s	-	-	-		-	-	37
Total Kjeldahl Nitrogen										
Spring	mg/L	0.5	---	-	-	-		-	-	3
Summer	mg/L	0.5	---	-	-	-		-	-	0.61
Fall	mg/L	0.5	---	-	-	-		-	-	2.1

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DL= Detection Limit; Contract Required Quantitation Detection Limit.

F = Field data.

S = Secondary Drinking Water Standard.

MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-5
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Cations/Anions by CLP

Location	UNITS	DL	MCL	UCD2-26 Duplicate	UCD2-27Z4	UCD2-27Z5	UCD2-27Z6	UCD2-27Z7	UCD2-27Z7 Duplicate
Alkalinity, Total (as CaCO3)									
Winter	mg/L	-	---	-	-	320	320	-	-
Spring	mg/L	-	---	-	330	320	320	300	-
Summer	mg/L	-	---	340	350	340	340	330	-
Fall	mg/L	-	---	-	360	310	310	310	-
Ammonia Nitrogen									
Winter	mg/L	-	---	-	-	0.17	0.17	-	-
Spring	mg/L	-	---	-	0.13	0.13	0.13	0.083	-
Fall	mg/L	-	---	-	-	0.059	Uxl 0.059	0.044	IB -
Calcium									
Winter	mg/L	2	---	-	-	31.7	31.7	-	-
Spring	mg/L	2	---	-	31.5	Jcl 33.7	Jcl 33.7	Jcl 36.3	-
Summer	mg/L	2	---	35.2	35.6	40.7	40.7	35.9	-
Fall	mg/L	2	---	-	36.8	39.7	39.7	36.3	IC -
Chloride									
Winter	mg/L	1	250-600s	-	-	22	22	-	-
Spring	mg/L	1	250-600s	-	26	21	21	20	-
Summer	mg/L	1	250-600s	21	20	21	21	21	-
Fall	mg/L	1	250-600s	-	22	22	Jhl 22	Jcl 18	Jcl -

See tables in Appendix C for explanation of data qualifiers.

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F = Field data.

S = Secondary Drinking Water Standard.

MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-5
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Cations/Anions by CLP

Location	UNITS DL MCL			UCD2-26 Duplicate	UCD2-27Z4	UCD2-27Z5	UCD2-27Z6	UCD2-27Z7	UCD2-27Z7 Duplicate	
Magnesium										
Winter	mg/L	2	---	-	-	66.7	Jcl	66.7	Jcl	-
Spring	mg/L	2	---	-	63.8	Jcl	56	Jcl	56	Jcl
Summer	mg/L	-	---	63.6	68.9	68.7	68.7	68.7	68.7	57.8
Fall	mg/L	-	---	-	69.3	66.6	66.6	66.6	66.6	57.7
Nitrogen, Nitrate (as N)										
Winter	mg/L	0.1	10.0	-	-	2.3	2.3	-	-	-
Spring	mg/L	0.1	10.0	-	1.7	2.5	2.5	1.9	-	-
Summer	mg/L	0.1	10.0	4.8	3.9	4.2	4.2	2	-	-
Fall	mg/L	0.1	10.0	-	4.5	3.7	3.7	2.2	-	-
Phosphate, Total (as P)										
Winter	mg/L	-	---	-	-	0.071	0.071	-	-	-
Spring	mg/L	-	---	-	0.079	0.093	0.093	0.058	-	-
Summer	mg/L	-	---	0.23	0.093	0.099	0.099	0.088	-	-
Fall	mg/L	-	---	-	0.082	0.099	0.099	0.091	-	-
Potassium										
Winter	mg/L	2	---	-	-	0.769	IB	0.769	-	-
Spring	mg/L	2	---	-	-	1.68	JclB	1.68	1.84	JclB
Fall	mg/L	-	---	-	-	1.31	IB	1.31	-	-

See tables in Appendix C for explanation of data qualifiers.

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DL= Detection Limit; Contract Required Quantitation Detection Limit.

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= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-5
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Cations/Anions by CLP

Location	UNITS	DL	MCL	UCD2-26 Duplicate	UCD2-27Z4	UCD2-27Z5	UCD2-27Z6	UCD2-27Z7	UCD2-27Z7 Duplicate
Sodium									
Winter	mg/L	2	---	-	-	34.8	34.8	-	-
Spring	mg/L	2	---	-	41.4	30.9	30.9	40.5	-
Summer	mg/L	-	---	35.6	40	36.5	36.5	40.7	-
Fall	mg/L	-	---	-	38.6	35.2	35.2	37.9	IC
Sulfate									
Winter	mg/L	1	250-600s	-	-	39	39	-	-
Spring	mg/L	1	250-600s	-	37	37	37	38	-
Summer	mg/L	1	250-600s	36	36	35	35	39	-
Fall	mg/L	1	250-600s	-	38	35	Jhl 35	35	-
Total Kjeldahl Nitrogen									
Spring	mg/L	0.5	---	-	-	-	-	-	-
Summer	mg/L	0.5	---	0.99	0.8	I* 0.99	I* 0.99	0.99	-

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DL= Detection Limit; Contract Required Quantitation Detection Limit.

F = Field data.

S = Secondary Drinking Water Standard.

MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

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= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-6
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
General

Location				UCD1- 1	UCD1- 4	UCD1-10	UCD1-11	UCD1-12	UCD1-13
UNITS	DL	MCL							
pH-F									
Winter	std	-	---	7.12	7.3	7.36	7.36	7.4	7.42
Spring	std	-	---	-	7.76	7.85	7.85	7.7	7.64
Summer	std	-	---	6.69	7.45	7.93	7.93	7.38	7.74
Specific Conductance (EC)-F									
Winter	umhos	-	---	963	870	1,500	1,500	1,890	1,278
Spring	umhos	-	---	-	477	1,005	1,005	1,011	831
Summer	umhos	-	---	1,111	890	1,945	1,945	2,220	1,760
Temperature-F									
Winter	deg C	-	---	18.2	18.2	18.5	18.5	18.2	18.5
Spring	deg C	-	---	-	19.3	19.3	19.3	19.1	18.7
Summer	deg C	-	---	19.4	17.7	19.6	19.6	19.1	19.3
Total Dissolved Solids									
Winter	mg/L	20	500s,#	-	550	1,300	1,300	1,500	1,100
Spring	mg/L	20	500s,#	-	790	1,200	1,200	1,600	1,100
Summer	mg/L	20	500s,#	-	550	1,300	1,300	1,200	730
Fall	mg/L	20	500s,#	-	500	1,300	1,300	20	930

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1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-6
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
General

Location	UNITS DL MCL			UCD1- 1	UCD1- 4	UCD1-10	UCD1-11	UCD1-12	UCD1-13
Turbidity									
Summer	NTU	0.1	0.5,#	-	2.1	2.1	2.1	1.6	0.73
Fall	NTU	0.1	0.5,#	-	0.89 Uxl	0.53	0.53	0.62 Uxl	0.1
Turbidity-F									
Winter	NTU	-	0.5,#	2.7	1.45	1.5	1.5 JhIH	1.7	2.8 JhIH
Spring	NTU	-	0.5,#	-	4.2	3.21	3.21	1.4	7.58
Summer	NTU	-	0.5,#	19.9	5.12	1.93	1.93	5.8	5.12

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Table B-6
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
General

Location				UCD1-18	UCD1-19	UCD1-20	UCD1-21	UCD1-22	UCD1-23
UNITS	DL	MCL							
pH-F									
Winter	std	-	---	7.46	7.53	7.79	7.79	7.49	7.34
Spring	std	-	---	-	7.81	-	-	-	-
Summer	std	-	---	-	8.16	7.9	7.9	7.55	7.75
Specific Conductance (EC)-F									
Winter	umhos	-	---	1,219	1,260	626	626	899	990
Spring	umhos	-	---	-	645	-	-	-	-
Summer	umhos	-	---	-	1,317	645	645	1,086	1,018
Temperature-F									
Winter	deg C	-	---	18.6	17.1	19	19	19	20.2
Spring	deg C	-	---	-	19.1	-	-	-	-
Summer	deg C	-	---	-	19.2	22.2	22.2	19.3	19.6
Total Dissolved Solids									
Winter	mg/L	20	500s,#	780	1,000	380	380	650	650
Summer	mg/L	20	500s,#	-	-	-	-	350	-
Turbidity									
Summer	NTU	0.1	0.5,#	-	0.62	-	-	-	-
Fall	NTU	0.1	0.5,#	-	0.2	-	-	-	-

See tables in Appendix C for explanation of data qualifiers.

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Table B-6
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
General

Location				UCD1-18	UCD1-19	UCD1-20	UCD1-21	UCD1-22	UCD1-23
	UNITS	DL	MCL						
Turbidity-F									
Winter	NTU	-	0.5,#	0.74	0.5	0.65	0.65	1.17	1.05
Spring	NTU	-	0.5,#	-	1.1	-	-	-	-
Summer	NTU	-	0.5,#	-	3.9	7.5	7.5	27.6	190

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Table B-6
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
General

Location				UCD1-24	UCD1-25	UCD1-25 Duplicate	UCD1-27Z3	UCD1-34	UCD1-34 Duplicate
	UNITS	DL	MCL						
Chemical Oxygen Demand									
Winter	mg/L	50	---	-	-	-	-	-	-
Spring	mg/L	50	---	-	-	-	-	-	-
Summer	mg/L	50	---	-	-	-	-	-	-
Fall	mg/L	50	---	-	-	-	-	-	-
pH-F									
Winter	std	-	---	7.34	7.5	7.5	7.5	7.48	-
Spring	std	-	---	-	7.95	-	-	7.9	7.9
Summer	std	-	---	-	7.56	-	-	7.5	-
Specific Conductance (EC)-F									
Winter	umhos	-	---	1,316	1,182	1,182	1,182	611	-
Spring	umhos	-	---	-	724	-	-	390	390
Summer	umhos	-	---	-	1,405	-	-	814	-
Temperature-F									
Winter	deg C	-	---	18.9	18.6	18.6	18.6	18.3	-
Spring	deg C	-	---	-	18.8	-	-	18.1	18.1
Summer	deg C	-	---	-	21.2	-	-	19.1	-

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1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

