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LABORATORY FOR ENERGY-RELATED HEALTH AND RESEARCH, UC DAVIS

SUPERFUND SITE

DAVIS, CALIFORNIA

NEWS ARTICLES, PRESS RELEASES, AND FACT SHEETS

6.700

PRESS RELEASES

UC DAVIS NEWS

November 21, 1994
Contact: Larry McEwen, DOE
(510) 637-1641
or Julie McNeal, Env. Health & Safety
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Public invited to attend

Update Meeting Scheduled to Discuss LEHR Site Cleanup

DAVIS, Calif. — Recent and upcoming cleanup activities at a former low-level radiation research facility and newly named Superfund site a mile south of the main University of California, Davis, campus will be discussed at a public meeting Tuesday, **Dec. 6**.

The update meeting, part of an ongoing process that encourages community "stakeholder" involvement in the cleanup of the former Laboratory for Energy-Related Health Research, is sponsored jointly by the U.S. Department of Energy and UC Davis.

Comments and questions from members of the public are welcome.

The meeting will begin at 6 p.m. in the Cabernet Room of the Silo on campus. Free parking passes will be available at the entrance to parking Lot #43.

Topics to be covered include the Superfund process and introduction to representatives of government agencies involved with the cleanup, a review of recent site accomplishments, and discussion of the newly completed work plan for a remedial investigation/feasibility study (RI/FS). This step involves intensive study of the groundwater and soil to identify the extent and possible sources of contamination, and to evaluate cleanup options.

Undergoing cleanup by DOE since 1990, the former LEHR site was placed on the federal Superfund list this year due to groundwater contamination and the potential for further contamination from old waste disposal areas. The 15-acre rural site was the location for more than 30 years of DOE-funded animal studies of the long-term health effects of exposure to low levels of radiation.

Copies of background information on the LEHR site, along with reports and plans, are available at the reserve desk of Shields Library on campus and the reference desk of the public library in the city of Davis, 315 E. 14th St.

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UC DAVIS NEWS

May 27, 1994
Contact: Larry McEwen, DOE
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FORMER LEHR SITE PLACED ON SUPERFUND LIST

DAVIS, Calif. — A former low-level radiation research facility undergoing cleanup a mile south of the main campus of the University of California, Davis, has been placed on the federal Superfund list by the U.S. Environmental Protection Agency. The U.S. Department of Energy and UC Davis say they will cooperate fully with EPA.

The former Laboratory for Energy-Related Health Research site became a potential candidate for listing in 1991 due to groundwater contamination detected during preliminary investigations. EPA placed the site on its proposed Superfund list this past January.

"We look forward to EPA joining our team as we continue our progress in cleaning up this facility," said Larry McEwen, acting DOE project manager for the site.

For more than 30 years the 15-acre LEHR site was the location of DOE-funded animal studies of the long-term health effects of exposure to low-level radiation. Also at the LEHR site, which is surrounded mostly by farms and other campus research facilities, are an inactive campus sanitary landfill and several former disposal areas for low-level radioactive wastes.

In 1989, two years before the final DOE research contract ended, DOE and UC Davis began conducting preliminary investigations of groundwater and soil in the area; the second phase of these studies was completed last year. In 1990, DOE added LEHR to its five-year planning process for facilities' cleanup and began cleanup activities at the site.

DOE has since surveyed and released to campus researchers 11 of 16 buildings on site, removed the last remains of radioactive research animals from the site, processed and disposed of approximately 34,000 gallons of low-level radioactive water and sludge from underground tanks, removed a device called a cobalt-60 irradiator, and cleaned three of the five remaining buildings (currently awaiting independent confirmation before release). This fall, DOE initiated the planning of a remedial investigation/feasibility study (RI/FS) of the groundwater and soil to identify in greater detail any possible sources of contamination and evaluate cleanup options.

-more-

To: John Martela	From: Paula Bruin
Dept./Agency: DOE	Phone #:
Fax #: 510) 423-7601	Fax #:

540-01-317-7868 5099-101 GENERAL SERVICES ADMINISTRATION

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FOR IMMEDIATE RELEASE: May 27, 1994

Contact: Barbara Hastings
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U.S. EPA
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THREE WESTERN SITES ADDED TO FEDERAL SUPERFUND LIST

(San Francisco)--The U.S. Environmental Protection Agency (U.S. EPA) today has announced its decision to add three sites in the western region to its final federal Superfund National Priorities List (NPL). Of these, two of the sites are located in California and one in Hawaii.

"After careful and thorough review of the environmental problems at these sites, and consideration of all the public comments received, we have determined that the appropriate studies and cleanup activities should proceed under the oversight of the Superfund program," said Jeff Zelikson, U.S. EPA's hazardous waste division director for the western regional office.

The three sites placed in final status in Region 9 includes:

Frontier Fertilizer, Davis, Calif.
LEHR/Old Campus Landfill (DOE). Davis, Calif.
Naval Computer EASTPAC, Wahiawa, Hawaii

Sites are placed in a final status on the NPL as part of the periodic review and update of the Superfund program. The NPL is U.S. EPA's list of the most serious hazardous waste sites potentially posing the greatest long-term threat to public health and the environment. U.S. EPA identifies and ranks NPL sites according to threats to nearby populations through actual or potential contamination of soils, groundwater, surface water or air.

With today's decision, there are now 107 final and six proposed sites in Region 9. Region 9 includes the states of Arizona, California, Hawaii, and Nevada and the Pacific Islands. Nationwide, there are 1,232 final and 54 proposed sites on the NPL, bringing the total number of NPL sites to 1,286.

# # #

NOTE TO EDITORS: A one-page fact sheet for each site is available upon request.

UC DAVIS NEWS

May 16, 1994
Contact: Larry McEwen, DOE
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UPDATE MEETING SCHEDULED TO DISCUSS LEHR SITE CLEANUP

DAVIS, Calif. — Recent and upcoming cleanup activities at a former low-level radiation research facility a mile south of the main University of California, Davis, campus will be discussed at a public meeting Thursday, **June 2**.

The update meeting, part of an ongoing process that encourages community "stakeholder" involvement in the cleanup of the former Laboratory for Energy-Related Health Research, is sponsored jointly by the U.S. Department of Energy and UC Davis. Comments and questions from members of the public are welcome.

The meeting will begin at 6 p.m. in Recreation Pool Lodge, located on Extension Center Drive near the Hutchison Drive entrance to campus. Free parking passes will be available at the entrance to parking Lot #30.

Topics to be covered include the proposed placement of LEHR on the Superfund list (the National Priorities List) by the U.S. Environmental Protection Agency, a review of DOE's five-year plan for the site, and plans for a remedial investigation/feasibility study (RI/FS) of the groundwater and soil to identify in greater detail any possible sources of contamination and to evaluate cleanup options.

Members of the public will also have an opportunity to meet the acting DOE project manager for the site, Larry McEwen. Roger Liddle, the former manager who has overseen the site cleanup since 1990, has been transferred to other DOE projects.

Copies of background information on the LEHR site, along with reports and plans, are available at the reserve desk of Shields Library on campus and the reference desk of the public library in the city of Davis, 315 E. 14th St.

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NEWS ARTICLES

Citizens air fears on LEHR findings

◆ Neighbors say data from ground water tests at site may be skewed

By ELISABETH SHERWIN
Enterprise staff writer

An investigation of exactly what contaminates the soil and water at UC Davis' Superfund site — the old Laboratory for Energy-Related Health Research — is continuing at a rate too slow to suit the neighbors, but the myriad government regulators involved say they are doing everything they can.

Final site characterization may be completed in eight months and then, after more than five years of study plus concurrent removal and cleanup, a remedy can be put into place.

Three remedies are available: leave the site as is; build a landfill and secure the site; or remove the tainted material — including soil — to an off-site disposal area. The latter remedy is highly unlikely, as it would cost more than $200 million.

The quarterly public meetings held jointly by the Department of Energy and UCD follow a predictable pattern: Several technical presentations are given to update the audience on work that has taken place since the previous meeting. The audience is then invited to ask questions, and these frequently reveal frustration and suspicion.

At the three-hour meeting Thursday night on campus, technical presentations were made on the cleanup of the campus landfill on the far west side of campus, and on the investigation of soil, gas and water samples at the Superfund site.

Officials assured the audience that there was no connection by land or water between the west campus landfill and the

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LEHR

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Superfund site.

The audience then asked questions about the legitimacy of a New Mexico lab used by the DOE that falsified tests results, asked about a UCD project undertaken for the U.S. Army on nerve agents, and complained about the rapid rate of cleanup taking place at the main campus landfill versus the slow cleanup at the Superfund site.

Joe Niland, of the subcontracting firm Dames and Moore, reviewed the results of continued soil, gas and water tests taking place on the contaminated property south of Interstate 80 off Old Davis Road. High concentrations of chloroform, nitrates, hexavalent chromium and tritium were found on the site, but not off.

To drive the point home, Otto Raabe, UCD professor emeritus formerly associated with LEHR, asked: "What alarming off-site contamination did you find?"

"We haven't seen a lot of off-site migration," replied Niland.

But since ground water testing first started in 1989, evidence of some contaminants off-site have alarmed neighbors, who are confused by the seeming inconsistency of test results.

One of those neighbors is Julie Roth, whose property lies across Putah Creek to the south of the Superfund site. She is now the executive director of a citizens' group that last month received a $50,000 grant from the Environmental Protection Agency to hire an expert to translate the data compiled to date.

"Our group will demand that all information be made available to neighbors," she said, "and we will ask what went so terribly wrong that this became a Superfund site."

Clyde Rust, another landowner, wanted to know why the old landfill on the Superfund site isn't being cleaned up as quickly as the new landfill west of Highway 113.

"I get the feeling if you let it go long enough, agriculture will do the (cleanup) job for you," he said. "Those fields are irrigated every year," he added. Eventually, rain and irrigation water will leach out contaminants.

"We haven't found alarming concentrations in the 23 (testing) wells we have," said DOE's Jim Littlejohn.

"If you had the choice of drink-

> *"I wouldn't have a problem drinking the water. We err on the conservative side."*
>
> — Jim Littlejohn, DOE

ing that water or the (bottled) water the university is providing us, which would you choose?" persisted Rust.

"I wouldn't have a problem drinking the water," said Littlejohn. "We err on the conservative side."

Bruce Maeda of the West Davis Community Association asked about problems with a New Mexico lab used by the Department of Energy.

The lab falsified results of some samples not associated with the university, and the DOE terminated its contract with Controls for Environmental Pollution in Santa Fe last June. But the lab also analyzed ground water at the LEHR site, and Maeda worried that those results might be skewed.

But the DOE had Dames and Moore compare ground water data analyzed by Lockheed and the tainted CEP lab for consistency. Julie McNeal of UCD said she was satisfied with the results.

"The data is reasonable and usable," she told Maeda.

Roth asked about another matter.

"What about the use of nerve gas on site?" she asked. "How was it used and where was it disposed?"

Raabe briefly described a project that took place in the late 1980s and ran for five years.

"We had a project for the U.S. Army on nerve agents," he said. "It was very carefully controlled." He said the Army wanted to learn how to safely dispose of nerve agents and wanted to learn if small quantities were carcinogenic.

"We had a special armed, locked room with bars on the windows to look at trace amounts," he said. Raabe said the toxicology studies also involved animals.

He said the Army delivered and took away the nerve agents — the university never was responsible for disposal.

This morning McNeal said this project was never associated with the Laboratory for Energy-Related Health Research.

She also said the Department of Energy has spent $21 million to date attending to the Superfund cleanup, and it's estimated that at least another $20 million will have to be spent to finish the job.

It is not known, she said, how much of that UCD will have to pay. The final amount will have to be negotiated between UCD and the DOE, who jointly ran the project that looked at the effects of radiation on beagles.

The DOE's Littlejohn assured the audience that he would include all points of view when the decision is made on how to progress on the final cleanup.

"We'll look at all the options," he said. "We want to involve everyone. As we conceptualize these ideas we will fully involve you ... this stuff won't be done in a vacuum. That was DOE 20 years ago. We seek your cooperation."

Additionally, Duncan Austin of the state Department of Toxic Substance Control said a toxicologist will attend the next quarterly meeting to answer health questions from the audience.

"Bring your questions," he said.

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UCD toxic lab cleanup monitoring is funded

◆ Citizens group gets EPA grant to review efforts to cleanse contaminated parcel

By ELISABETH SHERWIN
Enterprise staff writer

Recent cleanup activities at a former low-level radiation research facility and Superfund site a mile south of the main UC Davis campus will be discussed at a public meeting Thursday.

And a neighbor who is suing the university over the Superfund site announced that her group on Friday received a grant to hire an independent expert to review the cleanup to date.

The UCD/Department of Energy update is part of an ongoing process that encourages community involvement in the cleanup of the former Laboratory for Energy-Related Health Research. The meeting will begin at 6 p.m. in the Orchard Room of the University Extension complex on Extension Center Drive.

Topics to be covered include a review of recent site accomplishments, with emphasis on soil and ground water data collected for the newly implemented remedial investigation/feasibility study. This study aims to identify the extent and possible sources of contamination, and to evaluate cleanup options.

According to site managers, results of the recent soil and

See LEHR, Page A-3

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LEHR

Continued from Page A-1

ground water testing confirm previous data.

Undergoing cleanup by DOE since 1990, the former LEHR site was placed on the federal Superfund list in 1994 due to ground water contamination and the potential for further contamination from old waste disposal areas.

The 15-acre rural site was the location for more than 30 years of DOE-funded animal studies of the long-term health effects of exposure to low levels of radiation.

Copies of background information on the LEHR site, along with reports and plans, are available at the reserve desk of Shields Library on campus and the reference desk of the public library in the city of Davis, 315 E. 14th St.

In a related development, Julie Roth, a LEHR neighbor who is suing the university over the Superfund site, announced that her group has received a $50,000 grant from the Environmental Protection Agency.

"It took a long time," said Roth, "but we got it."

Roth, director of the Davis South Campus Superfund Oversight Committee, applied for the grant in November. The EPA makes grants available to communities where Superfund sites are located. The money will be used to hire an independent expert to review the complicated and sometimes contradictory studies undertaken over the years to determine what human health risks exist.

Ground water, surface water and soil investigations, which began in 1989, are continuing. So far, carbon 14, tritium, chromium, nitrate, a few volatile organic chemicals, and chlorinated pesticides have been found in shallow ground water under and adjacent to the site. Some concentrations are above drinking water standards in test wells.

Tritium has been detected in one test well at 85 feet but the levels do not exceed drinking water standards.

An extensive water and soil assessment and evaluation of cleanup options is under way, with the results due next year. More than $20 million has been

The Davis
nterprise

WEEKEND

Shakespeare festival celebrates 60 years

March 16, 1995 Vol. 99, No. 64 Copyright 1995 The Davis Enterprise, Davis, California

50 cents

Neighbors sue university over toxic site

◆ Farm owners say continued presence of toxic substances at nearby research site is injurious to families' health

By ELISABETH SHERWIN
Enterprise staff writer

Neighbors living near the toxic waste Superfund site at UC Davis have filed a lawsuit against the University of California asking for $7 million in damages.

Julie Roth and four members of her family, and Maryann Miller and her husband, are plaintiffs in the suit filed in Alameda Superior Court earlier this month, which charges the University of California Board of Regents with negligence in running the Laboratory for Energy-Related Health Research.

The plaintiffs are being represented by San Francisco attorney Scott Wechsler.

The LEHR site is located in Solano County about one mile south of the main UC Davis campus, bordering the south fork of Putah Creek. It covers 15 acres surrounded by other campus research facilities and private farms, including farms owned by the Roths and the Millers.

No research is currently taking place at the site. But for 30 years, research involved, among other things, the study of radioactivity in beagles. Toxic and radioactive wastes were disposed of and buried on site, contaminating soil and groundwater. Tens of thousands of cubic feet of waste — including toxic radioactive contaminants such as radium, strontium, tritium and plutonium — were found on-site.

The Environmental Protection Agency added the abandoned lab to the Superfund list of the nation's most serious toxic waste sites last year. The site, jointly owned by UC Davis and the Department of Energy, is in the process of being studie analyzed and cleaned up.

On Wednesday afternoon, Julie Ro said her attorney advised her not to co ment on the lawsuit.

And this morning, according to Kar Watson of the UCD News Service, no o at UCD has seen a copy of the complai and therefore no one was available comment.

But according to the lawsuit, the co tinuing existence and maintenance of t toxic radioactive, chemical and biolo

See LAWSUIT, Page A

LAWSUIT

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cal contaminants on the property is injurious to plaintiffs' health and is interfering with use of their property.

The Roths and the Millers cannot drink the water from their wells. For more than five years, the university has been supplying them with bottled water.

The plaintiffs cannot sell their property and move to a safer location, the lawsuit alleges. They also expect to incur enormous expenses investigating and cleaning contaminants from their soil and ground water when the extent of the damage is known.

Julie Roth is the director of a group known as the Davis South Campus Superfund Oversight Committee. Her group applied to the EPA for a $50,000 grant under a program where grants are made available to communities where Superfund sites are located. She hopes to have the grant within a matter of weeks.

The money will be used to hire an independent expert to review the complicated and sometimes contradictory studies undertaken over the years in an effort to determine what and how much contamination exists at LEHR.

Roth has complained for years that she has been unable to get straight answers from either UCD or DOE regarding the extent and severity of the environmental problems in her backyard.

In October, Roth wrote a letter to the DOE asking for clarifications to a series of questions regarding health and safety issues. She said she received no satisfactory response.

"It's disappointing that after five years, tons of documents, reports, sampling and millions of taxpayers' dollars being spent, we know very little more than we did after the first meeting," she wrote.

"If anything, the cleanup has become more complex and less clear."

From News Service

To
✓ Julie McNeal
✓ Alice Tackett
✓ Marj Dickinson
✓ Salem Attiga

NEIGHBORS/SACRAMENTO BEE 12-1-94

Update set on UC Davis cleanup

BY NICK BUDNICK
Neighbors staff writer

A contaminated former laboratory of the University of California, Davis, known for three decades of testing low-level radioactivity on beagles will be the topic of a public meeting Tuesday.

The meeting will discuss recent and upcoming cleanup activities at the 15-acre lot, a mile south of campus, which was recently added to the Superfund list of the most hazardous sites in the country. From 1960 to 1989, it housed the former Laboratory for Energy-Related Health Research, which was jointly operated with the U.S. Department of Energy.

The lab attained Superfund status because groundwater under the site is contaminated with levels of chromium, nitrate, tritium and volatile organic compounds in excess of drinking water standards.

Now the Environmental Protection Agency, which administers the fund, will attempt to accelerate the cleanup.

The meeting will discuss a recently completed work plan for a study to determine the extent and sources of groundwater contamination.

The Department of Energy has been removing contaminated equipment and hazardous waste from the site since 1990.

Both the Department of Energy and the EPA have been criticized in the past for their lengthy and expensive cleanup activities at the Davis site. But Bruce Maeda, a Davis activist, said, "They are making progress" in the cleanup.

However, he chided the Department of Energy for not providing information about the extent of radioactive contamination.

Maeda is a member of a citizens group that has applied for a $50,000 EPA grant to hire independent experts to oversee the cleanup.

The meeting will be held at 6 p.m. in the Cabernet Room of the Silo, on Hutchison Drive east of La Rue Road on campus. Free parking passes will be available at the entrance to parking lot No. 43.

WDCA attacks campus EIR

Aggie 10/27/94

By NATHANIEL LEVINE
AGGIE STAFF WRITER

The West Davis Community Association lost no time in reacting to its recent court setback by filing a new lawsuit Tuesday, in addition to filing papers challenging the university's compliance with a 1989 court decision.

According to Dan Whaley, who represents the WDCA, the new lawsuit focuses on issues omitted from the 1994 rewrite of the UC Davis long range development plan and environmental impact report.

That rewrite was a product of a 1989 California Supreme Court victory for the community association, which ordered the university to prepare a new LRDP and EIR, he said.

"Instead of just amending the 1989 LRDP and EIR, they went ahead and redid it completely," Whaley said. "In redoing it, they completely failed to properly analyze the wastewater treatment problems or take into account the construction of

See EIR, back page

EIR

Cont. from front page

off-campus facilities."

University officials said the campus has worked to comply with all environmental guidelines.

In another action, the community association filed a separate petition to challenge the university's compliance with the 1989 court order, which required more information on the Laboratory for Energy-Related Health Research.

"Basically, our objection goes to their failure to fully characterize the LEHR site, which is what they were ordered to do in the previous lawsuit," said Whaley, explaining that the petition is aimed at the laboratory site, while the new lawsuit targets the whole 1994 LRDP and EIR.

The LEHR site, located south of Interstate 80, has been designated as a Superfund site by the Environmental Protection Agency and is most famous for its radiation experiments on beagles.

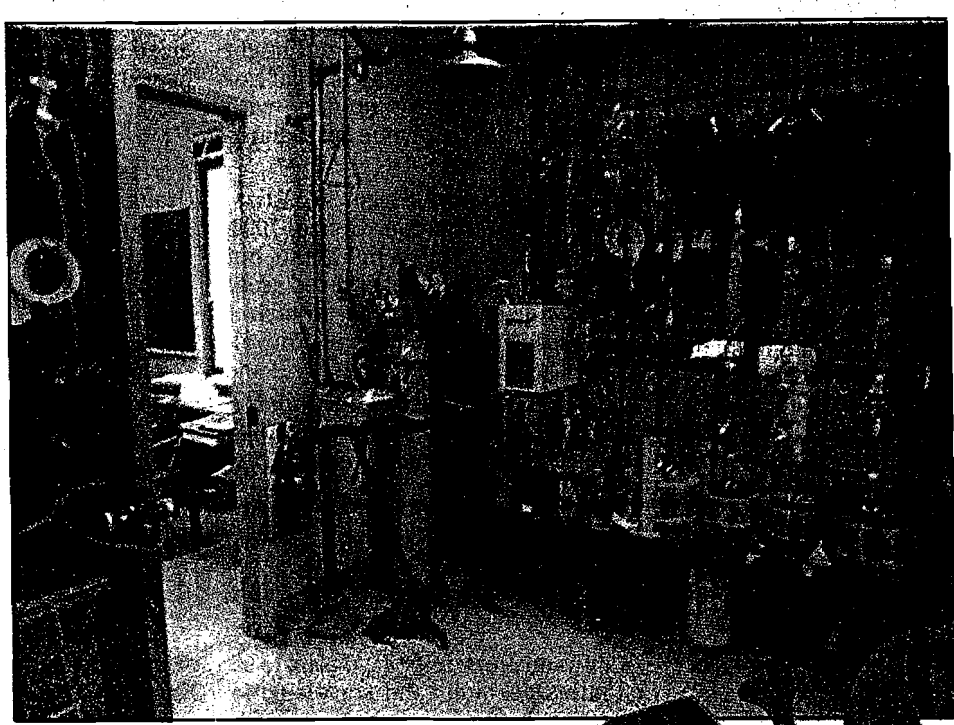
According to Richard Keller, director of planning and budget for UCD, the campus officials have received notice of the lawsuit, but believe the university is in full compliance with the court ruling.

"We've already filed with the court the information that was requested in the previous ruling and we think that it is fully respondent to the court's requests," he said. "We're anxious to resolve this."

ACCURACY

The California Aggie wants to ensure that all of its facts and details are accurate. Please bring any corrections to our attention by calling (916) 752-0208.

The Enterprise
Sunday, June 5, 1994



A fire door in this chemistry lab at UC Davis is tied open, left, just seven months after an accident in the lab ignited a fireball that injured a research assistant and melted plastic bottles full of chemicals.

Enterprise photo/Alison Portello

DANGER AT UCD

Campus works to minimize environmental hazards

By ELISABETH SHERWIN
Enterprise staff writer

On a Wednesday afternoon last November in Room 303 of the Chemistry Building at UC Davis, research assistant David Roseman was performing a routine procedure with sodium and potassium metals. He was using a funnel to add approximately six ounces of ethyl ether to a flask that contained the metals. Air reached the metals and the mixture ignited.

Roseman tried to put the flask in the fume hood where it would be safe but was unable to due to lack of counter space. Roseman dropped the flask and ran for the door. The flask broke and the ether ignited, creating a large fire ball. The fire ball spread to the lab east of Room 303 because the fire door between the labs was tied open.

According to the UCD Fire Department, the heat from the fire caused the door and other combustibles to ignite. It caused empty bottles in the vicinity to break, and plastic bottles containing chemicals, straps securing compressed gas cylinders and the nozzle on the CO2 extinguisher to melt.

Roseman ran from the lab, his pants and shoes burning. Shawn Eisenberg used his lab coat to smother the flames on Roseman's clothing. Someone pulled the fire alarm. Professor Mark Kurth heard the commotion from his office and ran to Room 303, where he put out the fire using two CO2 extinguishers.

Roseman was taken by ambulance to Sutter Davis Hospital for treatment of burns on his face, arms and feet. He was shaken up, but not seriously injured, and returned to work.

Last week, an Enterprise photographer found Roseman at work in his lab. He didn't want his picture taken. He said the Fire Department's report of his accident was accurate. And the lab's fire door was once again tied open.

This is just one of 13 injuries that were reported to UCD's Office of Environmental Health & Safety from January 1989 to November of 1993, at least two of which were life-threatening.

In addition to Roseman's near-miss, another potentially fatal accident occurred in a chemistry lab when a worker lost consciousness and was taken to the hospital after inhaling vapors from a spill. In the course of six other incidents, eight people were subjected to various cuts and burns from fires and chemical explosions that resulted from scientific experiments.

Lab safety

Bern Shanks, head of Environmental Health and Safety at UCD, says lab safety is the No. 1 environmental threat at the university.

He described Roseman's Nov. 10 fire as one that "came within 30 seconds of engulfing the lab."

"One of these days," he warns, "several students will be seriously injured or killed or we'll lose a building."

There are 3,600 labs at UCD. If each lab has two people working in it (and many have more), then at least 7,000 people are working in labs on any given day. Shanks says health and safety violations are rampant and routine safety inspections are a thing of the past.

"Lab safety is the most fundamental health and safety problem on campus," said Shanks. "We've had to rely on the individual approach (toward safety) and most people are not aware of the complexity of the problem or the severity of the penalties. We have no internal system of compliance.

"These issues cause me many sleepless nights," he added.

UCD Fire Chief Dave England agrees that the number of safety inspections undertaken by his office have fallen off. He also agrees that the Nov. 10 fire was one of the most serious incidents he's seen in the past four years.

"We don't have enough staffing," said England. "We hardly do any inspections. We don't have the time."

His department's budget has been cut 30 percent in four years. That's the bad news. The good news is that sometime this fall a new trained hazardous materials team and response vehicle will be online at UCD.

The formation of the UCD Hazardous Materials Team will make the campus a safer place. It will put five trained personnel at the scene of an emergency in three to five minutes, said England. Unfortunately, should any other emergency occur at the same time, no one would be able to attend to it. Five is the full number of staff per 24-hour shift at the Fire Department.

"We are going to be in a stronger position to deal with emergencies (this fall)," said England, "but not in preventing them. And prevention is the key, not emergency response."

England says faculty, department heads, lab managers and principal investigators — those people who actually work in the labs — are generally cooperative and well meaning but he admits that compliance is not 100 percent.

"Under the circumstances, everyone is doing the best they can," England said. "But (the Fire Department) is stretched thin."

If lab safety is the No. 1 environmental problem at UCD, what other issues are

See **DANGER,** Page C-3

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❖LEHR Newsletter❖

Published by the University of California, Davis April 1996

Welcome

This newsletter aims to keep the University of California, Davis (UC Davis) faculty, staff, students, and neighbors informed of the status of activities at the former Laboratory for Energy-related Health Research (LEHR). Since investigation and cleanup of the LEHR began in 1990, a great deal of progress has been made. In addition to monthly meetings with regulatory agencies and representatives of an interested citizens group, we thought this publication might be helpful in keeping up to date on the work at LEHR.

Announcement

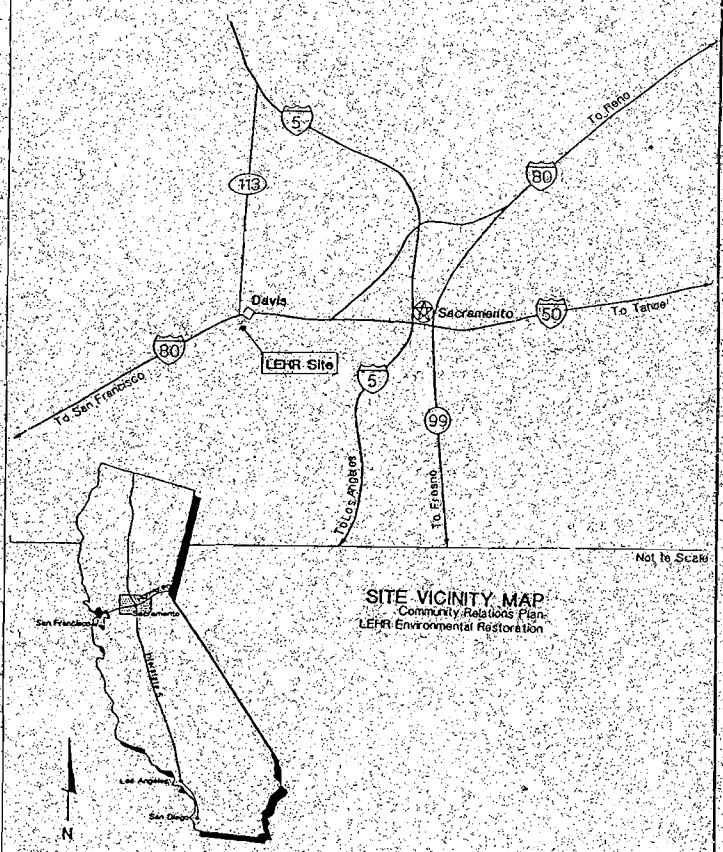
There will be a LEHR Public Meeting, sponsored by the U.S. Department of Energy (DOE) and UC Davis at 6:00 p.m. on May 23, 1996. The meeting will be held at the Rec Pool Lodge, off LaRue Road and Extension Center Drive, on the UC Davis campus. The focus of the meeting will be an update on the status of the investigation of the site, including a review of recent soil and groundwater sampling data. Discussions will be limited to issues involving the LEHR site. If you would like more information about other environmental programs at UC Davis, please contact Julie McNeal at (916) 752-5536.

History

For over 30 years, LEHR was the site of studies on the long-term health effects of low-level radiation on laboratory animals. The research projects at LEHR were primarily funded by the U.S. Department of Energy (DOE). Investigation of the site has found soil and groundwater contamination from chemical and radioactive wastes resulting from the disposal of laboratory and campus wastes on-site. Also near the site are three inactive landfill areas that were used for disposal of UC Davis campus wastes.

The LEHR/Old Campus Landfill site was placed on the National Priorities List (Superfund) by the U.S. Environmental Protection Agency (EPA) in May 1994, because of the possibility of contaminants in the groundwater. DOE and UC Davis are currently working with representatives of the U.S. EPA, and State of California agencies including the Regional Water Quality Control Board, Department of Toxic Substances Control (DTSC) and Department of Health Services (DHS) on the investigation and cleanup of the site.

LEHR is located approximately 1 mile south of the UC Davis Central Campus (see map) and occupies about 15 acres. LEHR is surrounded by rural campus property and private land, and borders the South Fork of Putah Creek. Most of the buildings formerly occupied by LEHR are now part of the Institute of Toxicology and Environmental Health (ITEH), an active research program at UC Davis.



Superfund Process

For Superfund sites, a Remedial Investigation (RI) is performed to assess the nature and extent of contamination and the associated risks to human health and the environment. The LEHR site is currently at the RI stage of the Superfund process. The RI stage is often very time-consuming since the parties involved need to be certain that they have sufficiently identified contamination at a site and have thoroughly considered the risks presented by the contamination. The next step is a Feasibility Study (FS), where cleanup alternatives are developed and analyzed.

Progress Report

During previous phases of the decontamination and decommissioning of the LEHR facility, DOE has accomplished the following actions: 1) removal and offsite shipment of over 100 drums of radioactive bioparts, 2) removal, solidification and offsite shipment of about 40,000 gallons of radioactive waste sludge, 3) removal and offsite shipment of several radioactive sources, including a large cobalt-60 source, 4) removal and offsite shipment of a radioactivity-contaminated tanker trailer, 5) demolition of a former waste treatment facility (Imhoff), and 6) decontamination and survey of four on-site buildings with radioactive contamination.

As part of the Remedial Investigation, DOE and UC Davis have continued to assess the soil and groundwater at the site. The following activities have occurred in the past year:

Groundwater

- A plume of chloroform-contaminated groundwater was identified migrating northeast from the LEHR property. UC Davis has presented a conceptual plan to start removing the chloroform, thought to be emanating from waste disposed on-site. The plan will be reviewed by the regulators and presented to the public in the next few months.
- Five new groundwater monitoring wells were installed in Fall 1995, making a total of 23 monitoring wells which are regularly sampled on and around the site. These wells were constructed to better define the extent of groundwater contamination at LEHR.
- Groundwater monitoring wells have been sampled quarterly to determine contaminant levels and trends. Volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, metals, radionuclide compounds and nitrate have been detected in groundwater beneath the site. In over five years of on-site monitoring, VOCs (particularly chloroform), hexavalent chromium, tritium and nitrate are compounds that have been found above drinking water standards in several on-site monitoring wells.
- Private domestic and irrigation wells at neighboring properties have been sampled on a quarterly basis to determine if LEHR-derived chemicals have contaminated nearby wells. While several wells have been found to contain elevated levels of nitrate or chromium, these findings do not appear to be attributable to LEHR. Chloroform has been detected in some private agricultural supply wells located immediately to the east of LEHR. The sampling program is currently being updated to provide better information for the LEHR investigation. Some wells that have been tested for a long time without showing evidence of contamination from LEHR will be eliminated from the program, while other wells will be added. In addition, chloroform has been added to the list of analyses due to findings of chloroform in some neighboring wells. Radiological compounds will no longer be monitored, since the results of previous sampling have not indicated the presence of these contaminants.
- A study by the State Water Resources Control Board confirmed that shallow groundwater in the area around LEHR flows to the east-northeast. However, the direction of flow can vary, due to domestic and agricultural pumping of groundwater during the irrigation season. This study also reported that Putah Creek recharges groundwater in the area, meaning that water from the creek seeps into groundwater, not vice-versa.

Soil

- Soil samples have been collected on-site to investigate areas believed to contain buried debris or waste materials. Soil samples were collected near the surface, from backhoe trenches, or from soil borings. Several metals, a few organic compounds and four radionuclides were found on-site at levels exceeding EPA Preliminary Remediation Goals.
- A waste burial site known as the "DOE Box" was investigated by digging with a backhoe to uncover the buried waste and collecting samples of the waste material and the soil beneath the waste. The findings show very little contamination and DOE is planning to remove the buried wastes for off-site disposal.
- Trenches in the two Animal Hospital buildings were backfilled with imported soil. These trenches were dug to remove piping that carried wastes from animal cages to an on-site treatment system. Soil sampling performed by DOE beneath the piping showed no residual contamination. These results were confirmed by independent sampling by the California Department of Health Services, and then the trenches were backfilled.

Air

- A year-long air monitoring program was initiated in August 1995. This program consists of three on-site sampling stations, one off-site background station and a meteorological station. Air is pumped through several

different filters, which are sent to a laboratory for analysis. The program was designed to determine if LEHR is producing any air emissions which could affect on-site personnel, visitors, or neighbors. The results of this study will be presented later this year.

Waste

- Recent LEHR waste management achievements include significant reductions in waste volume prior to disposal and the recycling of radioactive sources that are no longer needed. These achievements were the result of the LEHR Waste Minimization Program, a component of overall program management that continuously seeks ways to minimize the amounts of waste generated during the cleanup project and to reuse material whenever possible.

- Waste from the demolition of the LEHR Imhoff radioactive waste treatment building was sent to a private contractor to undergo supercompaction prior to disposal as low-level radioactive waste at the Westinghouse Hanford site in Washington. The volume of waste was reduced by 80% using these techniques, resulting in large cost savings for the disposal, and, as importantly, helping to conserve disposal capacity at Hanford.

- In September of 1995, 16 drums of mixed waste (waste containing both radioactive and chemical constituents) were sent to a private facility in Tennessee to be incinerated. Incineration destroys the hazardous component of this problematic waste, allowing the waste to then be disposed of as low-level radioactive waste.

- In February and March of 1996, two radioactive sources were transferred to a certified laboratory to be recycled for use in scientific and industrial applications. These sources, which were left over from DOE-funded research, were previously slated for disposal. LEHR staff successfully found a useful home for these sources. It is anticipated that this strategy may prove effective for other sources still in storage at LEHR.

Future Plans

- DOE, UC Davis and the regulatory agencies have agreed on a phased plan of action to collect additional soil and groundwater samples and to gather the additional data needed to complete the Remedial Investigation. Under this plan, DOE and UC Davis will drill up to 56 soil borings and dig 21 exploratory trenches to collect soil samples. Analysis of the samples will help to identify the wastes buried on-site and to determine which wastes may have migrated or are likely to cause pollution of groundwater. Following this sampling and analysis, modeling will be done to assess possible risks presented by each of the waste units on-site. Sampling to date has focused on identifying areas of concern at the site. This additional sampling will now allow the study to develop more information on specific areas and determine risks and selection of cleanup strategies.

- UC Davis has initiated an evaluation of treatment options for contaminated groundwater at the site. After consultation with the regulatory agencies and the public, UC Davis hopes to propose a plan of action for groundwater treatment in the next several months.

Questions & Answers

This section is intended to answer some common questions about the LEHR site or the Remedial Investigation.

How far has groundwater contamination spread?

Investigation activities to date have not fully defined the extent of groundwater contamination. Groundwater monitoring wells to the north, west and south appear to define the extent of the plume in those directions, however, planned additional monitoring wells are needed to the east. Hydropunch sampling has been used to help define the plume and the information gathered though Hydropunch will be used to determine the appropriate locations for new monitoring wells. Some members of the public have stated that, based on estimates of groundwater flow rates, the contamination may have been transported 5 to 10 miles from LEHR. Evidence from the site and from neighboring wells does not support this claim. Due to the complex properties of the soil and groundwater beneath the site and the chemicals of concern, it is estimated that it would take 25 years just for contamination to reach the principal groundwater aquifer beneath the site. Independent sampling of private domestic and irrigation wells by a representative of the State Water Resources Control Board indicated that LEHR-derived contaminants were in fact found in some off-site irrigation wells, however the extent of this impact appears to be limited to approximately 1/2 mile east of LEHR. Additional work is planned to investigate groundwater east of LEHR.

Why does DOE and UC Davis often re-test wells?

Groundwater samples are occasionally re-tested when a review of the results shows that a particular result is not following an established trend. Since groundwater monitoring at the site has been going on for over 6 years, a large amount of sample data exists. When a sample result is not consistent with historical data, two possibilities exist: 1) the result is in error, or 2) the result does not follow the trend, indicating a change in conditions. In this case, a well may be re-tested to confirm the unexpected result.

What are the levels of groundwater contamination?

The primary groundwater contaminants identified at LEHR are volatile organic compounds (particularly chloroform), hexavalent chromium, tritium and nitrate. Chloroform has been shown to have spread widely across the site, and recent data indicate that the chloroform plume extends to the east off UC Davis property. In 1995, on-site chloroform concentrations have ranged from non-detectable in several wells to 5,800 micrograms per liter (ug/L) in well UCD-12. Preliminary Hydropunch sampling has indicated chloroform concentrations of 12 to 68 ug/L at the UC Davis property boundary. These levels are similar to chloroform levels in many public drinking water supplies that use chlorine as a disinfectant. On-site concentrations of hexavalent chromium have ranged from non-detectable to 310 ug/L and nitrate has ranged from non-detectable to 72 mg/L. However, concentrations of nitrate and chromium appear to be elevated in the region, not just at LEHR. During 1995, the highest detected tritium concentration at LEHR was 19,600 picoCuries per liter(pCi/L), which is just below the drinking water standard of 20,000 pCi/L. Tritium contamination is localized around two monitoring wells in the southern portion of the site and does not appear to have spread significantly.

How deep is the groundwater at LEHR?

The monitoring wells around LEHR are constructed to draw water from the shallow aquifer, about 40 to 130 feet below ground surface. Beneath the shallow aquifer is a clay layer estimated to be about 90 feet thick. Beneath the clay layer is a second aquifer. Groundwater investigation at LEHR has focused on the shallow aquifer, so there is little information on the deeper groundwater zones beneath the site.

What is Hydropunch and why is it used?

During fall of 1995 and the early part of 1996, Hydropunch sampling was used to collect groundwater samples. Hydropunch is a sampling method where a hollow steel pipe is hydraulically driven into the ground, and then partially retracted to expose a slotted water accumulation chamber. Water is allowed to fill the chamber and then a bailer is lowered down through the pipe to retrieve a sample. These tests allowed the collection of groundwater samples without having to construct traditional monitoring wells. This allows DOE's contractor to collect a large number of samples in a short time. Onsite analysis of samples for chloroform allows the geologist to redirect the sampling effort daily to better define boundaries of the chloroform plume in groundwater. While this work was not meant to be a substitute for construction of additional monitoring wells, the data gathered by the Hydropunch technique will be used to determine the location of future monitoring wells.

For further information,

Call:

LEHR Information Line.....(916) 752-8351

Jim Littlejohn, DOE.....(510) 637-1526

Julie McNeal, UC Davis.....(916) 752-5536

or Write to:

LEHR Cleanup Project

University of California, Davis

Mail Stop ITEH

Old Davis Road

Davis, CA 95616

Documents relating to the LEHR Cleanup Project are available for review at two locations:

UC Davis Sheilds Library, Reserve Desk

University of California, Davis

Davis, California

(916) 752-1203

and

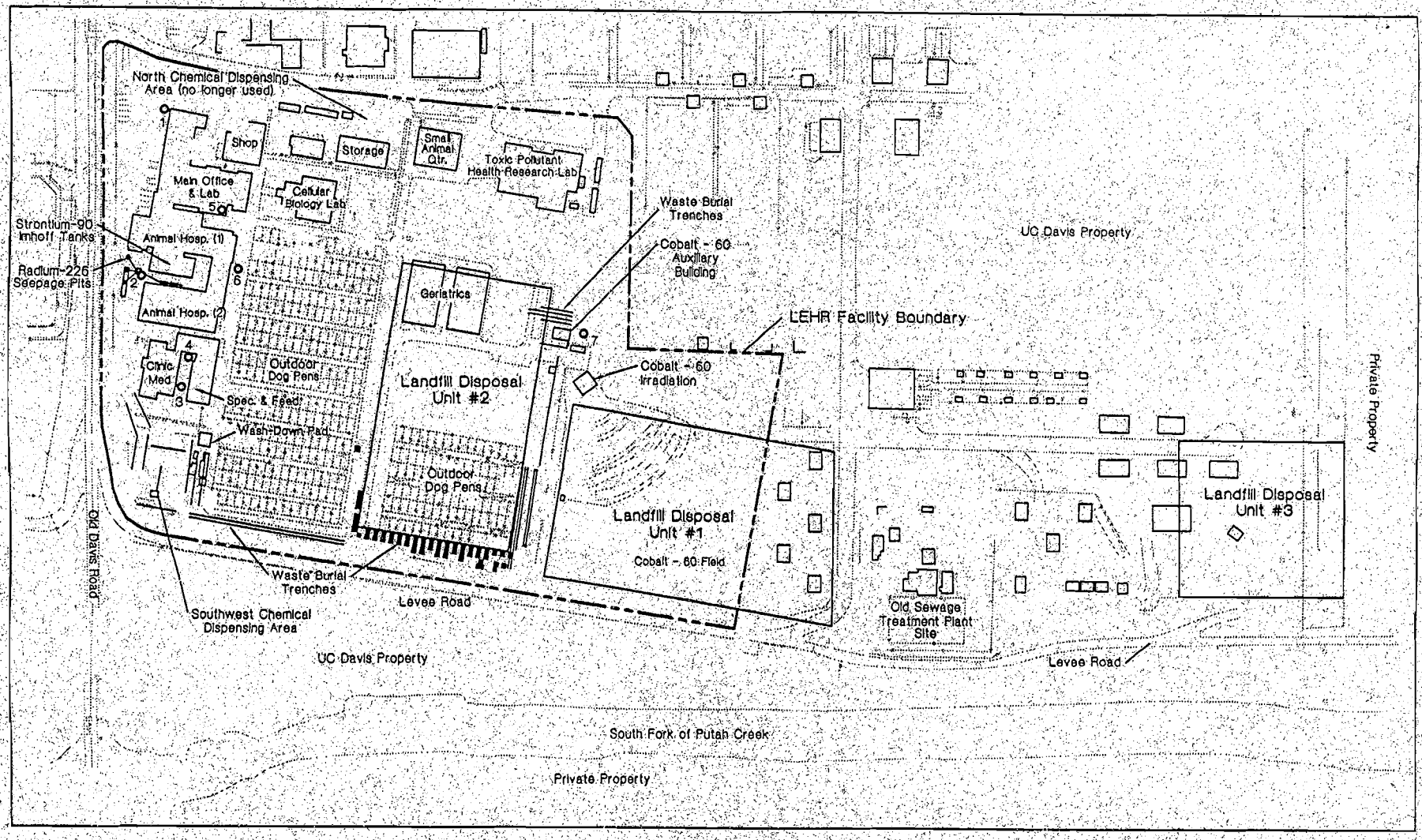
Yolo County Public Library, Davis Branch

Reference Desk

315 East 14th Street

Davis, California

(916) 756-2332



EXPLANATION

- ■ Radioactive Trenches and Holes
- — Waste Burial Trenches
- o Domestic Septic Tanks

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Scale in Feet

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SITE INVESTIGATION AREAS

LEHR Newsletter

University of California, Davis
M.S. ITEH
Old Davis Road
Davis, CA 95616

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Continued from Page C-1

on the list?