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Table B-6
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
General

Location	UNITS DL MCL			UCD2- 7	UCD2-14	UCD2-15	UCD2-16	UCD2-17	UCD2-26
pH-F									
Winter	std	-	---	7.79	8.19	7.9	7.9	7.64	7.81
Spring	std	-	---	-	7.62	7.84	7.84	-	8.36
Summer	std	-	---	8.09	7.75	7.97	7.97	8.27	-
Specific Conductance (EC)-F									
Winter	umhos	-	---	713	665	626	626	635	600
Spring	umhos	-	---	-	626	397	397	-	500
Summer	umhos	-	---	775	1,613	662	662	744	-
Temperature-F									
Winter	deg C	-	---	17.9	17.8	17.3	17.3	18.5	18.2
Spring	deg C	-	---	-	18.5	18.4	18.4	-	18.1
Summer	deg C	-	---	20.8	18.6	17.9	17.9	18.7	-
Total Dissolved Solids									
Winter	mg/L	20	500s,#	480	480	410	410	390	350
Spring	mg/L	20	500s,#	-	730	590	590	-	250
Summer	mg/L	20	500s,#	-	650	550	550	-	360
Fall	mg/L	20	500s,#	-	540	470	470	-	590

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Table B-6
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
General

Location	UNITS DL MCL			UCD1-24	UCD1-25	UCD1-25 Duplicate	UCD1-27Z3	UCD1-34	UCD1-34 Duplicate
Total Dissolved Solids									
Winter	mg/L	20	500s,#	1,000	890	910	910	430	-
Spring	mg/L	20	500s,#	-	830	-	-	500	380
Summer	mg/L	20	500s,#	-	860	390	390	370	-
Fall	mg/L	20	500s,#	-	800	-	-	350	640
Total Organic Carbon									
Winter	mg/L	1	---	-	1.1	0.92 IB	0.92	1.2	-
Spring	mg/L	1	---	-	0.7	IB	-	0.76	IB 0.78
Summer	mg/L	1	---	-	-	-	-	1.2	-
Fall	mg/L	1	---	-	0.85	IB	-	1.4	1.3
Turbidity									
Summer	NTU	0.1	0.5,#	-	13	15	15	8.7	-
Fall	NTU	0.1	0.5,#	-	0.29	-	-	0.69	0.46
Turbidity-F									
Winter	NTU	-	0.5,#	1.9	1.5	2	2 ID	3.53	-
Spring	NTU	-	0.5,#	-	3.3	-	-	6.56	6.56
Summer	NTU	-	0.5,#	-	40.7	-	-	1.72	-

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Table B-6
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
General

Location				UCD2- 7	UCD2-14	UCD2-15	UCD2-16	UCD2-17	UCD2-26
UNITS	DL	MCL							
Total Organic Carbon									
Winter	mg/L	1	---	-	-	-	-	-	0.68 IB
Spring	mg/L	1	---	-	-	-	-	-	0.57 IB
Fall	mg/L	1	---	-	-	-	-	-	0.74 IB
Turbidity									
Summer	NTU	0.1	0.5,#	-	3.3	0.66	0.66	-	0.05
Fall	NTU	0.1	0.5,#	-	1.1	0.89 Uxl	0.89	-	0.51
Turbidity-F									
Winter	NTU	-	0.5,#	1	0.24 JhlH	1.6	1.6	1.2	0.93
Spring	NTU	-	0.5,#	-	24.8	7.62	7.62	-	1.3
Summer	NTU	-	0.5,#	2.89	9.3	2.92	2.92	8.04	-

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Table B-6
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
General

Location	UNITS	DL	MCL	UCD2-26 Duplicate	UCD2-27Z4	UCD2-27Z5	UCD2-27Z6	UCD2-27Z7	UCD2-27Z7 Duplicate
Chemical Oxygen Demand									
Spring	mg/L	50	---	-	10	IB	-	-	-
pH-F									
Winter	std	-	---	-	-	8.68	8.68	-	-
Spring	std	-	---	-	7.96	8.1	8.1	7.98	7.98
Specific Conductance (EC)-F									
Winter	umhos	-	---	-	-	578	578	-	-
Spring	umhos	-	---	-	352	328	328	373	373
Temperature-F									
Winter	deg C	-	---	-	-	17.2	17.2	-	-
Spring	deg C	-	---	-	18.3	17.9	17.9	19.7	19.7
Total Dissolved Solids									
Winter	mg/L	20	500s,#	-	-	400	400	-	-
Spring	mg/L	20	500s,#	-	80	430	430	450	-
Summer	mg/L	20	500s,#	440	440	390	390	460	-
Fall	mg/L	20	500s,#	-	560	Uxl	570	Uxl	640
						JhlH	Uxl	Uxl	Uxl

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Table B-6
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
General

Location	UNITS DL MCL			UCD2-26 Duplicate	UCD2-27Z4	UCD2-27Z5	UCD2-27Z6	UCD2-27Z7	UCD2-27Z7 Duplicate
Total Organic Carbon									
Winter	mg/L	1	---	-	-	1.8	1.8	-	-
Spring	mg/L	1	---	-	1.4	-	- IB	0.43 IB	-
Summer	mg/L	1	---	-	1.1	-	-	-	-
Fall	mg/L	1	---	-	1.1	0.98	0.98	0.96	-
Turbidity									
Summer	NTU	0.1	0.5,#	0.45	0.39	0.59	0.59	0.0	-
Fall	NTU	0.1	0.5,#	-	0.59 Uxl	0.72 Uxl	0.72	0.95 Uxl	-
Turbidity-F									
Winter	NTU	-	0.5,#	-	-	3.2	3.2	-	-
Spring	NTU	-	0.5,#	-	9.06	0.76 Jol	0.76 Jol	0.76 Jol	0.24

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Table B-6
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
General

Location				UCD2-35	UCD2-35 Duplicate
	UNITS	DL	MCL		
pH-F					
Winter	std	-	---	7.84	-
Spring	std	-	---	8.39	8.39
Specific Conductance (EC)-F					
Winter	umhos	-	---	608	-
Spring	umhos	-	---	417	417
Temperature-F					
Winter	deg C	-	---	17.8	-
Spring	deg C	-	---	19.3	19.3
Total Dissolved Solids					
Winter	mg/L	20	500s,#	410	-
Spring	mg/L	20	500s,#	80	280
Summer	mg/L	20	500s,#	710	-
Fall	mg/L	20	500s,#	200	450
Total Organic Carbon					
Winter	mg/L	1	---	2.2	-
Spring	mg/L	1	---	0.67	IB
Fall	mg/L	1	---	0.86	IB

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Table B-6
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
General

Location				UCD2-35	UCD2-35 Duplicate
	UNITS	DL	MCL		
Turbidity					
Summer	NTU	0.1	0.5,#	4.8	-
Fall	NTU	0.1	0.5,#	0.46	0.41 Jhl
Turbidity-F					
Winter	NTU	-	0.5,#	6.56	-
Spring	NTU	-	0.5,#	9.49	9.49

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Table B-5
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Cations/Anions by CLP

Location	UNITS	DL	MCL	UCD1- 1	UCD1- 4	UCD1-10	UCD1-11	UCD1-12	UCD1-13		
Calcium											
Winter	mg/L	2	---	-	37.6	47.6	47.6	74.4	74.4		
Magnesium											
Winter	mg/L	2	---	-	70.6	189	189	236	194		
Nitrogen, Nitrate (as N)											
Winter	mg/L	0.1	10.0	17	2.7	36	36	56	ID	18	ID
Spring	mg/L	0.1	10.0	-	4.8	37	37	49		-	
Summer	mg/L	0.1	10.0	16	3.4	39	IH	39		63	
Fall	mg/L	0.1	10.0	-	3	41		41		55	
Potassium											
Winter	mg/L	2	---	-	-	-	-	1.94	IB	0.851	IB
Sodium											
Winter	mg/L	2	---	-	28.7	187	187	100		60.7	

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DL= Detection Limit; Contract Required Quantitation Detection Limit.

F = Field data.

S = Secondary Drinking Water Standard.

MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

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Table B-5
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Cations/Anions by CLP

Location	UNITS DL MCL			UCD1-18	UCD1-19	UCD1-20	UCD1-21	UCD1-22	UCD1-23	
Calcium Winter	mg/L	2	---	53.5	59	25	25	-	48	
Magnesium Winter	mg/L	2	---	140	175	59.8	59.8	-	112	
Nitrogen, Nitrate (as N) Winter	mg/L	0.1	10.0	27	18	6	6	ID	-	
Summer	mg/L	0.1	10.0	26	-	-	-	-	-	
Potassium Winter	mg/L	2	---	-	0.837	IB	-	-	1.39	IB
Sodium Winter	mg/L	2	---	50.8	72.4	41.2	41.2	-	44.9	

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Table B-5
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Cations/Anions by CLP

Location	UNITS	DL	MCL	UCD1-24	UCD1-25	UCD1-25 Duplicate	UCD1-27Z3	UCD1-34	UCD1-34 Duplicate
Alkalinity, Total (as CaCO3)									
Winter	mg/L	-	---	-	790	770	770	320	-
Spring	mg/L	-	---	-	700	-	-	350	340
Summer	mg/L	-	---	-	640	660	660	360	-
Fall	mg/L	-	---	-	700	-	-	350	340
Ammonia Nitrogen									
Winter	mg/L	-	---	-	-	0.049 IB	0.049	0.064	-
Spring	mg/L	-	---	-	0.089 Jel*	-	-	0.15 I*	0.11 Jel*
Summer	mg/L	-	---	-	-	-	-	-	-
Fall	mg/L	-	---	-	0.049 JdINB	-	- JdIN	0.048 IB	0.055
Calcium									
Winter	mg/L	2	---	54.8	51.8	50.8	50.8	34.9	-
Spring	mg/L	2	---	-	47.9	-	- Jcl	36.7	35.8
Summer	mg/L	2	---	-	43.3	40.7	40.7	36.7	-
Fall	mg/L	2	---	-	42.2	-	-	32.9	32.8

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Table B-5
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Cations/Anions by CLP

Location	UNITS DL MCL			UCD1-24	UCD1-25	UCD1-25 Duplicate	UCD1-27Z3	UCD1-34	UCD1-34 Duplicate
Phosphate, Total (as P)									
Winter	mg/L	-	---	-	0.12	0.12	0.12	0.19	-
Spring	mg/L	-	---	-	0.12	-	-	0.2	0.18
Summer	mg/L	-	---	-	0.15	0.14	0.14	0.21	-
Fall	mg/L	-	---	-	0.098	-	-	0.17	0.16
Potassium									
Winter	mg/L	2	---	0.628 IB	1 IB	1.33 IB	1.33	0.865 IB	-
Spring	mg/L	2	---	-	-	-	JclB	-	-
Sodium									
Winter	mg/L	2	---	79.1	86.8	85.1	85.1	56.8	-
Spring	mg/L	2	---	-	82.1	-	-	52.6	51.6
Summer	mg/L	-	---	-	78.4	73.8	73.8	63.4	-
Fall	mg/L	-	---	-	74.5	-	-	56.5	56.2
Sulfate									
Winter	mg/L	1	250-600s	-	41	41	41	33	-
Spring	mg/L	1	250-600s	-	39	-	-	25	25
Summer	mg/L	1	250-600s	-	37	38	38	18	-
Fall	mg/L	1	250-600s	-	40	Jhl	-	Jhl	22

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= USEPA MCL (no CA MCL)

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Table B-5
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Cations/Anions by CLP

Location				UCD1-24	UCD1-25	UCD1-25 Duplicate	UCD1-27Z3	UCD1-34	UCD1-34 Duplicate
	UNITS	DL	MCL						
Total Kjeldahl Nitrogen									
Spring	mg/L	0.5	---	-	-	-	-	-	9.7
Summer	mg/L	0.5	---	-	0.23	1*	0.61	0.61	1*
Fall	mg/L	0.5	---	-	2	-	-	Uxl	-

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Table B-5
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Cations/Anions by CLP

Location	UNITS DL MCL			UCD2- 7	UCD2-14	UCD2-15	UCD2-16	UCD2-17	UCD2-26
Alkalinity, Total (as CaCO3)									
Winter	mg/L	-	---	-	-	-	-	-	320
Spring	mg/L	-	---	-	-	11	IB	11	320
Summer	mg/L	-	---	-	-	-	-	-	340
Fall	mg/L	-	---	-	-	-	-	-	340
Ammonia Nitrogen									
Winter	mg/L	-	---	-	-	-	-	-	0.26
Spring	mg/L	-	---	-	-	0.09	Jel*	0.09	0.11 Jel*
Fall	mg/L	-	---	-	-	-	-	-	0.14 JdIN
Calcium									
Winter	mg/L	2	---	35.1	35	32.2		32.2	34.6
Spring	mg/L	2	---	-	47.7 Jcl	0.0699	IB	0.0699 Jcl	-
Summer	mg/L	2	---	-	59.5	-	-	-	-
Fall	mg/L	2	---	-	42.1	-	-	-	35.9
Chloride									
Winter	mg/L	1	250-600s	-	-	-	-	-	20
Spring	mg/L	1	250-600s	-	-	0.041	IB	0.041	21
Summer	mg/L	1	250-600s	-	-	-	-	-	21
Fall	mg/L	1	250-600s	-	-	-	-	-	21 Jhl

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Table B-5
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Cations/Anions by CLP

Location	UNITS DL MCL			UCD2- 7	UCD2-14	UCD2-15	UCD2-16	UCD2-17	UCD2-26
Magnesium									
Winter	mg/L	2	---	69.6	77.8	56.1	56.1	59.7	61.3
Spring	mg/L	2	---	-	118 Jcl	-	- Jcl	-	61.1
Summer	mg/L	-	---	-	152	-	-	-	67.1
Fall	mg/L	-	---	-	101	-	-	-	63.1
Nitrogen, Nitrate (as N)									
Winter	mg/L	0.1	10.0	10	2.5	1.7	1.7	1.8	2.5
Spring	mg/L	0.1	10.0	-	7.4	1.7	1.7	-	3.4
Summer	mg/L	0.1	10.0	10	11	1.6	1.6	2	4.9
Fall	mg/L	0.1	10.0	-	5.2 Jhl	1.5	1.5	-	4.5 Jhl
Phosphate, Total (as P)									
Winter	mg/L	-	---	-	-	-	-	-	0.18
Spring	mg/L	-	---	-	-	0.006 IB	0.006	-	0.2
Summer	mg/L	-	---	-	-	-	-	-	0.21
Fall	mg/L	-	---	-	-	-	-	-	0.16
Potassium									
Winter	mg/L	2	---	-	0.809 IB	0.697 IB	0.697	0.502 IB	1.2 IB
Fall	mg/L	-	---	-	-	-	-	-	1.53 IB

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Table B-5
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Cations/Anions by CLP

Location	UNITS DL MCL			UCD2- 7	UCD2-14	UCD2-15	UCD2-16	UCD2-17	UCD2-26
Sodium									
Winter	mg/L	2	---	48.3	39	27.1	27.1	30.2	34.4
Spring	mg/L	2	---	-	44	0.405 IB	0.405	-	39.4
Summer	mg/L	-	---	-	49.4	-	-	-	37.5
Fall	mg/L	-	---	-	42.7	-	-	-	35
Sulfate									
Winter	mg/L	1	250-600s	-	-	-	-	-	37
Spring	mg/L	1	250-600s	-	-	0.12 IB	0.12	-	37
Summer	mg/L	1	250-600s	-	-	-	-	-	36
Fall	mg/L	1	250-600s	-	-	-	-	-	37 Jhl
Total Kjeldahl Nitrogen									
Spring	mg/L	0.5	---	-	-	-	-	-	3
Summer	mg/L	0.5	---	-	-	-	-	-	0.61
Fall	mg/L	0.5	---	-	-	-	-	-	2.1

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Table B-5
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Cations/Anions by CLP

Location	UNITS	DL	MCL	UCD2-26 Duplicate	UCD2-27Z4	UCD2-27Z5	UCD2-27Z6	UCD2-27Z7	UCD2-27Z7 Duplicate
Alkalinity, Total (as CaCO3)									
Winter	mg/L	-	---	-	-	320	320	-	-
Spring	mg/L	-	---	-	330	320	320	300	-
Summer	mg/L	-	---	340	350	340	340	330	-
Fall	mg/L	-	---	-	360	310	310	310	-
Ammonia Nitrogen									
Winter	mg/L	-	---	-	-	0.17	0.17	-	-
Spring	mg/L	-	---	-	0.13	0.13	0.13	0.083	-
Fall	mg/L	-	---	-	-	0.059	Uxl 0.059	0.044	IB -
Calcium									
Winter	mg/L	2	---	-	-	31.7	31.7	-	-
Spring	mg/L	2	---	-	31.5	Jcl 33.7	Jcl 33.7	Jcl 36.3	Jcl -
Summer	mg/L	2	---	35.2	35.6	40.7	40.7	35.9	-
Fall	mg/L	2	---	-	36.8	39.7	39.7	36.3	IC -
Chloride									
Winter	mg/L	1	250-600s	-	-	22	22	-	-
Spring	mg/L	1	250-600s	-	26	21	21	20	-
Summer	mg/L	1	250-600s	21	20	21	21	21	-
Fall	mg/L	1	250-600s	-	22	22	Jhl 22	Jcl 18	Jcl -

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Table B-5
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Cations/Anions by CLP

Location	UNITS DL MCL			UCD2-26 Duplicate	UCD2-27Z4	UCD2-27Z5	UCD2-27Z6	UCD2-27Z7	UCD2-27Z7 Duplicate	
Magnesium										
Winter	mg/L	2	---	-	-	66.7	Jcl	66.7	Jcl	-
Spring	mg/L	2	---	-	63.8	Jcl	56	Jcl	56	Jcl
Summer	mg/L	-	---	63.6	68.9	68.7	68.7	68.7	68.7	57.8
Fall	mg/L	-	---	-	69.3	66.6	66.6	66.6	66.6	57.7
Nitrogen, Nitrate (as N)										
Winter	mg/L	0.1	10.0	-	-	2.3	2.3	-	-	-
Spring	mg/L	0.1	10.0	-	1.7	2.5	2.5	1.9	-	-
Summer	mg/L	0.1	10.0	4.8	3.9	4.2	4.2	2	-	-
Fall	mg/L	0.1	10.0	-	4.5	3.7	3.7	2.2	-	-
Phosphate, Total (as P)										
Winter	mg/L	-	---	-	-	0.071	0.071	-	-	-
Spring	mg/L	-	---	-	0.079	0.093	0.093	0.058	-	-
Summer	mg/L	-	---	0.23	0.093	0.099	0.099	0.088	-	-
Fall	mg/L	-	---	-	0.082	0.099	0.099	0.091	-	-
Potassium										
Winter	mg/L	2	---	-	-	0.769	IB	0.769	-	-
Spring	mg/L	2	---	-	-	1.68	JclB	1.68	1.84	JclB
Fall	mg/L	-	---	-	-	1.31	IB	1.31	-	-

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Table B-5
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
Cations/Anions by CLP

Location	UNITS	DL	MCL	UCD2-26 Duplicate	UCD2-27Z4	UCD2-27Z5	UCD2-27Z6	UCD2-27Z7	UCD2-27Z7 Duplicate
Sodium									
Winter	mg/L	2	---	-	-	34.8	34.8	-	-
Spring	mg/L	2	---	-	41.4	30.9	30.9	40.5	-
Summer	mg/L	-	---	35.6	40	36.5	36.5	40.7	-
Fall	mg/L	-	---	-	38.6	35.2	35.2	37.9	IC
Sulfate									
Winter	mg/L	1	250-600s	-	-	39	39	-	-
Spring	mg/L	1	250-600s	-	37	37	37	38	-
Summer	mg/L	1	250-600s	36	36	35	35	39	-
Fall	mg/L	1	250-600s	-	38	35	Jhl 35	35	-
Total Kjeldahl Nitrogen									
Spring	mg/L	0.5	---	-	-	-	-	-	-
Summer	mg/L	0.5	---	0.99	0.8	I* 0.99	I* 0.99	0.99	-

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Table B-6
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
General