University and community spokesmen came up with nine more issues: The need for a new sewage treatment plant, the need for a toxic wastes plant (the university calls it an "environmental services facility"), continued underground cleanup at the landfill west of Highway 113, compliance at the UCD Medical Center in Sacramento, continued cleanup at the Laboratory for Energy-Related Health Research, concerns about the Center for Neurosciences in South Davis, concerns about the Primate Center expansion, concern about indoor air quality at buildings across campus, and the need for tighter hazardous waste controls at the Veterinary Medical Teaching Hospital.

Shanks also emphasized two areas that aren't problems: the drinking water on campus is fine and risks from radioactive exposure on campus are minimal.

Other areas, like the sewage treatment plant, don't represent a problem now but may in the future. Shanks says the plant is at capacity and won't be able to accommodate future growth.

Sewage treatment plant

There's absolutely no doubt about the campus need for a new sewage treatment plant and a toxic wastes plant, according to Janet Hamilton, vice chancellor for administration. UCD's current sewage treatment plant is just about at capacity in terms of treating all liquid wastes poured, flushed or hosed across campus. And the campus currently doesn't have a toxic wastes plant, merely a holding yard.

"These are two drop-dead objec s for the campus; we don't have a choice," said Hamilton. Construction of the sewage treatment plant is supposed to be complete by 1999 with the toxic wastes plant complete by 1997.

Toxic wastes plant

Funding for $751,000 in working drawings for the toxic wastes plant will be provided by Proposition 1C if the measure passes in June.

The new toxics plant will cost $12 million to construct. The university has not yet decided on the exact location of the plant, but it will be located some place on the far west campus.

The plant is designed to be a state-of-the-art facility for receiving low-level radioactive, chemical and biological/medical wastes from instruction and research departments and to prepare the materials for holding, processing or transport to off-campus recycling or disposal sites.

Landfill

The fourth issue in terms of UCD environmental hazards concerns the leaking UCD landfill west of Highway 113.

"What we have found is not particularly alarming, is not out of the ordinary for most landfill operators," said Vice Chancellor Hamilton. The university found 600 parts per billion of chloroform in the ground water 50 to 90 feet below the surface and in a plume extending northeast of the landfill. The drinking water standard is 100 parts per billion.

"No one drinks the water out there," Hamilton said.

She said the university has been monitoring the underground leakage since 1989 and has been making regular reports to both the state and the county. The university has not been fined by any regulatory agency for landfill contamination.

"Now we're getting close to a decision on how to clean up the site," Hamilton said. It will cost millions to pump and treat the contaminated water at the landfill, but that won't be a deterrent. The new sewage treatment plant may be located north of the landfill to help with the plume cleanup.

"We will clean it up," said Hamilton. "We will do what we have to do."

Hamilton says UCD is the target of county, state and federal inspections (14 since November), regulations and red tape generated by myriad oversight agencies.

"We're on top of the regulations," she says firmly. "In some cases we're damn near perfect and in other cases we have work to do but there's nothing we're ignoring. For every environmental hazard we know of we have a plan in place or a plan is being developed."

The problem is, not everybody at UCD shares Hamilton's commitment to do what has to be done. Health and safety officer Shanks makes this charge against the UCD Medical Center.

UCD Medical Center

"We've had serious compliance problems at the Med Center," said Shanks, the person responsible for ensuring legal compliance. "Managers cut corners to save money in the disposal of a variety of hazardous materials including asbestos — not radioactive materials — and if disposal doesn't take place according to state regulations, the university could be fined $25,000 a day."

Shanks referred to the compliance problem as a "renegade operation" that he hopes will be brought under control by internal audit or ciplinary action. He said he couldn't discuss the matter further at this time.

"We don't cover up violations," he said. "I tell my staff that time and time again."

LEHR

The public has long been aware of environmental hazard No. 6 at UCD — the Laboratory for Energy-Related Health Research — a site recently added to the Environmental Protection Agency's Superfund list.

The addition of LEHR to the Superfund list surprised several people at UCD. "It sends the wrong message," said Hamilton.

The former low-level radiation research site south of campus is part of an ongoing cleanup operation between UCD and the Department of Energy. The public has been regularly invited to take part in progress review meetings, the most recent of which was held on campus last Thursday.

Shanks and Hamilton have both suggested that LEHR inclusion on the Superfund list came based on old information. EPA officials briefed this spring seemed surprised to learn that barrels of radioactive sludge, a cobalt-60 irradiator and materiel had been removed from the site years ago. The final beagle study ended in 1989.

The university administration has pledged its ongoing cooperation in the UCD/DOE cleanup, which will cost more than $33 million before it's completed.

Still, LEHR neighbors who have been drinking bottled water supplied by the university for five years due to contaminated wells have expressed bitterness over the university's efforts to downplay the danger.

"As far as we know, the facility operated according to the health and safety regulations in effect at the time," Karen Watson of the UCD News Service Office said in February in what has become the standard university line. "Of course," she added, "the standard practice then is not the standard practice now."

Center for Neurosciences

In a surprising and controversial change in policy, university administrators decided last year to allow primates to be housed off-campus at a new neurosciences building in the South Davis Research Park. Up to 20 research primates may be housed there eventually. Previously, all primates were kept at the Primate Research Center on UCD's west campus.

In February, the West Davis Community Association filed a lawsuit against the University of California regarding public safety and environmental hazards connected to the Center for Neurosciences.

The lawsuit charges that potential biohazardous and toxic dumping, employee and community safety, ground water contamination, air pollution, and documented poor animal treatment requires correction.

Larry Bidinian of the West Davis Community Association charges in his lawsuit that UCD was persuaded to allow primates off-campus and establish the Center for Neurosciences purely to satisfy "a particular professor and his large grant monies" in the face of earlier stated needs to consolidate all non-human primate research.

Bidinian is dismissed by most UCD administrators as a crank. However, Bidinian and the association brought a lawsuit against UCD that required the university to redo its Long-Range Development Plan, a process that is now being completed for the second time, because it failed to adequately address environmental issues at LEHR.

Update to be held on LEHR site cleanup

Recent and upcoming cleanup activities at a former low-level radiation research facility a mile south of the main UC Davis campus will be discussed at a public meeting Thursday, June 2.

The update meeting, part of an ongoing process that encourages community "stakeholder" involvement in the cleanup of the former Laboratory for Energy-Related Health Research, is sponsored jointly by the U.S. Department of Energy and UC Davis. Comments and questions from members of the public are welcome.

The meeting will begin at 6 p.m. in Recreation Pool Lodge, located on Extension Center Drive near the Hutchison Drive entrance to campus. Free parking passes will be available at the entrance to parking Lot #30.

Topics to be covered include the proposed placement of LEHR on the Superfund list (the National Priorities List) by the U.S. Environmental Protection Agency, a review of DOE's five-year plan for the site, and plans for a remedial investigation/feasibility study (RI/FS) of the groundwater and soil to identify in greater detail any possible sources of contamination and to evaluate cleanup options.

Members of the public will also have an opportunity to meet the acting DOE project manager for the site, Larry McEwen. Roger Liddle, the former manager who has overseen the site cleanup since 1990, has been transferred to other DOE projects.

Copies of background information on the LEHR site, along with reports and plans, are available at the reserve desk of Shields Library on campus and the reference desk of the public library in Davis, 315 E. 14th St.

Dateline 5/20/94 p. 2

August/September 1994, Number 194

RESEARCH RESOURCES

Announcements and Current News on Contract and Grant Funding Sources

The Office of the Vice Chancellor for Research
University of California, Davis

C6

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- Miscellaneous Government Programs pages 7-9
- National Science Foundation Programs pages 4-5
- Private Programs pages 5
- UC and UC Davis Programs page 3
- Funded Programs pages 10-12

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Robert N. Shelton
Vice Chancellor for Research
Jody House, Editor
752-9645

NIH GUIDE READERS SIGN-ON

NIH Guide for Grants and Contracts, including the full text of RFAs and PAs, is now available electronically within a day of publication.

Readers can sign on to the campus gopher and look in the Research Support area for the NIH Gopher. They can also sign up for delivery of an electronic version to the mail box on their personal computer. For this electronic subscribtion, two versions of the guide are available; one is the complete guide and one is the table of contents. Subscribers who do not want to receive a large volume of mail each week will want to consider choosing the table of contents version only.

For the complete Guide: Send a message via electronic mail to:

LISTSERV@JHUVM.HCF.JHU.EDU

In the body of the message, type:

$SUBSCRIBE NIHGDE-L Yourfirstname Yourlastname

(Your name should be in upper and lower case characters.)

For the Table of Contents Guide: Send a message via electronic mail to:

LISTSERV@LIST.NIH.GOV

In the body of the message, type:

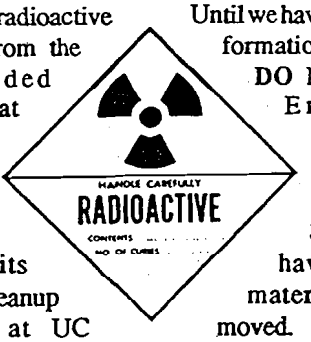
SUBSCRIBE NIHTOC-L Yourfirstname Yourlastname

For help in using the campus Gopher or the Internet, contact IT CAP 2-2548. At UCDMC call Information Services User Support 734-5650. ❑

* * * * * *

DOE CLEANUP

As you are probably aware, the U.S. Department of Energy (DOE) is investigating and cleaning up contaminated areas at the former Laboratory for Energy-Related Health Research at UC Davis. Part of this cleanup involves the disposal of unwanted hazardous or radioactive materials from the DOE-funded project at LEHR. DOE has recently extended its scope of cleanup activities at UC Davis to include the disposal of unwanted hazardous or radioactive materials from non-LEHR, DOE-funded projects.



In order to assist DOE in planning for this additional effort, DOE has asked UC Davis to identify the types and amounts of unwanted materials that were obtained under DOE funding. To verify the materials were purchased with DOE funds, we must also provide written verification, such as purchase orders, protocols, or similar documentation showing DOE grant number(s). DOE will review this information and advise us how to proceed.

Until we have more information, please **DO NOT** call Environmental Health & Safety to have these materials removed.

If you have unwanted materials that you believe may qualify for disposal by DOE, please provide an inventory, along with supporting documentation, to Alice Tackett at EH&S. Please submit this information **no later than 9/16/94.** For information, contact Ms. Tackett at 2-4959 or Julie McNeal at 2-5536.❑

LLNL REVISES IUT FORMS

UC Lawrence Livermore National Laboratory (LLNL) staff advises that the IUT (Intra-University Transfer) agreement document has been revised. These changes apply to all awards after June 1, 1994.

Administrators have developed new sample budget forms for research proposals. These forms should reduce or eliminate the requests for more data regarding proposal budgets. These samples are available from Office of Research staff.

Applicants are invited to contact the senior contract administrator, Services & Distribution Department at LLNL. Michael Cooke can be reached by telephone (510) 422-1356 or fax (510) 423-6739. The new mail stop is L-456. ❑

UC DAVIS
NEWSCLIPS
on UC Davis and Higher Education
Compiled by News Service

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Toxic cleanup oversight begins

◆ New group seeks a federal grant to monitor work at Davis' two Superfund sites

By ELISABETH SHERWIN
Enterprise staff writer 8/11/94

A Davis group with a new name and several familiar faces has been formed to apply for grants that will guarantee a third opinion when it comes to environmental cleanup at Davis' two Superfund sites.

Both Frontier Fertilizer and the UC Davis Laboratory for Energy-Related Health Research were added to the Environmental Protection Agency's Superfund list in May.

Superfund inclusion now means that neighbors can apply for grants to hire and pay for experts to interpret the results of the ongoing cleanup operations.

Davis residents Larry Bidinian and Julie Roth are co-directors of the group called the Davis Superfunds Oversight Committee (758-4751). The group is applying to the EPA for two $50,000 technical assistance grants — one for LEHR, one for Frontier.

Roth will chair the LEHR subcommittee, and Davis resident Pam Nieberg will chair the Frontier subcommittee.

According to Bidinian, 95 percent of the grant money will be used to pay for experts who can interpret and advise neighbors and activists. The LEHR subcommittee will hire a radiation landfill specialist, he said, and the Frontier subcommittee will hire a geological hydrologist.

"This is what we've wanted all along," Bidinian said this morning. "We've wanted dependable, in-depth scientific analysis from experts chosen by the public."

The EPA will not assign the grants for another two months.

See SUPERFUND, Page A-5

SUPERFUND

Continued from Page A-1

Roth, who lives less than a mile from the contaminated LEHR site, added that the expert her group can soon hire will be able to provide information that has not been forthcoming from UCD or the Department of Energy, a partner in the LEHR cleanup.

"I've been going to neighborhood meetings for four-plus years and have seen little or no progress in (south campus) landfill cleanup," said Roth. "We've never gotten answers to some questions," she added. "The EPA grant will give us a better voice on what's going on."

Roth lives off Old Davis Road south of Interstate 80 and south of LEHR. Her property extends to the middle of Putah Creek, which runs halfway between LEHR and her home. Anyone driving over the Putah Creek bridge can see kids playing and people fishing in the water and UCD sewage, unaware that they're frolicking in a Superfund site.

More than a year ago, Roth said, she posted signs around the creek warning of biological hazards.

"The signs didn't last 30 minutes," she said. "I've told kids: 'This water is polluted. Those fish are contaminated.' But this one little boy said: 'I'm not going to eat the fish — I'm going to give it to my friends.'

"I think the university has the responsibility to post the site," Roth said.

For nearly 30 years, the LEHR complex was used to conduct radiation experiments on beagle dogs. Cleanup at the site is ongoing. Radioactive beagle bodies and tons of sludge and old equipment have been removed over the past several years.

But neighbors like Roth are concerned with ground water contamination, the continued presence of radioactivity and chemicals, and the fact that old landfills may continue to contaminate the property.

The former Frontier Fertilizer company is located on East Second Street, a half-mile west of Mace Boulevard and adjacent to the new Mace Ranch development. The pesticide and distribution facility operated from 1972 to 1987.

While some slow progress is being made on the cleanup, tests reveal that ground water contamination continues to migrate north of the site.

The Department of Toxic Substances Control has spent more than $2 million so far on the cleanup and the state is suing the former businesses, as well as two former landowners, John Anderson and Pine Tree Properties, to recover the costs.

The cleanup method now being used at Frontier Fertilizer is pump-and-treat: Ground water is currently pumped from three extraction wells at a total flow rate of about a gallon per minute. The treatment system uses activated carbon in 55-gallon drums to remove pesticides and other organic contaminants from the ground water.

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FACT SHEETS

Site Assessment and Cleanup at LEHR: An Update

April 1995

OVERVIEW

The former Laboratory for Energy-Related Health Research (LEHR) at UC Davis, where for more than 30 years scientists studied the long-term health effects of exposure to low levels of radiation on laboratory animals, is in the midst of evaluating the environmental impact of chemical and low-level radioactive materials in its facilities and surrounding environment, and treating, containing, or removing these materials. The study was one of several projects the U.S. Department of Energy (DOE) supported for many years at various U.S. research institutions. Also at the site are an inactive campus landfill and several former disposal areas containing low-level radioactive wastes from the campus and the LEHR project.

In May 1994, as a result of groundwater contamination detected during preliminary investigations and the potential threat of contamination to public health and the environment, the U.S. Environmental Protection Agency placed the LEHR site on the National Priorities (Superfund) List.

DOE's assessment and cleanup activities at LEHR are estimated to cost $33 million. Some activities have already been completed, and the cost and plans for future activities will be determined once the assessment is completed, in 1996.

HISTORY AND DESCRIPTION OF LEHR

The Site Located about a mile south of the main UC Davis campus, LEHR occupies 15 acres surrounded by campus research facilities and private land. A levee along Putah Creek borders LEHR to the south. The site, now called the Institute of Toxicology and Environmental Health (ITEH) has outdoor dog kennels and 16 buildings, 11 of which house active research programs and require no treatment or removal of old LEHR research wastes.

UC Davis owns the LEHR land and leases the site to DOE, which built and owns LEHR's facilities. Once treatment or removal of LEHR's research wastes has been completed, UC Davis will assume ownership and operation of the entire facility.

An inactive campus landfill, used from the 1940s until the mid-1960s, covers about 6 acres of the LEHR site, plus another acre approximately 600 feet east of LEHR. Also at LEHR are several low-level radioactive waste burial areas, where the campus and LEHR buried wastes until 1974. The wastes were buried according to regulations that were in effect at the time. Adjacent to LEHR is the old campus sewage treatment plant, which closed in 1949. The site is the subject of a separate study by UC Davis.

The Research Through the support of DOE's predecessor, the U.S. Atomic Energy Commission, LEHR (also known in the earlier years as the Radiobiology Laboratory) began in 1951 as a research project investigating the biological effects of X-rays. A few years later, the Atomic Energy Commission contracted with LEHR for what became a 33-year study that investigated the health effects of internal exposure to low levels of strontium 90 and radium 226. In a separate but related project, research animals were exposed to cobalt 60 radiation. Research involving the use of small amounts of plutonium 241, thorium 228, and other radioisotopes was also performed.

Research at LEHR has focused on:

- understanding better the effects of exposure to low-level radiation on the skeleton and its blood-forming constituents;
- investigating the behavior of certain bone-seeking radioactive materials;
- studying the beagle as an experimental animal model;
- exploring how low-level radiation triggers and affects the formation of tumors and development of leukemia; and,
- developing effective ways to use results gathered from animal studies to assess risks to humans.

In all, 1063 beagles were used in the strontium and radium study. Selected because of their relatively long life spans and

and physiological similarities to humans, the beagles received regular medical attention throughout the study, and careful health records were kept. Most of the beagles lived in outside kennels. The last beagle in the strontium/radium study died at the age of 18½ in 1986. The final DOE research contract for the beagle study ended in 1989.

LEHR scientists have published more than 100 scientific papers based on their research with the beagles, and they are continuing to analyze information gathered during the project. They have completed a computerized database that includes all the clinical, radiation-exposure, and technical data collected during the strontium/radium study.

ASSESSMENT AND CLEANUP ACTIVITIES

Described below are the main projects that have been completed or are still undergoing assessment and cleanup at LEHR. Each project involves technical testing, assessment, and the investigation and selection of ways to eliminate, contain, or treat wastes and contamination in accordance with applicable federal, state, and local regulations. Environmental analysis of each project according to California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) requirements is also performed.

COMPLETED

The last frozen radioactive animal remains on the site were taken from storage refrigerators, packaged in drums, and sent to a DOE-licensed disposal site for low-level radioactive wastes in Hanford, Washington, in September 1990. Other specimens were packaged and transferred to other facilities for archival purposes or were sent to a DOE disposal site.

Approximately 34,000 gallons of low-level radioactive water and sludge from underground tanks were solidified and removed as waste in late 1991 and early 1992. The water and sludge consisted of the remaining by-products of a special on-site treatment facility (Imhoff Building and adjacent area) for processing animal wastes. The solidified waste was sent to a DOE-licensed disposal site in Hanford. The tanks themselves will be surveyed and decontaminated if necessary as part of upcoming activities.

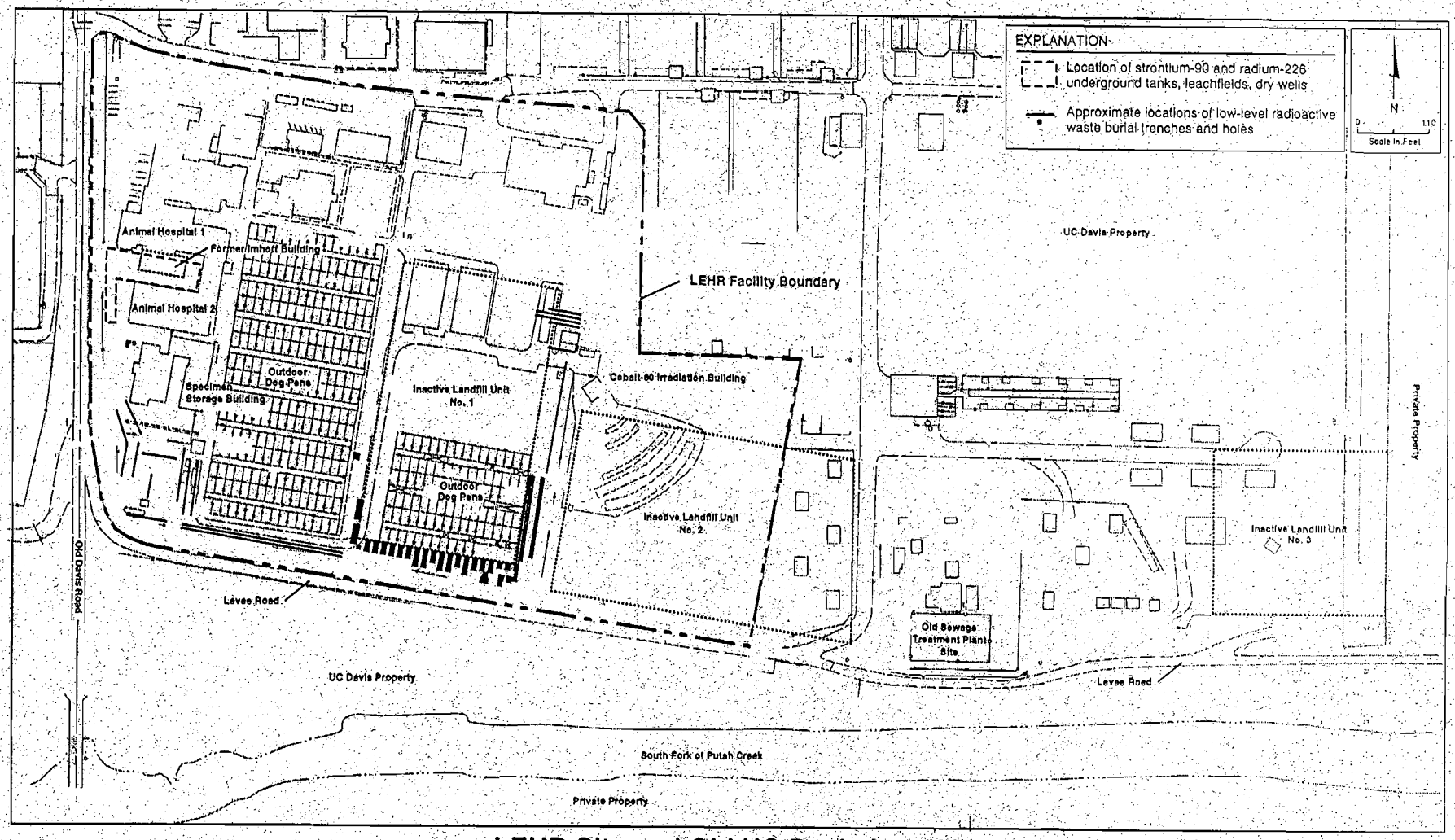
Removal of a device called a cobalt-60 irradiator used for exposing research animals in outdoor pens to external radiation was completed in January 1993. The irradiator was used in the 1970s and early 1980s to study radiation-induced leukemia. DOE conducted a study in 1990-91 that estimated the potential exposure to nearby private residences and campus employees and volunteers at surrounding campus research facilities when the device was operated. The study showed that the private residences and those who worked in the area received less than the DOE annual limit allowed for public exposure during the time the irradiator operated, and less exposure than the current annual limit allowed by the State of California, both of which are 500 millirem per year. The cobalt-60 source was transferred to General Electric Corp.

A tank trailer which was used to hold low-level radioactive liquid in the past, was removed and transported to a licensed waste-processing facility in October 1994.

IN PROGRESS

Decontamination and decommissioning (D&D) of buildings is nearing completion. Eleven of sixteen buildings have already been released to researchers involved in ongoing UC Davis research. Of the 5 remaining buildings, Animal Hospital 1, Animal Hospital 2, and a storage building for laboratory materials have been cleaned of residual low-level radioactivity and are awaiting independent confirmation of cleanup before transfer to UC Davis. Low-level wastes removed from these buildings were packaged and sent to a DOE-licensed disposal site in Hanford. Demolition of the Imhoff building was completed in March 1995. The building that housed the cobalt-60 irradiator is scheduled for decontamination and decommissioning by the end of 1996.

Groundwater, surface water, and soil investigations are continuing. So far, carbon 14, tritium, chromium, nitrate, a few volatile organic chemicals (VOCs), and chlorinated pesticides have been found in shallow groundwater (about 45-70 feet deep) under and adjacent to the site. Concentrations of chromium, nitrate, tritium, and VOCs are above drinking water standards in some of the shallow test wells. Tritium has been detected in one deeper test well at 85 feet, but the levels are below the drinking water standard. In surface water testing, low levels of metals and nitrate, and trace amounts of organic chemicals have been detected in samples collected upstream and downstream of LEHR. Contamination from LEHR is unlikely since the creek supplies water to, rather than draws water from, shallow groundwater in the area. In soil testing, low levels of nitrate, a few VOCs, chlordane, several trace metals, and radionuclides such as strontium 90, radium 226, tritium have been detected. Work is in progress to determine whether the levels exceed those that are typical for the area. A more extensive water and soil assessment and evaluation of cleanup options, called a remedial investigation/feasibility study (RI/FS), began in late 1994 and is expected to be completed by 1996.



LEHR Site and Old UC Davis Landfill

WHERE DO I GET MORE INFORMATION?
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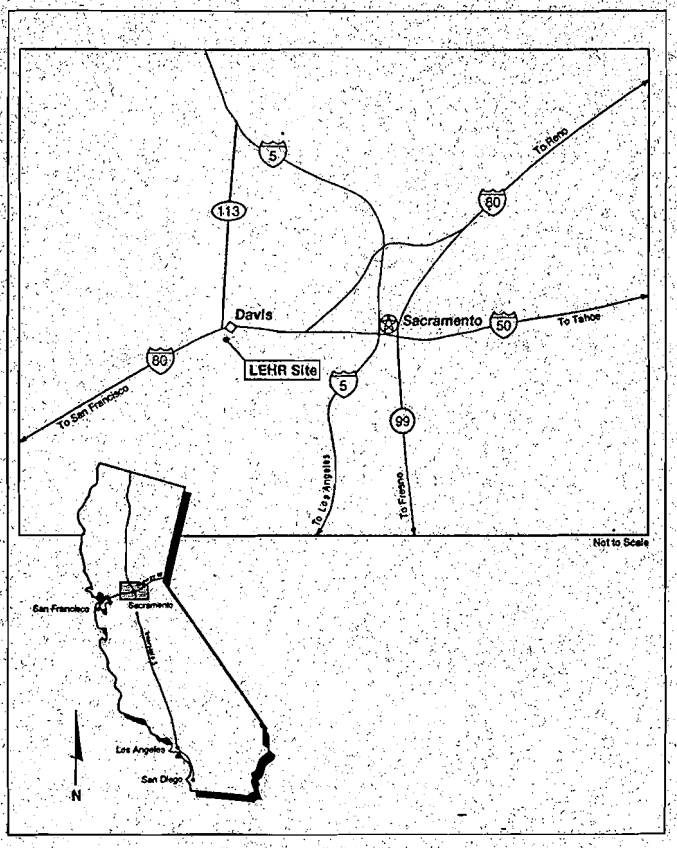

Decontamination and Decommissioning of LEHR Imhoff Building

April 1995

OVERVIEW

As part of its continuing effort to clean up a former research facility located at UC Davis, the U.S. Department of Energy (DOE) has completed the decontamination and decommissioning (D&D) of a special treatment facility ("Imhoff Building") that was used to process liquid radioactive waste at the former Laboratory for Energy-Related Health Research (LEHR), where for more than 30 years scientists studied the long-term health effects of exposure to radiation on laboratory animals.

From 1961 to 1987, laboratory animals (primarily beagles) housed in Animal Hospital 1 (AH-1) were fed strontium 90 to study the long-term effects of exposure to this radionuclide, a component of radioactive fallout. Excreta from the animals and wash water from the animal cages in AH-1 were discharged to the Imhoff Building through a special drainage system that was separate from the domestic sanitary sewage system at LEHR. The wastewater was processed through a series of underground holding and settling tanks and ion-exchange columns to remove the strontium 90. The treated effluent was then discharged to a leachfield under and adjacent to the building.

During the research project, water and sludge from the tanks were removed periodically and disposed off-site. In 1991-92, the remaining sludge was removed, solidified, and transported to a DOE-licensed disposal site in Hanford, Washington. After evaluating potential D&D options, DOE determined that demolition of the Imhoff Building was the best alternative because of its age and condition. In addition, more extensive soil testing under and around the underground tanks is planned. Access to these areas was very limited, and removal of the building will enable personnel collecting soil data to do so more safely and efficiently.

LOCATION

Approximately one mile south of the main UC Davis campus on Old Davis Road, the LEHR site covers 15 acres and is surrounded by scattered campus research facilities and private farms. The Imhoff Building is located on the west side of LEHR between Animal Hospitals 1 and 2.

IMHOFF BUILDING D&D PROCESS

Prior to finalizing the plans for the Imhoff D&D, DOE performed an assessment pursuant to the National Environmental Policy Act (NEPA) to evaluate potential impacts to the public and the environment from the planned D&D activity. From the assessment, DOE determined that the Imhoff D&D was eligible for a NEPA Categorical Exclusion because the process would not have a significant impact on public health or the environment.

DOE contracted Battelle Pacific Northwest Laboratory (PNL) to manage the site cleanup, which includes the Imhoff D&D. IT Corporation, based in Martinez, California, was selected by PNL to perform the actual D&D work. All activities were performed according to a work plan that was reviewed by DOE and UC Davis.

The first step in the process was the construction of a containment structure to enclose the entire building and surrounding area to assure that any radioactive or chemical contamination would be successfully contained during the operation. Access to the containment structure was limited to personnel directly involved in the actual work. Removal of all building contents and demolition of the building itself was performed inside the containment structure. All wastes from the project were packaged on-site and shipped to the DOE Hanford waste site in Richland, Washington, according to applicable federal and state regulations.

To isolate and prevent contaminants from being released to the environment, engineering controls, such as High-Efficiency Particulate Air (HEPA) filters were also used. Throughout the operation, extensive monitoring both inside and outside the containment structure was performed to verify that no radiation exposure to workers, the public, or the environment occurred. To further ensure the safety of workers, personnel were required to wear radiation detection badges and appropriate protective clothing during the activities.

Demolition of the building began in November 1994 and was completed in March 1995. Afterwards, the ground surface, tank covers, and air were checked to ensure there was no radioactivity above naturally occurring levels, and the containment structure was removed. The empty underground tanks that were under the building and surrounding soils will be further evaluated and remediated as necessary as part of other site cleanup activities.

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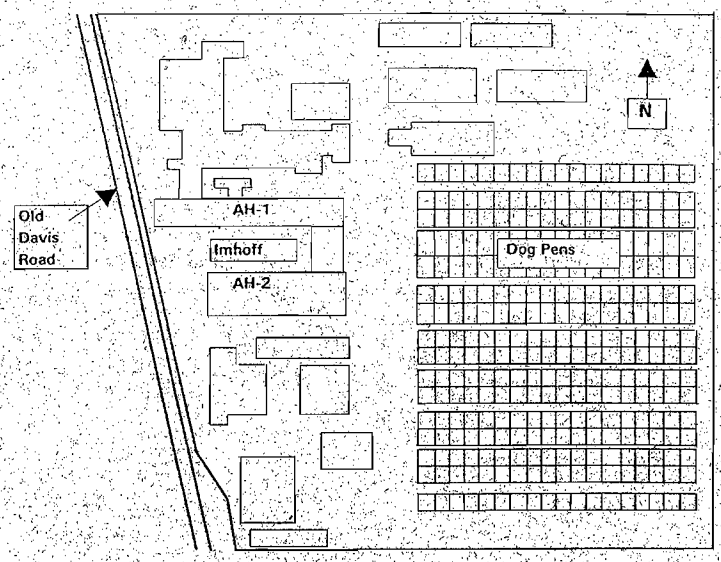
LEHR SITE (Western Section)



Hexavalent Chromium

April 1995

WHAT IS HEXAVALENT CHROMIUM?

Chromium is a naturally occurring metallic element that can be found in water and in soils or rocks. It is also present in the food we eat, either in the food itself or in residual soils that might remain on such items as produce. In addition, trace amounts of chromium exist in the environment as a result of industrial processes.

But in nature, as well as in human-made inorganic and organic chemical compounds, the chromium exists in various forms. When chromium is present in some solids or liquids, it is possible for it to have different electrical charges, which is related to the number of electrons present in the atom. The most common forms are trivalent and hexavalent. In its trivalent state, the chromium is missing three electrons. In its hexavelent state, the chromium is missing six electrons. In the environment, chromium usually exists in the trivalent form. It is possible for one form to change into the other when chemical conditions are right. Although we can measure the amount of hexavalent chromium in a liquid (such as groundwater) or in a solid (such as soil), the amount present at any one time is not necessarily the same as the starting amount because of the chemical changes that may occur.

HEALTH EFFECTS

Chromium is an essential nutrient and is necessary for the metabolism of sugars and for many enzyme reactions. The federal government recommends an adult daily intake of 50 to 200 micrograms (μg). Chromium is a common ingredient in many vitamin and mineral supplements.

Although the trivalent form of chromium shows very low toxicity, both the federal and California EPA have designated hexavalent chromium a carcinogen. Because of the carcinogenic properties of some chromium compounds, a risk-based drinking water standard of 50 micrograms per liter (μg/L) has been established for chromium. The federal EPA has proposed increasing the drinking water standard to 100 μg/L, but no action has been taken yet.

Potential health effects from chromium exposure are dependent on many factors. These include chemical form, the amount, the length of time the individual was exposed, and whether the chromium was ingested, inhaled, or absorbed through the skin. Once chromium enters the body, numerous biochemical reactions occur. These reactions and their potential effects are highly dependent on such characteristic traits as age, sex, weight, and health of the individual. Although a drinking water standard has been established, long-term human health effects from consuming water containing more than 50 μg/L of hexavelent chromium have not been identified.

HEXAVALENT CHROMIUM IN GROUNDWATER AND SURFACE WATER AT LEHR AND VICINITY

There have been detections of hexavalent chromium in groundwater at LEHR and in the vicinity. At LEHR, hexavalent chromium has been consistently detected in two shallow groundwater monitoring wells (about 55 - 70 feet deep). The concentrations range from less than 10 μg/L to 350 μg/L. This water is not used for drinking. On campus property adjacent to LEHR, concentrations of hexavalent chromium in shallow and slightly deeper monitoring wells range from less than 10 μg/L to 80 μg/L. Hexavalent chromium has also been detected in groundwater under private property and elsewhere in the Davis area. These levels range from less than 1 μg/L to 180 μg/L. The overall distribution of hexavalent chromium detections in regional groundwater is random, which suggests a natural origin. However, the sources and levels of hexavalent chromium in regional groundwater and the relationship, if any, to elevated levels at the LEHR site are not fully understood.

Trace amounts of hexavalent chromium have also been detected in the South Fork of Putah Creek near the LEHR facility and at the campus wastewater treatment plant outfall. These concentrations average about 3 μg/L.

FOR MORE INFORMATION:

Information on hexavalent chromium in water and soil in and around LEHR has been published in various documents, such as the Solid Waste Assessment Test (SWAT) Report for the Old Campus Landfill (1990), the DOE Phase II Report (1993), and the Annual Water Monitoring Report (1994).

or

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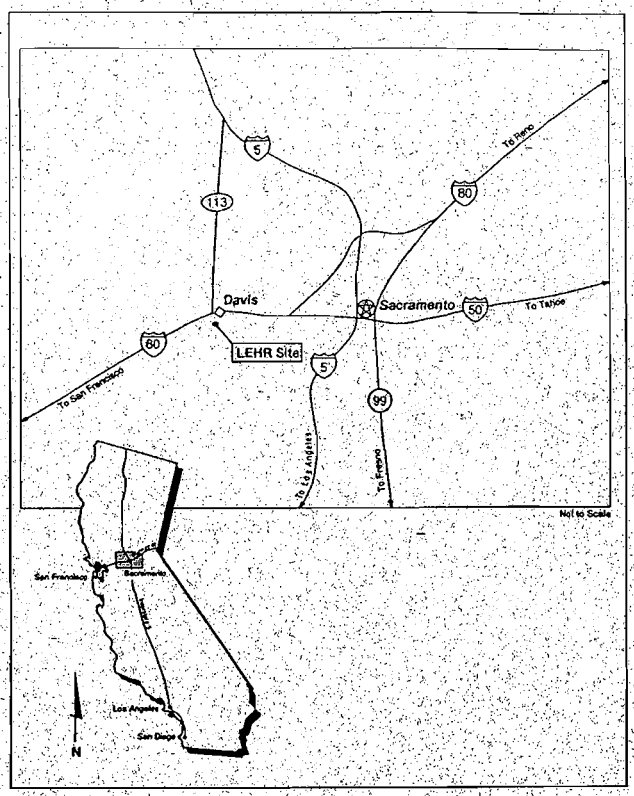

❖ Plutonium Research at LEHR ❖

April 1995

WHAT IS PLUTONIUM?

Plutonium (abbreviated Pu) is a human-made metallic element produced from uranium in nuclear fission reactors. Only traces are found naturally. The radioactive isotopes of plutonium include plutonium 238 (Pu-238), plutonium 239 (Pu-239), plutonium 240 (Pu-240), and plutonium 241 (Pu-241). All plutonium isotopes are radioactive. Plutonium is chemically and radiologically very similar to radioactive thorium that occurs naturally in all of the soil and rock on the earth.

Pu-239, Pu-239, and Pu-240 emit alpha radiation during the process of radioactive decay. It is the Pu-239 that supports a fission chain reaction and is used as nuclear fuel. The half-life of Pu-239 is 24,065 years, which means that half of the Pu-239 found in a source disappears in 24,065 years. The half-lives of Pu-238 and Pu-240 are 87 years and 6,537 years, respectively.

In contrast, the ionizing radiation emitted by Pu-241 is low-energy beta radiation, and the half-life is only 14 years. It decays to form americium 241 (Am-241), an alpha-emitting radionuclide with a half-life of 432 years and is widely used in home smoke detectors.

Although natural plutonium is rare, there are now trace amounts of plutonium in the surface soil and water and in the atmosphere of the earth as a result of world-wide fallout from nuclear weapons tests and accidental releases into the atmosphere. Because of its fine particle size, it can be easily inhaled. Some plutonium may be carried to the blood, from which it can enter other organs. As a result, billions of atoms of the plutonium isotopes are found in the lungs and body of every person living on the earth today. Middle-aged Americans have from 4 billion to 40 billion atoms of plutonium in their lung tissue, liver, or bones, but the radiation dose received from this plutonium is small compared to natural background exposures.

HEALTH EFFECTS

Plutonium has been inaccurately called "the most poisonous substance known to man." However, plutonium is not a "poison" in the chemical sense. Neither the low-energy beta radiation of Pu-241 nor the alpha radiation from the other isotopes of plutonium or Am-241 can penetrate the outer dead layer of human skin, so radiological exposure only occurs if plutonium is incorporated into the body. Certainly, large amounts deposited within the human body can be harmful with time since high-intensity alpha radiation can injure living cells, which can lead to cancer. But cells irradiated by alpha particles from human-made plutonium have no different response than if irradiated with alpha particles from naturally occurring radionuclides. In addition, even though hundreds of people have been occupationally exposed to plutonium, there are no known cases of plutonium-induced injury or cancer in people.

PLUTONIUM-241 STUDY AT LEHR

A tracer study of the metabolism of Pu-241 in laboratory animals was conducted at the Laboratory for Energy-Related Health Research (LEHR) at UC Davis from 1981 to 1986. Pu-241 was chosen for the study because it is a useful surrogate for the more potentially hazardous isotopes of plutonium, such as Pu-239. The purpose of the study was to determine the behavior (for example, pathways) of fine particles of plutonium deposited in lungs; it was not a biological effects study. Besides experiments involving animals, several chemistry experiments were also performed. The results of the Pu-241 experiments were summarized in the LEHR 1986 Annual Report.

Very small amounts (10 to 20 microcuries) of Pu-241 contained in a saline solution were placed into the lungs of a few selected laboratory animals, including rats, monkeys, and dogs. Animals were kept in metabolism cages to collect all excreta until the excreted Pu-241 dropped to negligible levels. All excreta were analyzed for plutonium. The animals' organs were also analyzed for plutonium so that all of the plutonium could be accounted.

The experiments began in 1981 in building AH-1 at LEHR using a special chemistry laboratory and metabolism cages. Rats and some beagles were used when the studies were conducted in AH-1. All plutonium waste, including animal excreta containing plutonium, was collected for analysis. Residual cage washings and some low-level liquid waste were disposed to the LEHR Imhoff radioactive wastewater treatment system. Records show that a total of about 40 μCi of Pu-241 was processed through the Imhoff facility. In 1983 the Pu-241 study moved to the newly constructed Toxic Pollutant Health Research Laboratory (TPHRL) building located at LEHR. Experiments with rats and beagles continued in the TPHRL, but the Pu-241 experiments involving monkeys were performed in a specially designated facility at the UC Davis California Regional Primate Research Center

(CRPRC), not at LEHR. All monkey samples were brought to the TPHRL for processing and analysis. Radioactive waste and excess plutonium source materials from all experiments were collected and sent to commercial disposal sites.

Strict radiation safety precautions were taken in all phases of these studies to protect the investigations, the public, and the environment. The UC Davis Office of Environmental Health and Safety (EH&S) and the San Francisco Operations Office of the U.S. Department of Energy were responsible for overseeing the study to ensure compliance with applicable state and federal regulations. As with all research projects involving the use of radioactive materials at UC Davis, the experimental protocols and amount of radioactivity used were reviewed and approved by UC Davis EH&S and the Radiation Use Committee. The approved protocols specified the maximum amount of Pu-241 that could be used (15,000 µCi), personal safety requirements for the researchers, environmental protection measures, and how the wastes were to be handled.

POTENTIAL ENVIRONMENTAL IMPACTS

Because the amount of Pu-241 used at LEHR was small and its use was well-controlled, there was minimal risk to the environment or the public from the study.

Site characterization at LEHR has included screening or specific testing for the possible presence of Pu-241. In addition to testing soil and water at the site, interior and exterior surfaces of buildings, cage drains, and plumbing systems have been checked. No Pu-241 contamination has been found in any of these areas except for traces that were found in a few AH-1 cage drains leading directly to the Imhoff facility. Traces of Pu-241 were found in the sludge that was in the Imhoff tanks. This sludge was removed in 1992, solidified, and shipped to a radioactive waste site in Richland, Washington. To date, tests of soils around the tanks and former plumbing systems have not indicated any environmental contamination associated with plutonium above average levels present in soil world-wide.

Extensive groundwater testing at and near the former LEHR facility has not shown any evidence of contamination that can be attributed to Pu-241. Additional tests are planned as part of the Remedial Investigation/Feasibility Study (RI/FS) currently in progress.

WHERE CAN I GET MORE INFORMATION?

Information on radionuclides in water and soil in and around LEHR has been published in various documents, such as the Solid Waste Assessment Test (SWAT) Report for the Old Campus Landfill (1990), the DOE Phase II Report (1993), and the Annual Water Monitoring Monitoring Report (1994).

or

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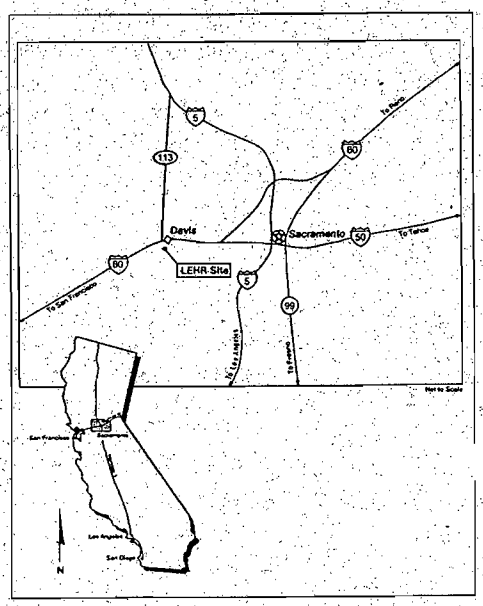

Nitrate

April 1995

WHAT IS NITRATE?

Nitrogen is an element essential to living matter. It occurs naturally in the environment in soil, water, and air. Nitrogen is present in many compounds, including ammonia and nitrate.

Ammonia is present in both human and animal waste. It can enter the soil from septic systems, animal enclosures, or manure storage facilities. Microorganisms then convert it to nitrate. Agriculture is a significant contributor to nitrogen levels in the soil. To improve crop yields, fertilizers that contain nitrogen are applied to crops. This nitrogen is also converted to nitrate in the soil. When more nitrate accumulates than the plants growing in the soil can use, water from irrigation and rain can carry it down through the soil into groundwater by a process known as leaching. How fast leaching occurs depends on the type of soil. However, this process does take time. Scientific studies indicate that most of the nitrates in regional groundwater are probably from crop irrigation water that infiltrated decades ago.

HEALTH EFFECTS

Nitrate itself is relatively nontoxic to humans. Health problems associated with nitrate result primarily after nitrate enters the body by way of ingestion, where bacteria convert the nitrate to nitrite (NO_2). Nitrite can cause methemoglobinemia, an oxygen-deficient condition in blood that can be expecially life-threatening to infants under 6 months of age. It is rarely a problem for healthy older children and adults.

Once nitrate has been converted to nitrite in the body, other reactions can occur that can form compounds called N-nitrosamines. Certain N-nitrosamines tested in animals have been found to be carcinogenic. There is no direct evidence that these compounds are human carcinogens. Though it is assumed that exposure to these compounds increases the risk of cancer in humans, it is unknown how much of that risk is caused by nitrate-contaminated drinking water.

The total health risk from increased exposure to nitrates is difficult to determine because of individual variability in the conversion of nitrate to nitrite and the subsequent reaction of nitrite to form other nitrogen-containing compounds such as N-nitrosamines. Furthermore, results from epidemiologic studies that evaluate the long-term effects of the coexistence of nitrogen-containing wastes, fertilizers, pesticides, and other chemicals in the environment are not yet available.

As a result of known and potential health effects of nitrate consumption, the U.S. Environmental Protection Agency (EPA) and the U.S. Public Health Service have recommended a maximum level of nitrate concentration in drinking water that they regard as safe for human consumption. That level (also called a Maximum Contaminant Level or MCL), is 10 milligrams of nitrate-nitrogen (NO_3-N) per liter (10 mg/L), or its equivalent of 45 mg/L of nitrate (NO_3).

NITRATES IN THE ENVIRONMENT

A number of studies have found increasing problems with nitrate in drinking water throughout the U.S. In the 1980's, surveys by the U.S. EPA and the U.S. Geological Survey reported that up to 6% of the nation's rural water supplies had nitrate levels above the regulatory standard. In the Davis area, none of the municipal wells are free of nitrates, and several municipal wells have had measurements very near the maximum allowable contaminant level for drinking water. Nitrate levels have generally been increasing in Davis municipal wells for the last 20 years. Many private domestic wells in this area are shallower and therefore closer to sources of nitrate contamination.

There have been detections of nitrate-nitrogen in groundwater at LEHR and in the vicinity. Over the past few years of groundwater sampling at LEHR, nitrate-nitrogen has been consistently detected in most site wells with results between 2mg/L and 68 mg/L. On campus property adjacent to LEHR, concentrations in shallow and slightly deeper monitoring wells range from 2mg/L to 20 mg/L. On private property in the LEHR vicinity, nitrate as nitrogen samples have ranged from 2 mg/L to 38 mg/L. Additional recent data regarding nitrate measurements in and around Davis are shown on the map (page 2).

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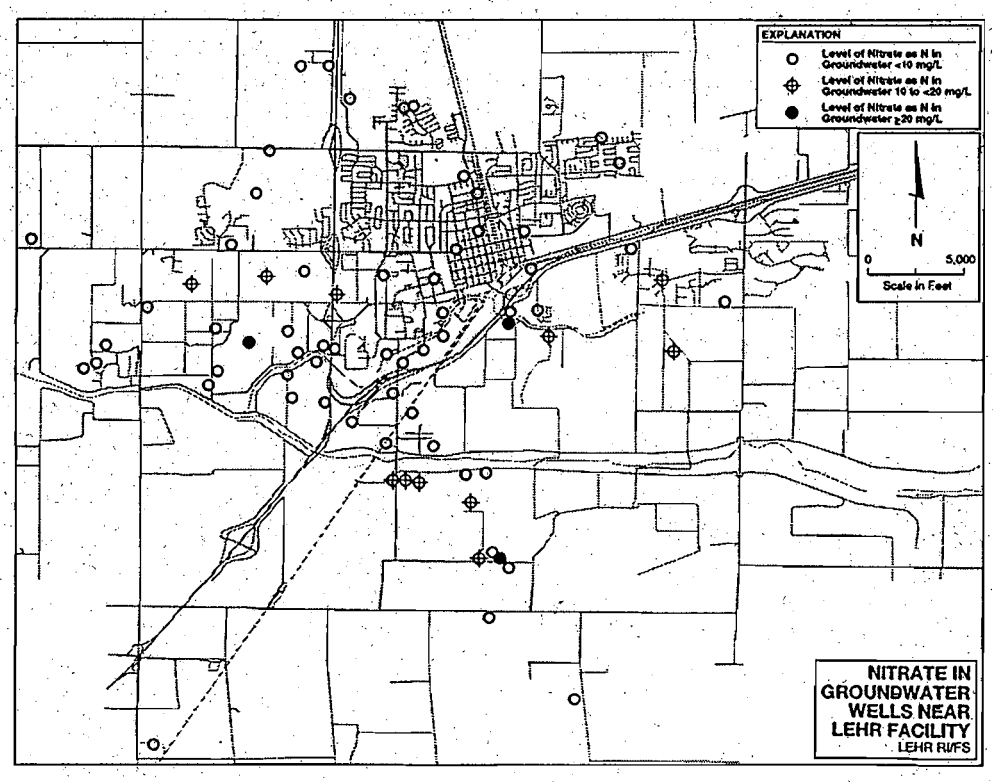

Tritium

April 1995

WHAT IS TRITIUM?

Tritium (abbreviated ^3H or H-3) is one of the naturally occurring forms of the element hydrogen. Since water consists of molecules of hydrogen and oxygen, tritium commonly exists in water. Unlike the other natural forms of hydrogen, tritium is radioactive. The half-life of tritium is 12 years, which means that half of the tritium found in a source disappears in 12 years. The ionizing radiation emitted by tritium is low-energy beta radiation. This low-energy beta radiation cannot penetrate the outer dead layer of human skin, so a human radiological exposure only occurs if tritium is incorporated into the body.

Tritium is continuously formed in the atmosphere by interaction of cosmic ray particles with the non-radioactive forms of hydrogen. From there, it is carried to earth in rainfall. Because tritium can be found in drinking water throughout the United States at average concentrations ranging from 100 to 200 picoCuries per liter (pCi/L), a person living in the U.S. probably has about 5,000 pCi of tritium in his or her body.

Tritium is also a by-product of the nuclear power industry and has been commercially produced for use in certain nuclear weapons and consumer products. Tritium is widely used in laboratory research to study biological systems and chemical reactions. It is also used as a tracer to study groundwater flow. Consumer products such as luminous watch dials and luminous exit signs often use tritium-containing compounds.

HEALTH EFFECTS

Human health effects from internal exposure to low levels of radiation depend on the amount of radioactive material deposited in the body, the type of radiation, the chemical form of the radioisotope, its half-life, and the length of time in the body.

Recognizing the potential for harmful effects, in 1977 the U.S. Environmental Protection Agency (EPA) established drinking water standards to limit the total human radiation dose from all radionuclides to less than 4 millirem per year (mrem/yr) to any organ or whole body from drinking two liters (about two quarts) per day per person. The 4 mrem dose was chosen because data indicated that exposure to 4 mrem/yr would not result in any additional risks beyond those that are a part of everyday life.

The current federal and state drinking water standard for tritium is 20,000 pCi/L. The resulting dose from drinking two quarts of water containing 20,000 pCi/L every day for a year would be 1.3 mrem. Recently the EPA has proposed changing the drinking water standard (also referred to as a maximum contaminant level, or MCL) to 60,000 pCi/L for tritium to better conform with the 4 mrem/yr dose limit. The radiation dose from drinking water with 60,000 pCi/L of tritium per liter daily throughout the year yields a radiation dose to the body about equal to that received during one transcontinental airline flight. At smaller concentrations (2,000 pCi/L, for example), the dose is proportionately smaller, less than 0.2 mrem. Compared to dose received from natural and human-made sources of radiation, the health risk from such small extra annual exposures to ionizing radiation is negligible.

TRITIUM AT UC DAVIS

At UC Davis tritium was and is still used as a tracer in biomedical research. For several years prior to 1975, some low-level radioactive wastes containing tritium were legally buried at the Laboratory for Energy-Related Health Research (LEHR) site. High-level tritium waste is disposed at special radioactive waste disposal sites outside California.

Some tritium-containing liquids from campus research activities have been and are still disposed through the UC Davis wastewater treatment plant according to strict safety limits established by state and federal regulations. The campus Office of Environmental Health and Safety (EH&S) disposes of approximately 90 millicuries (mCi) of tritium per year through the plant. This is well below the California limit of 5,000 mCi.

TRITIUM IN GROUNDWATER AND SURFACE WATER AT LEHR AND VICINITY

The highest level of tritium in water observed at LEHR is

from monitoring well UCD-13, which is about 65 feet below the ground surface directly next to and downgradient of the old low-level radioactive waste disposal areas. The tritium measurement at well UCD-13 have ranged from 20,000 to 30,000 pCi/L. Lower levels of tritium (about 4,300 pCi/L) have been detected in a slightly deeper monitoring well UCD-14, which is next to UCD-13. Water from these wells is not used for drinking.

Groundwater under private property near LEHR has also been tested for tritium. Tritium has been detected sporadically in some locations at levels far below the current EPA drinking water standard. The highest reported measurement of tritium is less than 2,000 pCi/L. The presence of tritium in these locations and the relationship, if any, to elevated levels at the LEHR site are not fully understood.

In the South Fork of Putah Creek adjacent to LEHR, tritium measurements have ranged from less than 250 pCi/L to about 1,800 pCi/L.

WHERE CAN I GET MORE INFORMATION?

Information on tritium in water and soil in and around LEHR has been published in various documents. The major ones include the Solid Waste Assessment Test (SWAT) Report for the Old Campus Landfill (1990), the DOE Phase II Report (1993), and the Annual Water Monitoring Report (1994). Reports of other smaller studies are also available from UC Davis or DOE.

Published references include:

National Council on Radiation Protection and Measurement (1987). *Exposure of the Population of the United States and Canada from Natural Background Radiation*, NCRP Report No. 94.

National Council on Radiation Protection and Measurement (1979). *Tritium in the Environment*, NCRP Report No. 62.

U.S. Environmental Protection Agency, Office of Radiation Programs (1993). *Environmental Radiation Data*, Report 67, 402-R-93-019.

For additional information:

CALL:

LEHR Information Line	(916) 752-8351
Jim Littlejohn, DOE	(510) 637-1526
Julie McNeal, UC Davis	(916) 752-3575

or

WRITE:
LEHR Cleanup Project
Mail Stop ITEH
Old Davis Road
Davis, CA 95616

or

DOCUMENTS RELATING TO THE LEHR CLEANUP PROJECT ARE AVAILABLE FOR REVIEW AT:

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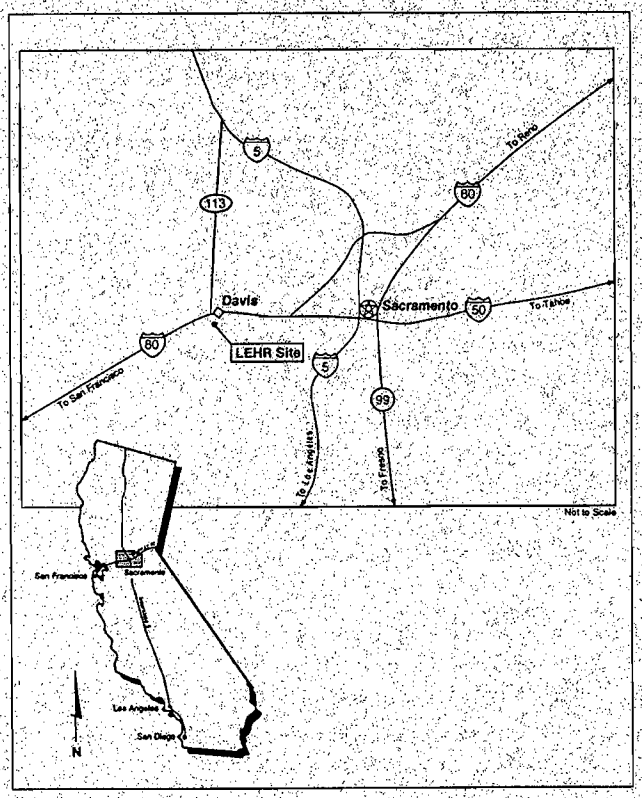

SUPERFUND ABBREVIATIONS and GLOSSARY

Abbreviation

AOC — Administrative Order on Consent

A legal agreement between EPA and PRPs whereby PRPs agree to perform or pay the cost of a site cleanup. The agreement describes the actions to be taken at a site and may be subject to a public comment period. Unlike a consent decree (CD), an AOC does not have to be approved by a judge.

Administrative Record

A file that is maintained and contains all information used by the lead agency to make its decision and selection of a response action under CERCLA. This file is available for public review and is established at or near the site, usually at one of the information repositories. Also, a duplicate file is held in a central location, such as a regional or state office.

ARARs — Applicable or Relevant and Appropriate Requirements

Federal, state, and local cleanup standards, control standards, and other substantive requirements, criteria, or limitations pertaining to the proposed remeidal action.

CD — Consent Decree

A legal document, approved and issued by a judge, that formalizes an agreement reached between EPA and PRPs where PRPs will perform all or part of a Superfund site cleanup. The CD describes actions that PRPs are required to perform and is subject to a public comment period.

CERCLA — Comprehensive Environmental Response, Compensation, and Liability Act

A federal law passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act (SARA). The Acts created a special tax that goes into a trust fund, commonly known as Superfund, to investigate and clean up abandoned or uncontrolled hazardous waste sites.

CLP — Contract Laboratory Program

Laboratories under contract to EPA that analyze soil, water, and waste samples taken from areas at or near Superfund sites.

CRP — Community Relations Plan

Formal plan for community relations activities at a Superfund site.

FFA Federal Facility Agreement

A legal agreement between various agencies such as EPA, California Department of Toxic Substances Control, and the DOE to undertake cleanups under CERCLA.

HRS Hazard Ranking System

A scoring system used to evaluate potential relative risks to public health and the environment from releases or threatened releases of hazardous substances. EPA uses the HRS to calculate a site score, from 0 to 100, based on the actual or potential release of hazardous substances from a site through air, soil, surface water, or groundwater. This score is the primary factor used to decide if a hazardous waste site should be placed on the NPL. Sites scoring 28.5 or higher are candidates for the NPL.

Information Repository

A file containing current information, technical reports, and reference documents regarding a Superfund site. The information repository is usually located in a public building that is convenient for local residents, such as a public school, city hall, or library.

Interim Action

A remedial action taken prior to the final cleanup action at a site. It is usually consistent with the final action.

NCP National Oil and Hazardous Substances Contingency Plan

The federal regulation that guides the Superfund program.

NPL National Priorities List

EPA's list of hazardous waste sites identified for possible long-term remedial response. EPA is required to update the NPL at least once a year.

OU Operable Unit

These are study areas at a Superfund site that can be categorized by media (groundwater, soil, or surface water), by geological similarities, or similar use or contents (for example, a landfill or underground tanks).

PRP — Potentially Responsible Party

Individual(s) or company(ies), such as owners, operators, transporters, or generators, potentially responsible for, or contributing to, the contamination problems at a Superfund site. Whenever possible, EPA requires PRPs, through administrative and legal actions, to clean up hazardous waste sites they have contaminated.

PA — Preliminary Assessment

The process of collecting and reviewing available information about a known or suspected hazardous waste site or release. EPA uses this information to determine if the site requires further study.

QA/QC — Quality Assurance/Quality Control

A system of procedures, checks, audits, and corrective actions used to ensure that field work and laboratory analysis during the investigation and cleanup of Superfund sites meet established standards.

ROD — Record of Decision

A public document that explains which cleanup alternative(w) will be used at NPL sites. The ROD is based on information and technical analysis generated during the RI/FS and consideration of public comments and community concerns.

RA — Remedial Action

The actual construction or implementation phase that follows the remedial design of the selected cleanup alternative at a site on the NPL.

RD — Remedial Design

An engineering phase that follows the ROD when technical drawings and specifications are developed for the subsequent remedial action at a site on the NPL.

RI/FS — Remedial Investigation/Feasibility Study

Investigative and analytical studies usually performed at the same time in an interactive, iterative process. They are intended to gather data necessary to determine the type and extent of contamination; establish criteria for cleaning up the site; identify and screen cleanup alternatives for remedial action; and analyze in detail the technology and costs of the alternatives.

Remedial Response

A long-term action that stops or substantially reduces a release or threatened release of hazardous substances that is serious, but does not pose an immediate threat to public health and/or the environment.

Removal Action

An immediate action taken over the short-term (6 to 18 months) to address a release or threatened release of hazardous substances.

RCRA Resource Conservation and Recovery Act of 1976

A federal law that established a regulatory system to track hazardous substances from the time of generation to disposal. The law requires safe and secure procedures to be used in treating, transporting, storing, and disposing of hazardous substances. RCRA is designed to prevent new, uncontrolled hazardous waste sites.

Risk Assessment

Characterization of the potential adverse health effects to human health and the environment as a result of contaminants present at a Superfund site.

RPM Remedial Project Manager

The EPA or agency official responsible for overseeing remedial response activities.

SI Site Inspection

A technical phase that follows a PA designed to collect more extensive information about a hazardous waste site. The information is used to score the site according to the HRS to determine whether a response action is needed.

Superfund

The common name used for the CERCLA, sometimes referred to as the trust fund.

SARA Superfund Amendments and Reauthorization Act

Modifications to CERCLA enacted in 1986.

TSDF Treatment, Storage, and Disposal Facility

Any building, structure, or installation where a hazardous substance has been treated, stored, or disposed. TSD facilities are regulated by EPA and states under the RCRA.

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The Remedial Process

Remedial Investigation (RI)

An assessment of the nature and extent of contamination and the associated health and environmental risks

Feasibility Study (FS)

Development and analysis of the range of cleanup alternatives for the site, according to the nine evaluation criteria; usually undertaken concurrently with the RI

↓

Selection of Remedy

Selection of the remedial alternative for the site. This step includes:

Proposed Plan

Identifies a preferred remedial alternative for a Superfund site and explains why it is the preferred alternative, and allows for public comment

Record of Decision (ROD)

The official report documenting the background information on the site and describing the chosen remedy and why it was selected

↓

Remedial Design (RD)

Preparation of technical plans and specifications for implementing the chosen remedial alternative

↓

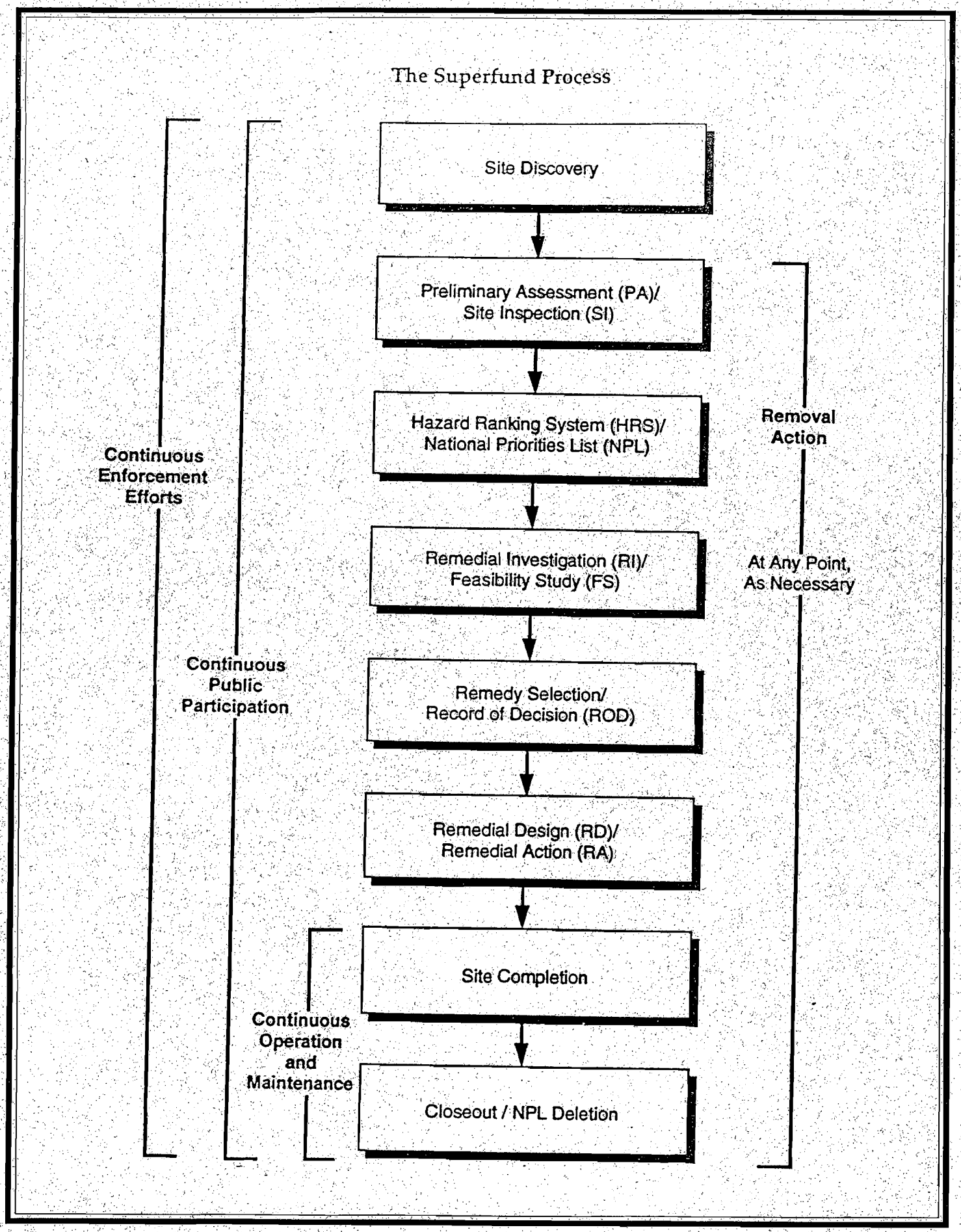
Remedial Action (RA)

Construction or other work necessary to implement the remedial alternative

↓

Operation & Maintenance (O&M)

Activities conducted at a site after a response action occurs to ensure that the cleanup methods are working properly and to ensure site remedy continues to be effective


The Superfund Process
Site Discovery
Preliminary Assessment (PA)/
Site Inspection (SI)
Hazard Ranking System (HRS)/
National Priorities List (NPL)
Remedial Investigation (RI)/
Feasibility Study (FS)
Remedy Selection/
Record of Decision (ROD)
Remedial Design (RD)/
Remedial Action (RA)
Site Completion
Closeout / NPL Deletion
Continuous Enforcement Efforts
Continuous Public Participation
Continuous Operation and Maintenance
Removal Action
At Any Point, As Necessary

RADIATION AND HUMAN HEALTH

Radiation is part of our everyday lives. Humankind has been exposed to naturally occurring radioactive materials and direct ionizing radiation from both terrestrial and cosmic sources since the beginning of life on the earth.

We are all exposed to radiation from the sun and in the atmosphere: naturally occurring radioactive materials are present in the earth, the houses we live in, and in the foods we eat. Radioactive gases are mixed in the air we breathe. Radon, a radioactive gas emitted from uranium in the earth, accounts for more radiation exposure than all other sources combined. Even our own bodies contain naturally occurring elements that are radioactive. Bones contain radioactive potassium, and radioactive carbon is found naturally in body tissues.

The average per capita effective ionizing radiation dose in the United States (from all sources exclusive of smoking) is about 360 millirem per year. Approximately 80% of this exposure, about 300 millirem, is from naturally occurring (or "background") sources. The average U.S. per capita dose from cosmic radiation is 27 millirem per year or about 7% of natural background. This inescapable radiation exposure is called "natural background," and it varies from place to place. For example, exposure to cosmic radiation increases with altitude as there is less atmosphere to absorb the radiation, so populations at higher elevations receive higher cosmic doses. People living at Lake Tahoe receive about 50 millirem more exposure per year than people living in the Sacramento Valley.

In addition to natural background radiation, there are human-made sources of radiation. Medical techniques used in the diagnosis and treatment of injury and disease account for 15% of the average American's annual radiation exposure. Another 3% comes from various consumer products such as televisions, household smoke detectors, and luminous watch dials. Less than 1% comes from the nuclear power industry or weapons testing.

What Is Radiation and How Is It Measured?

The word *radiation* is a general term and includes light, radio waves, and electric fields. There are two types of radiation, nonionizing and ionizing. Light, radio waves, and electric fields are examples of nonionizing radiations whose energies are lower than ionizing radiation. They do not affect matter in the same way. In contrast, ionizing radiation changes the physical state of atoms it strikes, causing them to become electrically charged or "ionized."

All matter is made up of atoms. The basic parts of atoms are neutrons, protons, and electrons. Neutrons and protons form the nucleus of the atom and electrons surround (orbit) the nucleus. An atom of a particular element has a unique number of protons in its nucleus. Certain combinations of protons and neutrons are stable (not radioactive). When an atom has an unstable combination of neutrons and protons, the atom will decay (emit radiation). These unstable atoms are called radioisotopes or radionuclides. As the atom decays, the amount of radiation decreases. The length of time it takes for half of the radioactivity in a source to decay is called the half-life.

Main Types of Ionizing Radiation

Alpha (α) radiation consists of heavy, positively charged particles emitted by atoms of heavy elements such as uranium and radium and some human-made sources. Alpha radiation is completely absorbed by the outer dead layer of skin and is therefore not a hazard outside the body. Alpha particles can effectively be stopped by an inert material such as paper. However, if alpha particles enter the body by inhalation or with food or water, they can directly expose internal tissues and can be a hazard. Radium 226, thorium 228, and uranium 232 are examples of alpha-emitting radioisotopes.

Beta (β) radiation (positively or negatively charged electrons) is emitted from the nucleus during radioactive decay. Beta particles are more penetrating than alpha particles and can sometimes penetrate the skin. But like alpha particles, they are generally more hazardous when inhaled or ingested. In air, beta particles may be stopped by plastic or wood. Carbon 14 and tritium, which are examples of radioisotopes that emit beta particles, are naturally produced in the environment. Other beta-emitting radioisotopes include plutonium 241 and strontium 90.

Gamma (γ) rays and X-rays are forms of electromagnetic radiation because they have both electric and magnetic properties. Gamma rays, or photons, come from the nucleus when materials decay. Cobalt 60 emits gamma radiation. X-rays are a result of electron removal or rearrangement in atoms. Gamma and X-ray radiations are used frequently in medicine because they can easily penetrate the human body. Gamma rays and X-rays are stopped by lead or concrete.

Neutrons are heavy, uncharged particles that cause the atoms that they strike to become ionized. Neutrons (n) are absorbed by hydrogen-rich materials such as wax, water, or plastic.

Radiation Measurements

Radioactivity is measured in the number of disintegrations (nuclear transformations or decays) a radioactive material undergoes in a certain period of time. The Curie (abbreviated Ci) is a measurement of the number of radioactive decays occurring in a source. There are 37 billion disintegrations per second (dps) in a 1-Curie source. Because the Curie is a large amount of radioactivity, fractions of Curies are often used as units of measure. These units include the picocurie (pCi), which is one trillionth of a Curie; microcurie (μCi), which is one millionth of a Curie; and millicurie (mCi), which is one thousandth of a Curie. A picocurie yields about two radioactive disintegrations per minute. When measured in solids (such as soil or sludge) or liquids (such as water), the amount of radioactivity is usually expressed in fractions of a Curie per unit of metric weight. For example, radioactive thorium occurs naturally in all of the soil and rock on earth at about 1 picocurie per gram (abbreviated 1 pCi/g).

Environmental Sampling Laboratory Analyses

In environmental sampling, laboratory methods for analyzing radioactivity in a sample include screening analyses and radioisotope-specific analyses. Various kinds of analytical equipment designed to measure the amount of radioactivity are used.

Gross alpha and gross beta analyses are types of screening methods. A gross alpha analysis provides a general measurement of the total alpha-emitting radioisotopes in a sample, but it does not specify which radionuclide is responsible for the radioactivity. Naturally occurring uranium is most often the alpha emitter causing alpha activity in water or soil samples. Gross beta analysis is similar to gross alpha analysis. It includes all sources of beta radiation, and some gamma radiation may also be detected since it is a component in some radioisotopic decays. As with gross alpha analysis, this method provides a means to determine whether further radioisotope-specific analysis is needed.

Radioisotope-specific analyses are usually more complicated. Typically, in order to isolate a specific radionuclide, additional steps are needed. These include the use of physical methods such as evaporation or distillation, or the addition of certain chemicals to remove the radioisotopes prior to analysis with specialized radioactivity counting equipment.

Measuring the amount of radioactivity in water or soil is not as precise as measuring the amount of other constituents such as chemicals or nonradioactive elements. Since measurements of radioactive decay present some variability, statistical methods are an important part in the analysis and reporting of the amount of radioactivity present. As a result, radiological results are reported with a small uncertainty value, which is usually

symbolized as "+/-" on analytical reports. The reported measurement (for example, 5 +/-2 pCi/L) represents an estimate with a high degree of certainty that the amount of radioactivity is somewhere between the resulting values obtained when adding or subtracting the uncertainty. In this example, the amount would be somewhere between 3 and 7. Additionally, a reported detection also takes into account calculations that are necessary to convert radioactive disintegrations (dps) to a concentration in water (pCi/L) or soil (pCi/g).

From Radiation Exposure to Dose

Damage from radiation depends on several factors such as whether the exposure was from internal or external sources, the length of time of exposure, properties of the chemical element itself, the distance from the source, the radioisotopes half life, and the type and amount of radiation. The dose of radiation is the quantity of radiation received over a certain period of time. The unit for measuring absorbed energy as radiation exposure to the human body is the rem (Roentgen Equivalent Man).

Any radioisotope can enter the body by inhalation, ingestion, or absorption through an open wound. In the case of an internal exposure, any kind of ionizing radiation can directly harm living cells. External radiation exposures come from a source outside the body, such as when a medical X-ray is taken. In order to cause any biological effect, the radiation must have enough energy to penetrate the body. Three factors affect the dose that the individual will receive: the amount of time the individual was exposed; the distance from the source of radiation; and the amount of shielding between the individual and the source of radiation.

The longer a person is exposed to a source of radiation, the higher the radiation dose. The relationship between distance and exposure is not as simple because the intensity of radiation falls off very quickly. This is referred to as the inverse square law. For example, if a source produces a dose rate to an individual of 1 rem per hour at a distance of 1 foot, then at twice the distance (2 feet), the dose rate will be one-fourth of 1 rem per hour or 0.25 rem per hour. Likewise, at 3 feet, the rate will be one-ninth of 0.11 rem per hour.

Radiation Dose Perspective

1 millirem	One one-thousandth of a rem (written as 0.001 rem or abbreviated mrem)
2.5 millirem	cosmic radiation dose to a person on a one-way flight from New York to Los Angeles
10 millirem	one chest X-ray using modern equipment

25 millirem	yearly exposure limit set by the U.S. Environmental Protection Agency for people who live near nuclear power plants
60-80 millirem	average yearly radiation dose from cosmic radiation to people who live in the Rocky Mountain States
83 millirem	estimate of the largest dose any off-site person could have received from the Three Mile Island accident
100 millirem	yearly limit from all sources of human-made radiation (non-radiation worker) set by the Nuclear Regulatory Commission (NRC) and DOE
160 millirem	yearly dose to the average flight crew members from cosmic radiation
300 millirem	average yearly dose to people in the U.S. (background radiation)
5 rem	yearly limit for radiation workers set by the NRC (external and internal)
25 rem	U.S. EPA guideline for voluntary maximum radiation dose to emergency workers for nonlifesaving work during a reactor emergency (assumed to be a once-in-a-lifetime event)
75 rem	U.S. EPA guideline for maximum radiation dose to emergency workers volunteering for lifesaving work

Can Radiation by Harmful?

There are no known health effects associated with the exposure of people to ionizing radiation at levels equal to or below the levels of normal natural background exposures. States and cities in the U.S. with higher natural background have been found to have lower cancer rates than states or cities with lower background.

An average of 1,800 people in every 10,000 die from cancer each year. If all 10,000 people received 1 rem each as a single exposure, we would expect 1 additional person to die of cancer. However, it is not possible to tell which of the 1,801 fatal cancers was caused by the radiation.

FOR MORE INFORMATION,

published references include:

Bushberg, Jerrold T. (1994). *The Essential Physics of Medical Imaging.*

Cember, Herman (1992). *Introduction to Health Physics.*

Committee on the Biological Effects of Ionizing Radiation (1990). *Health Effects of Exposure to Low Levels of Ionizing Radiation,* BEIR V.

Eisenbud, Merril (1987). *Environmental Radioactivity.*

National Council on Radiation Protection (1987). *Exposure of the Population of the United States and Canada from Natural Background Radiation,* NCRP Report No. 94.

U.S. Environmental Protection Agency, Office of Radiation Programs (1993). *Environmental Radiation Data,* Report No. 67, 402-R-93-019.

or write or call:

Radiation Safety Officer
Office of Environmental Health and Safety
University of California, Davis
Davis, CA 95616

916-752-1493

LEHR SLUDGE DISPOSAL TO BEGIN
An Update

WHAT:

Approximately 34,000 gallons of low-level radioactive sludge and water which has been pumped from underground storage tanks, treated and packaged, is being shipped from the former Laboratory for Energy-Related Health Research (LEHR) site to a disposal site in Hanford, Washington. Disposal of this material, which will take place in two stages, is part of ongoing environmental assessment and cleanup activities at the former LEHR site, and is being undertaken by the U.S. Department of Energy and UC Davis.

LOCATION:

Located roughly a mile south of the main UC Davis campus on Old Davis Road, the former LEHR site occupies 15 acres surrounded by scattered campus research facilities and private farms. The sludge and water scheduled for disposal comes from 12 underground concrete tanks along the western section of the site (see map on back).

SLUDGE HISTORY:

The sludge and water were the remaining byproducts from two specially designed waste-processing systems built at LEHR. These systems handled the low-level radioactive waste of research animals used to study the health effects of exposure to low-level radiation. Certain animals involved in the study, mostly beagles, were fed or injected with varying doses of strontium-90 and radium-226. Using the special systems, the wastes were collected and processed to remove the majority of radioactive contamination. Throughout the years of active DOE research at the site (the waste systems were last used in 1986), sludge was periodically removed from the tanks and shipped to a licensed low-level radioactive waste site. This disposal operation will complete the disposal of the sludge accumulated during the last few years of the study.

PROCESS:

Since September 1991, a contractor hired by the U.S. Department of Energy (Chem-Nuclear Environmental Services, Inc., based in South Carolina) has been preparing the sludge for disposal. After removal from the underground storage tanks, the sludge and water is mixed with non-hazardous fly ash and magnesium oxide, and solidified in 55-gallon drums. The solidified material in the drums, which contain about 200 millicuries total, are stored in a secured building on the LEHR site. A total of 480 drums are ready for shipment and will be transported during the weeks of January 27 and February 5 to the DOE low-level radioactive waste disposal site in Hanford, Washington. An additional 300 drums and two 200-cubic-foot steel cylindrical containers will be scheduled for shipment in mid-February. All packaging and transportation will adhere to U.S. Department of Transportation regulations. The emptied underground tanks at the LEHR site will be decontaminated at a later stage in the project.

TRANSPORTATION:

A licensed and experienced transportation contractor, Tri-State Motor Transit of Missouri, has been contracted to handle the transport of the drums. The planned schedule specifies that one truck per day for eight days will leave the LEHR work site. Each truck will hold 60 drums. Shipments will leave the site each afternoon. The trip to Hanford will take 2 days. All required transport permits have been obtained. The route the trucks will take is Route 113 to Interstate 5, the primary transportation route through California. During the second transport phase, the remaining 200 drums and two steel containers will be removed from LEHR and transported to the DOE Hanford site for disposal. All sludge processing work, transportation, and equipment removal is expected to be complete by mid-March.

1/16/92

WHERE DO I GET MORE INFORMATION?

To get additional information, please:

CALL:

LEHR
Information Line
(916) 752-8351

Larry McEwen/Salem Attiga
DOE Project Manager
(916) 752-5459

OR

WRITE:

LEHR Cleanup Project
Old Davis Road
Mail Stop: ITEH
Davis, CA 95616

COPIES OF INFORMATION RELATING TO THE LEHR CLEANUP PROJECT ARE AVAILABLE FOR REVIEW AT:

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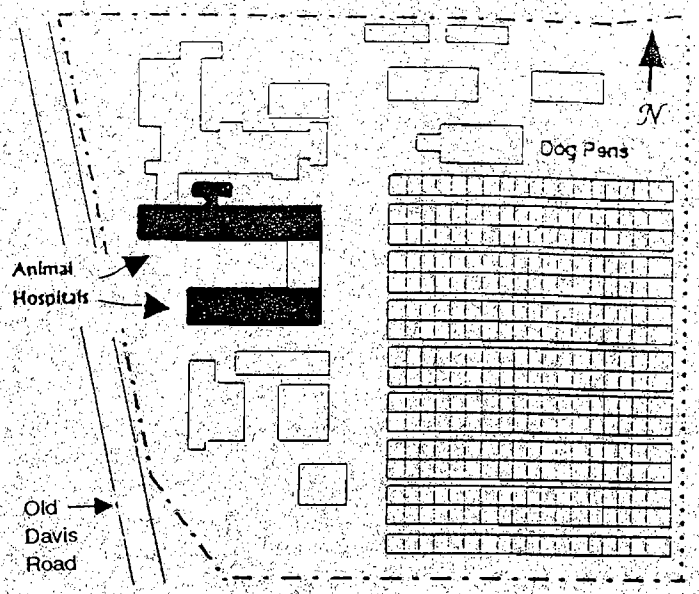
LEHR SITE (Western Section)



The LEHR Site is approximately one mile south of the main UC Davis campus.

LEHR SLUDGE DISPOSAL
An Overview

WHAT:

Approximately 34,000 gallons of low-level radioactive sludge and water will be pumped from underground storage tanks, treated, packaged and removed from the former Laboratory for Energy-Related Health Research (LEHR) site beginning in early September. Treatment and disposal of this material - expected to take about three months and cost an estimated $1.2 million - is part of ongoing environmental assessment and cleanup activities at the former LEHR site undertaken by the U.S. Department of Energy and UC Davis.

LOCATION:

Located roughly a mile south of the main UC Davis campus on Old Davis Road, the former LEHR site occupies 15 acres surrounded by scattered campus research facilities and private farms. The sludge and water that will be treated and removed are held in 12 underground concrete tanks along the western section of the site (see map on back).

SLUDGE HISTORY:

The sludge and water are the remaining byproducts of two specially designed waste-processing systems built at LEHR to handle the low-level radioactive waste of research animals used to study the health effects of exposure to low-level radiation. Certain animals involved in the study, mostly beagles, were fed or injected with varying doses of strontium 90 and radium 226. Using the special systems, the wastes were collected and processed to remove the majority of radioactive contamination. Throughout the years of active research at the site (the waste systems were last used in 1986), sludge was removed from the tanks when necessary and shipped to a licensed low-level radioactive waste site. This disposal operation will clear the tanks of what remains.

PROCESS:

During the first week in September, a contractor hired by the U.S. Department of Energy (Chem-Nuclear Environmental Services, Inc., based in South Carolina) will mark off sections of the site and set up operations. The sludge and water have already been evaluated and tested to determine the best method for handling and treating the materials. Since the sludge varies in consistency and volume from tank to tank, the sludge will be processed in batches. This processing involves pumping a certain amount of the material into a mixing tank, adding lime and cement to solidify the sludge, pumping this mixture into 55 gallon drums, "curing" the contents, sealing the drums and storing them temporarily in an empty, secured building in the center of the former LEHR site. Approximately 800 drums will be filled and then shipped within a few months to a DOE low-level radioactive waste disposal site in Hanford, Washington. The emptied tanks on the site will be decontaminated if necessary at a later stage in the project.

SAFETY ISSUES:

The process being used involves state-of-the-art technology, and it follows state and federal safety guidelines. To adequately ensure the protection of people and the environment during this operation, special steps will be taken. Only people directly involved with the operation will be allowed in the work areas and these people will be required to wear radiation detection badges and appropriate protective clothing. In addition, work areas will be covered with plastic sheeting and surrounded by berms. Throughout the operation, extensive monitoring and air sampling will be performed to guard against contamination. The concentration of radioactivity in the sludge and water is very low; about 200 milliCuries of strontium 90 and about .003 milliCuries of radium 226.

WHERE DO I GET MORE INFORMATION?

To get additional information, please:

CALL:

LEHR
Information Line
(916) 752-8351

Larry McEwen/Salem Attiga
DOE Project Manager
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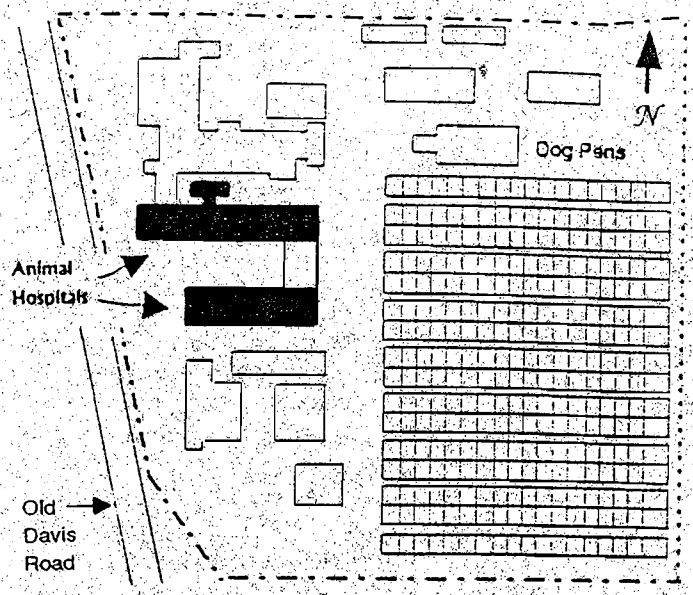
LEHR SITE (Western Section)



The LEHR Site is approximately one mile south of the main UC Davis campus.

COBALT 60 DOSE RECONSTRUCTION STUDY

An Overview

WHY?

The purpose of the study was to evaluate potential radiation doses to UC Davis employees, students and volunteers who worked in the vicinity of the former Laboratory for Energy-Related Health Research (LEHR) during the period of outdoor operation of the Cobalt 60 (Co-60) irradiator. The Co-60 irradiator was used from 1970 to 1985 for outdoor irradiation studies and for indoor irradiation studies until 1987.

WHAT?

The Co-60 irradiator facility, located at LEHR south of the University of California, Davis (UC Davis) campus, was an indoor-outdoor gamma irradiation facility designed to study the effects of low level continuous whole body radiation exposure to research animals. The LEHR site was operated for the U.S. Department of Energy (DOE) by UC Davis from 1970 to 1987 to study the effects of continuous Cobalt 60 radiation exposure on beagles. The last outdoor radiation exposure experiment at the Co-60 Irradiator Facility was completed in October 1985. At that time the Co-60 irradiator ceased outdoor radiation experimentation. The irradiator continued operation exclusively for indoor radiation experiments until 1987. In 1988 the Cobalt 60 irradiator was formally put in safe storage.

hough direct exposure to the outdoor portion of the irradiator beam was controlled to within a fenced area, environmental monitoring data show that low-level indirect radiation was present outside the fence perimeter. This indirect radiation was due to the photons (radiation) emitted from the irradiator undergoing multiple scattering in the air and on the ground.

HOW?

Determination of the potential radiation dose was performed by sophisticated computer modeling programs using:

Radiation monitoring data taken from various locations at LEHR and nearby environs from 1970 to 1985 (the period of outdoor radiation use) to determine radiation exposure rates;

Data from the actual irradiator use logs to determine the periods of time the radiation was exposed to the outdoors;

Construction and operating specifications of the irradiator and Co-60 sealed source to determine the radiation characteristics; and

Estimates of time individuals worked/lived in nearby locations to determine the maximum and average annual residence time (occupancy) for those areas.

RESULTS:

PART I, RECONSTRUCTION OF DOSE TO THE NEIGHBORING GENERAL PUBLIC (March 1991)

This study showed that potential dose to the public from the Co-60 irradiator was well below all regulatory limits.

For an individual living in the closest residence 24 hrs/day, 365 days/yr the maximum annual dose, in addition to natural background, was 1.6 mrem.*

For an individual present (fishing) at South Fork of Putah Creek for 5 hrs/wk, 52 wks/yr, the maximum annual dose, in addition to natural background, was 11 mrem.

PART II, RECONSTRUCTION OF DOSE TO UCD EMPLOYEES, STUDENTS AND VOLUNTEERS (May 1991)

This study showed that the potential dose to UC Davis staff, students, and volunteers who worked in the vicinity of LEHR was below the regulatory limits in place during the period of the irradiator's outdoor operation.

Natural Background Radiation:

For an individual living in the Central Valley continuously for one year, the natural background ranges from 110-150 mrem, excluding radon. If contributions from radon in air are included, the total natural background radiation dose is approximately 310 mrem. All subsequent data and limits mentioned below are in excess of natural radiation background.

The largest potential annual radiation dose was 360 mrem for a few individuals residing in a trailer at the Raptor Center 24 hours per day for approximately 1 year.

The study also calculated annual radiation doses to employees and volunteers at other locations near LEHR. The study calculated the annual radiation dose to Raptor Center staff as 200 mrem for 30 hours per week and Raptor Center volunteers as 94 mrem for 14 hours per week. For the Animal Resources Services area, known as the Goat Facility since 1981, the annual radiation dose was 220 mrem for 50 hours per week. The annual radiation dose was calculated as 190 mrem for isolation building areas for 7 hours per week. The annual radiation dose calculated for LEHR site buildings, Equine Research facility and Comparative Oncology area ranged from 13 to 34 mrem based on 50 hours per week, 50 weeks per year.

***A MILLIREM (mrem) IS A UNIT OF RADIATION DOSE.**

RELATIONSHIP TO RISK:

In 1990, The National Academy of Science issued a report (BEIR V) on radiation risk. The report noted that the primary effect from low level radiation exposure is cancer and determined that for every 100,000 people exposed to 1000 mrem for one year an additional 81 people may get cancer.