Location				UCD1- 1	UCD1- 4	UCD1-10	UCD1-11	UCD1-12	UCD1-13
UNITS	DL	MCL							
pH-F									
Winter	std	-	---	7.12	7.3	7.36	7.36	7.4	7.42
Spring	std	-	---	-	7.76	7.85	7.85	7.7	7.64
Summer	std	-	---	6.69	7.45	7.93	7.93	7.38	7.74
Specific Conductance (EC)-F									
Winter	umhos	-	---	963	870	1,500	1,500	1,890	1,278
Spring	umhos	-	---	-	477	1,005	1,005	1,011	831
Summer	umhos	-	---	1,111	890	1,945	1,945	2,220	1,760
Temperature-F									
Winter	deg C	-	---	18.2	18.2	18.5	18.5	18.2	18.5
Spring	deg C	-	---	-	19.3	19.3	19.3	19.1	18.7
Summer	deg C	-	---	19.4	17.7	19.6	19.6	19.1	19.3
Total Dissolved Solids									
Winter	mg/L	20	500s,#	-	550	1,300	1,300	1,500	1,100
Spring	mg/L	20	500s,#	-	790	1,200	1,200	1,600	1,100
Summer	mg/L	20	500s,#	-	550	1,300	1,300	1,200	730
Fall	mg/L	20	500s,#	-	500	1,300	1,300	20	930

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Table B-6
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
General

Location	UNITS DL MCL			UCD1- 1	UCD1- 4	UCD1-10	UCD1-11	UCD1-12	UCD1-13
Turbidity									
Summer	NTU	0.1	0.5,#	-	2.1	2.1	2.1	1.6	0.73
Fall	NTU	0.1	0.5,#	-	0.89 Uxl	0.53	0.53	0.62 Uxl	0.1
Turbidity-F									
Winter	NTU	-	0.5,#	2.7	1.45	1.5	1.5 JhIH	1.7	2.8 JhIH
Spring	NTU	-	0.5,#	-	4.2	3.21	3.21	1.4	7.58
Summer	NTU	-	0.5,#	19.9	5.12	1.93	1.93	5.8	5.12

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Table B-6
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
General

Location	UNITS DL MCL			UCD1-18	UCD1-19	UCD1-20	UCD1-21	UCD1-22	UCD1-23
pH-F									
Winter	std	-	---	7.46	7.53	7.79	7.79	7.49	7.34
Spring	std	-	---	-	7.81	-	-	-	-
Summer	std	-	---	-	8.16	7.9	7.9	7.55	7.75
Specific Conductance (EC)-F									
Winter	umhos	-	---	1,219	1,260	626	626	899	990
Spring	umhos	-	---	-	645	-	-	-	-
Summer	umhos	-	---	-	1,317	645	645	1,086	1,018
Temperature-F									
Winter	deg C	-	---	18.6	17.1	19	19	19	20.2
Spring	deg C	-	---	-	19.1	-	-	-	-
Summer	deg C	-	---	-	19.2	22.2	22.2	19.3	19.6
Total Dissolved Solids									
Winter	mg/L	20	500s,#	780	1,000	380	380	650	650
Summer	mg/L	20	500s,#	-	-	-	-	350	-
Turbidity									
Summer	NTU	0.1	0.5,#	-	0.62	-	-	-	-
Fall	NTU	0.1	0.5,#	-	0.2	-	-	-	-

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LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
General

Location				UCD1-18	UCD1-19	UCD1-20	UCD1-21	UCD1-22	UCD1-23
	UNITS	DL	MCL						
Turbidity-F									
Winter	NTU	-	0.5,#	0.74	0.5	0.65	0.65	1.17	1.05
Spring	NTU	-	0.5,#	-	1.1	-	-	-	-
Summer	NTU	-	0.5,#	-	3.9	7.5	7.5	27.6	190

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Table B-6
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
General

Location				UCD1-24	UCD1-25	UCD1-25 Duplicate	UCD1-27Z3	UCD1-34	UCD1-34 Duplicate
	UNITS	DL	MCL						
Chemical Oxygen Demand									
Winter	mg/L	50	---	-	-	-	-	-	-
Spring	mg/L	50	---	-	-	-	-	-	-
Summer	mg/L	50	---	-	-	-	-	-	-
Fall	mg/L	50	---	-	-	-	-	-	-
pH-F									
Winter	std	-	---	7.34	7.5	7.5	7.5	7.48	-
Spring	std	-	---	-	7.95	-	-	7.9	7.9
Summer	std	-	---	-	7.56	-	-	7.5	-
Specific Conductance (EC)-F									
Winter	umhos	-	---	1,316	1,182	1,182	1,182	611	-
Spring	umhos	-	---	-	724	-	-	390	390
Summer	umhos	-	---	-	1,405	-	-	814	-
Temperature-F									
Winter	deg C	-	---	18.9	18.6	18.6	18.6	18.3	-
Spring	deg C	-	---	-	18.8	-	-	18.1	18.1
Summer	deg C	-	---	-	21.2	-	-	19.1	-

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Table B-6
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
General

Location	UNITS DL MCL			UCD2- 7	UCD2-14	UCD2-15	UCD2-16	UCD2-17	UCD2-26
pH-F									
Winter	std	-	---	7.79	8.19	7.9	7.9	7.64	7.81
Spring	std	-	---	-	7.62	7.84	7.84	-	8.36
Summer	std	-	---	8.09	7.75	7.97	7.97	8.27	-
Specific Conductance (EC)-F									
Winter	umhos	-	---	713	665	626	626	635	600
Spring	umhos	-	---	-	626	397	397	-	500
Summer	umhos	-	---	775	1,613	662	662	744	-
Temperature-F									
Winter	deg C	-	---	17.9	17.8	17.3	17.3	18.5	18.2
Spring	deg C	-	---	-	18.5	18.4	18.4	-	18.1
Summer	deg C	-	---	20.8	18.6	17.9	17.9	18.7	-
Total Dissolved Solids									
Winter	mg/L	20	500s,#	480	480	410	410	390	350
Spring	mg/L	20	500s,#	-	730	590	590	-	250
Summer	mg/L	20	500s,#	-	650	550	550	-	360
Fall	mg/L	20	500s,#	-	540	470	470	-	590

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= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-6
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
General

Location	UNITS DL MCL			UCD1-24	UCD1-25	UCD1-25 Duplicate	UCD1-27Z3	UCD1-34	UCD1-34 Duplicate
Total Dissolved Solids									
Winter	mg/L	20	500s,#	1,000	890	910	910	430	-
Spring	mg/L	20	500s,#	-	830	-	-	500	380
Summer	mg/L	20	500s,#	-	860	390	390	370	-
Fall	mg/L	20	500s,#	-	800	-	-	350	640
Total Organic Carbon									
Winter	mg/L	1	---	-	1.1	0.92 IB	0.92	1.2	-
Spring	mg/L	1	---	-	0.7	IB	-	0.76	IB 0.78
Summer	mg/L	1	---	-	-	-	-	1.2	-
Fall	mg/L	1	---	-	0.85	IB	-	1.4	1.3
Turbidity									
Summer	NTU	0.1	0.5,#	-	13	15	15	8.7	-
Fall	NTU	0.1	0.5,#	-	0.29	-	-	0.69	0.46
Turbidity-F									
Winter	NTU	-	0.5,#	1.9	1.5	2	2 ID	3.53	-
Spring	NTU	-	0.5,#	-	3.3	-	-	6.56	6.56
Summer	NTU	-	0.5,#	-	40.7	-	-	1.72	-

See tables in Appendix C for explanation of data qualifiers.

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DL= Detection Limit; Contract Required Quantitation Detection Limit.

F = Field data.

S = Secondary Drinking Water Standard.

MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

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Table B-6
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
General

Location				UCD2- 7	UCD2-14	UCD2-15	UCD2-16	UCD2-17	UCD2-26
	UNITS	DL	MCL						
Total Organic Carbon									
Winter	mg/L	1	---	-	-	-	-	-	0.68 IB
Spring	mg/L	1	---	-	-	-	-	-	0.57 IB
Fall	mg/L	1	---	-	-	-	-	-	0.74 IB
Turbidity									
Summer	NTU	0.1	0.5,#	-	3.3	0.66	0.66	-	0.05
Fall	NTU	0.1	0.5,#	-	1.1	0.89 Uxl	0.89	-	0.51
Turbidity-F									
Winter	NTU	-	0.5,#	1	0.24 JhlH	1.6	1.6	1.2	0.93
Spring	NTU	-	0.5,#	-	24.8	7.62	7.62	-	1.3
Summer	NTU	-	0.5,#	2.89	9.3	2.92	2.92	8.04	-

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1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-6
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
General

Location	UNITS	DL	MCL	UCD2-26 Duplicate	UCD2-27Z4	UCD2-27Z5	UCD2-27Z6	UCD2-27Z7	UCD2-27Z7 Duplicate
Chemical Oxygen Demand									
Spring	mg/L	50	---	-	10	IB	-	-	-
pH-F									
Winter	std	-	---	-	-	8.68	8.68	-	-
Spring	std	-	---	-	7.96	8.1	8.1	7.98	7.98
Specific Conductance (EC)-F									
Winter	umhos	-	---	-	-	578	578	-	-
Spring	umhos	-	---	-	352	328	328	373	373
Temperature-F									
Winter	deg C	-	---	-	-	17.2	17.2	-	-
Spring	deg C	-	---	-	18.3	17.9	17.9	19.7	19.7
Total Dissolved Solids									
Winter	mg/L	20	500s,#	-	-	400	400	-	-
Spring	mg/L	20	500s,#	-	80	430	430	450	-
Summer	mg/L	20	500s,#	440	440	390	390	460	-
Fall	mg/L	20	500s,#	-	560	Uxl	570	Uxl	640
						JhlH	Uxl	Uxl	Uxl

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1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-6
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
General

Location	UNITS DL MCL			UCD2-26 Duplicate	UCD2-27Z4	UCD2-27Z5	UCD2-27Z6	UCD2-27Z7	UCD2-27Z7 Duplicate
Total Organic Carbon									
Winter	mg/L	1	---	-	-	1.8	1.8	-	-
Spring	mg/L	1	---	-	1.4	-	- IB	0.43 IB	-
Summer	mg/L	1	---	-	1.1	-	-	-	-
Fall	mg/L	1	---	-	1.1	0.98	0.98	0.96	-
Turbidity									
Summer	NTU	0.1	0.5,#	0.45	0.39	0.59	0.59	0.0	-
Fall	NTU	0.1	0.5,#	-	0.59 Uxl	0.72 Uxl	0.72	0.95 Uxl	-
Turbidity-F									
Winter	NTU	-	0.5,#	-	-	3.2	3.2	-	-
Spring	NTU	-	0.5,#	-	9.06	0.76 Jol	0.76 Jol	0.76 Jol	0.24

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MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

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p = Proposed USEPA MCL.

Table B-6
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
General

Location				UCD2-35	UCD2-35 Duplicate
	UNITS	DL	MCL		
pH-F					
Winter	std	-	---	7.84	-
Spring	std	-	---	8.39	8.39
Specific Conductance (EC)-F					
Winter	umhos	-	---	608	-
Spring	umhos	-	---	417	417
Temperature-F					
Winter	deg C	-	---	17.8	-
Spring	deg C	-	---	19.3	19.3
Total Dissolved Solids					
Winter	mg/L	20	500s,#	410	-
Spring	mg/L	20	500s,#	80	280
Summer	mg/L	20	500s,#	710	-
Fall	mg/L	20	500s,#	200	450
Total Organic Carbon					
Winter	mg/L	1	---	2.2	-
Spring	mg/L	1	---	0.67	IB
Fall	mg/L	1	---	0.86	IB

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1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

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Table B-6
LEHR Environmental Restoration
Summary of Detected Constituents in Ground Water Samples - 1996
General

Location				UCD2-35	UCD2-35 Duplicate
	UNITS	DL	MCL		
Turbidity					
Summer	NTU	0.1	0.5,#	4.8	-
Fall	NTU	0.1	0.5,#	0.46	0.41 Jhl
Turbidity-F					
Winter	NTU	-	0.5,#	6.56	-
Spring	NTU	-	0.5,#	9.49	9.49

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MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

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Table B-7
LEHR Environmental Restoration
Summary of Detected Constituents in Surface Water and Stormwater Samples - 1996
Volatile Organics by CLP

Location				LS-1		LS-1 Duplicate	PCD	PCD Duplicate	PCU	PCU Duplicate
	UNITS	DL	MCL							
Acetone										
Fall	ug/L	5	---	16	Jcl	-	-	-	-	-
Bromodichloromethane										
Winter	ug/L	1	100a	-	-	-	1.3	1.3	-	-
Spring	ug/L	1	100a	-	-	-	-	JylJ	-	-
Bromoform										
Winter	ug/L	1	100a	-	-	-	1.2	1.2	-	-
Spring	ug/L	1	100a	-	-	-	-	IJ	-	-
Chloroform										
Winter	ug/L	1	100a	-	-	-	1.2	1.2	-	-
Spring	ug/L	1	100a	-	-	-	-	JylJ	-	-
Fall	ug/L	1	100a	-	-	-	0.5	IJ	0.5	-
Dibromochloromethane										
Winter	ug/L	1	100a	-	-	-	1.4	1.4	-	-
Spring	ug/L	1	100a	-	-	-	-	IJ	-	-

See tables in Appendix C for explanation of data qualifiers.

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DL= Detection Limit; Contract Required Quantitation Detection Limit.

F = Field data.

S = Secondary Drinking Water Standard.

MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-7
LEHR Environmental Restoration
Summary of Detected Constituents in Surface Water and Stormwater Samples - 1996
Volatile Organics by CLP

Location				LS-1	LS-1 Duplicate	PCD	PCD Duplicate	PCU	PCU Duplicate
	UNITS	DL	MCL						
Methylene Chloride									
Winter	ug/L	1	5#	-	-	3.3	3.3	-	-
Fall	ug/L	1	5#	-	-	0.6	0.6	-	-

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1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

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Table B-7
LEHR Environmental Restoration
Summary of Detected Constituents in Surface Water and Stormwater Samples - 1996
Volatile Organics by CLP

Location	UNITS DL MCL			SD-1	SD-1 Duplicate	STPO	STPO Duplicate
	Acetone						
Winter	ug/L	5	---	-	-	5.2 Jcl	5.2 Jcl
Spring	ug/L	5	---	-	-	24 Jxl	24 Jcl
Fall	ug/L	5	---	16 Jcl	15 Jcl	-	-
Bromodichloromethane							
Winter	ug/L	1	100a	-	-	3.5	3.5
Spring	ug/L	1	100a	-	-	4.9	4.9
Fall	ug/L	1	100a	-	-	0.8 IJ	0.8 IJ
Bromoform							
Winter	ug/L	1	100a	-	-	3.5	3.5
Spring	ug/L	1	100a	-	-	7.5	7.5
Chloroform							
Winter	ug/L	1	100a	-	-	2.2	2.2
Spring	ug/L	1	100a	-	-	2.3	2.3
Fall	ug/L	1	100a	-	-	2.7	2.7
Dibromochloromethane							
Winter	ug/L	1	100a	-	-	4.4	4.4
Spring	ug/L	1	100a	-	-	9.1	9.1

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Table B-7
LEHR Environmental Restoration
Summary of Detected Constituents in Surface Water and Stormwater Samples - 1996
Volatile Organics by CLP

Location				SD-1	SD-1 Duplicate	STPO	STPO Duplicate
	UNITS	DL	MCL				
Methylene Chloride							
Winter	ug/L	1	5#	-	-	3.5	3.5
Spring	ug/L	1	5#	-	-	0.56	0.56 IJ
Fall	ug/L	1	5#	-	-	1.4	1.4 IJ

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Table B-8
LEHR Environmental Restoration
Summary of Detected Constituents in Surface Water and Stormwater Samples - 1996
Semivolatile Organics by CLP

Location				LS-1	LS-1 Duplicate		PCD		PCD Duplicate		PCU	PCU Duplicate	
	UNITS	DL	MCL										
Benzyl Butyl Phthalate													
Fall	ug/L	10	100p	0.74	IJ	-	-	-	-	-	-	-	-
Bis(2-Ethylhexyl)phthalate													
Winter	ug/L	10	---	0.82	IJ	0.83	IJ	-	-	-	-	-	21
Spring	ug/L	10	---	-	-	-	-	-	-	JxIJ	-	-	-
Summer	ug/L	10	---	-	-	-	-	1.2	UzIJ	1.2	-	-	-
Fall	ug/L	10	---	6.4	IJ	-	-	0.6	IJ	0.6	-	-	-

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DL= Detection Limit; Contract Required Quantitation Detection Limit.

F = Field data.

S = Secondary Drinking Water Standard.

MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

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Table B-8
LEHR Environmental Restoration
Summary of Detected Constituents in Surface Water and Stormwater Samples - 1996
Semivolatile Organics by CLP

Location				SD-1	SD-1		STPO		STPO
	UNITS	DL	MCL		Duplicate			Duplicate	
BenzyI Butyl Phthalate									
Fall	ug/L	10	100p	0.98	IJ	-	-	-	-
Bis(2-Ethylhexyl)phthalate									
Winter	ug/L	10	---	-		-	18		18
Spring	ug/L	10	---	-		-	1	JxIJ	1
Summer	ug/L	10	---	-		-	3.1	UzIJ	3.1
Fall	ug/L	10	---	3.7	IJ	9.8	0.62	UzIJB	0.62
Diethyl Phthalate									
Fall	ug/L	10	---	0.85	IJ	0.59	IJ	-	-

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DL= Detection Limit; Contract Required Quantitation Detection Limit.

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S = Secondary Drinking Water Standard.

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= USEPA MCL (no CA MCL)

p = Proposed USEPA MCL.

Table B-9
LEHR Environmental Restoration
Summary of Detected Constituents in Surface Water and Stormwater Samples - 1996
Pesticides and PCBs by CLP

Location	UNITS DL MCL			LS-1		LS-1 Duplicate		PCD		PCD Duplicate		PCU		PCU Duplicate	
	Alpha-Chlordane Fall	ug/L	-	---	0.0082	JslJ	-	-	-	-	-	-	-	-	-
Gamma-Chlordane Fall	ug/L	-	---	0.012	Jsl	-	-	-	-	-	-	-	-	-	-

See tables in Appendix C for explanation of data qualifiers.

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DL= Detection Limit; Contract Required Quantitation Detection Limit.

F = Field data.

S = Secondary Drinking Water Standard.

MCL = California Maximum Contaminant Level (primary), Title 22, Division 4, Chapter 15.

1 = Total Trihalomethanes MCL is the sum of bromoform, chloroform, bromodichloromethane, and dibromochloromethane.

= USEPA MCL (no CA MCL)

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Table B-9
LEHR Environmental Restoration
Summary of Detected Constituents in Surface Water and Stormwater Samples - 1996
Pesticides and PCBs by CLP

Location				SD-1	SD-1 Duplicate		STPO	STPO Duplicate
	UNITS	DL	MCL					
Alpha-Chlordane								
Fall	ug/L	-	---	-	0.0014	JslJP	-	-
Gamma-Chlordane								
Fall	ug/L	-	---	-	0.0031	JslJP	-	-

See tables in Appendix C for explanation of data qualifiers.