The American Cancer Society estimates that the lifetime chance of cancer from all causes is 18,000 out of 100,000 people. Using the BEIR V risk estimate, below are calculated the excess lifetime cancer risk for each year of exposure for the locations noted.

Location	Lifetime Excess Cancer Risk per Year of Exposure
Trailer Occupants	29 in 100,000
Raptor Center Staff	16 in 100,000
Raptor Center Volunteers	8 in 100,000
Goat Facility Area	18 in 100,000
Isolation Building	15 in 100,000
LEHR Site, Equine Research Facility, Comparative Oncology Area	1 to 3 in 100,000

REGULATORY LIMITS:

The current annual California State Regulatory limit for members of the general public is 500 mrem. The current annual DOE limit to the general public is 100 mrem. During the time of outdoor irradiator operation (1970-1985), the annual regulatory limit (California State and DOE) to the general public was 500 mrem.

WHERE DO I GET MORE INFORMATION?

To get additional information or to request copies of the reports, please:

CALL:
Cobalt 60 Information Line
(916) 752-8351

or

WRITE:
Cobalt 60 Study
Environmental Health & Safety
TB-30, UC Davis
Davis, CA 95616

COPIES OF THE COBALT 60 DOSE RECONSTRUCTION REPORT WILL BE AVAILABLE FOR REVIEW AT:

UC Davis Shields Library, Reserve Desk
University of California
Davis, CA 95616
(916) 752-1203

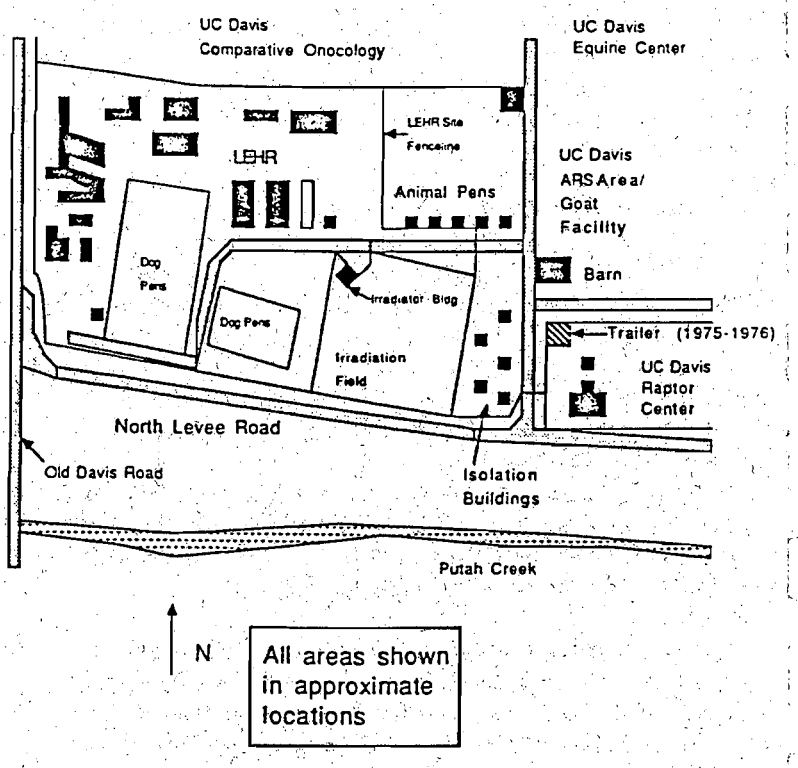
or

Davis Public Library, Reference Desk
315 East 14th St.
Davis, CA 95616
M 1-9 pm
T,W 10 am-9 pm
Th,F 10 am-6 pm
Sat 10 am-5 pm
(916) 756-2332

PRESENT STATUS AND FUTURE PLANS:

The Co-60 irradiator has been shut down for outdoor irradiation research since 1985 and indoor irradiation since 1987. The irradiator is no longer used for research and will be disposed of as radioactive waste.

MAP OF THE LEHR STUDY AREA



The LEHR Site is located approximately one mile south of the main UC Davis Campus.

Date: May 22, 1991 cobalt60.bro

UNIVERSITY OF CALIFORNIA AT DAVIS
DEPARTMENT OF ENERGY

COBALT 60 DOSE RECONSTRUCTION STUDY

An Overview March 1991

W IY?

The purpose of the study is to evaluate potential radiation doses t the general public and UC Davis employees, students, and v unteers from the operation of the Cobalt 60 irradiator during the years 1970-1985 of operation.

W IAT?

The Co-60 irradiator facility, located at the former Laboratory f Energy-Related Health Research (LEHR) near the U iversity of California, Davis (UC Davis) campus, was an indoor-outdoor gamma irradiation facility designed to study the e ects of low level continuous whole body exposure to r mmals. The LEHR site was operated for the U.S. Department of Energy (DOE) by UC Davis. From 1970 to 1985 outdoor radiation exposure experiments were conducted at the f ility to study the effects of continuous radiation exposure on beagles. The final outdoor radiation exposure experiment at the C 0 Irradiator Facility was conducted in October 1985, after w n the source was shut down.

Although direct exposure to the outdoor portion of the irradiator beam was controlled to within a fenced area, environmental monitoring data show that low-level indirect radiation exposure rates were present outside the fence perimeter. This indirect radiation was due to the photons (radiation) emitted from the irradiator undergoing multiple scattering in the air and on the ground.

H W?

Determination of the potential radiation dose is performed by sophisticated computer modeling programs using:

- Radiation monitoring data taken at LEHR and nearby environs from 1970 to 1985 at various locations;
- Data from the actual irradiator use logs to determine the periods of time the radiation source was exposed to the outdoors;
- Construction and operating specifications of the irradiator and Co-60 sealed source to determine the radiation field characteristics; and
- Estimates of time individuals worked/lived in nearby locations to determine the maximum and average annual residence time (occupancy) for those areas.

AVAILABLE RESULTS:

PART I, RECONSTRUCTION OF DOSE TO THE NEIGHBORING GENERAL PUBLIC

This study, now completed, showed that potential dose to the public from the Co-60 irradiator was well below all regulatory limits.

For an individual living in the Central Valley continuously for one year, the natural background ranges from 110-150 mrem*, excluding radon. If contributions from radon in air are included, the total natural background radiation dose is approximately 310 millirem.

*A millirem (mrem) is a unit of radiation dose.

For an individual living in the closest residence 24 hrs/day, 365 days/yr the maximum annual dose, in addition to natural background, is 1.6 mrem.

For an individual present (fishing) at South Fork of Putah Creek for 5 hrs/wk, 52 wks/yr, the maximum annual dose, in addition to natural background, is 11 mrem.

The current annual DOE regulatory limits to the general public, in excess of natural background, is 100 mrem. During the time of irradiator operation (1970-1985) the annual regulatory limit to the general public, in excess of natural background radiation was 500 mrem.

Status of the Report and Future Plans for the Irradiator

PART II, RECONSTRUCTION OF DOSE TO UCD EMPLOYEES, STUDENTS AND VOLUNTEERS

This study evaluates the potential radiation dose to UC Davis employees, students, and volunteers working near the LEHR facility. The results of this study will be available in late **May, 1991.**

The Co-60 irradiator has been shut down for outdoor irradiation research since 1985. The irradiator is no longer used for research and will be transferred or disposed of as radioactive waste.

WHERE DO I GET MORE INFORMATION?

To get additional information, please:

CALL:
Cobalt 60 Information Line
(916) 752-8351

or

WRITE:
Cobalt 60 Study
Environmental Health & Safety
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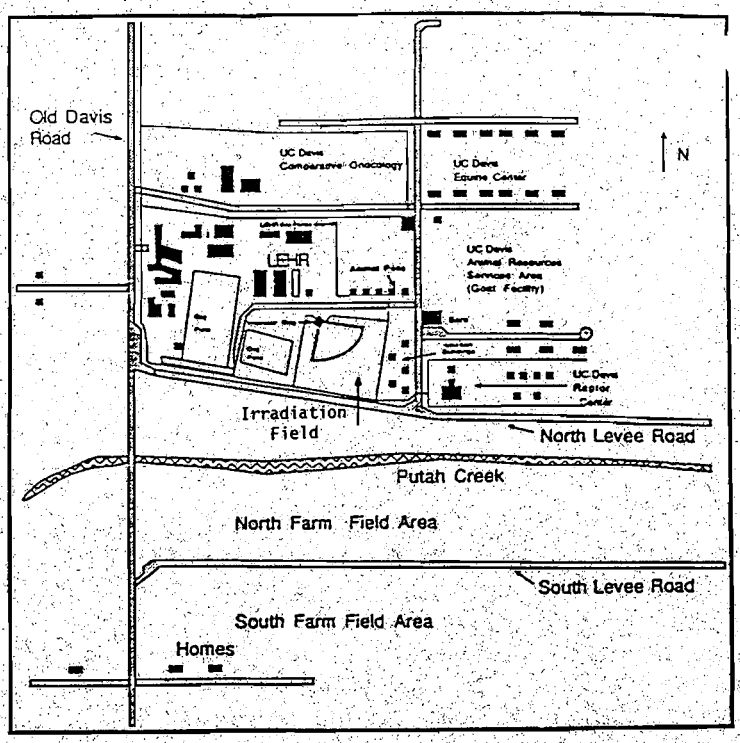
Th,F	10 am-6 pm
Sat	10 am-5 pm

(916) 756-2332

Date: 3/26/91 co60hand.out

LEHR Site
Areas included in the cobalt-60 outdoor radiation exposure study



The LEHR site is located approximately one mile south of the main UC Davis campus.

Cobalt 60 Study
Environmental Health and Safety
TB-30
University of California
Davis, California 95616

February 25, 1991

FACT SHEET
ON THE LEHR COBALT 60 (Co-60)
IRRADIATOR DOSE RECONSTRUCTION STUDY

I. Purpose of the Study

The Co-60 irradiator was used from the early 1970's to 1985 to perform outdoor, low-level radiation experiments. The purpose of the dose reconstruction study was to evaluate potential radiation exposures from the operation of the irradiator.

II. Findings of the Study

- For an individual living in the farmhouse 24 hrs/day, 365 days/yr the maximum annual dose, in addition to natural background, is 1.6 mrem.
- For an individual staying (fishing) at South Fork of Putah Creek for 5 hrs/wk for 52 weeks/yr, the maximum annual dose, in addition to natural background, is 11 mrem.
- For an individual living in the Central Valley continuously for one year, the natural background ranges from 100-150 mrem, excluding radon.
- This study showed that potential dose to the public from the C0-60 irradiator was well within the DOE off-site dose limits.

III. The Determination of the Dose Involved Using:

- Radiation monitoring data taken during the experimental period to determine radiation levels at various locations;
- Data from actual irradiator use logs to determine the periods of time the radiation source was exposed to the outdoors;
- Construction and operating specifications of the irradiator and Co-60 sealed source to determine the radiation field characteristics; and
- Estimates of times individuals worked/lived in certain locations to determine average annual residence time (occupancy) for those areas.

With this information, a sophisticated computer modeling program calculated the radiation dose to individuals working/living in specific locations indicated below.

Location	Distance From Source	Residence Time or Occupancy (If less time, then the dose would be less)	Annual Radiation Dose
Farmhouses (Residences)	1900 ft. SSW	24 hr/day; 365 days/yr	1.6 mrem/yr
S. Private Farm Fields (South of the southern levee of Putah Creek)	1300 ft. S	10 hr/week	1.9 mrem/yr
N. Private Farm Field (North of the southern levee of Putah Creek)	1000 ft. S	10 hr/week	6 mrem/yr
South Fork of Putah Creek	770 ft. S	5 hr/week	11 mrem/yr

(over)

IV. Background Radiation and Relationship to Standards

The following activities or sources contribute to a radiation dose:

Activity/Source	Dose
• Natural background radiation - Central Valley	100-150 mrem/yr (excluding radon)
• Natural background radiation - Colorado	165 - 250 mrem/yr (excluding radon)
• One round trip transcontinental airline flight	4-5 mrem/round trip flight
• One chest x-ray	10 mrem/exam
• Current allowable DOE radiation standards for the General Public	100 mrem/yr (in excess of Natural Background)

V. Relationship to Risk

The chances of excess cancer mortality above the natural cancer rate were calculated from the radiation doses determined by the computer modeling program.

Location	Lifetime Excess Cancer Risk per year of exposure
Farmhouses	1 in 1,000,000
S. Private Farm Fields	2 in 1,000,000
N. Private Farm Fields	5 in 1,000,000
South Fork of Putah Creek	10 in 1,000,000

For comparison, the risk of cancer per year in the general population is 3,000 in 1,000,000.

VI. Current Status and Future Plans

The CO-60 irradiator has been shut down for outdoor irradiation research since 1985. The irradiator is no longer used for research and will be transferred or disposed of as radioactive waste.

VII. Written Report

Final written report will be available by the end of March.

VIII. Persons to Contact for Questions

CALL:
LEHR
Information Line
(916) 752-8351

Larry McEwen/Salem Attiga
DOE Project Manager
(916) 752-5459

safety net

UC DAVIS ENVIRONMENTAL HEALTH AND SAFETY •• 2-1493

RADIATION AND HUMAN HEALTH

Where is it?

Radiation is part of our everyday lives. We are all exposed to radiation from the sun and in the atmosphere; naturally occurring radioactive materials are present in the earth, the house we live in, and the foods we consume. Radioactive gases are mixed in the air we breathe; and even our own bodies contain naturally occurring elements which are radioactive. This inescapable radiation exposure is called "natural background", and it varies from place to place.

We create and use sources of radiation for medical uses in the diagnosis and treatment of injury and disease.

What is it?

The word radiation is very general and includes light, radio waves, and electric fields. These are examples of non-ionizing radiations, whose energies are lower than the ionizing radiation. They do not affect matter in the same way.

Ionizing radiation changes the physical state of atoms which it strikes, causing them to become electrically charged or "ionized".

All matter is made up of atoms. The basic parts of atoms are neutrons, protons, and electrons. Neutrons and protons form the nucleus of the atom and electrons surround (orbit) the nucleus.

An atom of a particular element has a unique number of protons in its nucleus.

Certain combinations of protons and neutrons are stable (not radioactive). When an atom has an unstable combination of neutrons and protons, the atom will decay (emit radiation). These unstable atoms are called "radioisotopes".

Main Types of Ionizing Radiations:

Alpha Radiation consists of heavy positively charged particles emitted by atoms of heavy elements such as uranium and radium (naturally occurring) and some human-made sources. Alpha radiation is completely absorbed by the outer dead layer of skin and is therefore not a hazard outside the body. If it is taken into the body by inhalation or with food or water, it can expose internal tissues directly and can be a hazard.

Beta Radiations (positively or negatively charged electrons) are emitted from the nucleus during decay. These are more penetrating than alphas and can sometimes penetrate the skin, but like alphas, they are generally more hazardous when inhaled or ingested.

In air, betas may be stopped by plastic or wood. Carbon 14 (^{14}C), which is an example of a radioisotope that emits beta particles, is naturally produced in the atmosphere.

Gamma and X-rays are forms of electromagnetic radiations because they have both electric and magnetic properties. Gamma rays or photons come from the nucleus when materials decay and x-rays are a result of electron removal or rearrangement in atoms. Gamma and x-ray radiations are used frequently in medicine because they can easily penetrate the human body.

Neutrons are heavy, uncharged particles which cause ionizations indirectly in the atoms which they strike.

From Radiation Exposure to Dose

The damage from radiation depends on several factors we will discuss, such as whether the exposure was from internal or external sources. The unit for measuring absorbed energy as radiation exposure considering all factors, is the Rem (Roentgen Equivalent Man).

External Exposure

External radiation exposures come from a source outside of the body, such as when a medical x-ray is taken. To do harm, the radiation must have enough energy to penetrate the body. If it does, three factors affect the radiation dose that the individual will receive:

The amount of time the individual was exposed;
The distance from the source of radiation; and
The amount of shielding between the individual and the source of radiation.

The longer an individual is exposed to a source of radiation, the higher the radiation dose will be. The relationship between distance and exposure is not so simple because the intensity of radiation falls off very quickly. For example, if a source produces a dose rate to an individual of 1 Rem per hour at a distance of 1 foot, twice the distance (2 feet), the dose rate will be one-fourth of 1 Rem or 0.25 Rem. At three feet, the rate will be one-ninth or 0.11 Rem.

Internal Exposure

Any radioisotope may enter the body by inhalation, ingestion, or through an open wound. If that happens, any kind of radiation can directly harm living cells. The damage the radiation produces depends on the following factors:

The amount deposited into the body;
The type of radiation emitted;
The kind of element;
The half-life of the isotope (how fast it decays away); and
The length of time in the body.

Can Radiation be Harmful?

An average of 1,800 people in every 10,000 die from one or another form of cancer. If all 10,000 people received 1 rem (dose equivalent - effective energy deposited) each, we would expect 1 additional person to die of cancer. However, it is not possible to tell which of the 1,801 fatal cancers was caused by the radiation.

- Genetic disorders in offspring are estimated as follows: Assume a 1 rem dose to the sperm of 1 million fathers or the eggs of 1 million mothers. This dose may produce between 5 and 75 serious genetic illnesses per 1 million live births. Add this to the 90,000 genetic illnesses expected among any 1 million live births. Thus, a 1 rem dose plus the normal incidence rate would result in 90,005 genetic illnesses for each 1 million live births.

Radiation Dose Perspective

1 millirem dose:	One one-thousandth of a rem.
2.5 millirem dose:	Cosmic radiation dose to a person on a one-way flight from New York to Los Angeles.
10 millirem dose:	One chest x-ray using modern equipment.
25 millirem dose:	Yearly exposure limit set by the Environmental Protection Agency for people who live near nuclear power plants.
60 - 80 millirem dose:	Average yearly radiation dose from cosmic radiation to people who live in the Rocky Mountain States.
83 millirem dose:	The estimate of the largest dose any off-site person could have received from the Three Mile Island accident.
160 millirem dose:	Yearly dose to the average flight crew member from cosmic radiation.
300 millirem dose:	Average yearly dose to people in the U.S. (background radiation).
500 millirem dose:	Yearly limit from all sources of human-made radiation (non-radiation worker) set by the Nuclear Regulatory Commission.
5 rem dose:	Yearly limit for radiation workers set by the NRC.
25 rem dose:	EPA guideline for voluntary maximum radiation dose to emergency workers for non-lifesaving work during a reactor emergency. Assumed to be a once-in-a-lifetime event.
75 rem dose:	EPA guideline for maximum radiation dose to emergency workers volunteering for lifesaving work.

Radiation Dose Effects - Low Exposure

The effects of radiation are either "prompt" or "delayed". Prompt effects occur within the first several weeks after exposure and delayed effects occur over many years. Prompt effects include hair loss, severe loss of appetite, bleeding, increased risk of infections, and death. The delayed effects are cancer in exposed individuals and genetic illness in their descendants.

People differ in their response to high exposures of radiation. For small exposures, we know much less about long-term effects like genetic changes, so we estimate these effects based on what is known about exposure.

Radiation Dose Effect - High Exposure

This information is based on known cases of high exposures delivered quickly over the whole body.

50 - 200 rem:	At the lower end of this range, the radiation sickness symptoms of nausea and vomiting are delayed as much as a few weeks. If they occur, they are mild and last a short time. There is some reduction of the white blood cells which can cause some increased risk from infections.

As the dose increases, the symptoms are more severe and appear sooner. At the upper end, hair loss and severe diarrhea are likely as well. The reduction in the white blood count is worse. The threat of infection is greater. Fewer red blood cells form, resulting in anemia. Without medical care a small percentage of those exposed at the upper end of this range may die.

200 - 500 rem: As the dose increases, all symptoms appear sooner and are more severe. The number of white blood cells is greatly reduced. The bone marrow loses its ability to make new blood cells. Without medical treatment, about half of the people exposed to 400 rem will die within several weeks. Death is from a combination of dehydration, infection, and severe anemia. Proper medical care can reduce the death rate.

500 - 600 rem: In this range, the symptoms begin within the first day and are extreme. Above the upper end of the dose range, damage to the lining of the intestines causes greatly increased risk of infection, diarrhea, and dehydration. All white blood cells are killed. Even with major medical care, most people exposed to this dose would die within 30 days.

For further information, call Environmental Health and Safety at (916) 752-1493.

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Chloroform

May 1996

WHAT IS CHLOROFORM?

Chloroform is a chemical compound that is part of a group called volatile organic compounds (abbreviated as VOC). These compounds quickly evaporate at room temperatures; a pail of water containing volatile compounds left out in the sun will soon lose the compounds through evaporation. Chloroform has one of the simplest chemical structures of the chlorinated hydrocarbons; its formula is $CHCl_3$, which means it consists of one carbon atom, one hydrogen atom, and three chlorine atoms. It is an important industrial solvent used in many manufacturing processes. One method of producing it is the careful chlorination of methane gas (chemical formula CH_4). In this process, three chlorine atoms replace three of the hydrogen atoms. It is this chemical structure that gives chloroform its correct chemical name - *trichloromethane* (read as *tri-chloro-methane*).

Chloroform belongs to the family of trihalomethanes. These are compounds of methane that have had three of the hydrogen atoms replaced by halogen atoms (fluorine, bromine, chlorine and iodine are the halogen elements). Different combinations of the halogens on each carbon atom are possible: for example, *dibromochloromethane* (read as *dibromo-chloro-methane*) has two bromine and one chlorine atoms bonded to the carbon atom.

Although specifically manufactured in great quantity for industrial purposes, chloroform is also undesirably generated as a result of the chlorination of drinking water. Prior to the early 1900's, water-borne diseases such as cholera, typhoid, dysentery, salmonellosis, and hepatitis were rampant in the United States, killing a percentage of the population each year. The introduction of chlorine treatment of drinking water has almost completely controlled these diseases, and has since become the treatment of choice for most water suppliers. Unfortunately, chloroform and other trihalomethane byproducts are formed when the added chlorine reacts with organic matter in the water. The amount of chloroform generated in drinking water varies regionally due to differences in quality of source water and in treatment methods; the average value for systems using chlorination is 20 ug/L (micrograms of chloroform per liter of water), compared to one of the highest, Miami, at 311 ug/L.

Chloroform is also a groundwater contaminant often associated with old landfills. It forms by the interaction of discarded chlorinated products on decaying organic matter. It then leaches to groundwater by rainwater percolating through the landfill. Also, since chloroform has been a major industrial product for over a century, it is likely that concentrated waste chloroform has been discarded into many old landfills.

HEALTH EFFECTS AND REGULATORY FRAMEWORK

Chloroform was once widely used as an anesthetic, but due to its toxic effects at high dose levels on the liver and kidneys this use has been practically discontinued. In concentrated form, it is classified as a human poison, and very high dose levels of ingestion and inhalation can cause severe heart, kidney, and liver damage, and even death. Chloroform has been shown to be carcinogenic, as well as teratogenic (causing reproductive harm), in animals, but there is no direct evidence that it is a human carcinogen or teratogen. Due to the inconclusive human data, the U.S. Environmental Protection Agency (EPA) has classified it only as a possible human carcinogen.

Toxicological research on the human long-term chronic effects of low doses of chloroform, such as those found in drinking water, has also proved inconclusive. Epidemiological comparisons of human populations drinking chlorinated versus non-chlorinated water have not demonstrated any correlation of increased cancer risk with drinking chlorinated water. A major study by Jorgenson of rats and mice given chloroform-laced water showed increased tumor formation in the rats only at dose levels above 1,800,000 ug/L; only treated mice showed no effects. Research is ongoing to conclusively determine the human carcinogenicity of chloroform and its low dose level risks, but current studies appear to indicate that there is no significant human health risks to ingesting water containing the low levels of chloroform that result from the chlorination process.

Because of the variable animal research results, different public agencies have extrapolated different human cancer risk estimates. The U.S. EPA Integrated Risk Information System correlates a 1 in 10^6 (read as *one in one million*) cancer risk with a 6 ug/L chloroform concentration in water. The EPA's Office of Water Regulations and Standards correlates the same risk with a 0.2 ug/L concentration, while the California EPA calculates a level of 1.1 ug/L for this risk level. These cancer risk estimates are typically calculated using the reference standards of a 70 kg (154 lbs.) person drinking 2 liters of water per day for 70 years. A risk es-

timate of 1 in 10^6 means that if one million people drank 2 liters of water containing the associated concentration of chloroform each day for 70 years, then one case of cancer due to the chloroform would be expected out of that million people.

Recognizing the potential of chloroform and the other trihalomethanes for harmful effects, the U.S. EPA established a Maximum Contaminant Level (MCL) for total trihalomethanes in drinking water at 100 ug/L, which was also adopted by the Cal/EPA. This regulation applies only to chlorinated water systems and is not strictly derived from the cancer-based risks. The allowable level was set as low as possible considering the technical and financial realities of the chlorination process and recognizing its disease-prevention benefits to public health. The EPA MCL *recommended* goal for chloroform is 0 ug/L, as it is for all suspected carcinogens; at this point, however, the EPA is only considering lowering the trihalomethane MCL to 80 ug/L.

Prior to being rescinded by court order, the California Inland Surface Waters Plan, published by the State's Water Resources Control Board, promulgated water quality criteria for surface and ground water protection; for existing or potential sources of drinking water, the criteria for chloroform and trihalomethanes was set at 100 ug/L. The Basin Plan of the Central Valley Regional Water Quality Control Board contains criteria for regional groundwater and for Putah Creek, among other waters; for levels of chloroform in surface and groundwater used for drinking water supplies, it uses the Cal/EPA trihalomethane MCL of 100 ug/L. The Basin Plan criteria is currently the only existing regulatory criteria for chloroform in groundwater and surface water.

CHLOROFORM IN GROUNDWATER AND SURFACE WATER AT THE FORMER LEHR SITE

Chloroform is leaking from an apparently specific source (i.e., buried waste chloroform from research activities) from one of the old waste units at LEHR, and has entered the shallowest aquifer, which lies roughly 40 ft. to 130 ft. below the surface. This aquifer has a net gradient to the northeast, which means that water in the aquifer actually flows (like a very slow underground river) to the northeast, though this natural gradient can be distorted at times by local agricultural well pumping. This gradient creates a plume of chloroform contamination that extends to the northeast, and which becomes increasingly dilute as distance from the source increases. For example, the well nearest the source has had chloroform concentrations up to 17,000 ug/L, while 1/2 mile to the northeast sampling has indicated concentrations of less than 8 ug/L. Sampling activities have determined the boundaries of the plume to the north, west and south, but the northeastern edge of the plume will require more sampling to define. It is unknown at this time if a second deeper aquifer, separated from the first by a 90 ft. clay layer, has been impacted by any LEHR-derived contaminants.

At this point, it is unclear what dynamic state the chloroform source and plume are in, whether the concentrations in the plume are increasing, decreasing, or in a steady-state. More sampling has been planned to better characterize the plume, which will lead to more informed decisions concerning the risks associated with the plume. In the meantime, UC Davis has developed a conceptual plan to remediate the chloroform-contaminated groundwater, if this becomes necessary, and has initiated evaluation of treatment options.

Concentrations of chloroform ranging up to 9 ug/L have been found in Putah Creek downstream of the effluent outfall of the UC Davis wastewater treatment plant. The source for this chloroform is most likely the chlorination process the plant uses as part of its treatment of raw campus sewage. Monitoring of the effluent has shown chloroform levels of 5-15 ug/L. The plant employs a dechlorination step to remove most of the chlorine to keep the effluent below the 100 ug/L chlorine residual limit required by the permit issued by the Central Valley Regional Water Quality Control Board. Chloroform has been shown to have a half-life of 0.3-3 days in rivers and streams. This means that of an original amount of chloroform present in a stream, one half will disappear through evaporation or decomposition every one third of a day to three days, depending on conditions.

REFERENCES FOR FUTHER READING:

California Inland Surface Waters Plan, Water Resources Control Board, 1991.

Drinking Water and Health - Disinfectants and Disinfectant By-Products, National Academy Press, 1987.

Water Quality Control Plan (Basin Plan) of the Central Valley Regional Water Quality Control Board, Central Valley Regional Water Quality Control Board, 1992.

FOR MORE INFORMATION:

CALL:

LEHR Information Line	(916) 752-8351
Jim Littlejohn, DOE	(510) 637-1526
Julie McNeal, UC Davis	(916) 752-3575

or

WRITE:

LEHR Cleanup Project
Mail Stop ITEH
Old Davis Road
Davis, CA 95616

and

DOCUMENTS RELATING TO THE LEHR CLEANUP PROJECT ARE AVAILABLE FOR REVIEW AT:

UC Davis Shields Library, Reserve Desk
University of California
Davis, California 95616
(916) 752-1203

Davis Public Library, Reference Desk
315 East 14th Street
Davis, California 95616
(916) 756-2332

WHAT'S GOING DOWN THE DRAIN?

Overview of UC Davis Wastewater Treatment Operations

With over 21,000 students and 9,500 faculty and staff on campus, UC Davis generates approximately 1.5 million gallons of wastewater each day. UC Davis operates its own plant located on the southern edge of the central campus to treat this wastewater. UC Davis facilities west of Highway 113 are currently served by septic systems, although plans are underway to connect many of these facilities to the treatment plant. A sanitary sewer collection system across the campus carries wastewater from office buildings, housing, food service facilities, maintenance shops, and other support facilities to the wastewater treatment plant.

The vast majority of the wastewater generated on the campus is domestic sewage. However, wastewater from laboratory drains and other nondomestic wastewater sources are also connected to the sanitary sewer. While campus policy does not allow for disposal of hazardous chemicals to the sewer, the campus recognizes the potential for discharge of inappropriate materials into the sanitary sewer. Accordingly, UC Davis has implemented programs to help prevent inappropriate sewer disposal and to monitor the effectiveness of these programs.

How the Campus Protects Against Inappropriate Sewer Disposal

Although campus policies and procedures regarding hazardous waste disposal have been in place since the late 1970s, in 1991 UC Davis Office of Environmental Health and Safety (EH&S) staff informed campus administrators that they were aware of some sporadic incidents of hazardous materials being inappropriately disposed down laboratory drains. There were some suggestions that this was occurring because of the high cost of hazardous waste disposal. In response to the concerns raised by EH&S, the campus evaluated the situation and has developed appropriate measures to ensure hazardous materials are properly disposed.

Chemical Wastes

As noted above, campus policy does not allow the disposal of hazardous chemicals to the sewer. Hazardous chemical materials are picked up by EH&S staff and taken to the campus Environmental Services Facility for appropriate treatment, recycling, or disposal.

The campus recently went a step further beyond this policy by establishing specific guidelines describing what can be discharged into the sewer. This policy restricts disposal of even nonhazardous materials if they have the potential to upset or bypass the wastewater treatment plant. Discharge of large volumes of milk, for example, is limited because this has a potential to create problems at the plant.

Furthermore, UC Davis has developed a comprehensive system to monitor what goes into the wastewater treatment plant from the campus drains. This sampling program has been established to evaluate compliance with the campus' sewer disposal guidelines and to track down any noncompliance.

To address the suggestion that inappropriate sewer disposal has occurred due to the cost of disposal, the campus is planning to implement a system of "taxing" chemicals at the time of purchase. The fee would be used to pay for the disposal of unwanted or waste chemicals, so there will be no incentive to dispose of chemicals improperly. This tax is expected to go into effect July 1995. As an initial step, a chemical amnesty program has been initiated. This program provides funds for the disposal of all old, unwanted chemicals.

Radioactive Waste Disposal

As a condition of UC Davis' Radioactive Materials License, radiation users on campus must be trained in a variety of radiation issues, including proper waste disposal procedures. Radiation users are not allowed to dispose of radioactive materials down laboratory drains. Waste radioactive materials are picked up by EH&S for appropriate disposal. EH&S regularly audits each laboratory that uses radioactive materials. These inspections are comprehensive and include surveying laboratory sinks for radioactive contamination.

EH&S stores low-level radioactive liquid waste at the Environmental Services Facility. After an appropriate length of time, the levels of radioactivity in some of the waste decrease to the point where this waste can be safely released to the sanitary sewer in accordance with all state and federal regulations. These discharges are carefully monitoring and documented.

Wastewater Treatment Plant Monitoring

UC Davis operates its wastewater treatment plant under a permit issued by the California Regional Water Quality Board (RWQCB). The permit specifies how much treated wastewater can be discharged into the creek, where and when monitoring samples are to be collected, and what constituents must be tested. Samples are collected many times each month to monitor the treated wastewater before it is discharged into the South Fork of Putah Creek. Samples are also collected directly from the creek upstream and downstream of the treatment plant outfall to monitor for possible negative impacts to water quality. Beyond the requirements of the permit, the outfall is also monitored for a comprehensive list of constituents four times a year as part of the ongoing environmental restoration and cleanup activities at the former Laboratory for Energy-Related Health Research (LEHR).

The permit contains strict discharge limitations designed to protect water quality. The campus provides monitoring results to the RWQCB on a monthly basis to evaluate compliance with these limits. The RWQCB reviews this data, periodically inspects the plant, and has the authority to cite the campus for violating conditions of the permit.

The UC Davis wastewater treatment plant has a good record of compliance with all discharge requirement limits. None of the data suggest that large-scale dumping of hazardous materials into the sanitary sewer is occurring.

Conclusion

In an academic setting where scientific research is conducted by an ever-changing population of researchers, faculty, and students, it is not possible to completely eliminate the disposal of hazardous chemical or radioactive materials down laboratory drains. Monitoring results and laboratory inspections do not suggest this is a widespread problem. However, the campus has implemented a variety of programs to ensure that it does not become one. The campus will continue to evaluate the effectiveness of these programs and will revise them as needed to protect public health and the environment.

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LEHR Environmental Restoration
Evaluation of Controls for Environmental Pollution (CEP) Laboratory Results

Background

Recent investigations by the Federal Bureau of Investigation (FBI) have uncovered problems with bioassay (urinalysis) samples analyzed by Controls for Environmental Pollution (CEP), an analytical laboratory used by some U.S. Department of Energy (DOE) facilities. Soil and groundwater samples for the LEHR cleanup project were sent to CEP for analysis between February 1990 and August 1993. As a result of the FBI investigation, the DOE Headquarters Office instructed their field offices to determine the reliability of CEP data by reevaluating quality assurance (QA) samples. QA samples are a set of samples analyzed along with routine samples to determine the accuracy and validity of the routine samples.

The U.S. Environmental Protection Agency (EPA) provides specific criteria on QA activities to judge laboratory performance in terms of accuracy and validity of data. The purpose of QA activities for environmental sampling projects is to provide independent checks of laboratory performance to determine if routine data is reliable. These QA activities were performed by DOE's subcontractor, Dames & Moore, and by CEP during the period samples were collected for the LEHR cleanup project.

As part of the LEHR cleanup project, Dames & Moore personnel visited and audited CEP three times between 1990 and 1993 to evaluate CEP's sample handling, analytical, and QA procedures. The audits evaluated analytical processes, instrument calibrations, sample handling procedures, and data management. Based on these audits, CEP methods and procedures were in full compliance with EPA's recommended QA practices.

For reasons unrelated to the allegations, Dames & Moore began sending LEHR samples to a new laboratory, Lockheed Analytical Services, in late 1993. Lockheed participates in a QA program with EPA to demonstrate that it can produce accurate and valid results, and EPA audits this laboratory as well.

Results of the Evaluation

The CEP data was used to evaluate the presence or absence of selected chemical and radiological constituents and to determine the extent of significant concentrations of these constituents. A review and analysis of CEP quality assurance data revealed that although there were some discrepancies for a small part of the data (for example, missed holding times and variability in analytical detection limits), the overall reliability and representativeness of the data is good, usable for their intended purpose, and can withstand scientific scrutiny. In addition, the results of samples analyzed by the California Department of Health Services laboratory have also confirmed CEP's radiological results. As part of this evaluation, the CEP results were also compared to the Lockheed results and were found to be consistent and comparable with the data obtained from Lockheed.

Based on this evaluation, the CEP data can be used by the LEHR environmental restoration project along with other data for qualitative purposes in determining trends and evaluating potential risks to human health and the environment. The Lockheed data will be used both qualitatively and quantitatively to assess soil and groundwater impacts at LEHR. It may also be used to further evaluate the overall quality and reliability of the CEP results.

To obtain a copy of the written report describing the CEP evaluation for LEHR, please contact Jim Littlejohn at DOE Oakland Operations Office (510-637-1526) or Julie McNeal at UC Davis (916-752-3575).

April 1995
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LEHR Remedial Investigation/Feasibility Study (RI/FS)

WHAT:

Work is currently in progress at the former Laboratory for Energy-Related Health Research (LEHR) site at UC Davis to determine the environmental impacts from U.S. Department of Energy-sponsored research activities at LEHR. For over 30 years, scientists studied the long-term health effects of radiation on laboratory animals at the site. Also located at LEHR are low-level radioactive waste burial areas and an inactive campus landfill, which UC Davis has also been investigating for environmental contamination. These investigations have shown that some low-level radioactive materials and chemicals are present in shallow groundwater under and adjacent to LEHR and in soils at the site.

Throughout the investigations, DOE and UC Davis have coordinated their activities and worked closely with various state agencies. In May 1994, the federal Environmental Protection Agency (EPA), which has also been reviewing the results of the investigations since 1989, placed LEHR on the National Priorities List (Superfund) because of contaminants detected in groundwater and the potential threat of the contaminants to public health and the environment.

To follow up on the initial findings, and in anticipation of being placed on the Superfund list, DOE and UC Davis had previously determined that additional information was needed to further identify in greater detail possible sources of contamination and evaluate cleanup options. This assessment, called a "Remedial Investigation/Feasibility Study," is required by the EPA for sites placed on the Superfund list.

LOCATION:

LEHR is located about one mile south of the main UC Davis campus, on the east side of Old Davis Road, just north of the South Fork of Putah Creek. A levee separates the southern boundary of the site from Putah Creek. Occupying approximately 15 acres, LEHR is surrounded by various campus research facilities. A few residences and private farms are located to the south of LEHR on the south side of the creek.

RI/FS PROCESS:

A remedial investigation/feasibility study (RI/FS) is a two-part formal process for performing site assessment and cleanup activities according to strict EPA requirements. These requirements are set forth in the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). The RI examines the nature and extent of contamination at the site, and the FS identifies and evaluates alternatives for cleanup.

The key steps in the RI/FS process are shown below. Phrases in italics are the official names of these steps.

- Identify the areas of investigation
- Collect environmental data from these areas (*remedial investigation*)
- Analyze the data to determine what effects there might be from residual contamination to human health or the environment (*risk assessment*)
- Determine, evaluate, and test possible cleanup options based on results of the risk assessment (*feasibility study*)
- Reach agreement with regulatory agencies regarding cleanup methods and cleanup levels (*record of decision*)
- Design the actual cleanup systems (*remedial design*)
- Implement the cleanup plan (*remedial action*)

RI/FS at LEHR:

The first RI/FS activity, which is planned to begin in Fall 1994, is performing the remedial investigation (RI). At LEHR, the RI has been divided into a number of tasks designed to evaluate the impacts of past site activities on soil, water, vegetation/wildlife, and air. These tasks have been described in detail in a draft work plan that has been submitted to various regulatory agencies for review. The work plan also includes information on the measures that will be taken to ensure worker and public health and safety during the actual field work. Copies of the final work plan will be available for public review at Shields Library at UC Davis and the Davis Public Library.

During the RI, soil samples will be collected and analyzed from these areas:

- DOE low-level radioactive waste trenches
- radium-226 treatment system
- strontium-90 treatment system ("Imhoff")
- old domestic septic tanks
- former outdoor chemical dispensing areas
- outdoor dog pens
- UC Davis low-level radioactive waste trenches
- inactive UC Davis landfill

Various methods will be used to collect samples from these different areas. A soil gas survey will be performed and other special instruments will be used to delineate areas requiring further investigation. Soil samples will then be collected from these areas by boring holes with a drilling rig or excavating small sections with a backhoe. The samples will be analyzed for metals, organic and inorganic chemicals, pesticides, and radioactivity.

Groundwater under and adjacent to the site will continue to be tested using existing monitoring wells. In addition, cone penetrometer and hydropunch testing, which allows water samples to be collected from a predetermined depth without the need for drilling a monitoring well, will also be performed. The hydropunch information is highly useful for determining the best location to install new monitoring wells. As with the soil samples, water will be tested for metals, organic and inorganic chemicals, pesticides, and radioactivity. Other tests will be performed on groundwater to determine physical characteristics such as flow rate. Additionally, stormwater from the site and water from the South Fork of Putah Creek will be tested for the same constituents as groundwater.

Vegetation and wildlife at and near the site will also be evaluated as necessary to characterize potential impacts to the local ecology. In addition, air sampling, designed to monitor worker and public health during the RI, will also be performed.

Throughout the RI, sample collection and analyses will be performed according to strict EPA quality assurance requirements and applicable federal and state health and safety and environmental regulations.

During the RI, the data will be constantly evaluated to determine if more information is needed to perform the risk assessment or develop the feasibility study. Should significant changes be needed regarding the kind of information collected or the way it is collected, these changes will be discussed with the appropriate agencies, and the work plan will be modified as necessary.

NEPA/CEQA:

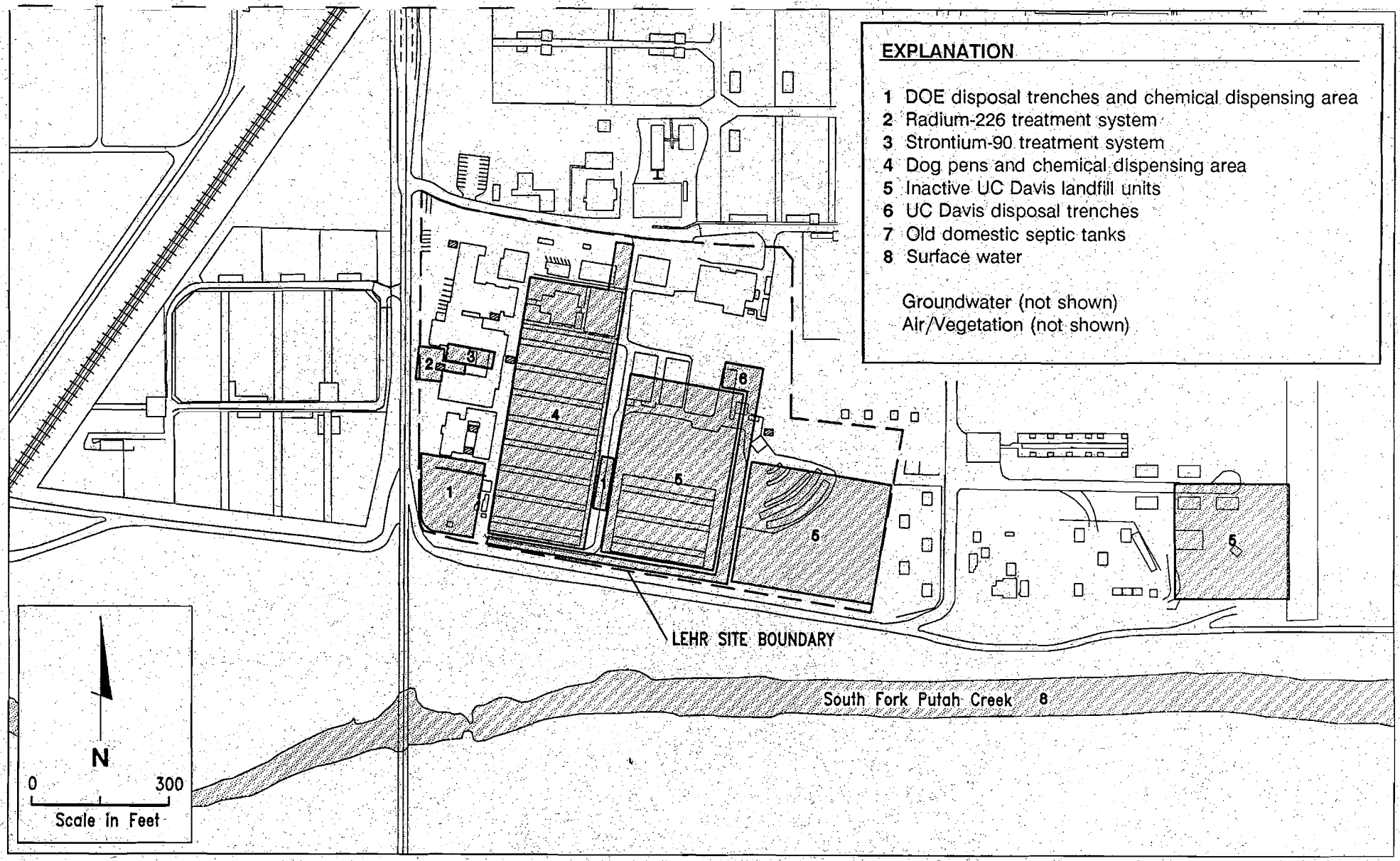
Environmental review and disclosure laws apply to DOE and UC Davis RI/FS activities. Both DOE and UC Davis have prepared appropriate documents intended to satisfy National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) requirements. Additional documentation will be prepared as needed for cleanup activities.

COMMUNITY INVOLVEMENT:

Community involvement and participation in the RI/FS is a vital part of the process and is also mandated by EPA. DOE and UC Davis will continue to hold public meetings and provide informational materials. In addition, a revised Community Relations Plan, updated to reflect specific EPA Superfund requirements, is also being prepared.

SCHEDULE:

Pending availability of funds, the RI/FS is anticipated to be completed in less than 3 years. A detailed schedule will be negotiated between DOE, UC Davis, and regulatory agencies as part of a formal agreement between these entities.