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Table B-10
LEHR Environmental Restoration
Summary of Detected Constituents in Surface Water and Stormwater Samples - 1996
Metals by CLP

Location	UNITS DL MCL			LS-1		LS-1 Duplicate		PCD		PCD Duplicate		PCU		PCU Duplicate	
	Antimony														
Winter	mg/L	0.005	0.006	0.0023	IB	0.0058		-		-		-			
Fall	mg/L	0.005	0.006	0.0047	IB	-		-		-		-			
Arsenic															
Spring	mg/L	0.002	0.05	-		-		0.0023		0.0023		0.0022		-	
Barium															
Winter	mg/L	0.02	1.0	0.0097	IB	0.0086	IB	0.0468		0.0468		0.048		-	
Spring	mg/L	0.02	1.0	-		-		0.0926		0.0926		0.096		-	
Summer	mg/L	0.02	1.0	-		-		0.1		0.1		0.097		0.1	
Fall	mg/L	0.02	1.0	0.0342		-		0.0013		0.0013		0.109		-	
Chromium															
Winter	mg/L	0.01	0.05	0.0058	IB	0.0072	IB	0.0029	UpIB	0.0029		0.0028	UpIB	-	
Summer	mg/L	0.01	0.05	-		-		0.0055	Uo,pIB	0.0055		0.0062	UpIB	0.0062	UpIB
Fall	mg/L	0.01	0.05	0.0192		-		0.0076	IB	0.0076		0.0074	IB	-	
Chromium, Hexavalent (+6)															
Winter	mg/L	0.02	---	0.01		0.01		-		-		-		-	
Spring	mg/L	0.02	---	-		-		0.004	IB	0.004		0.004	IB	-	
Fall	mg/L	-	---	-		-		-		-		0.003	IB	-	

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Table B-10
LEHR Environmental Restoration
Summary of Detected Constituents in Surface Water and Stormwater Samples - 1996
Metals by CLP

Location	UNITS DL MCL			LS-1		LS-1 Duplicate		PCD		PCD Duplicate		PCU		PCU Duplicate	
Cobalt															
Spring	mg/L	0.01	---	-		-		0.0011	IB	0.0011		-		-	
Fall	mg/L	0.01	---	0.0067	IB	-		-		-		-		-	
Copper															
Winter	mg/L	0.01	1.0s	0.0098	IB	0.0096	IB	0.0032	IB	0.0032		0.0029	IB	-	
Spring	mg/L	0.01	1.0s	-		-		-		-		0.0021	IB	-	
Summer	mg/L	0.01	1.0s	-		-		0.0015	IB	0.0015		0.0014	IB	0.0013	IB
Fall	mg/L	0.01	1.0s	0.0364		-		0.0031	UpIB	0.0031		0.0087	IB	-	
Iron															
Winter	mg/L	0.001	0.3s	0.909		0.78		0.0764	UpIB	0.0764		0.0575	UpIB	-	
Spring	mg/L	0.001	0.3s	-		-		0.118	Jel*	0.118	Jel*B	0.108	Jel*	-	
Summer	mg/L	0.001	0.3s	-		-		0.073	Uo,pIB	0.073		0.061	Uo,pIB	0.025	Uo,pIB
Fall	mg/L	0.001	0.3s	3.96	IN	-		0.0787	IB	0.0787		0.0578	IB	-	
Lead															
Winter	mg/L	0.002	0.05	0.0071		0.007		-		-		-		-	
Fall	mg/L	0.002	0.05	0.0225		-		-		-		-		-	

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Table B-10
LEHR Environmental Restoration
Summary of Detected Constituents in Surface Water and Stormwater Samples - 1996
Metals by CLP

Location				LS-1		LS-1 Duplicate		PCD		PCD Duplicate		PCU		PCU Duplicate	
	UNITS	DL	MCL												
Manganese															
Winter	mg/L	-	0.05s	0.0192		0.0177		0.0074	IB	0.0074		0.0059	IB	-	
Spring	mg/L	-	0.05s	-		-		0.0132	IB	0.0132	IB	0.0124	IB	-	
Summer	mg/L	-	0.05s	-		-		0.0036	IB	0.0036		0.0034	IB	0.0033	IB
Fall	mg/L	-	0.05s	0.106		-		0.009	IB	0.009		0.0094	IB	-	
Molybdenum															
Winter	mg/L	0.01	---	-		-		0.0021	IB	0.0021		-		-	
Spring	mg/L	0.01	---	-		-		0.0012	IB	0.0012		-		-	
Summer	mg/L	0.01	---	-		-		0.0013	Uo,pIB	0.0013		0.0013	Uo,pIB	-	
Fall	mg/L	0.01	---	-		-		0.001	IB	0.001		-		-	
Nickel															
Winter	mg/L	0.02	100	0.006	IB	0.0055	IB	0.0047	IB	0.0047		0.0049	IB	-	
Spring	mg/L	0.02	100	-		-		0.0051	IB	0.0051	IB	0.0031	IB	-	
Summer	mg/L	0.02	100	-		-		0.0029	UpIB	0.0029		0.0031	UpIB	0.003	UpIB
Fall	mg/L	0.02	100	0.0256		-		0.0041	IB	0.0041		0.0035	IB	-	
Silver															
Fall	mg/L	0.01	100s	0.0012	IB	-		-		-		-		-	

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p = Proposed USEPA MCL.

Table B-10
LEHR Environmental Restoration
Summary of Detected Constituents in Surface Water and Stormwater Samples - 1996
Metals by CLP

Location				LS-1		LS-1 Duplicate		PCD		PCD Duplicate		PCU		PCU Duplicate	
	UNITS	DL	MCL												
Vanadium															
Winter	mg/L	0.01	---	0.0029	IB	-		0.0072	UpIB	0.0072		0.0064	UpIB	-	
Spring	mg/L	0.01	---	-		-		0.0027	IB	0.0027	IB	-		-	
Summer	mg/L	0.01	---	-		-		0.0068	IB	0.0068		0.0057	IB	0.0058	IB
Fall	mg/L	0.01	---	0.0092	IB	-		-		-		-		-	
Zinc															
Winter	mg/L	0.020	5s	0.069		0.0655		0.0131	IB	0.0131		0.004	IB	-	
Spring	mg/L	0.020	5s	-		-		0.002	IB	0.002	IB	0.002	IB	-	
Summer	mg/L	0.020	5s	-		-		0.0086	UpIB	0.0086		0.0072	UpIB	0.0054	UpIB
Fall	mg/L	0.020	5s	0.185		-		0.0076	UpIB	0.0076		0.0086	UpIB	-	

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Table B-10
LEHR Environmental Restoration
Summary of Detected Constituents in Surface Water and Stormwater Samples - 1996
Metals by CLP

Location	UNITS DL MCL			SD-1	SD-1 Duplicate	STPO	STPO Duplicate		
	UNITS	DL	MCL						
Antimony									
Fall	mg/L	0.005	0.006	0.0078	0.0065	-	-		
Arsenic									
Winter	mg/L	0.002	0.05	-	-	0.0053	0.0053		
Spring	mg/L	0.002	0.05	-	-	0.0057	0.0057		
Summer	mg/L	0.002	0.05	-	-	0.004	0.004		
Fall	mg/L	0.002	0.05	-	-	0.0038	0.0038		
Barium									
Winter	mg/L	0.02	1.0	-	-	0.0413	0.0413		
Spring	mg/L	0.02	1.0	-	-	0.0474	0.0474		
Summer	mg/L	0.02	1.0	-	-	0.06	0.06		
Fall	mg/L	0.02	1.0	0.031	0.0266	0.0477	0.0477		
Chromium									
Winter	mg/L	0.01	0.05	-	-	0.0036	UpIB	0.0036	UpIB
Summer	mg/L	0.01	0.05	-	-	0.0062	UpIB	0.0062	UpIB
Fall	mg/L	0.01	0.05	0.0158	IB	0.0182	IB	0.0053	IB
Chromium, Hexavalent (+6)									
Fall	mg/L	-	---	-	-	0.003	IB	0.003	IB

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Table B-10
LEHR Environmental Restoration
Summary of Detected Constituents in Surface Water and Stormwater Samples - 1996
Metals by CLP

Location				SD-1	SD-1 Duplicate		STPO		STPO Duplicate	
	UNITS	DL	MCL							
Cobalt										
Fall	mg/L	0.01	---	0.0101	0.0088	IB	-		-	
Copper										
Winter	mg/L	0.01	1.0s	-	-		0.0069	IB	0.0069	IB
Spring	mg/L	0.01	1.0s	-	-		0.0075	IB	0.0075	
Summer	mg/L	0.01	1.0s	-	-		0.0025	IB	0.0025	
Fall	mg/L	0.01	1.0s	0.021	0.0158		0.0059	UplB	0.0059	UplB
Iron										
Winter	mg/L	0.001	0.3s	-	-		0.112	Upl	0.112	Upl
Spring	mg/L	0.001	0.3s	-	-		0.106	Jel*	0.106	
Summer	mg/L	0.001	0.3s	-	-		0.12	Uo,pl	0.12	
Fall	mg/L	0.001	0.3s	2.76	2.35	IN	0.096	IB	0.096	
Lead										
Winter	mg/L	0.002	0.05	-	-		0.0011	IB	0.0011	IB
Fall	mg/L	0.002	0.05	0.0418	0.035		-		-	

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Table B-10
LEHR Environmental Restoration
Summary of Detected Constituents in Surface Water and Stormwater Samples - 1996
Metals by CLP

Location				SD-1	SD-1 Duplicate	STPO	STPO Duplicate
	UNITS	DL	MCL				
Manganese							
Winter	mg/L	-	0.05s	-	-	0.0045 IB	0.0045 IB
Spring	mg/L	-	0.05s	-	-	0.0062 IB	0.0062
Summer	mg/L	-	0.05s	-	-	0.012 IB	0.012
Fall	mg/L	-	0.05s	0.0849	0.0734	0.0071 IB	0.0071 IB
Molybdenum							
Winter	mg/L	0.01	---	-	-	0.0059 IB	0.0059 IB
Spring	mg/L	0.01	---	-	-	0.0058 IB	0.0058
Summer	mg/L	0.01	---	-	-	0.0084 IB	0.0084
Fall	mg/L	0.01	---	-	-	0.0049 UpIB	0.0049 UpIB
Nickel							
Winter	mg/L	0.02	100	-	-	0.0045 IB	0.0045 IB
Spring	mg/L	0.02	100	-	-	0.0022 IB	0.0022
Summer	mg/L	0.02	100	-	-	0.003 UpIB	0.003
Fall	mg/L	0.02	100	0.0196 IB	0.0161 IB	0.003 UpIB	0.003 UpIB
Selenium							
Winter	mg/L	0.003	50	-	-	0.005	0.005
Spring	mg/L	0.003	50	-	-	0.0054	0.0054
Summer	mg/L	0.003	50	-	-	0.0054 JII	0.0054

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Table B-10
LEHR Environmental Restoration
Summary of Detected Constituents in Surface Water and Stormwater Samples - 1996
Metals by CLP