LEHR RI/FS
AREAS OF INVESTIGATION

WHERE DO I GET MORE INFORMATION?

To get additional information, please:

CALL:

LEHR	Larry McEwen
Information Line	DOE Project Manager
(916) 752-8351	(510) 637-1641

OR

WRITE:

LEHR Cleanup Project
Old Davis Road
Mail Stop: ITEH
Davis, CA 95616

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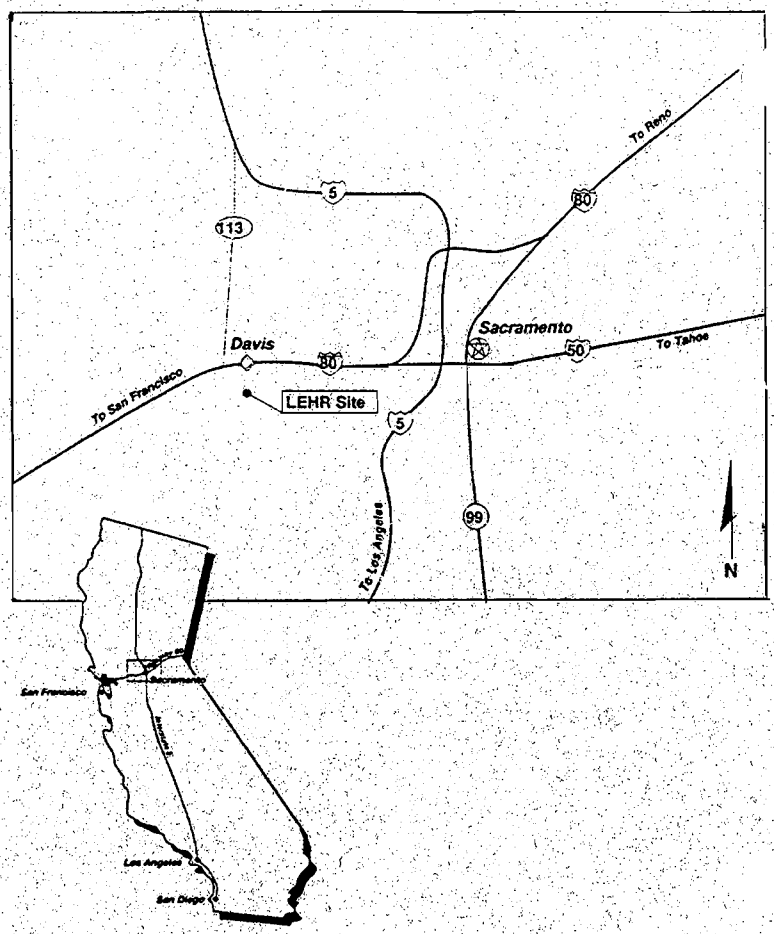

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Decontamination and Decommissioning of LEHR Imhoff Building To Begin

OVERVIEW

As part of its continuing effort to clean up a former research facility located at UC Davis, the U.S. Department of Energy (DOE) has finalized plans and will soon begin the decontamination and decommissioning (D&D) of a special treatment facility ("Imhoff Building") that was used to process radioactive waste at the Laboratory for Energy-Related Health Research (LEHR), where for more than 30 years scientists studied the long-term health effects of radiation on laboratory animals.

From 1961 to 1987, laboratory animals (primarily beagles) housed in Animal Hospital 1 (AH-1) were fed strontium 90 to study the long-term effects of exposure to this radionuclide, a component of radioactive fallout. Excreta from the animals and wash water from the animal cages in AH-1 were discharged to the Imhoff Building through a special drainage system that was separate from the domestic sanitary sewage system at LEHR. The wastewater was processed through a series of underground holding and settling tanks and ion-exchange columns to remove the strontium 90. The treated effluent was then discharged to a leachfield.

During the project, water and sludge from the tanks were removed periodically and disposed off-site. In 1991-92 the remaining sludge was removed, solidified, and transported to a DOE-licensed disposal site in Hanford, Washington. With the removal of the sludge, the Imhoff Building itself, ventilation, plumbing, and ion-exchange treatment equipment are now ready for D&D. After evaluating potential D&D options, DOE has determined that demolition of the Imhoff Building is the best alternative because of its age and condition. In addition, more extensive soil testing under and around the underground tanks is planned. Access to these areas is very limited, and removal of the building will enable personnel collecting soil data to do so more safely and efficiently.

LOCATION

Located approximately one mile south of the main UC Davis campus on Old Davis Road, the LEHR site covers 15 acres and is surrounded by scattered campus research facilities and private farms. The Imhoff Building is located on the west side of LEHR between Animal Hospitals 1 and 2.

IMHOFF BUILDING D&D PROCESS

Prior to finalizing the plans for the Imhoff D&D, DOE performed an assessment pursuant to the National Environmental Policy Act (NEPA) to evaluate potential impacts to the public and the environment from the planned D&D activities. From the assessment, DOE determined that the Imhoff D&D was eligible for a NEPA Categorical Exclusion.

DOE has contracted Battelle Pacific Northwest Laboratories (PNL) to manage the site cleanup and oversee the Imhoff D&D. IT Corporation, based in Martinez, California, has been selected by PNL to perform the actual D&D work. All activities will be performed according to a work plan that has been reviewed and approved by DOE and UC Davis.

The first step in the process will be the construction of a containment structure to enclose the entire building and surrounding area to assure that any radioactive or chemical contamination is successfully contained during the operation. Access to the containment structure will be limited to personnel directly involved in the actual work. Removal of all building contents and demolition of the building itself will be performed in the containment structure. All wastes from the project will be packaged on-site and shipped to the DOE Hanford waste site in Richland, Washington, according to applicable federal and state regulations.

To isolate and prevent contaminants from being released to the environment, engineering controls, such as High-Efficiency Particulate Air (HEPA) filters will be used. Throughout the operation, extensive monitoring both inside and outside the containment structure will also be performed to verify that no radiation exposure to workers, the public, or the environment occurs. To further ensure the safety of workers, personnel will be required to wear radiation detection badges and appropriate protective clothing during the activity.

Demolition of the building is expected to take approximately 6 months. Afterwards, the area will be checked to ensure there is no radioactivity above naturally occurring levels, and the containment structure will be removed. The empty underground tanks and surrounding soils will then be further evaluated and remediated as necessary as part of other site cleanup activities.

WHERE DO I GET MORE INFORMATION?

To get additional information, please:

CALL:

LEHR	Larry McEwen
Information Line	DOE Project Manager
(916) 752-8351	(510) 637-1641

OR

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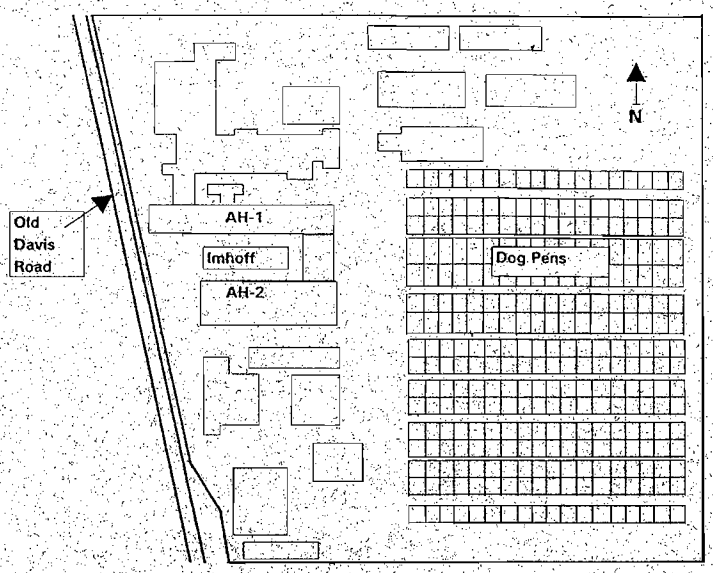
LEHR SITE (Western Section)



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Decontamination and Decommissioning of LEHR Animal Hospitals

OVERVIEW

In October 1993, the U.S. Department of Energy completed the Decontamination and Decommissioning (D&D) of two Animal Hospital buildings (AH-1 and AH-2) at the former Laboratory for Energy-related Health Research (LEHR) site on the UC Davis campus. Research was conducted in the Animal Hospitals from 1958 through 1989, focusing on the long-term health effects of low-level radiation exposure in beagles. The AH-1 and AH-2 D&D effort was a major component of the LEHR Environmental Restoration Project, which continues at the site. Throughout the D&D, project goals have focused on restoring the buildings to a condition that will permit transfer of ownership to UC Davis. A final verification that AH-1 and AH-2 are free of contamination will be performed by an independent contractor. This will allow release of the buildings to UC Davis for unrestricted use.

LOCATION

Located approximately one mile south of the main UC Davis campus on Old Davis Road, the former LEHR site occupies 15 acres surrounded by scattered campus research facilities and private farms. AH-1 and AH-2 are near the western site boundary (see map on back).

PROCESS

The focus of the Animal Hospital D&D was the elimination of any remnants of low-level radiation from the buildings. This involved removal of animal cages, plumbing and heating systems, ventilation and air-conditioning (HVAC), building fixtures, and walk-in freezers. Materials containing asbestos in floor coverings and insulation were also removed as needed to provide access to the ventilation systems and to the drainage systems (including pipes below the floor surface).

SAFETY AND ENVIRONMENTAL PROTECTION

Prior to the start of this activity, an Environmental Assessment was prepared and approved in 1992. Potential impacts to the public and the environment were evaluated, and a "Finding of No Significant Impact" (FONSI) was issued. Federal and state safety guidelines were clearly followed during the building restoration. High standards of safety and worker protection resulted in an excellent safety record.

Care was taken to assure that contamination within the buildings was successfully contained during the removal operations. The buildings were isolated from the external environment with engineering controls, such as High Efficiency Particulate Air (HEPA) filters, sealed plastic tentings both for inner building surfaces and for specific work areas, negative pressurization of work areas, controlled access to buildings, and exit survey checkpoints. To assess the effectiveness of controls, routine breathing zone air sampling and ventilation stack sampling were conducted throughout D&D work.

HAZARDOUS WASTE MINIMIZATION

Hazardous waste minimization during the AH-1 and AH-2 D&D was considered a success in both cost reduction and preservation of valuable landfill space. A significant decrease in volume of hazardous waste was achieved with implementation of an effective waste minimization program. Materials, including fixtures and cage rubble, were surveyed for contamination after removal. This facilitated segregation of clean vs. contaminated waste and permitted recycling of uncontaminated materials. In addition, a shredder and compactor were used to reduce the volume of hazardous waste by nearly 50%. These efforts resulted in a project savings of $870,000 in waste disposal costs.

WHERE DO I GET MORE INFORMATION?

To get additional information, please:

CALL:

LEHR	Larry McEwen/Salem Attiga
Information Line	DOE Project Manager
(916) 752-8351	(916) 752-5459

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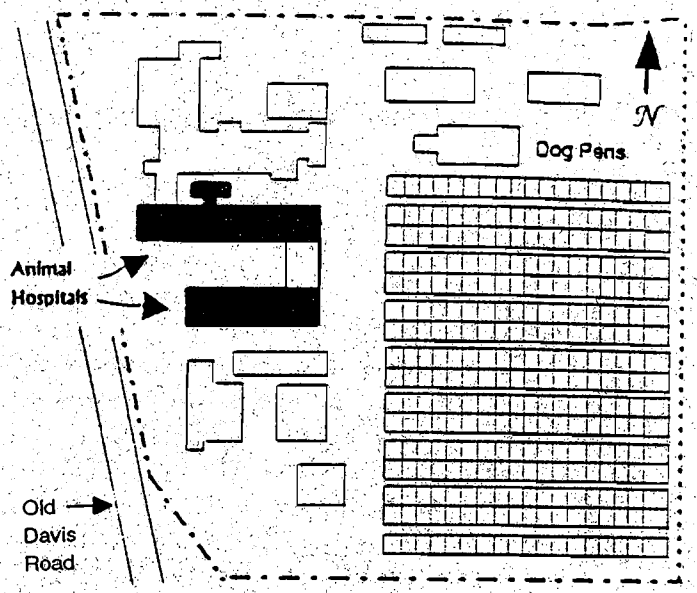
LEHR SITE (Western Section)



The LEHR Site is approximately one mile south of the main UC Davis campus.

LEHR Cleanup Project
Old Davis Road
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Cobalt 60 Source Removal

OVERVIEW:

A radioactive Cobalt 60 (CO-60) source, used for irradiation studies at the former *Laboratory for Energy-Related Health Research* (LEHR), will be removed and transported to a licensed nuclear facility in Pleasanton, California in January 1993. Removal of the source, which will take approximately 1 week, is part of on-going environmental assessment and cleanup activities at the LEHR site conducted by the *US Department of Energy* (DOE) and UC Davis. Battelle's *Environmental Management Operations* (Battelle EMO) has been contracted by the DOE to manage the site restoration.

LOCATION:

Located approximately one mile south of the main UC Davis campus on Old Davis Road, the former LEHR site covers 15 acres and is surrounded by scattered campus research facilities and private farms. The pencil-sized CO-60 source is housed in a building located on the southeast corner of the site. (See map on reverse.)

CO-60 HISTORY:

The CO-60 irradiator facility was an indoor-outdoor facility designed to study the effects of low-level whole-body radiation exposure to research animals. The study was one of several studies conducted at the LEHR site to examine the effects of continuous CO-60 radiation exposure on beagles. The study ran from 1970 to 1987, with the last outdoor exposure experiment completed in October, 1985. The irradiator continued to be operated exclusively for indoor irradiation experiments until 1987. In 1988 the CO-60 irradiator was formally put into safe storage.

REMOVAL PROCESS:

During late January, the CO-60 source, along with its support structure (a weather-tight housing structure bolted to the roof of the CO-60 irradiator building) will be removed, packaged and transported to a nuclear facility in Pleasanton, California. EMO's contractor, *Bechtel Environmental, Inc.* of Oakridge Tennessee, will effect the actual removal, packaging and transport of the source.

Beginning the last week in January, Bechtel will remove the irradiator from the roof of the CO-60 irradiator building and package it for shipment to *General Electric Vallecitos Nuclear Center*, where removal of the actual source and packaging for final disposition will take place. Bechtel will use a licensed transportation company and shielded cask to transport the irradiator to the facility, where the source will be removed from its shielded housing. The tasks involved in removal of the source from the LEHR site are expected to require a few days.

SAFETY ISSUES:

The operations which will take place at the LEHR site – *removal* and *packaging* of the CO-60 sealed source – pose virtually no public threat. The cask used for the operation is specially designed to contain and shield radiation such as that emitted by the CO-60 source, and all work will follow applicable State and Federal guidelines. In addition, an *Emergency Response Plan* has been written, environmental monitoring will be performed, and work zone access will be limited to personnel directly involved in the actual work. To adequately ensure the safety of those workers involved in the actual task, special steps will be taken, and personnel will be required to wear radiation detection badges and appropriate protective clothing. Throughout the operation, extensive monitoring will be performed to ensure that no unnecessary radiation exposure occurs.

WHERE DO I GET MORE INFORMATION?

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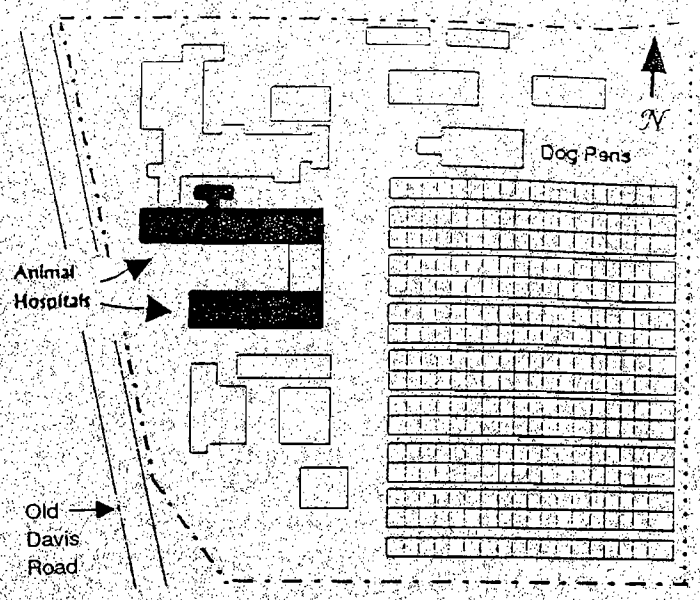


The LEHR Site is approximately one mile south of the main UC Davis campus.

Phase II Site Characterization Results
Laboratory for Energy-Related Health Research

WHAT:

As part of its effort to assess the extent of environmental contamination from a former research project located at UC Davis, the U.S. Department of Energy (DOE) has been testing soil and water under and adjacent to the Laboratory for Energy-Related Health Research (LEHR) facility for possible chemical and radioactive contamination. DOE began the soil, groundwater, and surface water investigation ("Phase II site characterization") in January 1990 to follow up on the results of a study that began in 1987. Details of the Phase II study, which was completed in November 1991, have been compiled into a comprehensive report, *Phase II Site Characterization Report: LEHR Environmental Restoration*, soon to be issued by DOE.

DOE and UC Davis have been working closely with the California Department of Health Services and the Regional Water Quality Control Board on the investigation.

LOCATION:

LEHR is located about one mile south of the main UC Davis campus, on the east side of Old Davis Road, just north of the South Fork of Putah Creek. A levee separates the southern boundary of the site from Putah Creek. Occupying approximately 15 acres, LEHR is surrounded by various campus research facilities. A few residences and private farms are located to the south of LEHR on the south side of the creek.

PHASE II SITE CHARACTERIZATION PROCESS:

The Phase II study was designed to investigate specific areas at LEHR. These areas included outdoor dog pens, areas adjacent to former special waste treatment facilities (strontium-90 leachfield and radium-226 seepage pits), and former outdoor chemical storage/dispensing areas. Over 200 soil samples were collected from these areas as well as from off-site UC Davis property to provide a means of comparison.

To evaluate potential environmental impacts on water, DOE tested groundwater under the site and surface water from the South Fork of Putah Creek. During the Phase II investigation, DOE installed 10 monitoring wells in order to collect groundwater samples. Seven of the wells are approximately 70 feet deep ("shallow wells"), and three are approximately 120 feet deep ("deep wells"). Installation of these new wells increased the monitoring network at LEHR to 23 wells. Groundwater samples were collected and analyzed on a quarterly basis. DOE also collected water from the South Fork of Putah Creek upstream and downstream from the LEHR site on a quarterly basis as part of the Phase II study. Additional hydrologic testing was conducted to learn more about groundwater flow under and near the site. Soil and water samples were tested for organic and inorganic chemicals, metals, pesticides, and radioactivity by certified laboratories according to U.S. Environmental Protection Agency or other approved procedures.

An inactive campus landfill and low-level radioactive waste burial trenches are also present at the site. Although the waste burial areas were not specifically included in the Phase II study, DOE and UC Davis have been investigating them. Further studies are planned for these areas.

RESULTS OF THE PHASE II STUDY:

Hydrogeology

Subsurface materials LEHR consist of layers of sediments. The upper zone consists of about 80 feet of clay and fine sands. Underlying this is a sand and gravel zone, which ranges from 80 to 140 feet deep. Additional clay and sand/gravel units are known to exist below these two zones, but they have not yet been thoroughly investigated as part of the LEHR cleanup project. The groundwater level beneath the site varies from 40 to 65 feet deep, depending on the season. Groundwater flows predominantly toward the

northeast at the LEHR site. Prior to this study, it was thought that the clay and sand/gravel zones were not connected hydrologically, but the results of the Phase II investigation indicate that they are. Data from the Phase II study also indicated that the South Fork of Putah Creek, which flows eastward, recharges the water table under the LEHR site. This means that groundwater from the LEHR site does not flow into Putah Creek, but away from it.

Soil

Metals were detected in soils across the site. In general, the amounts measured were similar to what is found naturally in the soil in the Davis area. No significant levels of organic chemicals were detected in soil samples. Elevated levels of chlordane, which was used to treat the dogs for fleas, were found in some soils in the outdoor dog pen areas. Low levels of nitrate were detected in on-site soil samples, but were similar to off-site samples. Low levels of tritium, strontium 90, and radium 226 were detected in some soil samples collected from the areas investigated. Further work is planned to determine how these levels compare to levels in off-site soils.

Groundwater

Several organic chemicals have been detected in groundwater at the LEHR site. High levels of chloroform have been detected consistently in an on-site shallow well adjacent to one of UC Davis' inactive campus landfill units. Other organic compounds such as 1,1-dichloroethane, 1,2-dichloroethane, and 1,1-dichloroethylene have also been detected consistently in the same well but at much lower concentrations. Concentrations of these four organic chemicals exceeded drinking water standards. Other organic compounds have been detected sporadically at very low levels in other wells at the site. The levels of these compounds have not exceeded drinking water standards.

In general, the concentrations of metals detected in the on-site shallow and deep monitoring wells are similar to those found in off-site wells. Concentrations of antimony and thallium exceeded drinking water standards a few times. Hexavalent chromium (a form of chromium) was detected consistently in most sampling rounds in several shallow wells. In many of these wells, the level of hexavalent chromium exceeded the drinking water standard for total chromium. Since chromium and other metals occur naturally in soil, further studies are planned to determine whether the metals in groundwater at LEHR are naturally occurring, are the result of geochemical processes in the soil, or are the result of past activities at the site.

Small amounts of various chlorinated pesticides such as aldrin, dieldrin, heptachlor, and others were detected sporadically in some wells. Chlordane was not detected in any of the samples. The presence of pesticides in groundwater in the Davis area is not unusual, and additional data will be needed to determine whether LEHR is the only source of these compounds.

Nitrate was detected in several monitoring wells at the site. In many cases, the concentrations were above the drinking water standard. Other possible sources of nitrate, such as wastewater effluent and regional agricultural practices, must be further evaluated to determine whether LEHR is the only source of the nitrate in groundwater.

Tritium was detected consistently at levels above the drinking water standard in an on-site shallow well next to former radioactive waste burial trenches. Lesser amounts (below the drinking water standard) of tritium and carbon 14 were detected in an adjacent 85-foot well. Trace amounts of tritium were detected sporadically in other shallow wells. Small amounts of strontium 90 were detected sporadically, but the levels did not exceed the drinking water standard. Radium 226 was not detected in any groundwater samples.

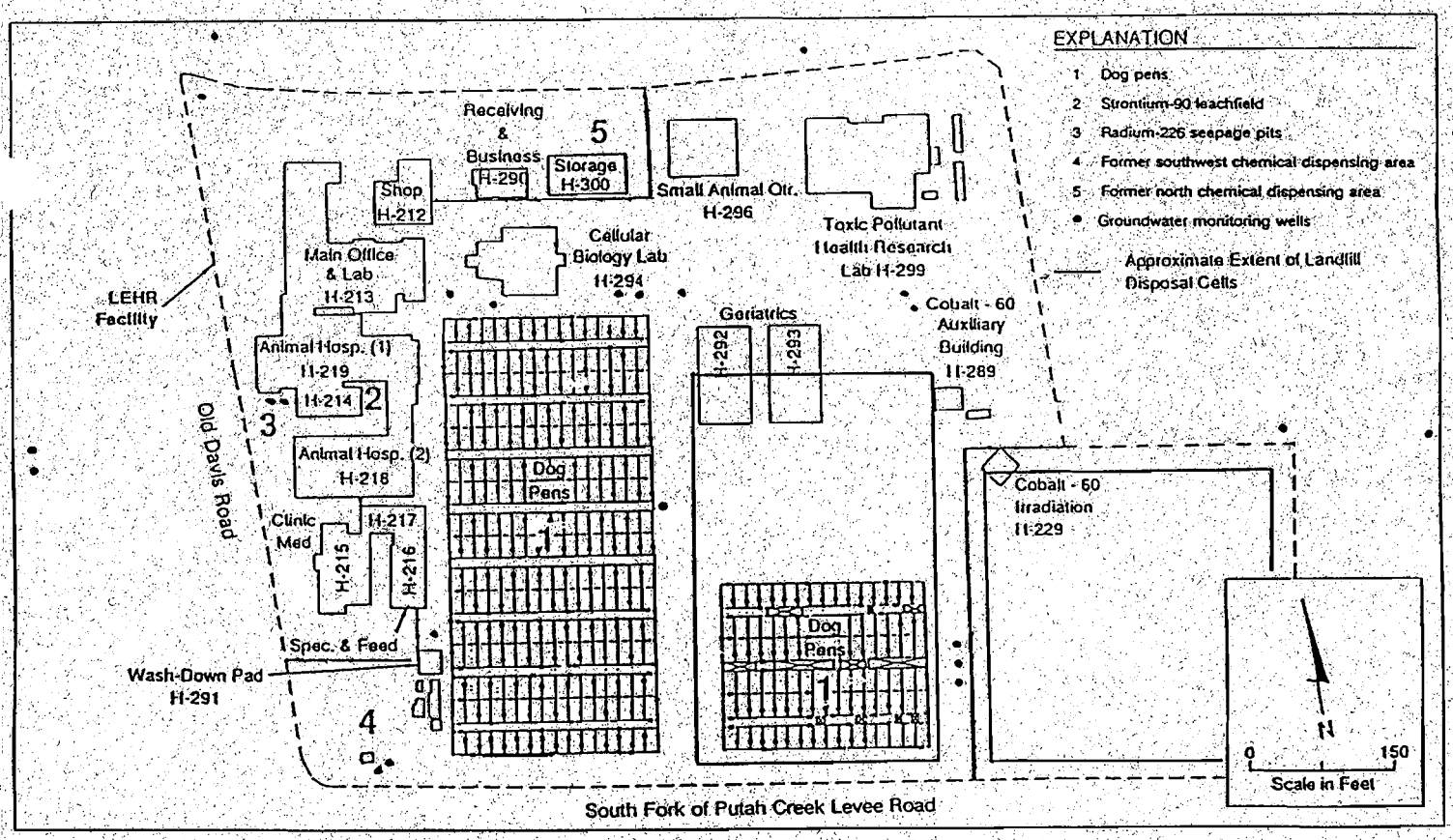
Surface Water (South Fork of Putah Creek)

Some organic chemicals and pesticides were detected in surface water samples collected both upstream and downstream of LEHR. Small amounts of metals such as antimony, barium, hexavalent chromium, lead, thallium, and zinc were detected in upstream and downstream samples. Nitrate was detected consistently in upstream and downstream samples. In a few cases, levels of some of these compounds exceeded drinking water standards. Since the South Fork of Putah Creek receives water from many upstream sources, additional tests will be necessary to determine what effect, if any, the LEHR site has had on the chemical quality of the creek and the significance of those chemicals whose levels exceeded drinking water standards. Tritium, carbon 14, and strontium 90 were detected sporadically in surface water samples. None of the levels exceeded drinking water standards.

FUTURE PLANS:

As noted, more data is needed to adequately evaluate some of the findings of the Phase II study.In addition, other areas, such as the trenches and landfill, must be further investigated. To complete the soil and groundwater investigation, DOE and UC Davis are preparing a site-wide plan, called a "Remedial Investigation/Feasibility Study" (RI/FS). Information from the RI/FS will be used to develop the plans to clean up the soil and groundwater as necessary.

February 1993



LEHR PHASE II SITE CHARACTERIZATION
AREAS OF INVESTIGATION

FOR MORE INFORMATION:

Call: LEHR Information Line
(916) 752-8351

or

Larry McEwen, DOE
(510) 637-1641

or

Julie McNeal, UC Davis
(916) 752-5536

Write: LEHR Cleanup Project
ITEH
UC Davis
Old Davis Road
Davis, CA 95616

COPIES OF DOCUMENTS RELATING TO THE LEHR CLEANUP PROJECT ARE AVAILABLE FOR REVIEW AT:

Shields Library
Reserve Desk
UC Davis
Davis, CA 95616
(916) 752-1203

Davis Public Library
Reference Desk
315 East 14th Street
Davis, CA 95616
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LEHR Cleanup Project
UC Davis
ITEH
Old Davis Road
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UC DAVIS
NEWS

September 11, 1991
Contact: Carolyn Owen
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TRACES OF RADIOACTIVE MATERIAL REPORTED IN GROUNDWATER NEAR LEHR SITE

DAVIS, Calif. — Preliminary testing near a former University of California, Davis, low-level radiation research facility shows trace levels of a radioactive material in shallow groundwater south of the 15-acre site, according to an environmental consulting company hired by UC Davis.

The company has reported finding tritium — a radioactive form of hydrogen commonly used in laboratory tests — while using a relatively new technology to scout for groundwater contamination as part of ongoing environmental assessment and cleanup of the former Laboratory for Energy-Related Health Research.

The tritium, identified but not confirmed at two test spots on private property roughly 1,500 feet from the edge of the rural LEHR site, was in concentrations well within acceptable levels set by drinking water standards and poses no health threat to the public. Drinking water for UC Davis and the city of Davis comes from deep wells far from the area. However, campus officials have asked the state Department of Health Services to perform additional testing to confirm the findings.

"The information we have at this point is very preliminary. We need to take and examine more samples to determine whether a problem exists and to ensure that no error has been made in the handling or analysis of these two samples," said Carolyn Owen, the radiation safety officer and assistant director of environmental health and safety at UC Davis.

The tritium is reported in data collected for UC Davis by the Sacramento office of the environmental consulting firm Dames & Moore. Using a relatively new technology called hydropunching to screen for potential test well sites, workers performed 25 hydropunch tests (generally 75 feet to 95 feet deep) in locations around the border of the LEHR site. The results are the first indication that radioactive material in higher than naturally occurring concentrations may be in groundwater off the campus property.

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2-2-2 LEHR Groundwater

Levels of tritium higher than the natural background levels of 100 picocuries to 200 picocuries per liter — but well below the 20,000 picocuries set as the drinking water limit — were found in three areas. In two spots 1,500 feet from the site's southern edge, two water samples showed tritium concentrations of 1,517 picocuries and 930 picocuries. Several hundred feet northeast of the site, on campus property, a water sample showed 2,220 picocuries. Due to the nature of the tests, the three sample measurements could be in error by as much as 50 percent.

UC Davis and the U.S. Department of Energy are in the midst of a multiyear assessment and cleanup of the LEHR site, where for more than 30 years DOE-funded scientists studied the health effects of exposure to low levels of radiation. The property is also the site of an inactive campus sanitary landfill, closed in 1966, and several inactive disposal sites for low-level radioactive wastes, which the campus and LEHR used until 1974, according to regulations.

Extensive soil and groundwater testing has been under way for more than four years at the site, located a mile south of the main UC Davis campus. Since 1988, the campus has reported finding elevated levels of nitrates, the trace metal hexavalent chromium, tritium, carbon 14 and organic chemicals in test wells on the LEHR site.

Quarterly testing of domestic wells on nearby private property since 1989 has shown elevated levels of nitrates and chromium, whose source is unclear. The campus has been supplying these neighbors with drinking water since 1989.

If additional tests confirm that tritium has migrated in groundwater from the LEHR property, a possible source is the campus's inactive low-level radioactive waste disposal sites, according to Owen. She said it is doubtful that the tritium came from past research activities at the LEHR site itself, since LEHR research involved the use of different radioactive materials, strontium and radium.

Working with the Regional Water Quality Control Board and state Department of Health Services, the campus will continue conducting tests to identify and map any groundwater contamination from the inactive landfill and disposal sites, according to Owen. The assessment is expected to be completed by the end of 1992.

-kw-

UC DAVIS
NEWS

August 26, 1991
Contact: Carolyn Owen
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EDITOR'S NOTE: Reporters interested in filming the operation may want to wait until setup is completed and pumping and packaging begins (currently planned for the third week in September).

Next step in cleanup
SLUDGE REMOVAL TO BEGIN AT LEHR

DAVIS, Calif. — Workers will treat and package approximately 34,000 gallons of low-level radioactive sludge and water stored at a research facility a mile south of the main University of California, Davis, campus beginning in September as they prepare to ship the waste to a licensed disposal site.

The operation — expected to take three months — marks the next major step in environmental assessment and cleanup of the former Laboratory for Energy-Related Health Research site by the U.S. Department of Energy and UC Davis.

The sludge and water are the remaining byproducts of two specially designed waste-processing systems built at LEHR to handle the low-level radioactive wastes of research animals used in studies of the health effects of exposure to radiation. The 33-year project, which involved mostly dogs, was one of several similar projects supported by DOE at various U.S. research institutions.

During the years of active research at the site (the waste systems were last used in 1986), the sludge generated by the waste-processing systems was removed from underground storage tanks when necessary and shipped to a licensed radioactive waste site. This disposal operation will clear the tanks of what remains.

The concentration of radioactivity in the sludge and water is very low. It consists mostly of about 200 millicuries of strontium 90 and about .003 millicuries of radium 226.

During the first week in September, a DOE contractor will set up operations near the tanks, located along the western edge of the 15-acre LEHR site. Using state-of-the-art technology and environmentally sound practices, workers will process the sludge and water pumped from the

-more-

tanks and package it in about 800 55-gallon drums. These drums will be shipped within a few months to a DOE low-level radioactive waste disposal site in Hanford, Wash.

The estimated cost for treatment, packaging, shipping and disposal of the low-level radioactive waste is $1.2 million.

-kw-

Phase II Site Characterization Results
Laboratory for Energy-Related Health Research

WHAT:

As part of its effort to assess the extent of environmental contamination from a former research project located at UC Davis, the U.S. Department of Energy (DOE) has been testing soil and water under and adjacent to the Laboratory for Energy-Related Health Research (LEHR) facility for possible chemical and radioactive contamination. DOE began the soil, groundwater, and surface water investigation ("Phase II site characterization") in January 1990 to follow up on the results of a study that began in 1987. Details of the Phase II study, which was completed in November 1991, have been compiled into a comprehensive report, *Phase II Site Characterization Report: LEHR Environmental Restoration*, soon to be issued by DOE.

DOE and UC Davis have been working closely with the California Department of Health Services and the Regional Water Quality Control Board on the investigation.

LOCATION:

LEHR is located about one mile south of the main UC Davis campus, on the east side of Old Davis Road, just north of the South Fork of Putah Creek. A levee separates the southern boundary of the site from Putah Creek. Occupying approximately 15 acres, LEHR is surrounded by various campus research facilities. A few residences and private farms are located to the south of LEHR on the south side of the creek.

PHASE II SITE CHARACTERIZATION PROCESS:

The Phase II study was designed to investigate specific areas at LEHR. These areas included outdoor dog pens, areas adjacent to former special waste treatment facilities (strontium-90 leachfield and radium-226 seepage pits), and former outdoor chemical storage/dispensing areas. Over 200 soil samples were collected from these areas as well as from off-site UC Davis property to provide a means of comparison.

To evaluate potential environmental impacts on water, DOE tested groundwater under the site and surface water from the South Fork of Putah Creek. During the Phase II investigation, DOE installed 10 monitoring wells in order to collect groundwater samples. Seven of the wells are approximately 70 feet deep ("shallow wells"), and three are approximately 120 feet deep ("deep wells"). Installation of these new wells increased the monitoring network at LEHR to 23 wells. Groundwater samples were collected and analyzed on a quarterly basis. DOE also collected water from the South Fork of Putah Creek upstream and downstream from the LEHR site on a quarterly basis as part of the Phase II study. Additional hydrologic testing was conducted to learn more about groundwater flow under and near the site. Soil and water samples were tested for organic and inorganic chemicals, metals, pesticides, and radioactivity by certified laboratories according to U.S. Environmental Protection Agency or other approved procedures.

An inactive campus landfill and low-level radioactive waste burial trenches are also present at the site. Although the waste burial areas were not specifically included in the Phase II study, DOE and UC Davis have been investigating them. Further studies are planned for these areas.

RESULTS OF THE PHASE II STUDY:

Hydrogeology

Subsurface materials LEHR consist of layers of sediments. The upper zone consists of about 80 feet of clay and fine sands. Underlying this is a sand and gravel zone, which ranges from 80 to 140 feet deep. Additional clay and sand/gravel units are known to exist below these two zones, but they have not yet been thoroughly investigated as part of the LEHR cleanup project. The groundwater level beneath the site varies from 40 to 65 feet deep,

depending on the season. Groundwater flows predominantly toward the northeast at the LEHR site. Prior to this study, it was thought that the clay and sand/gravel zones were not connected hydrologically, but the results of the Phase II investigation indicate that they are. Data from the Phase II study also indicated that the South Fork of Putah Creek, which flows eastward, recharges the water table under the LEHR site. This means that groundwater from the LEHR site does not flow into Putah Creek, but away from it.

Soil

Metals were detected in soils across the site. In general, the amounts measured were similar to what is found naturally in the soil in the Davis area. No significant levels of organic chemicals were detected in soil samples. Elevated levels of chlordane, which was used to treat the dogs for fleas, were found in some soils in the outdoor dog pen areas. Low levels of nitrate were detected in on-site soil samples, but were similar to off-site samples. Low levels of tritium, strontium 90, and radium 226 were detected in some soil samples collected from the areas investigated. Further work is planned to determine how these levels compare to levels in off-site soils.

Groundwater

Several organic chemicals have been detected in groundwater at the LEHR site. High levels of chloroform have been detected consistently in an on-site shallow well adjacent to one of UC Davis' inactive campus landfill units. Other organic compounds such as 1,1-dichloroethane, 1,2-dichloroethane, and 1,1-dichloroethylene have also been detected consistently in the same well but at much lower concentrations. Concentrations of these four organic chemicals exceeded drinking water standards. Other organic compounds have been detected sporadically at very low levels in other wells at the site. The levels of these compounds have not exceeded drinking water standards.

In general, the concentrations of metals detected in the on-site shallow and deep monitoring wells are similar to those found in off-site wells. Concentrations of antimony and thallium exceeded drinking water standards a few times. Hexavalent chromium (a form of chromium) was detected consistently in most sampling rounds in several shallow wells. In many of these wells, the level of hexavalent chromium exceeded the drinking water standard for total chromium. Since chromium and other metals occur naturally in soil, further studies are planned to determine whether the metals in groundwater at LEHR are naturally occurring, are the result of geochemical processes in the soil, or are the result of past activities at the site.

Small amounts of various chlorinated pesticides such as aldrin, dieldrin, heptachlor, and others were detected sporadically in some wells. Chlordane was not detected in any of the samples. The presence of pesticides in groundwater in the Davis area is not unusual, and additional data will be needed to determine whether LEHR is the only source of these compounds.

Nitrate was detected in several monitoring wells at the site. In many cases, the concentrations were above the drinking water standard. Other possible sources of nitrate, such as wastewater effluent and regional agricultural practices, must be further evaluated to determine whether LEHR is the only source of the nitrate in groundwater.

Tritium was detected consistently at levels above the drinking water standard in an on-site shallow well next to former radioactive waste burial trenches. Lesser amounts (below the drinking water standard) of tritium and carbon 14 were detected in an adjacent 85-foot well. Trace amounts of tritium were detected sporadically in other shallow wells. Small amounts of strontium 90 were detected sporadically, but the levels did not exceed the drinking water standard. Radium 226 was not detected in any groundwater samples.

Surface Water (South Fork of Putah Creek)

Some organic chemicals and pesticides were detected in surface water samples collected both upstream and downstream of LEHR. Small amounts of metals such as antimony, barium, hexavalent chromium, lead, thallium, and zinc were detected in upstream and downstream samples. Nitrate was detected consistently in upstream and downstream samples. In a few cases, levels of some of these compounds exceeded drinking water standards. Since the South Fork of Putah Creek receives water from many upstream sources, additional tests will be necessary to determine what effect, if any, the LEHR site has had on the chemical quality of the creek and the significance of

SITE ASSESSMENT AND CLEANUP AT LEHR

An Overview

The Laboratory for Energy-Related Health Research (LEHR) at UC Davis, where for more than 30 years scientists studied the long-term health effects of exposure to low levels or radiation, is in the midst of evaluating the environmental impact of chemical and low-level radioactive materials in its facilities and surrounding environment, and treating, containing, or removing these materials.

These activities mark the close of LEHR's principal research project, a 33-year study of beagles exposed to strontium, radium, and cobalt. The study was one of several beagle projects the U.S. Department of Energy (DOE) supported for many years at various U.S. research institutions.

Also at the LEHR site are an inactive campus landfill and several former disposal areas for low-level radioactive wastes. DOE and UC Davis have been investigating groundwater and soil in these areas for contamination since 1987.

DOE's assessment and cleanup activities at LEHR are estimated to cost $33 million. Some activities have already been completed, and the cost and plans for future activities will be determined once the assessment is completed, in 1995.

History and Description of LEHR

The Site

Located about a mile south of the main UC Davis campus, LEHR occupies 15 acres surrounded by campus research facilities and private land. A levee along Putah Creek borders LEHR to the south. The site itself, now called the Institute of Toxicology and Environmental Health, has outdoor dog kennels and 16 buildings, 11 of which house active research programs and require no treatment or removal of old LEHR research wastes.

UC Davis owns the LEHR land and leases the site to DOE, which built and owns LEHR's facilities. Once treatment or removal of LEHR's research wastes has been completed, UC Davis will assume ownership and operation of the entire facility.

An inactive campus landfill, used from the 1940s until the mid-1960s covers about 6 acres of the LEHR site, plus another acre approximately 600 feet east of LEHR. Also at LEHR are several low-level radioactive waste burial areas, where the campus and LEHR buried wastes until 1974. The wastes were buried according to regulations that were in effect at the time. Adjacent to LEHR is the old campus sewage treatment plant, which closed in 1949. The site is the subject of a separate study by UC Davis.

The Research

Through the support of DOE's predecessor, the U.S. Atomic Energy Commission, LEHR (also known in the earlier years as the Radiobiology Laboratory) began in 1951 as a research project investigating the biological effects of X-rays. The Atomic Energy Commission authorized its first contract with LEHR in 1962 for what became a 33-year (1956-89) study that investigated the health effects of internal exposure to low levels of strontium 90 and radium 226. In a separate but related project, research animals were exposed to cobalt 60 radiation.

Research at LEHR has focused on:

- understanding better the effects of exposure to low-level radiation on the skeleton and its blood-forming constituents;
- investigating the behavior of certain bone-seeking radioactive materials;
- studying the beagle as an experimental animal model;
- exploring how low-level radiation triggers and affects the formation of tumors and development of leukemia; and
- developing effective ways to use results gathered from animal studies to assess risks to humans.

In all, 1063 beagles were used in the strontium and radium study. Selected because of their relatively long life spans and physiological similarities to humans, the beagles received regular medical attention throughout the study, and careful health records were kept. Most of the beagles lived in outside kennels. The last beagle in the strontium/radium study died at the age of 18½ in 1986. The final DOE research contract for the beagle study ended in 1989.

LEHR scientists have published more than 100 scientific papers based on their research with the beagles, and they are continuing to analyze information gathered during the project. They have completed a computerized database that includes all the clinical, radiation-exposure, and technical data collected during the strontium/radium study.

Assessment and Cleanup Activities

Described below are the main projects that have been completed or are still undergoing assessment and cleanup at LEHR. Each project involves technical testing, assessment, and the investigation and selection of ways to eliminate, contain, or treat wastes and contamination in accordance with applicable federal, state, and local regulations. Environmental analysis of each project according to California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) requirements is also performed.

The last radioactive animal remains on the site were taken from storage refrigerators, packaged in drums, and sent to a DOE-licensed disposal site for low-level radioactive wastes in Hanford, Washington, in September 1990.

Approximately 34,000 gallons of low-level radioactive water and sludge from underground tanks were solidified and removed as waste in late 1991 and early 1992. The water and sludge consisted of the remaining byproducts of a special on-site treatment facility (Imhoff Building and adjacent area) for processing animal wastes. The solidified waste was sent to a DOE-licensed disposal site in Hanford. The tanks themselves will be surveyed and decontaminated if necessary as part of upcoming activities.

Removal of a device called a cobalt-60 irradiator used for exposing research animals in outdoor pens to external radiation was completed in January 1993. The irradiator was used in the 1970s and early 1980s to study radiation-induced leukemia. DOE conducted a study in 1990-91 that estimated the potential exposure to nearby private residences and campus employees and volunteers at surrounding campus research facilities when the device was operated. The study showed that the private residences and those who worked in the area received less than the DOE annual limit allowed for public exposure during the time the irradiator operated and the current annual limit allowed by the State of California, both of which are 500 millirem per year. The cobalt-60 source was transferred to General Electric Corp.

A radioactively contaminated tanker, which was used to hold low-level radioactive liquid in the past, is expected to be disposed of as waste in late 1994.

Decontamination and decommissioning (D&D) of buildings is nearing completion. Eleven of 16 buildings have already been released to researchers involved in ongoing UC Davis research. Of the 5 remaining buildings, Animal Hospital 1, Animal Hospital 2, and a storage building for laboratory materials have been cleaned of residual low-level radioactivity and are awaiting independent confirmation of cleanup before transfer to UC Davis. Low-level wastes removed from these buildings were packaged and sent to a DOE-licensed disposal site in Hanford. The Imhoff building and the building that housed the cobalt-60 irradiator are scheduled to be cleaned within the next few years.

Groundwater, surface water, and soil testing, which began in 1987, is continuing. So far, carbon 14, tritium, chromium, nitrate, a few volatile organic chemicals (VOCs), and chlorinated pesticides have been found in shallow groundwater (about 45-70 feet deep) under and adjacent to the site. Concentrations of chromium, nitrate, and VOCs are above drinking water standards in some of the test wells. Tritium has been detected in one test well at 85 feet but the levels do not exceed the drinking water standard. In surface water testing, low levels of metals and nitrate, and trace amounts of organic chemicals have been detected in samples collected upstream and downstream of LEHR. Contamination from LEHR is unlikely since the creek supplies water to, rather than draws water from, shallow groundwater in the area. In soil testing, low levels of nitrate, a few VOCs, chlordane, radionuclides such as strontium 90, radium 226, tritium, and several trace metals have been detected. Further work is necessary to determine whether the levels exceed background levels. A more extensive water and soil study, called a remedial investigation/feasibility study, is scheduled to begin in early 1994 and is expected to be completed by 1995.

UC DAVIS NEWS

November 1, 1993
Contact: Roger Liddle, DOE
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or Karen Watson, News Service
(916) 752-9842

UPDATE MEETING SCHEDULED FOR LEHR SITE CLEANUP

DAVIS, Calif. — Recent and upcoming cleanup activities at a former low-level radiation research facility a mile south of the main University of California, Davis, campus will be discussed at a public meeting Tuesday, Nov. 16.

The update meeting, part of an ongoing process that encourages community "stakeholder" involvement, is sponsored jointly by the U.S. Department of Energy and UC Davis. It will begin at 6 p.m. in the Orchard Room of the University Extension complex, located on Extension Center Drive near the Hutchison Drive entrance to campus. Free parking passes will be available at the parking lot entrance.

Comments and questions from members of the public are welcome.

DOE has made substantial progress in its environmental assessment and cleanup at the former DOE-funded Laboratory for Energy-Related Health Research, where for more than 30 years research focused on the long-term health effects of exposure to low-level radiation.

In recent months, three buildings (Animal Hospital-1, Animal Hospital-2 and a storage building for laboratory materials) have been cleaned of residual low-level radioactivity and are awaiting independent confirmation of cleanup before their expected transfer to the university. Of the 16 buildings on site only two remain to be assessed and cleaned — a special sewage treatment facility for animal waste and a building that housed a cobalt-60 irradiator. They are scheduled to be cleaned within the next few years.

DOE officials estimate that roughly $780,000 was saved during the past few months through the implementation of progressive waste-management procedures that greatly reduced the volume of waste generated by the cleanup of the three buildings. In addition to costing less for disposal, the specially packaged waste will also occupy substantially less landfill space.

Currently, DOE is preparing to launch a study to investigate in greater detail any soil or groundwater contamination that may exist on the LEHR site as well as in the nearby campus

-more-

sanitary landfill, closed since 1966, and in several adjacent low-level radioactive waste burial areas. The campus and LEHR deposited wastes in the burial areas until 1974.

The study, called a remedial investigation/feasibility study, is expected to take up to two years to complete.

Copies of background information on the LEHR site, along with reports and plans, are available at the reserve desk of Shields Library on campus and the reference desk of the public library in the city of Davis, 315 E. 14th St.

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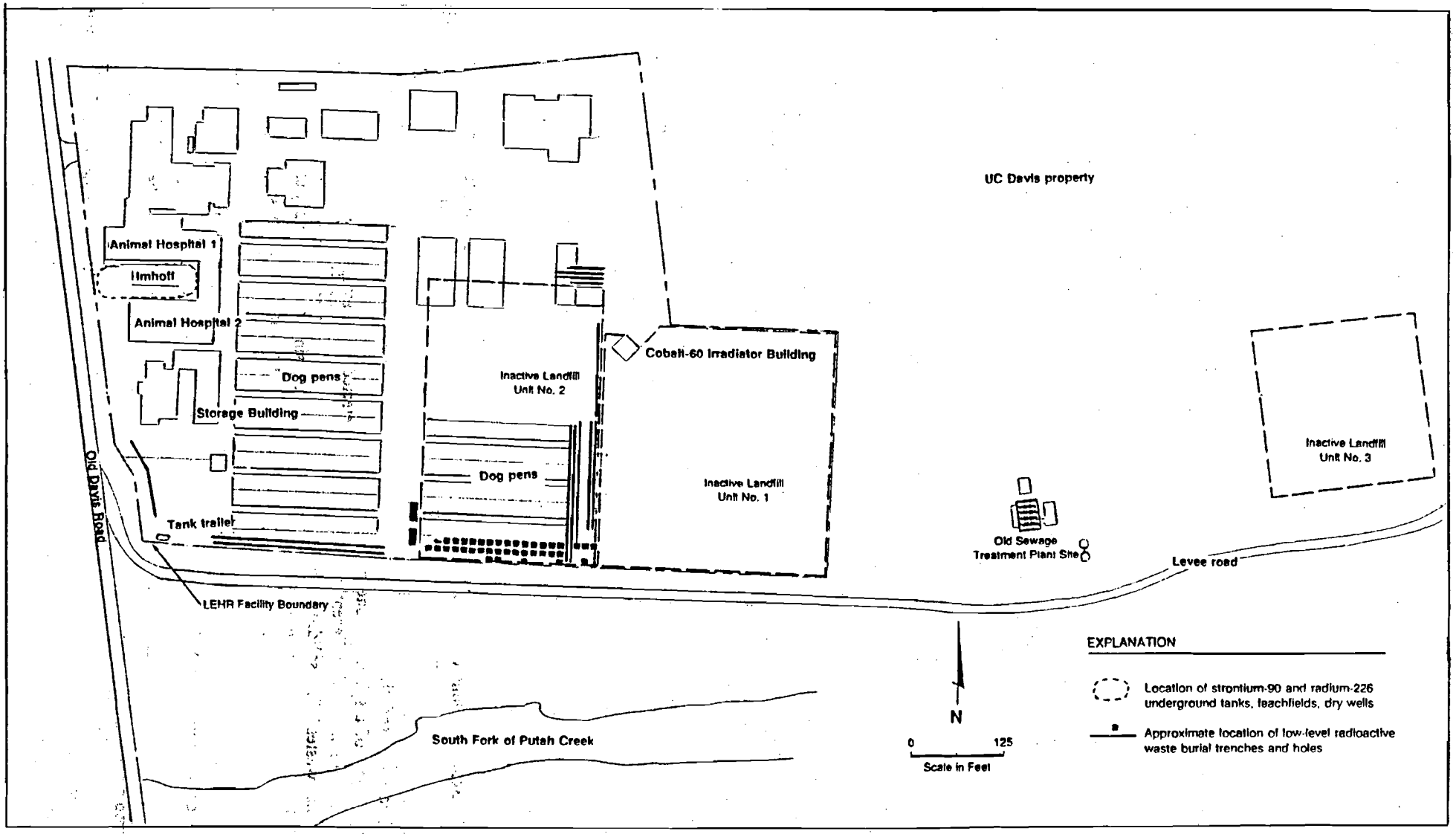


LEHR Site and Old UC Davis Landfill

WHERE DO I GET MORE INFORMATION?

To get additional information, please:

CALL:

LEHR
Information Line
(916) 752-8351

Roger Liddle/Salem Attiga
DOE Project Manager
(916) 752-5459

OR

WRITE:

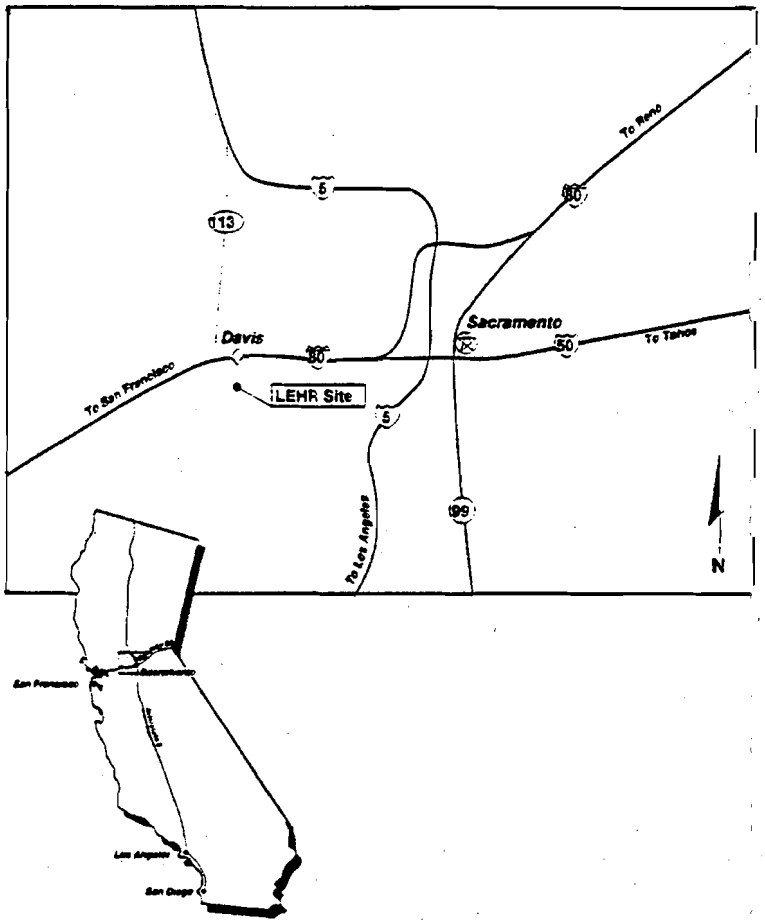
LEHR Cleanup Project
Old Davis Road
Mail Stop: ITEH
Davis, CA 95616

COPIES OF INFORMATION RELATING TO THE LEHR CLEANUP PROJECT ARE AVAILABLE FOR REVIEW AT:

UC Davis Shields Library, Reserve Desk
University of California
Davis, CA 95616
(916) 752-1203

OR

Davis Public Library, Reference Desk
315 East 14th Street
Davis, CA 95616
(916) 756-2332



LEHR Cleanup Project
Old Davis Road
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Davis, California 95616

Cobalt 60 Source Removal

OVERVIEW:

A radioactive Cobalt 60 (CO-60) source, used for irradiation studies at the former *Laboratory for Energy-Related Health Research* (LEHR), will be removed and transported to a licensed nuclear facility in Pleasanton, California in January 1993. Removal of the source, which will take approximately 1 week, is part of on-going environmental assessment and cleanup activities at the LEHR site conducted by the *US Department of Energy* (DOE) and UC Davis. Battelle's *Environmental Management Operations* (Battelle EMO) has been contracted by the DOE to manage the site restoration.

LOCATION:

Located approximately one mile south of the main UC Davis campus on Old Davis Road, the former LEHR site covers 15 acres and is surrounded by scattered campus research facilities and private farms. The pencil-sized CO-60 source is housed in a building located on the southeast corner of the site. (See map on reverse.)

CO-60 HISTORY:

The CO-60 irradiator facility was an indoor-outdoor facility designed to study the effects of low-level whole-body radiation exposure to research animals. The study was one of several studies conducted at the LEHR site to examine the effects of continuous CO-60 radiation exposure on beagles. The study ran from 1970 to 1987, with the last outdoor exposure experiment completed in October, 1985. The irradiator continued to be operated exclusively for indoor irradiation experiments until 1987. In 1988 the CO-60 irradiator was formally put into safe storage.

REMOVAL PROCESS:

During late January, the CO-60 source, along with its support structure (a weather-tight housing structure bolted to the roof of the CO-60 irradiator building) will be removed, packaged and transported to a nuclear facility in Pleasanton, California. EMO's contractor, *Bechtel Environmental, Inc.* of Oakridge Tennessee, will effect the actual removal, packaging and transport of the source.

Beginning the last week in January, Bechtel will remove the irradiator from the roof of the CO-60 irradiator building and package it for shipment to *General Electric Vallecitos Nuclear Center*, where removal of the actual source and packaging for final disposition will take place. Bechtel will use a licensed transportation company and shielded cask to transport the irradiator to the facility, where the source will be removed from its shielded housing. The tasks involved in removal of the source from the LEHR site are expected to require a few days.

SAFETY ISSUES:

The operations which will take place at the LEHR site -- *removal* and *packaging* of the CO-60 sealed source -- pose virtually no public threat. The cask used for the operation is specially designed to contain and shield radiation such as that emitted by the CO-60 source, and all work will follow applicable State and Federal guidelines. In addition, an *Emergency Response Plan* has been written, environmental monitoring will be performed, and work zone access will be limited to personnel directly involved in the actual work. To adequately ensure the safety of those workers involved in the actual task, special steps will be taken, and personnel will be required to wear radiation detection badges and appropriate protective clothing. Throughout the operation, extensive monitoring will be performed to ensure that no unnecessary radiation exposure occurs.

WHERE DO I GET MORE INFORMATION?

To obtain additional information, please:

CALL:

LEHR	Roger Liddle/Salem Attiga
Info Line	DOE Project Manager
(916)752-8351	(916) 752-5459

OR

WRITE:

LEHR Cleanup Project
Old Davis Road
Mail Stop: ITEH
Davis, CA 95616

COPIES OF INFORMATION RELATING TO THE LEHR CLEANUP PROJECT ARE AVAILABLE FOR REVIEW AT:

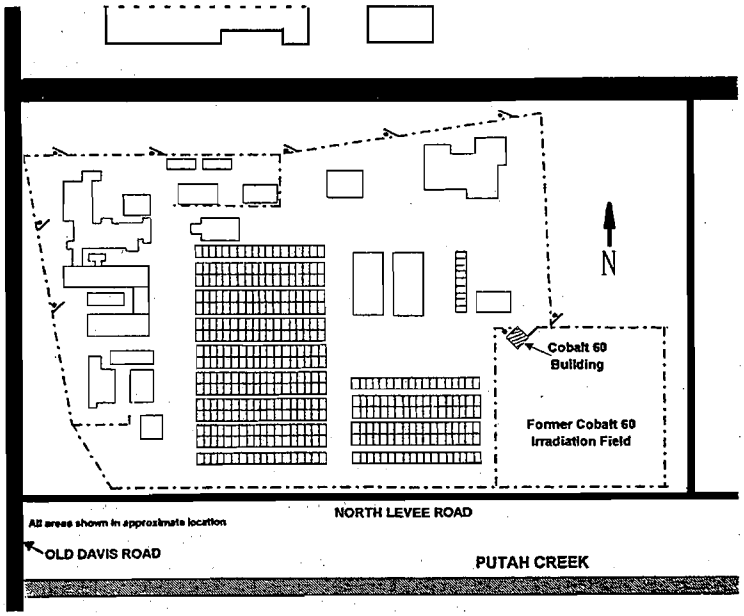
UC Davis Shields Library, Reserve Desk
University of California
Davis, CA 95616
(916) 752-1203

OR

Davis Public Library, Reference Desk
315 East 14th Street
Davis, CA 95616
(916) 756-2332

LEHR Cleanup Project
Old Davis Road
Mail Stop: ITEH
Davis, California 95616

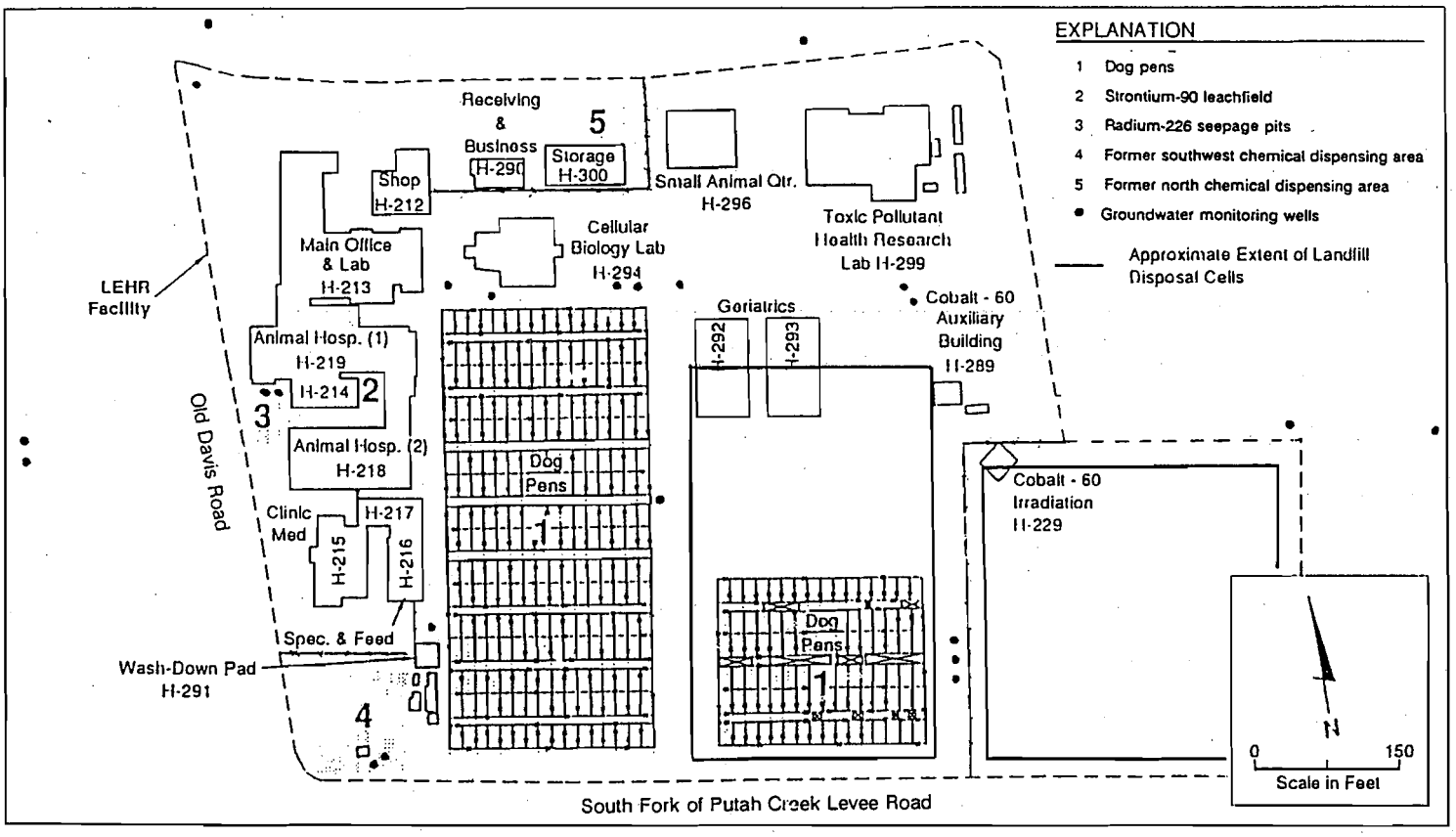
LEHR SITE MAP:



chemical quality of the creek and the significance of those chemicals whose levels exceeded drinking water standards. Tritium, carbon 14, and strontium 90 were detected sporadically in surface water samples. None of the levels exceeded drinking water standards.

FUTURE PLANS:

As noted, more data is needed to adequately evaluate some of the findings of the Phase II study. In addition, other areas, such as the trenches and landfill, must be further investigated. To complete the soil and groundwater investigation, DOE and UC Davis are preparing a site-wide plan, called a "Remedial Investigation/Feasibility Study" (RI/FS). Information from the RI/FS will be used to develop the plans to clean up the soil and groundwater as necessary.



LEHR PHASE II SITE CHARACTERIZATION
AREAS OF INVESTIGATION

FOR MORE INFORMATION:

Call: LEHR Information Line
(916) 752-8351

or

Roger Liddle, Project Director/
Salem Attiga, Project Manager
(916) 752-5459

Write: LEHR Cleanup Project
ITEH
UC Davis
Old Davis Road
Davis, CA 95616

COPIES OF DOCUMENTS RELATING TO THE LEHR CLEANUP PROJECT ARE AVAILABLE FOR REVIEW AT:

Shields Library
Reserve Desk
UC Davis
Davis, CA 95616
(916) 752-1203

Davis Public Library
Reference Desk
315 East 14th Street
Davis, CA 95616
(916) 756-2332

LEHR Cleanup Project
UC Davis
ITEH
Old Davis Road
Davis, CA 95616

UC DAVIS NEWS

November 18, 1991
Contact: Steve Eckberg
(916) 752-4959
Ed Bailey
(916) 322-3482
or Karen Watson
(916) 752-9842

NEW TESTS SHOW NO RADIOACTIVE CONTAMINATION IN GROUNDWATER NEAR LEHR SITE

DAVIS, Calif. — No radioactive contamination was found in a second round of groundwater testing near a former University of California, Davis, low-level radiation research facility, according to the state Department of Health Services and an environmental consulting company hired by UC Davis.

The university had requested additional testing of groundwater on private property near the former Laboratory for Energy-Related Health Research site in September when preliminary tests indicated the presence of minute levels of tritium — a radioactive form of hydrogen commonly used in laboratory tests — in two tests spots roughly 1,500 feet from the edge of the rural LEHR site.

Campus officials reported the preliminary results to the public at that time and requested that the state Department of Health Services participate in a second round of testing in September and October to confirm the findings.

The earlier identification of tritium may have been due to an error in the handling or analysis of the two samples in the first round of testing, according to Steve Eckberg, who oversees UC Davis environmental assessment and cleanup operations under way at LEHR. The two tritium measurements — which were 13 and 21 times below the level set as the drinking water limit — could have been in error by as much as 50 percent, because of the nature of the tests.

"This time we requested the use of a more sophisticated laboratory test on the second round of samples in order to receive more accurate information about possible contamination," Eckberg said.

If radioactive contamination had been found, it would have been the first time that radioactive material in higher than naturally occurring concentrations was identified in groundwater off campus property.

The Sacramento office of the consulting firm Dames & Moore handled both rounds of testing.

The relatively new technology used by Dames & Moore to collect the groundwater samples

-more-

will help the campus identify possible sites for the installation of additional monitoring wells. This technology allows workers to "punch" through the ground temporarily with a test device and collect water samples at depths of 75 to 95 feet. Although these samples provide helpful screening information, long-term monitoring wells are considered the best method for tracking and measuring any contamination.

UC Davis and the U.S. Department of Energy are in the midst of a multiyear assessment and cleanup of the LEHR site, where for more than 30 years DOE-funded scientists studied the health effects of exposure to low levels of radiation. Also located on the 15-acre site are an inactive campus sanitary landfill, closed in 1966, and several inactive campus and LEHR disposal sites for low-level radioactive wastes, which were closed in 1974.

Extensive soil and groundwater testing has been under way for more than four years at LEHR, located a mile south of the main UC Davis campus. Since 1988, the campus has publicly reported finding elevated levels of nitrates, the trace metal hexavalent chromium, tritium, carbon 14 and organic chemicals in test wells on the LEHR site.

Quarterly testing of domestic wells on nearby private property since 1989 has shown elevated levels of nitrates and chromium, whose source is unclear. The campus has been supplying these neighbors with drinking water since 1989.

In the second round of testing, 23 samples were collected from locations on the LEHR site and nearby surrounding private property. Duplicate samples were taken at the locations where tritium had been identified in the first round of testing. (Two spots on private property and one on the LEHR site). The state Department of Health Services analyzed the extra samples, and the university's consultant handled samples from all the locations.

With the exception of the tritium, the second round of results was similar to those in the first round of testing, with findings of trace levels of some organic chemicals and chromium below drinking water standards and one sample off the LEHR site with nitrate above drinking water standards. The latest testing confirmed the presence of tritium in groundwater on the LEHR site.

According to Ed Bailey, head of the radiological health branch of the state Department of Health Services, the state found no tritium above natural background levels in the samples state workers tested.

-kw-

DAMES & MOORE A PROFESSIONAL LIMITED PARTNERSHIP
8801 FOLSOM BLVD., SUITE 200, SACRAMENTO, CALIFORNIA 95826
(916) 387-8800 FAX NO. (916) 387-0802

November 14, 1991

University of California
Office of Environmental Health and Safety
Davis, CA 95616

Attention: Ms. Carolyn Owen

RE: Results of Rerun
Analysis for Carbon-14

Dear Ms. Owen:

The result of a rerun analysis of a groundwater sample collected during second-round CPT/Hydropunch investigation is presented below. The sample that was analyzed was HP-37-71 which initially had a reported Carbon-14 result of 545 +/- 334 picoCuries per liter (pCi/l).

Reanalysis of this sample following a bicarbonate precipitation preparation technique yielded a result of less than the detection limit of 500 pCi/l. The bicarbonate precipitation technique is a more sensitive analysis than that used initially. If you have any questions, please call me at (916) 387-7530.

Sincerely,

DAMES & MOORE

Jim Brake
Project Manager

UC DAVIS
NEWS

January 24, 1992
Contact: Roger Liddle
(510) 273-6251
or Salem Attiga
(916) 752-5459
or Karen Watson
(916) 752-9842

EDITOR'S NOTE: Reporters interested in filming the loading of the truck are welcome to observe the operations Tuesday, Jan. 28, at 2 p.m. Please call 752-9842 to make arrangements.

DISPOSAL OF LEHR SLUDGE TO BEGIN

DAVIS, Calif. — The treatment and packaging of approximately 34,000 gallons of low-level radioactive sludge and water stored at a research facility one mile south of the main University of California, Davis, campus is nearly complete, and shipment of the material is scheduled to begin the week of Jan. 27.

The disposal of the waste — expected to take place in two stages — marks a major step in the environmental assessment and cleanup of the former Laboratory for Energy-Related Health Research (LEHR) site by the U.S. Department of Energy and UC Davis.

During the weeks of Jan. 27 and Feb. 3, a total of 480 55-gallon drums filled with the solidified waste will be transported to the DOE low-level radioactive waste disposal site in Hanford, Wash. An additional 300 drums and two, 200-cubic-foot steel cylinders (used in the treatment process) are scheduled for shipment in mid-February.

The Missouri-based, DOE-contractor Tri-State Motor Transit has been hired to transport the drums by truck, following all state and federal environmental and safety guidelines.

The sludge and water are the remaining byproducts of two specially designed waste-processing systems built at LEHR to handle the low-level radioactive wastes of research animals used in studies of the health effects of exposure to radiation. The 33-year project, which involved mostly dogs, was one of several similar projects supported by DOE at various U.S. research institutions.

During the years of active DOE research at the site (the waste systems were last used in 1986), the sludge generated by the waste-processing systems was removed periodically from underground storage tanks when necessary and shipped to a licensed radioactive waste site. The entire disposal operation will clear the tanks of what remained. The emptied tanks will be decontaminated if necessary at a later stage in the project.

-more-

2-2-2 Sludge Disposal

The concentration of radioactivity in the sludge and water is very low. It consists mostly of about 200 millicuries of strontium 90 and about 4 millicuries of radium 226.

Treatment and packaging of the sludge began in late September, when the South Carolina-based DOE-contractor Chem-Nuclear Environmental Services Inc. set up operations along the western edge of the 15-acre LEHR site.

The estimated cost of treatment, packaging, shipping and disposal of the waste is $1.2 million, which is being funded by DOE.

-kw-

LEHR

Department of Energy
San Francisco Field Office
1333 Broadway
Oakland, California 94612

July 28, 1992

Dear Neighbor,

The Department of Energy has prepared a draft environmental assessment (EA) covering the next phase of its cleanup operations at our former site on the University of California/Davis campus. We are providing you with a copy of this document and would like to invite you to attend our next update meeting, which we are co-sponsoring with the University, on Thursday night, August 13 at 6:00 p.m.. It will be held in the Cabernet Room of the Silo on Hutchison Drive across from Haring Hall on the campus.

As you can tell from the document, the next cleanup phase at the 15-acre Laboratory for Energy-Related Health Research (LEHR) site focuses on four buildings: Animal Hospital-1, Animal Hospital-2, the cobalt-60 building and a specimen storage facility. In addition, this fall we plan to remove the cobalt-60 irradiator and, by 1994, a contaminated tank trailer containing 250 gallons of low-level radioactive liquid. Following successful decontamination procedures, our intent is to release these buildings to the University for their use as research laboratories.

Staff from both DOE and UC/Davis will be available at the meeting to discuss this assessment as well as progress to date on our cleanup activities. I would like to urge you to attend and will look forward to seeing you there.

Sincerely,

Roger H. Liddle
LEHR Project Manager
Environmental Restoration &
Waste Management Division

Attachment:
As stated

UC DAVIS NEWS

July 27, 1992
Contact: Roger Liddle, DOE
(510) 273-6251
or Karen Watson, News Service
(916) 752-9842

Draft environmental assessment for next phase released

UPDATE MEETING SCHEDULED FOR LEHR SITE CLEANUP

DAVIS, Calif. — Recent cleanup activities and environmental testing as well as a draft environmental assessment for the next cleanup phase at a former low-level radiation research facility a mile south of the main University of California, Davis, campus will be discussed at a public meeting Thursday, Aug. 13.

The update meeting is sponsored jointly by the U.S. Department of Energy and UC Davis. It will begin at 6 p.m. in the Cabernet Room of the Silo, on Hutchison Drive across from Haring Hall. Suggested parking is in lot 43.

Comments and questions from members of the public are welcome.

DOE has completed several stages of a five-year cleanup plan for the former DOE-funded Laboratory for Energy-Related Health Research (LEHR) since releasing the plan in 1990. These include the removal and disposal of the remaining radioactive sewage byproducts and biological remains of research animals to a licensed site in the state of Washington. DOE also has been investigating soil and groundwater contamination together with UC Davis, which has a leaking inactive campus sanitary landfill on the LEHR site.

The draft environmental assessment, released this week by DOE, outlines steps for the next major phase of cleanup operations at the 15-acre site, where for more than 30 years research animals were used to study the long-term health effects of exposure to low-level radiation.

Expected to begin in late August, this next phase focuses primarily on four buildings: Animal Hospital-1, Animal Hospital-2, the cobalt-60 building and a specimen storage facility. Most of the radioactive contamination has been identified in the buildings' plumbing, cages, in spots on walls and floors and in a specialized air filtering system.

In addition, DOE plans this fall to remove a cobalt-60 irradiator used to study radiation-induced leukemia, and by 1994 remove a contaminated tank trailer containing approximately 250 gallons of low-level radioactive liquid.

After reviewing the environmental assessment for this next cleanup phase — required

-more-

under the National Environmental Policy Act (NEPA) — DOE officials in Washington, D.C., have made a preliminary determination that the proposed cleanup in the next phase would not pose any significant environmental impacts as described by the federal guidelines in NEPA.

Copies of the draft EA, along with other reports and information about the cleanup project at LEHR, are available at the reserve desk of Shields Library on campus and the reference desk of the public library in the city of Davis. Copies also will be available at the public meeting.

-kw-

U.S. DEPARTMENT OF ENERGY

UNIVERSITY OF CALIFORNIA, DAVIS

LEHR SLUDGE DISPOSAL TO BEGIN

An Update

WHAT:

Approximately 34,000 gallons of low-level radioactive sludge and water which has been pumped from underground storage tanks, treated and packaged, is being shipped from the former Laboratory for Energy-Related Health Research (LEHR) site to a disposal site in Hanford, Washington. Disposal of this material, which will take place in two stages, is part of ongoing environmental assessment and cleanup activities at the former LEHR site, and is being undertaken by the U.S. Department of Energy and UC Davis.

LOCATION:

Located roughly a mile south of the main UC Davis campus on Old Davis Road, the former LEHR site occupies 15 acres surrounded by scattered campus research facilities and private farms. The sludge and water scheduled for disposal comes from 12 underground concrete tanks along the western section of the site (see map on back).

SLUDGE HISTORY:

The sludge and water were the remaining byproducts from two specially designed waste-processing systems built at LEHR. These systems handled the low-level radioactive waste of research animals used to study the health effects of exposure to low-level radiation. Certain animals involved in the study, mostly beagles, were fed or injected with varying doses of strontium-90 and radium-226. Using the special systems, the wastes were collected and processed to remove the majority of radioactive contamination. Throughout the years of active DOE research at the site (the waste systems were last used in 1986), sludge was periodically removed from the tanks and shipped to a licensed low-level radioactive waste site. This disposal operation will complete the disposal of the sludge accumulated during the last few years of the study.

PROCESS:

Since September 1991, a contractor hired by the U.S. Department of Energy (Chem-Nuclear Environmental Services, Inc., based in South Carolina) has been preparing the sludge for disposal. After removal from the underground storage tanks, the sludge and water is mixed with non-hazardous fly ash and magnesium oxide, and solidified in 55-gallon drums. The solidified material in the drums, which contain about 200 millicuries total, are stored in a secured building on the LEHR site. A total of 480 drums are ready for shipment and will be transported during the weeks of January 27 and February 5 to the DOE low-level radioactive waste disposal site in Hanford, Washington. An additional 300 drums and two 200-cubic foot steel cylindrical containers will be scheduled for shipment in mid-February. All packaging and transportation will adhere to U.S. Department of Transportation regulations. The emptied underground tanks at the LEHR site will be decontaminated at a later stage in the project.

TRANSPORTATION:

A licensed and experienced transportation contractor, Tri-State Motor Transit of Missouri, has been contracted to handle the transport of the drums. The planned schedule specifies that one truck per day for eight days will leave the LEHR work site. Each truck will hold 60 drums. Shipments will leave the site each afternoon. The trip to Hanford will take 2 days. All required transport permits have been obtained. The route the trucks will take is Route 113 to Interstate 5, the primary transportation route through California. During the second transport phase, the remaining 200 drums and two steel containers will be removed from LEHR and transported to the DOE Hanford site for disposal. All sludge processing work, transportation, and equipment removal is expected to be complete by mid-March.

1/16/92

WHERE DO I GET MORE INFORMATION?

To get additional information, please:

CALL:

LEHR
Information Line
(916) 752-8351

Roger Liddle/Salem Attiga
DOE Project Manager
(916) 752-5459

OR

WRITE:

LEHR Cleanup Project
Old Davis Road
Mail Stop: ITEH
Davis, CA 95616

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(916) 756-2332

LEHR Cleanup Project
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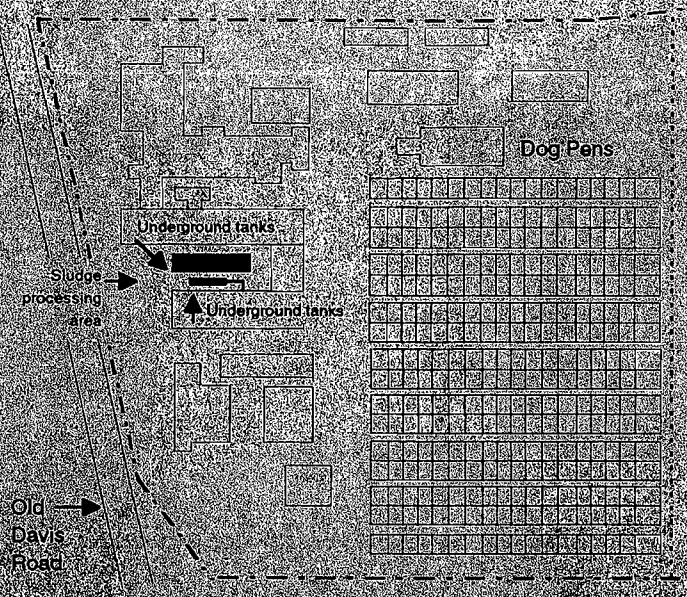
Davis, California 95616

LEHR SITE (Western Section)



The LEHR Site is approximately one mile south of the main UC Davis campus

Decontamination and Decommissioning of LEHR Animal Hospitals

OVERVIEW

In October 1993, the U.S. Department of Energy completed the Decontamination and Decommissioning (D&D) of two Animal Hospital buildings (AH-1 and AH-2) at the former Laboratory for Energy-related Health Research (LEHR) site on the UC Davis campus. Research was conducted in the Animal Hospitals from 1958 through 1989, focusing on the long-term health effects of low-level radiation exposure in beagles. The AH-1 and AH-2 D&D effort was a major component of the LEHR Environmental Restoration Project, which continues at the site. Throughout the D&D, project goals have focused on restoring the buildings to a condition that will permit transfer of ownership to UC Davis. A final verification that AH-1 and AH-2 are free of contamination will be performed by an independent contractor. This will allow release of the buildings to UC Davis for unrestricted use.

LOCATION

Located approximately one mile south of the main UC Davis campus on Old Davis Road, the former LEHR site occupies 15 acres surrounded by scattered campus research facilities and private farms. AH-1 and AH-2 are near the western site boundary (see map on back).

PROCESS

The focus of the Animal Hospital D&D was the elimination of any remnants of low-level radiation from the buildings. This involved removal of animal cages, plumbing and heating systems, ventilation and air-conditioning (HVAC), building fixtures, and walk-in freezers. Materials containing asbestos in floor coverings and insulation were also removed as needed to provide access to the ventilation systems and to the drainage systems (including pipes below the floor surface).

SAFETY AND ENVIRONMENTAL PROTECTION

Prior to the start of this activity, an Environmental Assessment was prepared and approved in 1992. Potential impacts to the public and the environment were evaluated, and a "Finding of No Significant Impact" (FONSI) was issued. Federal and state safety guidelines were clearly followed during the building restoration. High standards of safety and worker protection resulted in an excellent safety record.

Care was taken to assure that contamination within the buildings was successfully contained during the removal operations. The buildings were isolated from the external environment with engineering controls, such as High Efficiency Particulate Air (HEPA) filters, sealed plastic tentings both for inner building surfaces and for specific work areas, negative pressurization of work areas, controlled access to buildings, and exit survey checkpoints. To assess the effectiveness of controls, routine breathing zone air sampling and ventilation stack sampling were conducted throughout D&D work.

HAZARDOUS WASTE MINIMIZATION

Hazardous waste minimization during the AH-1 and AH-2 D&D was considered a success in both cost reduction and preservation of valuable landfill space. A significant decrease in volume of hazardous waste was achieved with implementation of an effective waste minimization program. Materials, including fixtures and cage rubble, were surveyed for contamination after removal. This facilitated segregation of clean vs. contaminated waste and permitted recycling of uncontaminated materials. In addition, a shredder and compactor were used to reduce the volume of hazardous waste by nearly 50%. These efforts resulted in a project savings of $870,000 in waste disposal costs.

WHERE DO I GET MORE INFORMATION?

To get additional information, please:

CALL:

LEHR
Information Line
(916) 752-8351

Roger Liddle/Salem Attiga
DOE Project Manager
(916) 752-5459

OR

WRITE:

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Old Davis Road
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Davis, CA 95616

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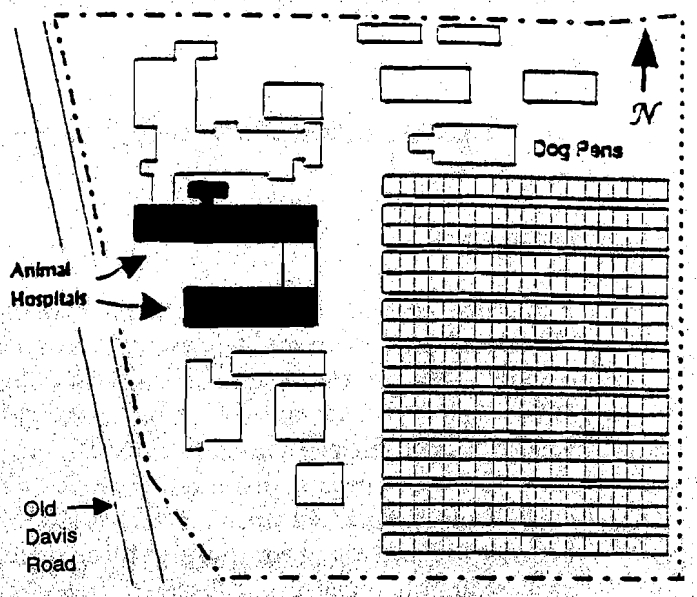

The LEHR Site is approximately one mile south of the main UC Davis campus.

TO: HEDY FICHLIN, EPA
SUSAN TIMM, AWQCB
DUNCAN AUSTIN, DTSC
JULIE McNEAL, UCO
BRIAN OATMAN, UCO
SALEM AHIGA, SAA
MIKE DAESEN, WEISS
JOE NOLAN, DPM

DON WILLIAMS

LEHR RECEIVED
JUL 15 1996

FYI,
THIS WAS IN THE 7/10/96 DAVIS ENTERPRISE

Jim L. 7/16

al or Greater Davis, a local service organization, will hold its r... efit golf ... day, Aug ... Municip ... Net p ... tournam ... Soroptim ... and/or s ... have a d ... local co ... ients ha ... House a ... pital. ... Busin ... support ... help ma ... a financ ... interest ... sponsor, ... more in ... Judi Ee ...

further police investigation. Bross' sons were placed in cus-

Leisure Industries, ... Dole's current ...

announced later this month.

PUBLIC NOTICE OF REMOVAL ACTION AT LABORATORY FOR ENERGY-RELATED HEALTH RESEARCH UNIVERSITY OF CALIFORNIA, DAVIS, CA

The Department of Energy (DOE) announces that a removal action will be performed at the Laboratory for Energy-Related Health Research (LEHR) starting in mid to late August. The LEHR site is approximately one-half mile south of the main UC Davis campus and approximately three-quarters of a mile south of Interstate 80 on County Road 79 (Old Davis Road). The removal will consist of the excavation, removal, packaging and off-site shipment of approximately 55 cubic yards of soil contaminated with low-level radioactive waste from a small on-site trench.

The on-site waste subject to this Removal Action consists of buried gravel and labware including syringes, small bottles, and vials. Laboratory analysis results indicated that the waste contains elevated levels of Radium-226 and Strontium-90. This soil that is being removed is in small areas in a former 40 ft by 12 ft by 10 ft trench known as the DOE Disposal Box.

More detailed information on this removal action is contained in an Action Memorandum in the LEHR Administrative Record at the Yolo County Library, Davis Branch, located at 315 E. 14th, Davis California. For more information call Jim Littlejohn at DOE (510) 637-1526.

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United States Environmental Protection Agency

Office of Solid Waste and Emergency Response (OS-510W)

EPA520-F-92-001
August 1992

EPA

Superfund Information Repositories and Administrative Records: Introduction for Librarians

What is Superfund?

In 1980, Congress passed the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund). This Act authorized the U.S. Environmental Protection Agency (EPA) and the States to respond to threats of uncontrolled hazardous waste. CERCLA also established a Trust Fund which EPA could use in emergency situations and at sites where long term remedies are required. The Superfund process involves site investigations, studies of the feasibility of different technologies, and actual cleanups. Using enforcement authorities, EPA can compel potentially responsible parties (PRPs) to clean up sites or pay for the costs. When PRPs are unwilling or unable to conduct or pay for the cleanup, money from the Trust Fund may be used.

INTRODUCTION

Members of the public play a central role in the Superfund program. EPA considers public input when making site cleanup decisions, particularly the Agency's selection of the response action for the site. This fact sheet discusses two features of EPA's Superfund Community Relations Program: the information repository and the administrative record.

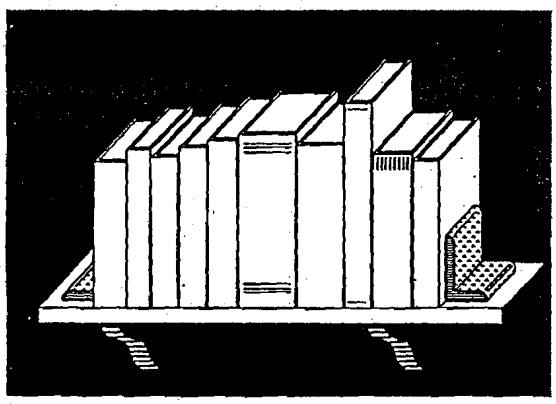
1. What is an information repository?

An information repository is where current information, technical reports, and reference materials regarding a Superfund site are stored. EPA or the State establishes the repository in the community at the beginning of site studies to provide the public with easily-accessible information. Repositories are established for all sites where cleanup activities are expected to last for more than 45 days. Typical repository locations include public libraries or municipal offices.

2. What is an administrative record?

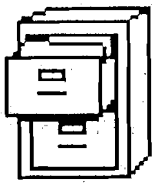
The administrative record is a specialized file containing the information which was used to select the remedy at a Superfund site. Administrative records contain technical reports specific to each Superfund site, and key technical and administrative guidance for cleanups. An administrative record must be available at every site to encourage public participation in the remedy selection process. EPA maintains an identical copy of the administrative record at the EPA Regional Office or a State office.

Although agencies may establish more than one information repository in a community, EPA or the State typically establishes only one local administrative record. Since the information repository is opened first, quite often the administrative record will be at the same location so that the public can access both.

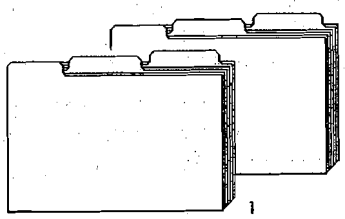


3. When does EPA establish the information repository?

EPA prefers to establish information repositories as early in the site cleanup process as possible and before technical activity begins. The earlier the repository is



established, the greater the opportunity for the public to access information on the activities at the site. There will be some occasions, however, when the governmental agencies must move quickly to address site conditions. Setting up the information repository may follow those technical activities.