Location				SD-1	SD-1 Duplicate		STPO		STPO Duplicate	
	UNITS	DL	MCL							
Vanadium										
Winter	mg/L	0.01	---	-	-	-	0.0108	Upl	0.0108	UplB
Spring	mg/L	0.01	---	-	-	-	0.0094	IB	0.0094	
Summer	mg/L	0.01	---	-	-	-	0.017		0.017	
Fall	mg/L	0.01	---	0.0054	IB	0.0069	IB	0.0112	0.0112	
Zinc										
Winter	mg/L	0.020	5s	-	-	-	0.0422		0.0422	
Spring	mg/L	0.020	5s	-	-	-	0.0296		0.0296	
Summer	mg/L	0.020	5s	-	-	-	0.03	Upl	0.03	
Fall	mg/L	0.020	5s	0.257		0.246	0.0331		0.0331	

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Table B-11
LEHR Environmental Restoration
Summary of Detected Constituents in Surface Water and Stormwater Samples - 1996
Cations/Anions by CLP

Location				LS-1		LS-1 Duplicate		PCD		PCD Duplicate		PCU		PCU Duplicate	
	UNITS	DL	MCL												
Calcium															
Winter	mg/L	2	---	1.06	IB	1.05	IB	21.6		21.6		23.6			-
Spring	mg/L	2	---	-		-		31.8		31.8		31.2			-
Summer	mg/L	2	---	-		-		28.8		28.8		29.3			29.3
Fall	mg/L	2	---	4.92		-		31.5		31.5		31.2			-
Magnesium															
Winter	mg/L	2	---	0.453	IB	0.425	IB	25.9		25.9		25.2			-
Spring	mg/L	2	---	-		-		39.8		39.8		38.9			-
Summer	mg/L	-	---	-		-		35.2		35.2		35.8			35.7
Fall	mg/L	-	---	3.02	IB	-		40.5		40.5		40.3			-
Nitrogen, Nitrate (as N)															
Winter	mg/L	0.1	10.0	0.091	IB	0.26		2		2		0.25			-
Spring	mg/L	0.1	10.0	-		-		2.7		2.7		2.4			-
Summer	mg/L	0.1	10.0	-		-		2		2		2.1			2
Fall	mg/L	0.1	10.0	-		-		3.2		3.2		2.8	IW		-
Potassium															
Winter	mg/L	2	---	0.596	IB	0.854	IB	4.82		4.82		1.46	IB		-
Fall	mg/L	-	---	3.08		-		2.75		2.75		1.38	IB		-

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Table B-11
LEHR Environmental Restoration
Summary of Detected Constituents in Surface Water and Stormwater Samples - 1996
Cations/Anions by CLP

Location				LS-1		LS-1 Duplicate		PCD		PCD Duplicate		PCU		PCU Duplicate	
	UNITS	DL	MCL												
Sodium															
Winter	mg/L	2	---	0.952	IB	0.943	IB	53.4		53.4		15.1		-	
Spring	mg/L	2	---	-		-		27.3		27.3		21.8		-	
Summer	mg/L	-	---	-		-		33.8		33.8		23.2		23.2	
Fall	mg/L	-	---	5	IB	-		32		32		22.4		-	

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Table B-11
LEHR Environmental Restoration
Summary of Detected Constituents in Surface Water and Stormwater Samples - 1996
Cations/Anions by CLP

Location				SD-1		SD-1 Duplicate		STPO		STPO Duplicate	
	UNITS	DL	MCL								
Calcium											
Winter	mg/L	2	---	-		-		23.7		23.7	
Spring	mg/L	2	---	-		-		24.9		24.9	
Summer	mg/L	2	---	-		-		27.3		27.3	
Fall	mg/L	2	---	4.22	IB	5.19		-		-	
Magnesium											
Winter	mg/L	2	---	-		-		29.9		29.9	
Spring	mg/L	2	---	-		-		29.1		29.1	
Summer	mg/L	-	---	-		-		35		35	
Fall	mg/L	-	---	2.09	IB	1.83	IB	-		-	
Nitrogen, Nitrate (as N)											
Winter	mg/L	0.1	10.0	-		-		9.6		9.6	
Spring	mg/L	0.1	10.0	-		-		9.7		9.7	
Summer	mg/L	0.1	10.0	-		-		3.6		3.6	
Fall	mg/L	0.1	10.0	-		-		6.7		6.7	
Potassium											
Winter	mg/L	2	---	-		-		13.4		13.4	
Spring	mg/L	2	---	-		-		9.02		9.02	
Summer	mg/L	-	---	-		-		7.8		7.8	

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= USEPA MCL (no CA MCL)

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Table B-11
LEHR Environmental Restoration
Summary of Detected Constituents in Surface Water and Stormwater Samples - 1996
Cations/Anions by CLP

Location				SD-1	SD-1 Duplicate	STPO	STPO Duplicate
	UNITS	DL	MCL				
Sodium							
Winter	mg/L	2	---	-	-	156	156
Spring	mg/L	2	---	-	-	154	154
Summer	mg/L	-	---	-	-	172	172
Fall	mg/L	-	---	3.73	IB	3.55	-

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Table B-12
LEHR Environmental Restoration
Summary of Detected Constituents in Surface Water and Stormwater Samples - 1996
General

Location	UNITS DL MCL			LS-1	LS-1 Duplicate	PCD	PCD Duplicate	PCU	PCU Duplicate
pH-F									
Winter	std	-	---	-	-	7.71	7.71	7.74	-
Spring	std	-	---	-	-	8.33	8.33	8.71	-
Summer	std	-	---	-	-	8.52	8.52	8.43	8.43
Specific Conductance (EC)-F									
Winter	umhos	-	---	-	-	453	453	296	-
Spring	umhos	-	---	-	-	298	298	218	-
Summer	umhos	-	---	-	-	536	536	453	453
Temperature-F									
Winter	deg C	-	---	-	-	13.4	13.4	11.9	-
Spring	deg C	-	---	-	-	21.8	21.8	21.4	-
Summer	deg C	-	---	-	-	20.7	20.7	19	19
Total Dissolved Solids									
Winter	mg/L	20	500s,#	-	-	310	310	200	-
Spring	mg/L	20	500s,#	-	-	-	-	130	-
Summer	mg/L	20	500s,#	-	-	260	260	-	230
Fall	mg/L	20	500s,#	100	-	450	450	390	-

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= USEPA MCL (no CA MCL)

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Table B-12
LEHR Environmental Restoration
Summary of Detected Constituents in Surface Water and Stormwater Samples - 1996
General

Location	UNITS			LS-1	LS-1 Duplicate	PCD	PCD Duplicate	PCU	PCU Duplicate
	DL	MCL							
Total Oil and Grease									
Fall	mg/L	-	---	0.21	J	-	-	-	-
Turbidity									
Summer	NTU	0.1	0.5,#	-		14	14	19	17
Fall	NTU	0.1	0.5,#	66	Jhl	15	15	16	-
Turbidity-F									
Winter	NTU	-	0.5,#	19	19	33	33	29	-
Spring	NTU	-	0.5,#	-	-	19	19	29	-
Summer	NTU	-	0.5,#	-	-	17.05	17.05	19.7	19.7

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Table B-12
LEHR Environmental Restoration
Summary of Detected Constituents in Surface Water and Stormwater Samples - 1996
General

Location	UNITS DL MCL			SD-1	SD-1 Duplicate	STPO	STPO Duplicate
	pH-F						
Winter	std	-	---	-	-	7.31	7.31
Spring	std	-	---	-	-	7.73	7.73
Summer	std	-	---	-	-	7.84	7.84
Specific Conductance (EC)-F							
Winter	umhos	-	---	-	-	787	787
Spring	umhos	-	---	-	-	592	592
Summer	umhos	-	---	-	-	1,206	1,206
Temperature-F							
Winter	deg C	-	---	-	-	15.8	15.8
Spring	deg C	-	---	-	-	22.9	22.9
Summer	deg C	-	---	-	-	25.5	25.5
Total Dissolved Solids							
Winter	mg/L	20	500s,#	-	-	610	610
Spring	mg/L	20	500s,#	-	-	180	180
Summer	mg/L	20	500s,#	-	-	320	320
Fall	mg/L	20	500s,#	140	50	610	610
Total Oil and Grease							
Fall	mg/L	-	---	0.27	IJ	-	-

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p = Proposed USEPA MCL.

Table B-12
LEHR Environmental Restoration
Summary of Detected Constituents in Surface Water and Stormwater Samples - 1996
General

Location	UNITS DL MCL			SD-1	SD-1 Duplicate	STPO	STPO Duplicate
	Turbidity						
Summer	NTU	0.1	0.5,#	-	-	3.4	3.4
Fall	NTU	0.1	0.5,#	28.2	Jhl	27	Jhl
						6.6	6.6
Turbidity-F							
Winter	NTU	-	0.5,#	-	-	7.4	7.4
Spring	NTU	-	0.5,#	-	-	9.07	9.07
Summer	NTU	-	0.5,#	-	-	3.42	3.42

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APPENDIX C

DATA QUALIFIERS

The following tables provide brief explanations of the qualifiers assigned in the data review process. Validation reason codes for GC/MS organics, GC organics, metals and non-metals are recorded by the data reviewers and retained in support documentation for the data review process.

Table C-1. Flag Qualifier Definition

Flag	Data Qualifier Definition
U	The analyte was analyzed for but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified but the associated numerical value is approximate.
N	The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification."
NJ	The analysis indicates the presence of an analyte that has been "tentatively identified," and the associated numerical value represents its approximate concentration.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and might or might not represent the actual limit of quantitation necessary to accurately measure the analyte in the sample.
R	The sample results are rejected due to serious deficiencies in the ability to analyze the sample and meet quality control criteria. The presence or absence of the analyte cannot be verified.
a	Analytical sequence deficiency or omission.
b	Gross compound breakdown (4,4'-DDT/Endrin).
c	Calibration failure; poor or unstable response.
d	Matrix spike/matrix spike duplicate imprecision or matrix duplicate imprecision.
e	Laboratory duplicate control sample imprecision.
f	Field replicate or duplicate imprecision.
g	Poor chromatography.
h	Holding time violation.
i	Internal standard failure.
j	Poor mass spectrographic performance.
k	Serial dilution imprecision (inorganics only).
l	Laboratory control sample recovery failure.
m	Matrix spike/matrix spike duplicate recovery failure.
n	Interference check sample recovery failure.
o	Calibration blank contamination (metals/inorganics only).
p	Preparation blank contamination (metals/inorganics only).
q	No valid quantitation column present.
r	Linearity failure in initial calibration.
s	Surrogate spike recovery failure (GC organics and GC/MS organics only).
t	Instrument tuning failure.
u	No confirmation column present (GC organics only).
w	Retention time (RT) outside of RT window.
x	Field blank contamination.
y	Trip blank contamination.
z	Method blank contamination.
Q	Result not used since valid data already exist for analyte.