4. What does the information repository contain?

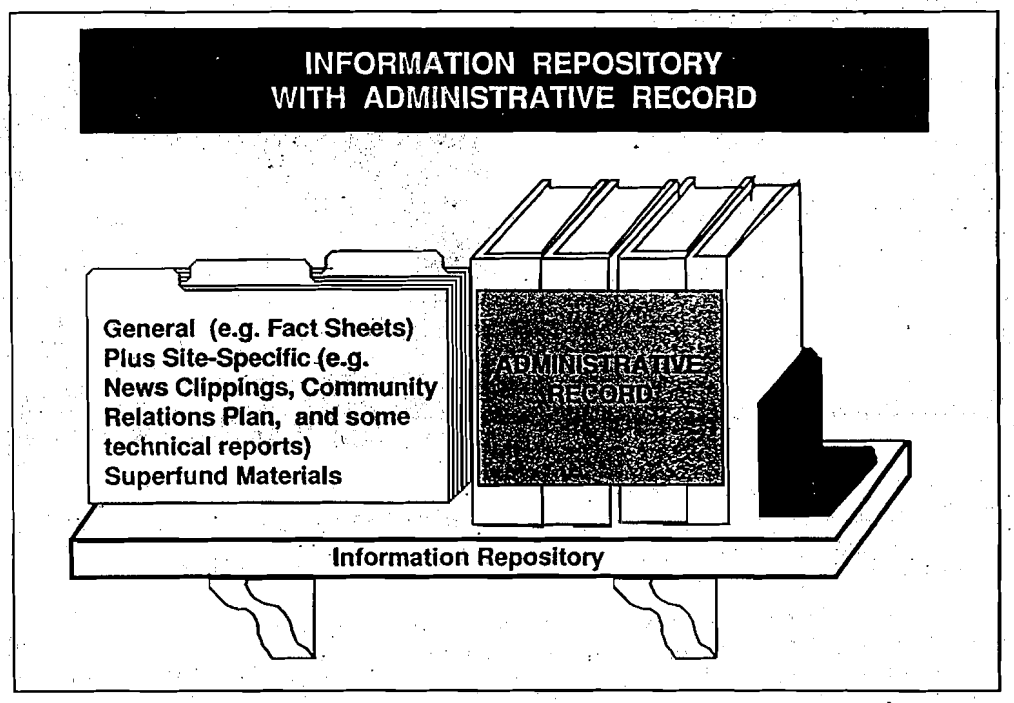
The repository contains general information about EPA, Superfund, and the enforcement program. In addition, EPA includes fact sheets, maps and other materials about a particular Superfund site in the repository and the Community Relations Coordinator (CRC) submits items of interest, such as newspaper clippings about the site and community reactions. A description of common documents can be found on pages 5 through 8 of this fact sheet. In many situations, the repository contains the administrative record and its documents as they are being compiled. Administrative record materials need to be clearly marked.

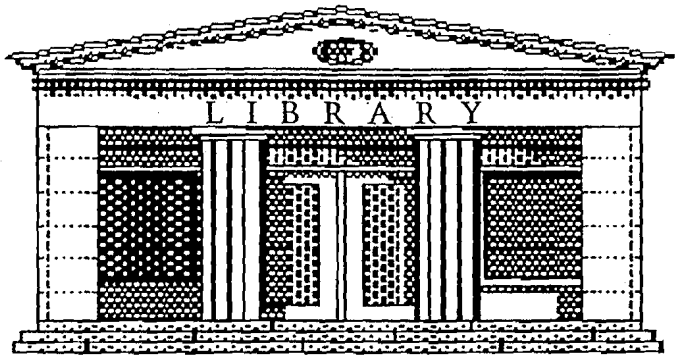
5. Why should I be an information repository librarian?

The information repository is one of the best ways to involve the public in the site cleanup process. Because you already hold a position as an information source in the community, you are especially qualified to keep information for the public. Your service in helping EPA maintain the information repository is invaluable in facilitating meaningful public involvement in the site cleanup.

6. Where is the information repository located?

Information repositories are usually located near the site in a public building, such as a public library or school. The primary consideration in choosing the location is public accessibility. Whenever possible, repositories are located in buildings with photocopying facilities, and are accessible for people with physical handicaps. In some cases, two repositories are





Community libraries or other public buildings may house the information repository, the administrative record, or both. Librarians will choose among these options according to the best fit for their facility space and other factors.

established for a site. A public library branch near the site, for example, may be an appropriate location for the repository. In addition, the main library, which is typically located in the center of the community and therefore more accessible to a larger number of citizens, would be a second appropriate location. The actual repository may be contained on bookshelves, in file cabinets, or in notebooks.

7. From whom do I get information to put into the information repository?

Most information will be provided by the EPA or the State CRC. You, as the repository librarian, and other members of the community, may also identify relevant newspaper clippings or local publications for inclusion in the repository. You should confirm the appropriateness of all materials with the CRC before actually placing them in the repository. The administrative record has its own index; the Administrative Record Coordinator (ARC) will supply all materials.

8. How do I maintain the repository?

Repository maintenance consists of the same routine you use to organize files or shelves for the public. It also involves adding new information from EPA or the State. Librarians may find it helpful to keep a chronological log of all information EPA or the State sends. The agencies, however, and not local librarians, bear ultimate responsibility and liability for the contents of nformation repositories and administrative records.

9. How is the information repository organized?

The repository is organized by the CRC, depending on the information available. Subject categories include, for example: general Superfund information, site sampling data and analytical results, legal documents relating to the site, public involvement records, and information on the selected cleanup technology.

If the administrative record is included with the information repository, documents should be marked as such and kept separate from the general materials of the repository. During periods of high interest in the site, EPA will readily furnish you with extra copies of requested administrative record documents.

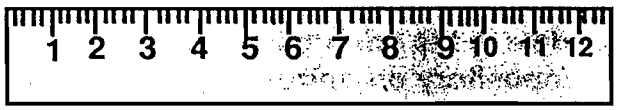
10. What time commitment is involved in maintaining the information repository/ administrative record?

Depending upon the reference system currently in place, it may take a few to several hours to set up the space and tracking system for these files. Many libraries already serve as repositories for state or federal agency documents, so adding another repository may be a familiar exercise. The time commitment involved in receiving, logging in and referring library users to the documents also would vary, depending on the level of community interest in the site and on phases of site activity. Typically, ongoing maintenance of the files involves a few hours per month.

The overall time-frame for information repositories can be several years. But during that time, EPA will assist you with deleting old files so that adding site documents does not burden your available space.

11. What space commitment is involved in maintaining the information repository/administrative record?

As with time, space required for the files can vary, according to the particular site circumstances or complexities. Seldom, however, does the space requirement exceed that of two file drawers or a standard library shelf. It is best to discuss this question with the CRC, who may be able to predict the amount of space you may need.



12. May I add information to the repository?

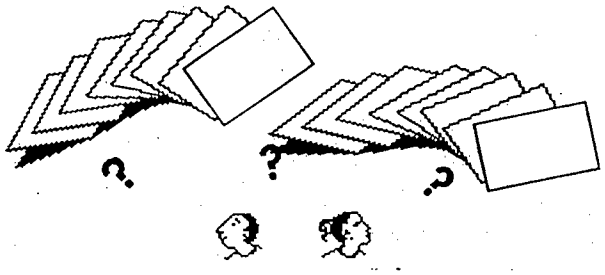
The information repository, yes; the administrative record, no. As indicated earlier, you may be in the best position to identify potentially useful information for the repository. EPA encourages and appreciates any ideas you may have for enhancing the effectiveness of the information repository. Because the administrative record, however, provides documentation for the specific remedy selected at the site, only EPA or the State may add or delete information to this file.

13. May library users remove documents from the repository?

No. It is important that the information in the repository remain accessible to all members of the community who may want to use it. Therefore, individuals should not remove documents from the repository for their personal use. In some cases, EPA will provide you with extra copies of certain documents, such as fact sheets, which members of the public may take with them. Generally, however, persons wanting their own copy of the information must either make a copy of the document (provided you have a copying machine) or request a copy from EPA. If you notice that documents are missing, contact your CRC or ARC.

STANDARD INFORMATION REPOSITORY DOCUMENTS

Although the contents of each information repository vary depending on the site and phase of site cleanup, certain documents are found in most repositories. This section briefly describes some but certainly not all of the documents that could be included.



General Superfund Information

Most information repositories contain introductory background information on the Superfund program. This information may include fact sheets and brochures on various aspects of the Superfund program and the cleanup process. General program information provides a context within which the public may consider site-specific information and explains the overall Superfund goals.

Copies of CERCLA and RCRA

Information repositories typically contain copies of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and the Resource Conservation and Recovery Act (RCRA). CERCLA provides the statutory authority for the Superfund cleanup and enforcement programs. RCRA is a comprehensive waste management law. CERCLA and RCRA are complementary laws that establish waste management and cleanup programs for past and present disposal practices. These statutes are generally included in repositories to provide the public with a framework for understanding the activities at the site.

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP)

The NCP is the central regulation of Superfund. By setting forth guidelines and specific procedures that must be followed, it acts as a blueprint for conducting Superfund cleanups.

Hazard Ranking System (HRS) Information

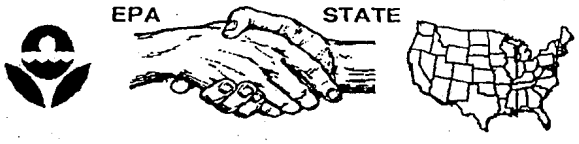
The Hazard Ranking System (HRS) is a method used by EPA to evaluate potential risks to health and the environment by the release of hazardous substances at a site. The HRS produces a site score (a number between 1 and 100) which is the primary factor in deciding if a hazardous waste site should be placed on the National Priorities List (NPL). The NPL is a list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term cleanup, using money from the Superfund. HRS information includes site investigation reports and site soil, water, and air sampling data and analysis.

Press Releases

Press releases that are relevant to the site or the Superfund Program are typically included in information repositories. Press releases provide a record of activity at the site, and may document community concerns and EPA or State responses.

Cooperative Agreement

In some cases, the State may be conducting cleanup work at the site. When the State assumes lead responsibility for cleaning up a Superfund site, the State's responsibilities are set forth in a Cooperative Agreement with EPA.



Technical Assistance Grants (TAG) Brochure and Citizens Handbook

The TAG program is designed to provide grants of up to $50,000 to eligible groups living near Superfund sites. The recipient of a TAG award may hire a Technical Advisor, such as an epidemiologist, toxicologist, or hydrologist. The Advisor interprets technical data on the nature of hazards at the site and the recommended alternatives for cleanup. Only one TAG is available per Superfund site. A brochure briefly outlining the TAG program and announcing the availability of the grant is included in the repository. Detailed information about the program and information on how to apply for a TAG are contained in the Citizens' Handbook. The Handbook contains detailed information on the TAG program requirements and instructions on organizing a community to apply for a grant. For a copy of the Handbook, or additional information about the program, contact the CRC.

STANDARD ADMINISTRATIVE RECORD DOCUMENTS

The Administrative Record evolves over time, and documents are added corresponding to site activities. These documents will be used as the basis for selecting the removal action or the site remedy. Until the final decision document is signed, there is no complete administrative record for a site. The "administrative record file" refers to the documents as they are being compiled. The record file must be made available at or near the site except for emergency removals that last fewer than 30 days. This section briefly describes some, but certainly not all the documents that could be included.

Community Relations Plan (CRP)

The Community Relations Plan (CRP) is a document prepared by EPA or the state, which describes the site background; identifies community concerns regarding the site; sets forth a strategy for addressing those concerns; and identifies opportunities for public involvement regarding the sites. The CRP also contains names and addresses of EPA and State contacts. The key planning information in the CRP is derived from interviews with members of the local community. CRPs are prepared for all Superfund actions lasting longer than 120 days.

Administrative Order on Consent (AOC)

An AOC is a legal agreement between EPA and Potentially Responsible Parties (PRPs) in which the PRPs agree to perform or pay for some or all of the cost of a removal or an RI/FS. AOCs are issued by EPA, and may also be signed by the State.

Engineering Evaluation/Cost Analysis (EE/CA)

If a period of at least six months exists before a removal begins, an EE/CA will be done. The EE/CA analyzes removal alternatives and their costs for a site.

Action Memo

An Action Memo provides a concise written record of the decision selecting a removal action. It describes the site's history, current activities, and health and environmental threats. It outlines the proposed actions and costs, and documents approval of the removal. An addendum to the Action Memo sets forth the enforcement strategy. Because Action Memos are the primary decision documents to select and authorize removal actions, they are the critical component of the administrative record. When an Action Memo is signed, the administrative record for a removal closes.

Remedial Investigation/Feasibility Study (RI/FS) Work Plan

The RI/FS is a series of investigative and analytical studies that are usually performed at the same time to:

- Gather the data necessary to determine the type and extent of contamination at the site
- Establish goals for cleaning up the site
- Identify and screen cleanup alternatives
- Analyze the technology and costs of the cleanup alternatives.

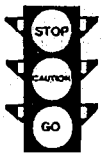
The RI/FS work plan sets forth detailed procedures for conducting the RI/FS, including how and where sampling will be conducted, treatment alternatives to be explored, and methodologies for conducting site studies.

Health Assessment

The health assessment is a study required by CERCLA that determines the potential risks to human health posed by the site. Health assessments are conducted by personnel from the Agency for Toxic Substances and Disease Registry (ATSDR). They review environmental sampling data and other site-related information. The health assessment determines whether any current or potential health threat exists. It does this by evaluating the completeness of the information and considering the types of contamination present, pathways the contamination might take, and the extent to which the site area is used by humans and animals.

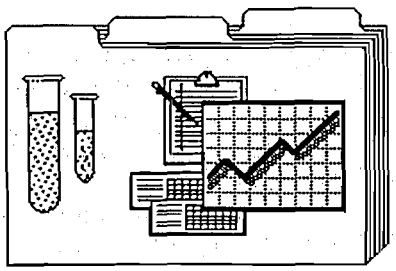
Risk Assessment

Risk assessments are evaluations performed as part of the RI/FS to estimate the damage a Superfund site could cause to health or the environment. As such, risk assessments help determine the levels of chemicals that can remain on the site, as well as the need for action. They also provide a basis for comparing different cleanup methods.



Site Sampling Data and Results

Soil, air, and water at Superfund sites may be sampled and tested for contamination at various stages of the cleanup process. Information on sampling activity is typically included in the administrative record file and enables the public to better understand the nature and



extent of contamination at the site. These reports are often highly technical; other documents such as the RI and FS reports generally will summarize the information and provide an analysis of the results.

Remedial Investigation (RI) Report

The RI report includes information on physical and chemical monitoring studies, the nature and extent of contamination, potential routes of exposure, and a baseline assessment of the potential risks to human health posed by the site. The RI report generally begins with a brief synopsis of the whole report.

Feasibility Study (FS) Report

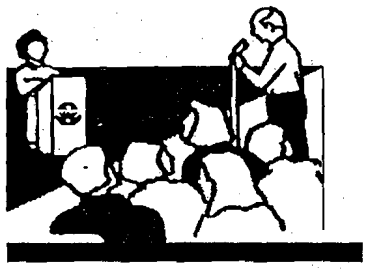
The FS report contains a detailed analysis of the feasible cleanup alternatives, and supports the selection of the appropriate cleanup alternative. The FS report evaluates each of the proposed cleanup alternatives against criteria such as short and long term effectiveness, implementability, cost, compliance with State cleanup requirements, and the effectiveness of the alternative in maintaining protection of human health and the environment. The FS report also compares the alternatives being considered.

Proposed Remedial Action Plan

The Proposed Remedial Action Plan (Proposed Plan) describes all the cleanup technologies considered for the site by EPA and identifies the alternative(s) proposed by EPA to be the best cleanup method. The Proposed Plan provides the public with a comparison of cleanup alternatives considered feasible by EPA.

Public Meeting Transcript and Summaries

CERCLA requires EPA to provide the opportunity for a public meeting to discuss the site cleanup plan, and to make a transcript of the meeting available to the public. At sites where there is a high level of community interest, public meetings may be held more frequently to provide the community and EPA with the opportunity to exchange information on the site. For these meetings, when no transcript of the meeting is taken, a meeting summary will be placed in the information repository. Public meetings also provide the opportunity for members of the community to express their concerns regarding the site, and for EPA to respond to those concerns. Transcripts of public meetings are included in the information repository as a means of documenting public involvement in the site cleanup process.



Responsiveness Summary

Responsiveness summaries outline oral and written public comments received by EPA during public comment periods on key documents, such as the Proposed Plan, and contain EPA's response to these comments. As such, they document community concerns regarding the cleanup for EPA decision-makers and are a key part of the Agency's record of decision.

Record of Decision (ROD)

The ROD is EPA's official decision document that explains which cleanup alternatives will be used at Superfund sites. The ROD is based on information and technical analysis generated during the RI/FS. The ROD also takes into consideration public comments and community concerns.

POST-DECISION DOCUMENTS

The administrative record normally closes when the ROD is signed. On occasion, new information is received on site conditions or the technology selected, which requires the ROD to be amended or an explanation of significant differences to be written. These materials may be added to the administrative record file and kept in a post-decisional file.

More documents pertaining to the site will be generated after the close of the administrative record. The following documents will be part of the information repository:

Remedial Design (RD)

The RD specifies detailed, site-specific procedures and schedules for conducting the actual remedial work at the site. The RD may be prepared by EPA, the State, or the PRPs in cases where PRPs are conducting site activities. The RD provides the public with information on activities to be conducted at the site and the schedule for completion of those activities. After completion of the final engineering design, a fact sheet will be placed in the information repository. A public briefing will be scheduled prior to the initiation of the remedial action.

Remedial Action (RA)

The RA is the actual construction that follows the remedial design of the selected cleanup alternative at a Superfund site.

Consent Decree (CD)

A CD is a legal agreement between EPA, the PRPs, and sometimes the State, whereby the PRPs consent to perform or pay for all or part of the RD/RA. The Consent Decree describes the actions for which PRPs are responsible and is subject to a public comment period. Consent Decrees are approved and issued by U.S. District Court judges.

Unilateral Administrative Order (UAO)

A UAO is a legal document issued by EPA directing PRPs to perform the RD/RA. It sets forth the liability of the parties for the cleanup, describes actions to be taken, and subjects the recipients to penalties and damages for noncompliance. UAOs may be enforced in court.

EPA

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Washington, DC 20460

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FACT SHEET

Frontier Fertilizer Superfund Site
Davis, California
Pesticide Pond Soil Removal Action Administrative Record

The "administrative record" is the collection of documents which form the basis for an agency's decision, in this case the selection of a response action at a Superfund site. Under Section 113(k) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), EPA is required to establish an administrative record for every Superfund response action and to make a copy of the administrative record available at or near the site.

The administrative record must be reasonably available for public review during normal business hours. It should be treated as a non-circulating reference document, in order to allow the public greater access to the record and also to minimize the risk of loss or damage. Individuals may copy any documents contained in the administrative record, according to the copying procedures at the local repository.

The administrative record will be maintained at the local repository until further notice. Periodically EPA may send supplements and indexes directly to the local repository. These supplements must be placed with the initial administrative record. Questions regarding the maintenance of the administrative record should be directed to:

Elaine Chan
Administrative Record Coordinator
U.S. Environmental Protection Agency
75 Hawthorne Street (H-7-4)
San Francisco, CA 94105
(415) 744-2380

Please address questions on this administrative record to:

Michael Bellot
Remedial Project Manager
U.S. EPA (H-7-2)
75 Hawthorne Street
San Francisco, CA 94105
(415) 744-2364

or:

Angeles Herrera
Community Relations
Coordinator
U.S. EPA (H-1-1)
75 Hawthorne Street
San Francisco, CA 94105
(415) 744-2183 or
1-800-231-3075

Department of Energy
San Francisco Field Office
1333 Broadway
Oakland, California 94612

December 21, 1994

Sara Fergusen
Davis/Yolo County Library
315 E. 14th St.
Davis, CA 93063

Dear Ms. Fergusen:

I have enclosed a copy of Baseline Environmental Management Report (BEMR) summaries for facilities under the U.S. Department of Energy Oakland Operations Office, including the Laboratory for Energy-related Health Research near Davis.

The summaries outline historic site missions; sources of contamination; assumptions on the future use of facilities and waste treatment, storage and disposal; restoration and waste management activities; and other issues. The Baseline Environmental Management Report is required by Congress as a means to improve performance in the Department of Energy's Environmental Management Program.

In order to provide the public with access to this information, please place the summaries in your reading room. They may be discarded at the end of April. Thank you for your assistance. If you have any questions, please call me at (510) 637-1809.

Sincerely,

David Christy
Community Relations Specialist

LAWRENCE BERKELEY LABORATORY

1. Historic Mission

The 134-acre Lawrence Berkeley Laboratory (LBL) site has been leased to the Department of Energy (DOE) by the University of California for a wide range of energy-related research activities including research in nuclear and high-energy physics, accelerator research and development, materials research, research in chemistry, geology, and molecular biology, and biomedical research. As part of LBL's energy research mission, the facility has developed and operated national experimental facilities including: three large accelerators — the Bevatron, the Super Heavy Ion Linear Accelerator (HILAC), and the 88-inch Cyclotron; several small accelerators; the National Center for Electron Microscopy; the Human Genome Center; a number of radiochemical laboratories; several large gamma irradiators; the National Tritium Labeling Facility; and the newly completed Advanced Light Source.

2. Sources of Contamination

Laboratory operations at LBL result in the generation of hazardous, low-level, radioactive waste (LLW) and mixed, low-level, radioactive waste (MLLW). The types of hazardous wastes handled at LBL include polychlorinated biphenyls (PCBs), corrosive liquids, organic solvents, heavy metals, water-reactive chemicals, oxidizing agents, flammable liquids, strong acids, and asbestos. Mixed radioactive waste streams include lab-packed liquids and solids with acids, alkalines, reactives, oxidizers, organic liquids, induced lead and mercury waste, scintillation fluids, and contaminated debris.

Past practices resulted in radioactive and hazardous soil and groundwater contamination. The predominant contaminants identified to date are solvents in groundwater. The potential contaminant sources identified to date are several sewer systems and aboveground and underground storage tanks. The current site-wide investigation is designed to determine the lateral and vertical extent of contamination at LBL by volatile organic compounds (VOCs), metals, and tritium. The results of past investigations indicate that contamination is restricted to localized areas near the source area, but this has yet to be confirmed. To date, five plumes of contaminated groundwater have been identified at LBL: solvent plumes south of Building 71, north of Building 7 (probably related to an abandoned sump), and east and south of Building 6; a tritium plume southeast of Building 75 (the National Tritium Labeling Facility); and a plume of petroleum hydrocarbons at the location of a former underground fuel tank south

of Building 7. Given that soil and groundwater contamination has not been fully characterized, the quantity and extent of potential contamination are presently unknown, and a site-wide public health and environmental risk assessment has yet to be performed.

3. Site Assumptions

Mission

- The current mission of LBL as a center for multidisciplinary research in the general sciences, energy sciences, and life sciences is assumed to be unchanged.

Future Use

- The future use of the facility is expected to be similar to the past and current use for laboratory research. In accordance with changing research requirements, some facilities may be decommissioned or converted for new missions. Given that the land occupied by LBL is owned by the University of California, the installation will be cleaned to the standards required for unrestricted use.

Treatment, Storage, and Disposal

- A new hazardous waste handling facility (HWHF) is currently under construction and is expected to be completed in FY1996. The existing HWHF is scheduled for RCRA closure by FY1997. Most of the wastewater generated by LBL environmental cleanup activities will be treated onsite. Hazardous waste generated from the wastewater treatment process will be removed from the site to a permitted disposal facility. Solid and other hazardous wastes generated at LBL will be shipped to a variety of permitted disposal, treatment, and recycling facilities.

- Induced metals and LLW will continue to be sorted at the HWHF and then shipped to DOE Hanford for disposal.

- Some treatment of Federal Facility Compliance Act (FFCA) mixed wastes will occur onsite with remaining wastes treated at other DOE facilities. Onsite neutralization of mixed-acid and mixed-base waste streams will occur at the HWHF prior to disposal at DOE Hanford. Onsite amalgamation of liquid-induced mercury will be the subject of a treatability study. Mixed reactives wastes will be sent to Oak Ridge National Laboratory for chemical oxidation treatment. All other mixed wastes will be sent to DOE Hanford for incineration, stabilization, and/or macroencapsulation.

- The small quantities of transuranic (TRU) waste generated will be stored at LBL along with accumulated TRU waste pending the opening of a long-term national storage facility.

4. Restoration Activities

The principle environmental concerns at LBL involve soil and groundwater contamination from past operations. Corrective action measures were initiated in compliance with a Regional Water Quality Control Board Order in October 1988, which focused on contamination detected in a network of hydraugers. LBL was issued a RCRA Part B permit for hazardous waste storage on May 4, 1993. The permit indicates the corrective actions required at LBL and is now the primary driver of the remedial actions. The California Department of Toxic Substances Control (DTSC) completed a RCRA facility assessment of LBL in November 1992 and required LBL to conduct RCRA facility investigations (RFIs) of several solid waste management units (SWMUs).

A total of 15 SWMUs are currently being investigated in a single RFI to determine the source and extent of soil and groundwater contamination. The RFI is being conducted using a phased approach with all RFI tasks scheduled for completion in FY 1997. A RCRA corrective measures study (CMS) will begin in FY 1996 and be completed in FY 1998. RCRA corrective measure designs will be finalized in FY 1999 and implemented in FY 2001.

RCRA closure of the existing HWHF is scheduled to commence in FY 1996 after the completion of the new HWHF, and closure is scheduled for completion in FY 1998. The intention is a one-time final closure of the HWHF with no post-closure care required because all waste, equipment, and structures and any contaminated soils will be removed. The current HWHF includes Buildings 75, 75A, and 69, the Corporation Yard, and the Building 77 coolant evaporator. It handles a variety of organic solvents, waste acids, oxidizers, corrosive liquids, waste oil, PCBs, asbestos, metal sludge, mercury waste, waste coolant, and contaminated soils. Contamination is considered to be restricted to the actual HWHF structures and the shallow subsurface soil in the immediate vicinity and is not expected to have impacted groundwater. In order to reduce the expense and health risk of moving wastes to the new HWHF, the remaining radioactive and mixed waste stored in the existing HWHF (estimated volume = 613 m^3) will be shipped off site in FY 1995 to the Hanford site or other DOE-approved facilities. Closure of the HWHF will generate approximately 10 m^3 of LLW in the form of concrete rubble and 40 m^3 of LLW contaminated soil. Rinsate from the closure of the HWHF will generate approximately 870 drums (181 m^3) of waste water. The closure hazardous waste will be disposed at offsite treatment, storage, and disposal (TSD) facilities.

Several interim actions have been taken to prevent migration of known contaminants at the site. These include extraction and treatment of groundwater at three locations, treatment of effluent from the hydraugers near Building 51 and excavation of contaminated soils in source areas. Future cleanup strategies are yet to be developed but may include groundwater extraction and treatment, soil gas extraction and treatment, and soil removal. Storage and disposal requirements for environmental-restoration-generated waste are yet to be determined and will depend on the results of the RFI and CMS studies and the types of remediation selected.

5. Waste Management Activities

Waste Management activities include the transport, limited treatment, and storage of hazardous, radioactive (including TRU), and mixed radioactive wastes. Current sources of these wastes include normal laboratory operations and existing restoration interim actions. Future sources include environmental restoration-generated waste from the closure of the existing HWHF and any remedial efforts. Waste management activities currently occur in Buildings 75, 75A, 69, the Corporation Yard, the Building 77 coolant evaporator, and adjacent storage yards. LBL operates under a RCRA Part B permit issued on May 4, 1993, which allows for the consolidation, neutralization, and solidification of mixed radioactive waste as well as the temporary storage of hazardous and radioactive wastes prior to disposal at approved offsite disposal facilities. A replacement HWHF is currently under construction for planned completion in FY 1996.

Key facility compliance actions concern air emissions, wastewater discharge, and sanitary sewer discharge. As of 1991, LBL was in compliance with the radiation dose limit of 10 rem per year to an offsite individual, which is set by the National Emissions Standard for Emissions of Radionuclides Other than Radon from Department of Energy Facilities (NESHAPS); however, LBL was found not in compliance with monitoring and quality assurance provisions of NESHAPS. EPA and DOE have negotiated a Federal Facility Compliance Agreement, which would bring LBL into full compliance with federal and state laws governing air emissions by FY 1995. LBL has an agreement in place with the East Bay Municipal Utility District (EBMUD) regarding wastewater discharge compliance. Quarterly inspections and sampling are being conducted by EBMUD with fees related to samples collected from the Building 25 and 77 waste treatment units and whole facility effluent. By FY 1995, LBL expects to meet all requirements of its sanitary sewer permit.

Near-term goals for waste management at LBL include monitoring or removal of inadequate underground storage tanks in FY 1995, full compliance with NESHAPS in FY 1995, completion of the new HWHF in FY 1996, and installation of deionization regeneration equipment in FY 1996. A further priority of the WM program at LBL is the waste minimization program which focuses on implementing recycling opportunities, toxicity reductions, materials substitution, and source process modifications.

Treatment

There is an onsite neutralization waste treatment unit at LBL, which is permitted under LBL's existing HWHF RCRA Part B permit. The permit allows for the storage of mixed radioactive waste streams in Building 75A-4 and treatment in Unit 131AFH. Onsite treatment of Federal Facility Compliance ACt (FFCA) mixed waste will consist of the neutralization of two MLLW streams (total estimated volume = 3.15 m^3) of lab-packed, flammable and nonflammable, acidic and alkaline solutions and solids with metals and radionuclides. These wastes will then sent to Hanford for disposal or treatment. The amalgamation of liquid-induced mercury (estimated volume = 0.11 m^3) on site will be the subject of a treatability study.

Water pumped from the site hydraugers is currently treated using an activated carbon system with the treated water being used to replace cooling-tower water per agreement between LBL, the California State Water Resources Control Board, and the EBMUD. On-site treatment of wastewater generated by LBL environmental cleanup activities will occur in the future. No other treatment of hazardous wastes occurs at the site, and none will occur in the future other than preprocessing or minimization to conform with waste storage and disposal requirements.

Storage

Wastes handled at LBL include a wide range of chemical substances originating from the many research and support facilities on site. Storage of most hazardous wastes is for less than 90 days. The RCRA Part B permit allows storage of some hazardous waste in designated areas up to one year. Storage of LLW and MLLW also occurs prior to shipment to DOE Hanford site.

Current annual generation estimates include 350,000 lb of hazardous wastes and approximately 36 m^3 of LLW. The volume of MLLW wastes stored as of mid 1994 was approximately 6 m^3. The projected generation of MLLW through 1997 is an additional 4 m^3. In addition, the total volume of

mixed waste potentially generated from environmental restoration is estimated at 1.6 m^3. TRU waste has been accumulating at LBL since the mid 1970s, and the inventory at LBL consisted of fewer than 10 55-gallon drums in 1993. Storage of TRU waste will continue pending the opening of a long-term national storage facility.

The existing HWHF is in several separate buildings, and, with completion of the new, improved HWHF in FY 1996, LBL will consolidate all waste handling and monitoring activities in the new facility with sufficient space for its waste-handling operations.

Disposal

Hazardous wastes from LBL are disposed at a variety of permitted disposal, treatment, and recycling facilities. In 1992, LBL received authorization from the Westinghouse Hanford Company to ship LLW and MLLW to the Hanford Site. The estimated disposal total for each of FY 1995 and FY 1996 is 39 m^3 of LLW. The estimated annual disposal of LLW will rise to 59 m^3 in FY 1997. Mixed reactives wastes (estimated volume = 0.74 m^3) will be sent to Oak Ridge National Laboratory for chemical oxidation treatment. All mixed wastes (estimated volume = 6.46 m^3) not treated on site or sent to Oak Ridge will be sent to the Hanford site for incineration, stabilization, and/or macroencapsulation.

6. Facility Stabilization, Maintenance, and Monitoring

Currently, no facilities at LBL are under the Facilities Transition program.

7. Landlord Activities

The Office of Energy Research is the DOE landlord for LBL. The University of California owns the land and leases it to DOE for the LBL. Key landlord activities include permitting and monitoring.

8. Program Management/Miscellaneous

Program management tasks supporting the ER program at LBL include the following: personnel management; maintenance of site-wide environmental data; strategic planning; financial management; interaction with DOE, external regulatory agencies and the public; permitting; monitoring of project progress; provision of a technical advisory board; and administrative support. Program management tasks supporting the WM program at LBL include the following: facility management; personnel management

and training; administrative support; document, guidance, and procedure preparation and revision; database and waste-tracking management; liaison with DOE and external regulatory agencies; audits; contractor oversight; budget preparation and control; and waste minimization planning. Waste minimization planning includes evaluation, training, and implementation of the following programs: recycling; substitution of less hazardous or nonhazardous raw materials; volume and/or toxicity reductions; and source process modifications. The waste minimization program is carried out in compliance with the California Hazardous Waste Source Reduction and Management Review Act.

Costs for program management in Table 1 reflect only those management tasks supporting the ER program. Costs for program management tasks supporting the WM program are included in the waste management summary totals in Table 1 and are intrinsic to the cost line items in Table 9.

DOE Oakland and the State of California have an Agreement-in-Principal providing for technical and financial support to the State for its activities at LBL and five other DOE sites in California in environmental oversight, monitoring, access, emergency preparedness, and other initiatives to ensure compliance with applicable Federal, state, and local regulations at the site.

Table 10
MAJOR ACTIVITY MILESTONES

Program	Task		Completion Date
Environmental Restoration	RFI-Soil and GW[1]	Phase I Progress Report	FY 1995
		Phase II Progress Report	FY 1996
		RFI Report	FY 1997
	CMS-Soil and GW[1]	Phase I CMS Report	FY 1996
		Phase II CMS Report	FY 1997
		Phase III CMS Report	FY 1998
	Corrective Measures Final Design[2]		FY 1999
	Corrective Measures Implementation		FY 2001
	RCRA Closure of Existing HWHF	Begin Closure	FY 1996
		Complete Closure	FY 1998
Waste Management	Removal of inadequate USTs		FY 1995
	Full Compliance with NESHAPS		FY 1995
	Install Deionization Regeneration Equipment		FY 1996
	New HWHF Construction		FY 1996

[1] Completion dates are for submission of reports to regulatory authorities.

[2] Completion date is for submission to DOE HQ.

GENERAL ELECTRIC VALLECITOS NUCLEAR CENTER

1. Historic Mission

The General Electric Vallecitos Nuclear Center (GE) is a privately owned and operated nuclear facility on approximately 1,600 acres in Pleasanton, Alameda County, California. Two work locations, the high-level Hot Cell No. 4 and the Emission Spectrograph Enclosure known as the "Glovebox", were constructed and operated by GE to conduct projects for DOE and the former Atomic Energy Commission (AEC). Both work locations have been idle for more than 10 years. The Hot Cell and Glovebox are the only facilities at GE with which DOE has been involved. The current DOE mission at GE is the cleanup of these facilities.

Hot Cell No. 4 is one of four hot cells constructed by GE in 1958 for post-irradiation examination of uranium fuel and irradiated reactor components. It is in the Radioactive Materials Laboratory in Building 102 and has an alpha enclosure used to contain plutonium. Between 1965 and 1967, Hot Cell No. 4 was decontaminated, equipped with a stainless steel liner, and dedicated to the study of mixed oxide fuel rods in support of the AEC's fast breeder reactor development programs. The fuel rod examination activities were conducted almost exclusively for DOE. In 1978, Hot Cell No. 4 was placed in a standby condition but was used by Lawrence Livermore National Laboratory (LLNL) for six months in 1981 and 1982 and by GE for corporate business for less than 10 days per year thereafter. DOE plans to decontaminate Hot Cell No. 4, remove the alpha enclosure, and certify the cell free of transuranic (TRU) contamination so that it will be suitable to support future GE commercial usage.

The Glovebox is a 3-foot-wide, 9-foot-long, 6-foot-high, stainless steel glove box installed by GE in 1968 for emission spectrographic analyses of mixed-oxide fuel specimens for DOE. It is in the Analytical Chemistry Laboratory in Building 103 and has not been used since 1980. DOE plans to decontaminate and dispose of the Glovebox.

2. Sources of Contamination

No active processes or experiments involving DOE research are currently operating or planned at GE; Fuel examination activities in Hot Cell No. 4 and the Glovebox resulted in radioactive contamination. The estimated volume of radioactively contaminated materials that will be generated by the decontamination

and decommissioning (D & D) activities at these two facilities is approximately 17 cubic meters (m^3). On the basis of process knowledge, the likelihood of any hazardous components being found in either of these facilities is small; however, the two facilities and their associated wastes have not been fully characterized for hazardous components, and the potential for the generation of mixed waste during decontamination and D & D activities is unknown. Contamination is currently confined within the boundaries of Hot Cell No. 4 and the Glovebox, and the potential health risk to GE site workers and the public is likely to be extremely limited; however, site characterization has not been completed, and the potential risk will have to be reassessed once site contamination has been better profiled.

3. Site Assumptions

Mission

- Use of Hot Cell No. 4 and the Glovebox for DOE research ended in the early 1980s. No further DOE use of these facilities is expected.

Future Use

- Upon completion of D & D, Hot Cell No. 4 will be used by GE for commercial projects. The Glovebox will be decontaminated and disposed.

Treatment, Storage, and Disposal

- D & D activities will attempt to use processes that will not result in the generation of mixed low-level waste (MLLW) or mixed transuranic (MTRU) waste.
- Cost for D & D activities will be split evenly between DOE and GE.
- TRU contamination will be limited to Hot Cell No. 4.
- The quantity of D & D-generated TRU and low-level waste (LLW) contaminated structural material will be less than 20 m^3, and contamination is limited to the area within Hot Cell No. 4 and the Glovebox.
- The quantity of mixed waste, if generated, will not exceed 2 m^3.
- All radioactive wastes will be shipped to DOE Hanford.
- Disposal of TRU wastes will require the design and licensing of a new TRU storage and shipping container. The DOE Hanford shipping weight limit for TRU wastes will remain the same, and no other DOE disposal site will be available. The weight limit will extend the D & D project to FY 2030.

4. Restoration Activities

Hot Cell No. 4 and the Glovebox have been contaminated with mixed fission products and mixed activation products as a result of fuel examination activities. Two radioactive waste stream will be generated during decontamination activities: (1) nonaqueous and remotely-handled TRU in the form of construction debris and equipment and (2) nonaqueous LLW, also in the form of construction debris and equipment. On the basis of radiological surveys and site evaluations, the quantity of contaminated materials that will be removed during decontamination activities is 20 m^3. This material will be disposed of as TRU waste with estimated radioactive dose rates of 1 millirad (mrad) to 5 rad per hour. Additionally, removal of the steel liner will result in approximately 13 m^3 of waste with a dose rate of less than 1 rad per hour. Contamination is currently confined within the boundaries of Hot Cell No. 4 and the Glovebox.

Site and waste characterization of Hot Cell No. 4 and the Glovebox have not been performed. Initial characterization will begin in FY 1995 and will include radiological surveys to determine locations and concentrations of radioactive contamination. Following characterization, if it is determined that mixed waste will be generated through D & D or other restoration-related activities at GE, the facility will develop a schedule to conduct treatment technology assessment, followed by development of a Site Treatment Plan to examine treatment alternatives for the mixed waste.

Preparations to begin decontamination operations including preparing required documents are scheduled to commence in FY 1997. The standard approach will be to use simpler and more passive methods first, advancing to more aggressive methods if needed. When feasible, passive decontamination techniques will be applied as dictated by radioactive surface characterization. These techniques include standard vacuuming, damp cloth wiping, and, to a limited degree, hand washing/scrubbing operations. When these passive methods fail to reduce surface contamination to acceptable levels, more aggressive decontamination methods will be used. In order of preference, they are: (1) dry abrasive blasting with a vacuum; (2) scabbing and scarification; and (3) washing with ultra-high-pressure water. Decontamination and removal of the Glovebox is scheduled to commence at the end of FY 1997. Decontamination of Hot Cell No.4 will commence in FY 1998. The removal and decontamination of remote and manned waste in Hot Cell No. 4 will commence in FY 2000.

LLW will be packaged to meet DOE Hanford's criteria and shipped to DOE Hanford for burial. Remotely-handled TRU waste will be packaged per DOE Hanford's criteria and shipped to DOE Hanford for storage. The facility may need to design and license a new shielded storage and shipping container

for TRU wastes that will meet Hanford Site Radioactive Solid Waste Acceptance Criteria for radiation limits that will not weigh in excess of the current container weight limit of 1,000 lb. The initial design and licensing of the new container will occur in FY 1997. Given the expected amount of TRU waste and the DOE Hanford weight limit, D & D activities are scheduled to occur over an extended period with completion expected in FY 2030.

5. Waste Management Activities

All DOE activities at GE including waste management are funded and managed through the ER program. These activities were discussed in the last paragraph of Section 4. No Federal Facility Compliance Act (FFCA) mixed wastes are currently present on site although D & D activities could generate limited amounts of mixed waste (estimated at less than $2m^3$). Treatment and disposal options will be considered once any mixed waste stream is generated and characterized.

6. Facility Stabilization, Maintenance, and Monitoring

No activities at the GE site are funded through the DOE Facility Transition Program.

7. Landlord Activities

Hot Cell No. 4 and the Glovebox are GE property. The Glovebox will be decontaminated and disposed. Upon completion of D & D, Hot Cell No. 4 will be turned over to GE for commercial use.

8. Program Management and Miscellaneous

Program management at the site supports the integration of ER activities at GE and includes: tracking, collecting, and reporting costs; preparing programmatic documents; coordinating permitting and public involvement with appropriate units of GE; personnel management; funding for Independent Verification Contractor (IVC) activity; liaison with external regulatory agencies; and establishing, documenting, and maintaining technical, cost, and schedule baselines.

Table 10

MAJOR ACTIVITY MILESTONE

Program	Task	Completion Date
Environmental Restoration	Preliminary Waste Characterization	FY 1995
	Environmental Assessment for D & D Project	FY 1996
	Initial Design and Licensing of Shipping and Storage Container for Remotely Handled TRU Wastes	FY 1997
	Begin Decontamination and Removal of Glovebox	FY 1997
	Begin Decontamination of Hot Cell No. 4	FY 1998
	Release of Hot Cell No. 4 to GE	FY 2030

LABORATORY FOR ENERGY-RELATED HEALTH RESEARCH

1. Historic Mission

The Laboratory for Energy-Related Health Research (LEHR), a former DOE research facility, is 1.5 miles south of the main campus of the University of California, Davis (UCD) and is currently undergoing restoration activities. The 15-acre site is owned by UCD and has been leased to DOE since 1958. The LEHR facility consists of a main administration and office building, two animal hospitals, a specimen storage room, a laboratory and support building, waste treatment facilities, and outdoor dog pens. Research at LEHR originally focused on the health effects of chronic exposures to radionuclides, using beagles to simulate radiation effects on humans. Energy Research terminated its research program in 1988 and transferred the facility to the Surplus Facilities Management Program for Environmental Restoration. In May 1994, the site was placed on the U.S. Environmental Protection Agency's (EPA's) National Priority List (NPL). The schedule for cleanup activities is being negotiated with EPA and is expected to be formalized as part of the site's Federal Facility Agreement (FFA).

2. Sources of Contamination

Research activities involving radioactive and hazardous materials have resulted in the contamination of several buildings, the waste treatment facilities, underground tanks, and outdoor dog pens; the primary radionuclides used in research were strontium-90 and radium-226. Disposal of research-derived wastes contributed to contamination in onsite trenches and possibly an onsite landfill. Soil, gravel, and groundwater have been impacted by site waste handling and disposal. Groundwater at the site has been found to contain nitrates, chromium, chloroform, tritium, and carbon-14 at levels above EPA primary drinking standards.

Decontamination and decommissioning (D & D) activities have been completed at many of the LEHR facilities. The two remaining contaminated buildings are currently undergoing D & D, which are scheduled to be completed in Fiscal Year (FY) 1995. Underground settling and domestic septic tank systems may be contaminated with radioactive and hazardous chemicals and will undergo characterization in FY 1995. The site also has more than 500 outdoor dog pens believed to be contaminated with radioactive materials and chlordane; the pens will undergo D & D starting in FY 1995.

Radioactive waste was buried onsite by both UCD and DOE in shallow unlined trenches in the south, southwest, and central areas. A six-acre, inactive, unlined, leaking UCD landfill is also onsite and may contain contaminants due to disposal of LEHR facility waste. Finally, thousands of research samples containing both radioactive and hazardous chemicals are onsite and must undergo characterization to allow offsite treatment or disposal.

3. Site Assumptions

Mission

The mission of the environmental restoration (ER) project at LEHR is to: (1) assess the nature and extent of site contamination; (2) determine and negotiate cleanup levels; (3) decontaminate and decommission contaminated buildings; (4) remove onsite radioactive, chemical, and mixed waste sources; (5) remediate soils and groundwater and underground tank systems as required; and (6) verify that the site and associated facilities have been adequately cleaned and meet to established criteria for transfer to UCD for unrestricted use.

Future Use

Prior to transfer to UCD, the remaining contaminated LEHR facilities and 500 outside dog pens will require D & D, and a remedial investigation/feasibility study (RI/FS) will be necessary. Remediation of soils and the design of a treatment system for groundwater may also be required. LEHR is scheduled to release the 18 site buildings to UCD for unrestricted use by FY 1997. Remediation of the soils and the septic tank system continue beyond FY 2000. The LEHR facilities will be transferred to UCD for unrestricted use once D & D and soil remediation are completed. Groundwater remediation, if required, may continue after the transfer of the facilities to UCD.

Treatment, Storage, and Disposal

An existing onsite facility will be renovated to serve as a waste-staging facility for ER-generated wastes prior to disposal. LEHR does not have the capacity to store or treat of their mixed waste streams onsite and does not plan to do so. Biological mixed waste will be packaged, shipped, and stored at DOE Hanford. Low-level radioactive waste generated from D & D activities will be packaged, shipped, and disposed at DOE Hanford or other DOE-approved facilities.

4. Restoration Activities

Restoration activities at LEHR will include soil and groundwater assessment and remediation and the D & D of certain facilities.