Table C-2. LAS Laboratories Data Qualifiers for Organic Analyses

For Use On the Analytical Data Reporting Forms	
A	<i>For CLP analyses only</i> - The Tentatively Identified Constituents (TIC) is a suspected aldol-condensation product.
B	Any constituent that was also detected in the associated blank whose concentration was greater than the Practical Quantitative or Reporting Detection Limit (PQL or RDL).
C	Constituent confirmed by GC/MS analysis (<i>pesticide/PCB analyses only</i>).
D	Constituent detected in the diluted sample. Also indicates that an accurate quantitation is not possible because surrogates were diluted out of the samples during the course of the analysis.
E	Constituent concentration exceeded the calibration range.
G	The quantitation is not gasoline or diesel but believed to be some other combination of hydrocarbons.
H	Sample analysis performed outside of method - or client - specified maximum holding time requirement.
J	<i>Estimated value</i> - 1) constituent detected at a level less than the RDL or PQL and greater than or equal to the MDL; 2) estimated concentration for TICs (<i>for CLP reporting only</i>).
N	<i>For CLP reporting only</i> - TICs identified based on mass spectral library search.
P	<i>For CLP reporting only</i> - The percent difference between the concentrations detected on both GC columns was greater than 25% (<i>pesticide/PCB analyses only</i>).
U	<i>For CLP reporting only</i> - Constituent was analyzed for but not detected (sample quantitation must be corrected for dilution and percent moisture).
X, Y, or A	Analyst-defined qualifier
N/A	N/A in the % moisture cell indicates that data are reported on an "as received" basis. A value in the % moisture cell indicates that data are reported based on a "dry weight" basis. <i>For non-CLP work</i> , RDLs are not adjusted for % moisture even when data are reported on a "dry weight" basis.

For Use On the QC Data Reporting Forms	
*	QC data (i.e., percent recovery data for matrix spike, matrix spike duplicate, laboratory control standard, or surrogates; and RPD for matrix spike duplicate or unspiked duplicate) exceeded acceptance limits.
a ^(a)	The spike recovery and/or RPD for matrix spike and matrix spike duplicates cannot be evaluated due to insufficient spiking level compared with the elevated sample analyte concentration.
b ^(b)	The RPD cannot be computed because the sample and/or duplicate concentration was below the RDL.

Notes:

(a,b) = Used as footnote designations on the QC summary form.

Table C-3. LAS Laboratories - Data Qualifiers for Inorganic Analyses

For Use On the Analytical Data Reporting Forms	
B	<i>For CLP analyses only</i> - Reported value is less than the Contract Required Detection Limit (CRDL) but greater than or equal to the Instrument Detection Limit (IDL).
C	<i>For routine, non-CLP analyses only</i> - Any constituent that was also detected in the associated blank whose concentration was greater than the Reporting Detection Limit (RDL).
D	Presence of high levels of interfering constituents required diluting sample, increasing the RDL by the dilution factor.
E	Estimated value due to interference.
H	Sample analysis performed outside of method - or client - specified maximum holding time requirement.
M	<i>For CLP analyses only</i> - Duplicate injection precision criterion was not met.
N	Matrix spike recovery exceeded acceptance limits.
S	Reported value was determined from the method of standard addition.
U	<i>For CLP reporting only</i> - Constituent was analyzed for but not detected (sample quantitation must be corrected for dilution and percent moisture).
W	<i>For Atomic Absorption Spectrometry (AAS) only</i> - Post-digestion spike for furnace AAS did not meet acceptance criteria, and sample absorbance is less than 50% of spike absorbance.
X, Y, or Z	Analyst-defined qualifier.
*	Relative percent difference (RPD) for duplicate analysis exceeded acceptance limits.
+	Correlation coefficient, r, or the Method of Standard Additions (MSA) is less than 0.995.

For Use On the QC Data Reporting Forms	
a ^(a)	The spike recovery and/or RPD for matrix spike and matrix spike duplicates cannot be evaluated due to insufficient spiking level compared with the elevated sample analyte concentration.
b ^(b)	The RPD cannot be computed because the sample and/or duplicate concentration was below the RDL.

Notes:

(a,b) = Used as footnote designations on the QC summary form.

Table C-4. LAS Laboratories Data Qualifiers for Radiochemical Analyses

For Use On the Analytical Data Reporting Forms	
B	Any constituent that was also detected in the associated blank whose concentration was greater than the reporting detection limit (RDL) and/or Minimum Detectable Activity (MDA).
C	The MDA exceeded the RDL due to the residue weight limitations forcing a volume reduction.
D	Constituent detected in the diluted sample.
E	Constituent concentration exceeded the calibration or attenuation curve range.
F	<i>For Alpha Spectrometry Only</i> - Full width half-max exceeds acceptance limits.
H	Sample analysis performed outside of method-specified maximum holding time requirement.
Y	Chemical yield exceed acceptance limits.

For Use On the QC Data Reporting Forms	
*	QC data (i.e., percent recovery data for laboratory control standard and matrix spike; and RPD for replicate analyses) exceeded acceptance limits.
a ^(a)	The spike recovery and/or RPD for matrix spike and matrix spike duplicates cannot be evaluated due to insufficient spiking level compared with the elevated sample analyte concentration.
b ^(b)	The RPD cannot be computed because the sample and/or duplicate concentration was below the MDA.

Notes:

(a,b)	Used as footnote designations on the QC summary form.
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APPENDIX D

ACRONYMS AND ABBREVIATIONS

ACRONYMS AND ABBREVIATIONS

AEC	Atomic Energy Commission
ADS	Activity Data Sheet
AH-1	Animal Hospital 1
AH-2	Animal Hospital 2
ALARA	As Low As Reasonably Achievable
ANSI	American National Standards Institute
BHC	Hexachlorocyclohexane
Bq	becquerel
CAA	Clean Air Act
CCR	California Code of Regulations
CEQA	California Environmental Quality Act
CEP	Controls for Environmental Pollution, Inc.
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
Ci	Curie
CLP	Contract Laboratory Program
Co-60	Cobalt 60
CPT	Cone Penetrometer Testing
CSTP	Conceptual Site Treatment Plan
Cs-137	Cesium 137
CWA	Clean Water Act
CX	Categorical Exclusion
DCG	Derived Concentration Guide
D&D	Decontamination and Decommissioning
DHS	California Department of Health Services
DOE	U.S. Department of Energy
DCE	Dichloroethane
D&M	Dames & Moore
DTSC	California Department of Toxic Substances Control
DW	Domestic Well
EA	Environmental Assessment
EC	Electrical Conductivity
EH-22	Department of Energy Office of Environmental Compliance
EH&S	Environmental Health and Safety Office
EMO	Battelle's Environmental Management Operations
EPA	U.S. Environmental Protection Agency
EPIP	Environmental Protection Implementation Plan
ER/WM	Environmental Restoration

ESA	Endangered Species Act
FAPAP	Federal Agency Pollution Abatement Plan
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FONSI	Finding of No Significant Impact
g	Gram
Ger	Geriatrics Building
GSA	Gamma Spectral Analysis
H-3	Tritium
HEPA	High Efficiency Particulate Air Filter
HSU	Hydrostratigraphic Unit
ILC	Inorganic Carbon Concentration
ITEH	Institute Toxicology and Environmental Health
L	Liter
LAL	Lockheed Analytical Laboratory
LAS	Lockheed Analytical Services
LEHR	Laboratory for Energy-Related Health Research
LOD	Limit of Detection
LSC	Liquid Scintillation Counter
MCL	Maximum Contaminant Level
MDA	Minimum Detectable Amount
MeV	Megaelectron-volts
mg	milligram
mR	milliroentgen
mrem	millirem
mSv	millisievert
ND	Not Detected
NEPA	National Environmental Policy Act
NESHAPS	National Emission Standard for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute for Standards and Testing
NPDES	National Pollution Discharge Elimination System
NQA	National Quality Assurance
NTU	Nephelometric Turbidity Units
NVLAP	National Volunteer Laboratory Assurance Plan
OAK	Oakland Operations Office
OLC	Organic Low Concentration
OLM	Organic Low Medium Concentration
OMB	Office of Management and Budget
ORPS	Occurrence Reporting and Processing System
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PARCC	Precision, Accuracy, Representativeness, Comparability, Completeness
PCB	Polychlorinated Biphenyl

PCD	Putah Creek Downstream
pCi	picocurie
PCU	Putah Creek Upstream
pH	potential of Hydrogen
PNNL	Battelle's Pacific Northwest National Laboratory
PRG	Preliminary Remediation Goal
Pu-241	Plutonium 241
QA	Quality Assurance
QAM	Quality Assurance Manual
QAPP	Quality Assurance Project Plan
QC	Quality Control
Ra-226	Radium 226
Rad	Radiation Absorbed Dose
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RDC	Radiation Detection Company
rem	Roentgen Equivalent Man
RESRAD	Residual Radioactive
RI/FS	Remedial Investigation/Feasibility Study
RWQCB	Regional Water Quality Control Board
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SOP	Standard Operating Procedures
SOW	Statement of Work
Sr-90	Strontium-90
SSDC	System Safety and Development Center
Stor	Storage
STPO	Wastewater (Sewage) Treatment Plan Outfall
SWAT	Solid Waste Assessment Test
SWRCB	State Water Resources Control Board
TLD	Thermoluminescent Dosimeter
TSCA	Toxic Substances Control Act
UC Davis	University of California at Davis
uCi	microcurie
µg/L	micrograms per liter
umhos	units of specific conductance
VOC	Volatile Organic Compound
WSF	Waste Staging Facility (H-29)
YSAQMD	Yolo-Solano Air Quality Management District