Site-wide soil characterization and assessment activities will consist of drilling and sampling soil borings in onsite burial trenches, leach fields, and seepage pits (UCD and DOE areas) as well as the characterization and remediation of underground tanks. It is estimated that approximately 623 cubic meters (m^3) of low-level radioactively contaminated soil and gravel are present onsite at depths ranging from a few inches to approximately 6 feet. The contaminated soil at these locations will be remediated as necessary. Groundwater characterization and assessment will include installing and sampling deep and shallow groundwater monitoring wells. The extent of groundwater contamination is not fully characterized although preliminary data indicate onsite and offsite groundwater contamination. The data from a remedial investigation will be used to conduct a feasibility study of groundwater and soil remediation if required. The RI/FS is scheduled for completion by FY 1997. The remedial design for soil and soil remediation are scheduled for completion by FY 2000. The remedial design for groundwater is scheduled for completion by FY 2000. The disposal of characterization waste will be completed by FY 1997. Groundwater remediation, if required, is likely to consist of pumping and treatment. Groundwater remediation costs are not included in the BEMR baseline. The preliminary estimate of the volume of contaminated soil and groundwater requiring disposal or treatment from FY 1995 on is 5,645 m^3 of low-level radioactive waste (LLW) and mixed low-level radioactive waste (MLLW). All wastes from restoration activities will be shipped to DOE Hanford.

The remaining D & D of LEHR facilities will consist of the following actions: removal of a cobalt-60 source (1,500 curie) from a storage well on the main campus; the decontamination and demolition of two buildings (the Imhoff Building and the Co-60 Building); the characterization and remediation of dog pens as required; and disposal of wastes generated. The D & D of the two animal hospitals and the Specimen Storage Room have been completed, and the facilities are awaiting clearance by an Independent Verification Contractor (IVC). The Imhoff facility is currently undergoing demolition, and the resulting LLW and asbestos will be shipped to either DOE Hanford or other DOE-approved, LLW disposal sites. The Co-60 Building and the dog pens will undergo D & D in FY 1995.

D & D wastes will consist of LLW including sludge, dry active waste, and contaminated soils as well as hazardous waste including asbestos, chemical, and biological waste. It is estimated that D & D

activities from FY 1995 onward will generate 440 m^3 of LLW and 35 m^3 of MLLW. Although funded by the Environmental Restoration (ER) program, waste management activities are discussed in Section 5.

The environmental monitoring program at LEHR consists of air, groundwater, surface water, soil, and radiation monitoring at routine intervals. The monitoring program will continue for the duration of site restoration activities.

5. Waste Management Activities

Given that DOE-funded research at LEHR has ceased, there are no ongoing routine operations associated with DOE programs that produce waste. Prior to FY 1994, all waste management activities were funded by the ER program at LEHR. As of FY 1995, Waste Management (WM) took over responsibility for waste management activities at LEHR. LEHR operates an Interim Status storage facility under a RCRA Part A Permit.

The major waste streams identified consist of residual wastes from past research activities and wastes generated from the environmental restoration actions. Most of the waste streams generated from site restoration activities are expected to be LLW, which will be shipped to DOE Hanford for disposal. To facilitate waste handling and loading, an existing onsite facility will be renovated to serve as a waste-staging facility. As part of the waste management program, a waste management plan, a waste certification plan, and a waste minimization plan have been developed and implemented.

Treatment

Because of the lack of characterization data, LEHR has not identified treatment options for any of its mixed radioactive wastes under the Federal Facility Compliance Act (FFCA). No treatment of hazardous waste is conducted or will be conducted onsite.

Storage

Storage of ER-generated wastes will occur at a renovated waste-staging facility prior to disposal. The preliminary estimated volume of contaminated soil and groundwater requiring treatment or disposal is 5,645 m^3 of LLW and MLLW. The estimated volume of D & D waste from FY 1995 onward is 440

m^3 of LLW and 35 m^3 of MLLW.

Disposal

Disposal of hazardous waste will be at permitted treatment, storage, and disposal facilities (TSDFs). Disposal of LLW will be at the Hanford DOE site. The disposal site for MLLW is to be determined.

6. Facility Stabilization, Maintenance, and Monitoring

No activities at LEHR are funded through the transition program.

7. Landlord Activities

The University of California owns the land at LEHR, and DOE owns the buildings. The ER program of DOE's Environmental Management Program is the DOE landlord for the buildings, and key landlord activities include quarterly monitoring and building surveillance and maintenance.

8. Program Management and Miscellaneous

Program management at the site supports the ER activities at LEHR and includes: tracking, collecting, and reporting costs; technical, health and safety, and Quality Assurance (QA) oversight; preparation of programmatic documents; coordinating permitting and public involvement; liaison with DOE, UCD, external regulatory agencies, and the public; subcontracting; establishing, documenting, and maintaining technical, cost and schedule baselines; and development and imnplementation of a waste minimization plan emphasizing waste reduction, segregation, and minimization.

A Memorandum of Agreement (MOA) between DOE and the University of California for the D & D of LEHR facilities and remediation of the site was executed by both parties. The MOA identified the roles of DOE and UCD in the conduct of the ER project. Independent verification will be performed by a contractor (the Oak Ridge Institute for Science and Education) to verify that the site has been restored according to established cleanup criteria. DOE Oakland has signed an Agreement-In-Principle (AIP) with the State of California to ensure that building D & D and site restoration activities comply with state environmental regulations. As part of the AIP, state technical staff will review major activity

work plans and perform spot-check surveys and onsite monitoring.

Table 10

MAJOR ACTIVITY MILESTONES

Program	Category	Task	Completion Date
Environmental Restoration	Characterization, Assessment, and Remediation	Draft Site-Wide Remedial Investigation Report for Soil and Groundwater	FY 1997
		Draft Site-Wide Feasibility Study for Groundwater	FY 1997
		Soil Remedial Design	FY 2000
		Soil Remediation	FY 2000
		Groundwater Remedial Design	FY 1997
	Decontamination and Decommissioning	D & D of Imhoff Building and Tank Remediation	FY 1995
		D & D of Tank Trailer	FY 1995
		D & D of Co-60 Building and Dog Pens	FY 1995
	Release to UCD	Imhoff Building Site, Underground Tanks, and Tank Trailer	FY 1995
		Dog Pens and Co-60 Building	FY 1997
	Disposal of ER Wastes	Existing Research Waste	FY 1995
		Tank Trailer	FY 1995
		Characterization Waste	FY 1997
Waste Management	MLLW Waste Management	Incorporation of Treatment Evaluation of MLLW Waste Streams into Site Treatment Plan	FY 1995

LAWRENCE LIVERMORE NATIONAL LABORATORY
MAIN SITE

1. Historic Mission

The Lawrence Livermore National Laboratory (LLNL) site was purchased by the Navy in 1942 and was initially used as a flight-training base and engine-overhaul facility. The transition from Navy operations to a research facility began in 1950 when the Atomic Energy Commission (AEC) authorized construction of the Materials Test Accelerator facility at the site. In 1951 the University of California (UC) Radiation Laboratory (operated for the AEC by UC) began using some of the former Navy facilities to support AEC-sponsored nuclear weapons research. In 1952, the AEC established the UC Radiation Laboratory, Livermore Site (LLNL's predecessor), as a second laboratory dedicated to nuclear weapons research. UC managed and operated LLNL on behalf of the AEC from 1952 to 1975, the Energy Research and Development Agency from 1975 to 1977, and the Department of Energy (DOE) from 1977 to the present.

LLNL's current mission is research, testing, and development focusing on national security, energy, the environment, and biomedicine. LLNL also has a specific defense mission, the research, testing, and development of technologies related to nuclear weapons. The LLNL Main Site was placed on the National Priorities List (NPL) in 1987.

2. Sources of Contamination

Past operations involving the handling and storage of hazardous materials resulted in the release and subsequent migration of contaminants into soil and groundwater. Nineteen different source areas have been identified in various parts of the site. The major contaminants in soil and groundwater are solvents and fuel hydrocarbons. During the early years of operation at the LLNL Main Site, solvents were released to the ground and infiltrated the underlying strata and groundwater; chlorinated hydrocarbons have been detected in groundwater at concentrations of up to 10 parts per million. A further source of groundwater contamination is an underground fuel storage tank that released approximately 17,000 gallons of leaded gasoline between 1961 and 1979. Tritium has also been detected in an onsite monitoring well at concentrations above the drinking water standards. To date, only one source of tritium has been identified, a 1991 leak from a tank at Building 292, although ongoing investigations

are focused on profiling all remaining sources of tritium in groundwater at the site.

The primary groundwater plume at the Main Site is a 1.4-square-mile plume of mainly trichloroethene (TCE) that threatens private wells and the nearby City of Livermore's municipal drinking water wells. Private wells threatened by the plume have been closed and their users provided with an alternative water supply. The TCE plume is not expected to impact the municipal wells for the next 70 years. The planned remediation at LLNL to remove the solvents including TCE from the underlying groundwater to the federal and/or state maximum contaminant levels (MCLs) is expected to take only slightly more than 50 years. On the basis of current data and NIOSH guidelines, the low levels of groundwater and soil contamination do not pose any measurable health risks to site workers.

3. Site Assumptions

Mission

- The mission of LLNL is to serve as a national resource for science and engineering with a focus on national security, energy, the environment, and biomedicine and with a special responsibility for nuclear weapons. The mission has been broadened over the years to meet national needs such as enhancement of economic competitiveness and science education.

Future Use

- That future uses of LLNL will be primarily diverse research operations such as those mentioned above is not expected to change.

Treatment, Storage, and Disposal

- The LLNL Main Site will continue to operate its treatment, storage, and disposal (TSD) facilities for hazardous, mixed, and low-level wastes under interim status (RCRA Part A) pending approval of its RCRA Part B permit application.

- Agreements-in-Principle (AIPs) negotiated with the State of California will remain fully funded.

- It is assumed that the MCLs will be the cleanup standards for offsite plans.

- Waste disposal will be primarily offsite. Low-level radioactive solids will be disposed at the Nevada Test Site. The disposal site for mixed low-level wastes has yet to be determined but may be DOE Hanford or a permitted commercial site. Hazardous wastes will be disposed at permitted TSD facilities.

4. Restoration Activities

In 1987, the LLNL Main Site was placed on the NPL because past operations involving the handling and storage of hazardous materials had resulted in the contamination of onsite soils and groundwater. Remedial activities focus on the implementation of the Record of Decision (ROD) for the site, which was approved in July 1992. DOE Oakland Operations Office has negotiated applicable, relevant, and appropriate requirements (ARARs) with the United States Environmental Protection Agency (EPA) and the State of California for the onsite cleanup on the basis of continued DOE research and industrial use of the site. It is assumed that the MCLs will be the cleanup standards for offsite plans. The scope of remedial action includes: treatment facility design; construction and operation of treatment facilities such as retention and recharge basins, infiltration trenches, and wells; source investigations; building and tank investigations; surface treatment technology engineering and design; and well placement optimization. RCRA closure of inactive surplus hazardous waste facilities and underground storage tanks (USTs) are also conducted.

The groundwater at the site is being remediated using new pump-and-treat methods at five treatment units, and the plume of contaminated groundwater is being contained by means of onsite extraction wells. In FY 1993, more than 73 million gallons of groundwater were extracted and treated to remove organic solvents, and more than 10,000 gallons of gasoline were recovered. Groundwater treatment plans have been proposed to remove solvents, gasoline, and other contaminants to below drinking water standards. Tritium in groundwater will be allowed to decay naturally *in situ* and will be prevented from migrating offsite by means of extraction wells. Wastes contaminated with volatile organic compounds generated by remedial actions are placed in granular-activated-carbon (GAC) canisters and removed to offsite treatment facilities.

In addition, the wastewater treatment system, several fuel tank systems, a sewage system, and several transformers are being upgraded to meet local, state, and federal regulations. Closure of the Building 612-3 Hazardous Waste Facility Yard has been completed and is pending final approval by the State of California.

5. Waste Management Activities

The major focus of the LLNL Waste Management Department (WM) is the treatment, storage, and offsite disposal of hazardous, low-level radioactive wastes (LLW), mixed low-level radioactive wastes

(MLLW), transuranic (TRU) wastes, and mixed-TRU wastes from both the Main Site and Site 300. Main Site WM facilities are operated under interim status (RCRA Part A) pending approval of a submitted RCRA Part B permit application. In addition to normal operations, EM-30 will also bear the cost of closure at Building 419.

The solid hazardous wastes generated are projected to decrease from 311,849 pounds (lb) and 149 cubic meters (m^3) in 1994 to 261,677 lb and 140 m^3 by the year 2000. Solid low-level wastes generated are projected to increase from 254,976 lb in 1994 to 319,527 lb by 2000; solid mixed wastes generated are projected to decrease from 5,158 lb in 1994 to 4,925 lb by 2000. Liquid hazardous wastes generated are projected to decrease from 132,490 gallons (gal) in 1994 to 115,800 gal by 2000. Liquid low-level wastes generated are projected to decrease from 28,522 gal in 1994 to 25,639 gal by 2000. Liquid mixed wastes are projected to decrease from 5,699 gal in 1994 to 3,902 gal by 2000.

Treatment

Treatment of wastes at LLNL Main Site is currently limited to aqueous hazardous wastes, LLW, and MLLW and consists of filtration and precipitation of metals and radioactive constituents. Building 513 has a shredder unit for LLW and MLLW (capacity = 1,272 m^3/year) and a solidification unit for hazardous wastes, LLW, and MLLW (capacity = 1,329 m^3/year). Building 514 has a wastewater filtration unit for hazardous wastes, LLW, and MLLW (capacity = 3,389 m^3/year) and a silver recovery unit (capacity = 76 m^3/year). Area 514 has a wastewater treatment tank farm for hazardous wastes, LLW, and MLLW (capacity = 6,807 m^3/year). Building 612 has a drum/container crushing unit for LLW, and MLLW (capacity = 9,901 m^3/year) and a size reduction unit for hazardous wastes, LLW, and MLLW (capacity 588 m^3/year). In addition, a transportable treatment unit for metals recovery is available (capacity = 2,281 m^3/year). All treatment capacity estimates are based on 240 days of operation per year and are potential treatment capacities rather than actual or historical volumes. Following chemical analysis to confirm that wastewater meets discharge standards, wastewater is discharged to the local sanitary sewer.

In support of LLNL's mission regarding environmental research and waste management, a Mixed Waste Management Facility (MWMF) project is in progress. This project, started in FY 1992, will design and construct a pilot-scale treatment system for low-level, mixed organic wastes without the use of incineration. The purpose of this project is to provide engineering and design information for the deployment of full-scale treatment capabilities at other DOE locations. The pilot facility will be used to

test treatment technologies at least through FY 2000.

Storage

WM operates a federal- and state-permitted TSD facility at LLNL; it serves both the Main Site and Site 300. The Building 233 facility is a container storage unit for hazardous waste and will eventually be used for the storage of hazardous wastes, LLW, MLLW, and/or TRU wastes. Building 513 has a container storage unit for LLW and MLLW. Building 514 has several container storage areas for LLW and MLLW and a storage tank farm for hazardous wastes, LLW, and MLLW. Area 612 has portable tank, tank trailer, container, and other storage units for hazardous wastes, LLW, MLLW, and TRU wastes and a receiving, segregation, and storage area. Building 612 has a laboratory packing storage area for hazardous wastes and a container storage area for hazardous wastes, LLW, and MLLW. Building 614 has cell storage for hazardous wastes, LLW, and MLLW. Building 625 has container storage units for hazardous wastes, MLLW, and TRU wastes, and Building 693 has a storage unit for hazardous wastes. The Building 419 facility includes inactive treatment units, which are awaiting regulatory closure. Estimates of practical storage capacity at the various units at the LLNL Main Site are 850 m^3 for hazardous wastes, 1,606 m^3 for LLW, 1,695 m^3 for MLLW, and 1,059 m^3 for TRU wastes.

Disposal

There are currently no waste disposal activities at LLNL. LLW solid wastes are disposed at the Nevada Test Site. Mixed low-level wastes are currently stored at the Main Site, pending resolution of ultimate disposal sites, which may be at DOE Hanford or a permitted commercial unit. Hazardous wastes are disposed offsite at permitted TSD facilities. TRU wastes are currently stored at the Main Site in the storage units noted above and are designated for disposal at the Waste Isolation Pilot Project (WIPP).

6. Facility Stabilization, Maintenance, and Monitoring

This program, also known as the Facility Transition Program, is in its beginning stages, and many of its policies governing scope and long-term responsibilities are currently under development. Cost estimates associated with the transition of facilities to other uses will be developed by DOE-HQ.

The facilities managed by DOE-OAK will likely be among the first to undergo transition within the DOE complex. Production facilities at other DOE sites are intended for complete decontamination and decommissioning (D & D) to "greenfield" status; however, the DOE-OAK facilities will probably be converted to other research and development (R & D) uses. It is assumed that existing facilities used for R & D will continue to be managed by DOE. In order for this to occur, it is necessary that questions regarding environmental health and safety and property liability be answered to the satisfaction of all stakeholders and potential future users.

7. Landlord Activities

DOE's Defense Program conducts most of the research and development at LLNL and is responsible for landlord functions at the Main Site.

8. Program Management and Miscellaneous

Program management tasks supporting the ER program at the LLNL Main Site include: personnel management; strategic planning; financial management; interaction with DOE and external regulatory agencies; monitoring of project progress; and administrative support. Program management tasks supporting the WM program at the LLNL Main Site include: facility management; personnel management and training; administrative support; document, guidance, and procedure preparation and revision; database and waste-tracking management; liaison with DOE and external regulatory agencies; inspections and audits; budget preparation and control; and waste minimization planning. Waste minimization planning includes the evaluation, training, and implementation of the following programs: recycling; substitution of less hazardous or nonhazardous raw materials; volume and/or toxicity reductions; and source process modifications. The waste minimization program is carried out in compliance with the California Hazardous Waste Source Reduction and Management Review Act.

The costs for program management in Table 1 reflect only those management tasks supporting the ER program. Costs for program management tasks supporting the WM program are included in the waste management summary totals in Table 1 and are intrinsic to the cost line items in Table 9.

DOE and the State of California have an AIP providing for technical and financial support to the State for its activities at the LLNL Main Site and five other DOE sites in California which include environmental oversight, monitoring, access, emergency preparedness, and other initiatives to ensure

compliance with applicable federal, state, and local regulations at the site.

TABLE 10 MAJOR ACTIVITY MILESTONES

Program	Activity	Estimated Time of Completion
Environmental Restoration	Begin Operation of B518 Vapor Extraction System	FY 95
	Begin Operation of Treatment Facility G	FY 96
	Issue Compliance Monitoring Plan	FY 96
	Issue Contingency Plan	FY 97

LAWRENCE LIVERMORE NATIONAL LABORATORY
SITE 300

1. Historic Mission

The 11-square-mile Site 300 is in the sparsely developed Altamont Hills 15 miles east of Livermore, California, and 10 miles southwest of the San Joaquin Valley town of Tracy. The site was purchased from local ranchers in the 1950s. The surrounding area is agricultural and has an average population density of less than one person per square mile.

The site's former and current mission is research and testing of nonnuclear high-explosive (HE) components in support of the United States Department of Energy's (DOE's) nuclear weapons program. Site 300 consists of several HE component processing and fabrication areas, HE component thermal testing facilities, several instrumented firing tables for explosives testing, an advanced test particle accelerator, and various support facilities such as a motor pool shop and machine shops.

2. Sources of Contamination

Past operations involving processing, testing, and deactivation of explosive materials resulted in soil and groundwater contamination at the site. The sources of contamination included leaking pipes, disposal sites (landfills, debris piles, drywells, and evaporation ponds), and spills. The contaminants include HE compounds including beryllium, lead, and uranium; halogenated hydrocarbons, mainly trichloroethene (TCE) and perchloroethene (PCE); and tritium. In 1990, Site 300 was placed on the National Priorities List (NPL) primarily because releases of contaminants had caused several volatile organic compound (VOC) plumes in groundwater beneath the site.

The major area of concern at Site 300 is the General Services Area (GSA), a support area with machine shops, administrative offices, motor pool facilities, and other infrastructure. At several locations at the GSA, solvents were discharged to drywells or the ground. These practices, long discontinued, resulted in soil and groundwater contamination. TCE plumes have reached the shallow alluvial aquifer in the Corral Hollow Basin, and the contaminated groundwater threatens two water supply wells, which are monitored monthly for potential impact. When the risk of contamination of these wells is considered imminent, DOE plans to close these wells and provide their users with an alternative water supply. An

An analysis of areas of contamination to date indicated that the levels of contamination in groundwater and soil do not pose health risks to site workers.

In the HE Process Area, low concentrations of VOCs and HE compounds are present in soil and perched water-bearing zones.

At Building 834, a thermal testing facility has been operating since 1957. Prior to 1994, this facility used TCE as its heat-transfer fluid. In the 1950s, 1960s, and 1970s, TCE was released to the ground through pipe leaks and spills. In the 1980s, the facility piping and solvent storage areas were upgraded to prevent further releases. On the basis of facility data and characterization work, it is believed that up to 550 gallons of TCE was released to the Building 834 area. Most of this material is still present as soil and groundwater contamination.

The groundwater at Building 834 is perched on a lens of clay that, together with another clay lens and 280 feet of unsaturated sediments, physically separates it from the regional aquifer. The perched groundwater has no pathway offsite; thus, the site poses no off-site risk. Contaminant concentrations in soil and groundwater are very high at Building 834, and it believed that pockets of free product TCE (Dense Non-Aqueous Phase Liquid or DNAPL) are present. DOE plans to use the Building 834 area to test VOC and DNAPL cleanup technologies.

In groundwater in the Pits 3 and 5/Building 850 area, a low-level tritium plume is emanating from Pits 3 and 5 at the closed landfill and from the Building 850 firing table. The tritium plume is entirely onsite, and fate and transport calculations indicate that tritium concentrations offsite are well below both state and federal drinking water standards. In addition, polychlorinated biphenyls (PCBs), VOCs, and depleted uranium have been detected in the operable unit (OU). The extent of PCB and uranium contamination in soil and VOCs contamination in groundwater in this area is still being investigated.

At Pit 6, VOCs from the closed landfill have contaminated the uppermost aquifer; however, groundwater from this unit flows to the surface approximately 500 feet west of the landfill on DOE land where the contaminants slowly evaporate. The concentrations of VOCs in the groundwater have dropped significantly since 1987.

Several facilities not discussed above such as the Building 832 Canyon have been identified as sites where hazardous spills, leaks, or discharges may have occurred. Although these facilities do not

pose current health or environmental risks, they could require remediation in the future.

All major groundwater plumes have been delineated, and it is anticipated that the main drinking water aquifers will remain uncontaminated. Only groundwater contamination in the GSA has extended offsite, and potentially impacted drinking water wells are monitored monthly. If the GSA contamination impacts these wells, DOE will seal and abandon them and replace them with clean water supplies.

3. Site Assumptions

Mission

- DOE will continue to use Site 300 for HE component testing in support of Defense Programs, or another site mission will be identified so that institutional control of the site can be maintained.

Future Use

- It is assumed that future use of Site 300 will continue to include the diverse types of research operations currently being conducted and that it will remain a federal facility. No future residential use is anticipated. No buildings are slated for decontamination and decommissioning (D & D).

Treatment, Storage, and Disposal (TSD)

- Vadose-zone VOC-contaminated soils will be treated by *in situ* vapor extraction; VOC-contaminated groundwater will be treated by conventional aboveground pump-and-treat technology.

- Tritium in groundwater poses no offsite risk and will not require remediation.

- Pits 2, 3, 4, and 5 will not require additional capping.

- TCE in groundwater at Pit 6 will be allowed to degrade *in situ* without remediation.

- TCE in groundwater at Pit 5 will not require EM-40 to perform Solid Waste Assessment Tests (SWATs) of the Site 300 landfills.

- Canisters of loaded (spent) granular activated carbon (GAC) from certain remediation projects will be stored onsite prior to shipment for offsite disposal.

- Explosives wastes will be stored in Building 883, a RCRA Part B permitted storage unit. All other site wastes will be stored for less than 90 days in several accumulation areas at Site 300 and then either transferred to storage units at the LLNL Main Site or disposed offsite.

- Planned funding levels assume no new treatment facilities will be required to comply with the Federal Facility Compliance Act (FFCA).

- The new Explosive Waste Treatment Facility (EWTF) will be scheduled for completion by the end of FY 1997. Treatment of HE wastes at the HE Burn Pits will be allowed to continue under the existing RCRA Part B permit until the EWTF is completed.

4. Restoration Activities

The environmental restoration at Site 300 focuses on the assessment and remediation of releases of solvents, tritium, and HE components from landfills, drywells, spills, leaks, and other sources at the site. Particular attention centers on: (1) weapons component testing areas and solvent releases from Buildings 833 and 834; (2) solvent releases from debris piles and drywells at the southeast GSA; (3) solvent and HE component releases from the HE Process Area; (4) tritium releases from the Building 850 firing table and the Pit 7 landfill complex; and (5) solvent releases from the Pit 6 landfill.

In 1991, treatment of TCE-contaminated groundwater began at the eastern GSA. The eastern GSA plume extends offsite and down the Corral Hollow alluvial channel for approximately 1 mile. By the end of FY 1993, 12.8 million gallons of contaminated groundwater had been treated and discharged to an ephemeral stream. At the central GSA, groundwater from a shallow alluvial aquifer is being remediated for TCE contamination with both pump-and-treat and soil-vapor-extraction systems.

RCRA closure of the HE Burn Pits will begin once the new EWTF is operational, currently scheduled for the end of FY 1997. Closure of the HE Burn Pits will be followed by post-closure monitoring with the cost of closure borne by EM-40.

Following technology testing, Building 834 will be remediated to risk-based standards. DOE is pursuing an exemption for this activity from the Central Valley Regional Water Quality Control Board (CVRWQCB) Basin Plan. It is assumed that the CVRWQCB will not require EM-40 to perform SWATs of the Site 300 landfills.

5. Waste Management Activities

The Waste Management (WM) department of Lawrence Livermore National Laboratory (LLNL) operates a federal-and state-permitted RCRA Part B TSD storage facility at Building 883 at Site 300 and

an interim status (RCRA Part A) explosives treatment facility at the HE Burn Pits. The interim status of the HE Burn Pits is conditional on the progress of the construction of the new EWTF. A RCRA Part B permit application has been submitted for the EWTF. The focus of WM is the storage, treatment, and disposal of hazardous, mixed, aqueous, and low-level radioactive wastes at both facilities. Wastes generated at Site 300 include explosive waste from testing activities, wastes from various other operations, and environmental restoration generated wastes. The Waste Minimization Project (WMP) is also a WM priority at Site 300 and aims to reduce the amounts and toxicity of hazardous, radioactive, mixed, and nonhazardous wastes. Waste management activities at Site 300 also include the confirmatory gravel sampling and analysis plan, which addresses the characterization of newly generated debris from firing table operations.

Treatment

Currently, the only treatment of waste conducted at Site 300 is burning of explosive waste at the HE Burn Pits under interim status (RCRA Part A), which is conditional and will cease when the new EWTF is completed. A RCRA Part B application has been submitted for the EWTF, and construction of this new facility is scheduled to be completed by the end of FY 1997. Residual wastes from the HE Burn Pits are either transferred to WM units at the LLNL Main Site or disposed offsite at permitted TSD facilities. Some onsite treatment of restoration wastes is performed by ER at Site 300 including *in situ* vapor extraction treatment of vadose-zone VOC-contaminated soils and aboveground pumping and treatment of VOC-contaminated groundwater.

Storage

Building 883 is the only permitted storage unit at Site 300. Building 883 has a RCRA Part B permit for the storage of explosives wastes prior to treatment. Explosives wastes are currently treated at the HE Burn Pits and will be treated in the future at the new EWTF. There are also several waste accumulation areas at Site 300 where wastes are stored for less than 90 days. Wastes accumulated at Site 300 are either disposed offsite at permitted TSD facilities or transferred to the various WM facilities at the LLNL Main Site.

Disposal

No wastes are currently disposed at Site 300 or the LLNL Main Site. LLNL LLW solids are

disposed at the Nevada Test Site. Federal Facility Compliance Act (FFCA) mixed wastes are currently stored at LLNL Main Site pending determination of ultimate disposal, which may occur at DOE Hanford or a permitted commercial site. Hazardous wastes are disposed offsite at permitted TSD facilities. Construction of the proposed Mixed Waste Management Facility (MWMF) at the Main Site may reduce the amount of offsite disposal from LLNL.

6. Facility Stabilization, Maintenance, and Monitoring

The facilities managed by DOE-OAK will likely be among the first to undergo transition within the DOE complex. Production facilities at other DOE sites are intended for complete D & D to "greenfield" status; however, the DOE-OAK facilities will probably be managed by DOE. In order for this to occur, it is necessary that questions regarding environmental health and safety and property liability be answered to the satisfaction of all stakeholders and potential future users.

7. Landlord Activities

DOE's Defense Program conducts most of the research and development at LLNL and is responsible for landlord functions at Site 300. Landlord environmental issues include: the continued open-air testing of HE components; construction of the EWTF; construction of a new domestic sewage treatment facility and cleanup of the current sewer pond; connection of the site to the San Francisco municipal water supply and the subsequent closure of all remaining supply wells; and residential development around Site 300.

8. Program Management and Miscellaneous

Program management tasks supporting the ER program at LLNL Main Site include: personnel management; strategic planning; financial management; interaction with DOE and external regulatory agencies; monitoring of project progress; and administrative support. Program management tasks supporting the WM program at LLNL Main Site include: facility management; personnel management and training; administrative support; document, guidance, and procedure preparation and revision; database and waste-tracking management; liaison with DOE and external regulatory agencies; inspections and audits; budget preparation and control; and waste minimization planning. Waste minimization planning includes evaluation, training, and implementation of the following programs: recycling; substitution of less hazardous or nonhazardous raw materials; volume and/or toxicity reductions; and

source process modifications. The waste minimization program is carried out in compliance with the California Hazardous Waste Source Reduction and Management Review Act.

Costs for program management in Table 1 reflect only those management tasks supporting the ER program. Costs for program management tasks supporting the WM program are included in the waste management summary totals in Table 1 and are intrinsic to the cost line items in Table 9.

DOE and the State of California have an Agreement-in-Principal providing for technical and financial support to the State for its activities at LLNL Site 300 and five other sites in California which include environmental oversight, monitoring, access, emergency preparedness, and other initiatives to ensure compliance with applicable federal, state, and local regulations.

Table 10

MAJOR ACTIVITY MILESTONES

Program	Activity	Estimated Date of Completion
Environmental Restoration	RCRA HE Burn Pit Closure	FY 1998
	Submit Final OU No. 1 Record of Decision (ROD) to Regulatory Agencies	FY 95
	Submit Final OU No. 2 ROD to Regulatory Agencies	FY 96
	Submit Final OU No. 3 ROD to Regulatory Agencies	FY 97
	Submit Final OU No. 4 ROD to Regulatory Agencies	FY 97
	Submit Final OU No. 5 ROD to Regulatory Agencies	FY 97
	Submit Final OU No. 6 ROD to Regulatory Agencies	FY 98
	Initiate OU No. 1 Final Remedy	FY 98
	Initiate OU No. 2 Final Remedy	FY 97
	Initiate OU No. 3 Final Remedy	FY 98
	Initiate OU No. 4 Final Remedy	FY 98
Waste Management	Construction of the EWTF	FY 97

STANFORD LINEAR ACCELERATOR

1. Historic Mission

The 426-acre Stanford Linear Accelerator Center (SLAC) site is a high-energy research facility owned and operated by Stanford University under contract to the Department of Energy (DOE). SLAC was established in 1962 as an energy research facility for high-energy particle physics and the development of new techniques using high-energy accelerators and experimental apparatus and this is SLAC's current mission for DOE. The four major experimental facilities are the linear accelerator (LINAC), the Positron Electron Project (PEP) storage ring, the Stanford Positron Electron Asymmetric Ring (SPEAR), and the SLAC Linear Collider (SLC).

2. Sources of Contamination

SLAC generates mainly hazardous wastes and small amounts of radioactive and mixed wastes. The hazardous waste streams include: waste oils from machine shops, the motor pools, pumps, and compressors; waste solvents from various degreasers, assembly shops, and "clean" operations; polychlorinated biphenyl (PCB)-contaminated oils and PCB capacitors from various operations; the plating shop and its associated wastewater treatment facility; aqueous liquids with metals from metal-cleaning activities; and soil, clothing, and asphalt from the cleanup of spills and leaks. A small amount of radioactive waste arises from the accumulation of corrosion products such as induced-radioactivity-containing copper in cooling-water, resin-bed filters and pipe and other metal pieces from the accelerator. A very limited amount of low-level mixed waste could be generated when hazardous substances such as solvents are used to clean activated material or when oil in vacuum pumps serving the accelerator are irradiated by beam particles.

Past waste management practices and facility operations have resulted in contamination of soils by PCBs, petroleum hydrocarbons, lead, and other metals and volatile organic compound (VOC) contamination of groundwater. The known sources of groundwater contamination are a former leaking underground storage tank, the plating shop, and a former hazardous waste storage yard. Known sources of contaminated soil include Interaction Region 6 and 8 (IR-6 and IR-8) drainage ditches, the 3.0-megawatt (MW) Power Supply, the IR-8 Power Supply, the Master Substation inactive area, and the Substation 505 Power Supply. A total of 40 discrete areas of contamination have been identified to date.

Soil contamination has been found on and off-site, while groundwater contamination to date is only on-site. However, the exact extent of soil and groundwater contamination is not completely defined. Based on current site knowledge, the anticipated health risk to site workers and the public is low, but potential risks will need to assessed once site characterization is complete.

3. Site Assumptions

Mission

- The current mission of SLAC as a center of research and development using high-energy accelerators and experimental apparatus is assumed not to change.

Future Use

- Consistent with no change in mission, the future use of the site will be consistent with current activities. Land use planning is designated as unrestricted use.

Treatment, Storage, and Disposal

- No treatment of hazardous, radioactive, or mixed wastes occurs now or presumably in the future. Hazardous waste is stored for less than 90 days prior to disposal at a variety of permitted disposal, treatment, and recycling facilities. Radioactive and mixed wastes are currently stored at the existing radioactive material storage yard (RAMSY) prior to ultimate disposal at DOE-approved facilities. With the construction of a new Radioactive and Mixed Waste Storage Facility (RMWSF) in FY 1995, mixed and radioactive wastes will be staged at the RAMSY for processing only and then stored in the RMWSF prior to offsite disposal. No Federal Facility Compliance Act (FFCA) Site Treatment Plan currently exists for SLAC.

4. Restoration Activities

A preliminary assessment completed in 1993 identified approximately 40 discrete areas of contamination requiring some degree of remedial action. Because of the large number of sites, SLAC has chosen a site-wide approach to the remedial investigation (RI), which will integrate soil and groundwater concerns at all sites, replacing the individual sampling and analysis activities to date for previously identified "high-priority" sites. Soil and groundwater interim actions are scheduled to commence in FY 1995, depending upon funding. In addition, groundwater monitoring will continue at the site of a former leaking underground storage tank, and a groundwater peripheral monitoring network will be completed between FY 1996 and FY 1999. The RI reports for contaminated soil and groundwater are scheduled for completion in FY 1998. The site-wide feasibility study (FS) is scheduled for

completion in FY 1999. The site-wide Record of Decision (ROD) is scheduled to be completed by FY-2000. Current estimates of contaminated media requiring treatment or disposal include 1337 m^3 of VOC-contaminated groundwater, 628 m^3 of PCB-contaminated soil, and 925 m^3 of PCB-and lead-contaminated soil.

5. Waste Management Activities

Hazardous waste is generated by operations such as vehicle and equipment maintenance, the plating shop, its associated waste treatment plant, and general facility maintenance. Approximately 350 tons of hazardous waste are generated annually. Other waste streams are more variable, and the volume generated depends on the level of activity in the high-energy research program. Wastes generated from the ER Program Interim Actions are expected starting in FY 1995.

Radioactive waste includes low-level (LLW) and mixed waste (MLLW) and is generated through a variety of means including: activation due to proximity to the beam line (largest volume); sealed sources and standards no longer in use; resin beds used in water recirculation; and solvents contaminated by their use in fabrication. Approximately 84 m^3 of LLW and 1 m^3 of MLLW are expected to be generated annually at SLAC.

Other scheduled waste management projects include the installation of an oil/water separator and the waste minimization program. A new oil/water separator at IR-8 is scheduled for completion by early FY 1995. The waste minimization program focuses on implementing recycling opportunities, toxicity reductions, materials substitution, and source process modifications.

SLAC has operating permit conditions and contracts with the South Bay System Authority and the West Bay Sanitary District (sanitary sewer limits and pretreatment standards), the Bay Area Air Quality Management District (operating permits for air sources and pollution devices), the Regional Water Quality Control Board (NPDES permit and Waste Water Discharge Permit), and San Mateo County Office of Environmental Health (RCRA generator permit).

Waste Treatment

SLAC does not treat hazardous, radioactive, or mixed wastes on site.

Waste Storage

There are currently four major storage areas for hazardous and radioactive wastes: the Chemical Storage Area, the PCB Storage Area, the RAMSY, and Building 660 at IR-6. Specific waste accumulation sites are located throughout the facility.

SLAC generates a small amount of radioactive waste, which is stored in the fenced and bermed RAMSY while awaiting disposal at a DOE-approved facility. When experiments are completed, accelerator components and commercially procured radioactive material that are no longer used are categorized as either radioactive material for storage to be recycled at SLAC; radioactive material for storage to be recycled at a non-SLAC facility; or radioactive waste for storage and disposal. Approximately 15 percent of all radioactive material is declared waste by SLAC.

The new RMWSF is scheduled to be completed in FY 1995. The RAMSY used now will then be used solely as a staging area to receive, segregate, and process material and to store recyclable radioactive material. IR-6 is also used to store recyclable radioactive material. The separate RMWSF will be used exclusively for nonrecyclable radioactive and mixed waste storage prior to treatment or disposal off site.

SLAC currently has about 1 m^3 of MLLW in storage and coordinates staging and ultimate disposal of land disposal restricted (LDR) mixed waste with the DOE Hanford site.

Waste Disposal

SLAC does not dispose of any hazardous, radioactive, or mixed wastes on site.

Hazardous waste is manifested and sent off site to EPA-permitted treatment, storage, and disposal facilities (TSDFs) for disposal, treatment, or recycling. Some radioactive material is recycled at SLAC, and some material is sent to non-SLAC recyclers. Nonrecyclable radioactive and mixed waste is shipped to the DOE Hanford site for treatment and/or disposal or to other approved DOE facilities. Current estimates for annual disposal are 350 tons of hazardous wastes, 84 m^3 of LLW waste, and 1 m^3 of MLLW. Future volumes will depend on the level of research activity.

6. Facility Stabilization, Maintenance, and Monitoring

No activities at SLAC are funded through the Facilities Transition program (EM-60).

7. Landlord Activities

The Office of Energy Research is the DOE landlord at SLAC while Stanford University owns the facility land.

8. Program Management/Miscellaneous

Program management tasks supporting the ER program at SLAC include the following: personnel management; strategic planning; maintenance of site-wide environmental data; financial management; interaction with DOE, external regulatory agencies, and the public; permitting; monitoring of project progress and audits; and administrative support. Program management tasks supporting the WM program at SLAC include the following: facility management; personnel management and training; administrative support; spill control support; document, guidance, and procedure preparation and revision; database and waste-tracking management; liaison with DOE and external regulatory agencies; audits of TSD facilities that receive hazardous waste from SLAC; payment of disposal and inspection fees; budget preparation and control, and waste minimization planning. Waste minimization planning includes evaluation, training, and implementation of the following programs: recycling; substitution of less hazardous or nonhazardous raw materials; volume and/or toxicity reductions; and source process modifications. The waste minimization program is carried out in compliance with the California Hazardous Waste Source Reduction and Management Review Act.

Costs for program management in Table 1 reflect only those management tasks supporting the ER program. Costs for program management tasks supporting the WM program are included in the waste management summary totals in Table 1 and are intrinsic to the cost line items in Table 9.

DOE and the State of California have an Agreement-in-Principle (AIP) providing for technical and financial support to the state for its activities in environmental oversight, monitoring access, facility emergency preparedness, and initiatives to ensure compliance with applicable federal, state, and local laws at SLAC and five other DOE facilities in California.

SLAC currently has no Interagency Agreements, Compliance Agreements, or Consent Orders with federal, state or local regulatory agencies with the exception of a waste discharge order from the California Regional Water Quality Control Board for monitoring groundwater at the site of a leak from an underground solvent tank, which has been removed, and characterization and remediation of the former tank site.

Table 10

MAJOR ACTIVITY MILESTONES

Program	Task	Completion Date
Environmental Restoration	Site-Wide Remedial Investigation for Contaminated Soil and Groundwater[1]	FY 1998
	Site-Wide Feasibility Study for Contaminated Soil and Groundwater[1]	FY 1999
	Site-Wide Remedial Action Plan for Contaminated Soil and Groundwater[1]	FY 1999
	Site-Wide Record of Decision for Contaminated Soil and Groundwater[1]	FY 2000
	Site-Wide Remedial Design for Contaminated Soil and Groundwater[1]	FY 1999
Waste Management	Install New Oil/Water Separator at IR-8	FY 1995
	Radioactive and Mixed Waste Storage Facility (RMWSF) Construction	FY 1995

[1] Completion dates are for submission of Draft Reports to DOE HQ.

GENERAL ATOMICS

1. Historic Mission

General Atomics (GA) occupies approximately 120 acres on two contiguous sites 13 miles north of San Diego, California. The two sites are referred to as the Main Site and the Serrano Valley Area (SVA). In support of DOE and its predecessor agencies as well as commercial customers, GA has maintained a fully operational Hot Cell Facility (HCF) at the Main Site for over 30 years. GA activities at the HCF primarily supported the High Temperature Gas-Cooled Reactor (HTGR) Program. The HCF is currently the only facility at GA in the EM program. The HCF became contaminated with varying amounts of radioactive materials and small amounts of hazardous materials. GA decided to shut down the HCF because of reduced demand and continuing private industrial development around the site. The decontamination and decommissioning (D & D) of the HCF will eliminate the potential for future environmental releases and make the HCF available for other uses.

The HCF occupies Building 23 and the outdoor service yard at GA's Main Site. The interior of Building 23 has approximately 7,000 square feet (ft^2) of floor space consisting of offices, three hot cells, an operating gallery, and auxiliary areas. The HCF has been used for numerous examinations of DOE fuels, structural material, and instrumentation. Operations in the Building 23 have been performed subject to Nuclear Regulatory Commission (NRC) Special Nuclear Material License No. SNM-696 and the California Department of Health Services (DOHS) Radioactive Material License No. 0145-80.

Building 23 is surrounded by 41,740 ft^2 of fenced service yard, which includes several concrete pads used for staging heavy equipment and making material transfers into and out of the building. The remaining area is comprised of asphalt, soil, scattered small rocks, and disturbed vegetation. There is a 400-ft^2 metal ancillary building and two aboveground waste storage tanks. The HCF is presently in a fully operational but safe shutdown condition and houses significant quantities of materials and equipment normally associated with the work scope requirements of an operational HCF. These materials and equipment are radioactively contaminated and/or contain minimal amounts of hazardous materials.

2. Sources of Contamination

The examination of irradiated fuel, structural material, and instrumentation in the HCF has contaminated the facility with mixed fission and mixed activation products. On the basis of preliminary radiological surveys and a site evaluation, the quantity of wastes present which will be removed during the D & D, is estimated at 2,250 cubic meters (m^3) of low-level waste (LLW) in categories 1 and 3 and mixed low-level waste (MLLW), as well as undetermined amounts of asbestos, lead, and other hazardous materials. Contamination is confined within the boundaries of the HCF, and health risks to GA workers and the public are likely to be extremely limited; however, the exact nature and extent of soil and groundwater contamination are currently being defined, and potential risks will need to be reviewed after this assessment is completed. No surface or subsurface contamination is anticipated outside the boundaries of the facility.

The irradiated fuel material from the Thermionic Fuel Element (TFE) and HTGR programs and the New Production Reactor (NPR) program process and equipment wastes are currently in the process of being removed from the HCF.

3. Site Assumptions

Mission

- GA is a privately owned facility. The only facility currently under the EM program is the HCF, which is undergoing D & D and has no future mission.

Future Use

- The HCF site will be released for unrestricted use NRC to GA.

Treatment, Storage, and Disposal

- Irradiated fuel material will be removed from the HCF and shipped to Oak Ridge Reservation for interim storage upon State of Tennessee approval of an Environmental Assessment (EA) for these activities.

- The total waste from the D & D of the HCF that will require disposal will be 2,250 m^3 of LLW and MLLW and an undetermined amount of hazardous waste. D & D activities will not generate any transuranic (TRU), mixed TRU, or high-level waste.

- All LLW generated by D & D will be disposed at DOE Hanford.

- All mixed wastes will be treated and disposed at DOE Hanford except the following: the elemental-mercury mixed-waste stream will be the subject of an onsite treatability study or will be sent to INEL for treatment (DOE OAK-recommended scenario); the corrosives mixed-waste stream will be subjected to onsite neutralization, filtration, and stabilization; and the organic-liquid mixed-waste stream, will be subjected to incineration and stabilization at the Idaho National Engineering Laboratory (INEL).

- All mixed-waste storage and treatment activities will be performed at GA's Mixed Waste Management Facility (MWMF).

- The scope of the GA D & D project includes dispensation of NPR program process and equipment waste and Reduced Enriched Research Test Reactor (RERTR), TFE, and HTGR irradiated fuel material.

4. Restoration Activities

Environmental restoration activities at GA concern the assessment, remediation, and D & D of the HCF. HCF D & D activities are currently being performed in three phases. Phase 1 includes pre-D & D Nuclear Energy (NE) and NPR program process and equipment waste removal and disposal, shipment of irradiated fuel material from the HCF to the Oak Ridge Reservation for interim storage, and site characterization. Phase 2 includes D & D of the HCF, decontamination outside HCF surface and subsurface areas, packaging, shipment, and disposal of radioactive and nonradioactive wastes, and soil remediation. Phase 3 includes the closure site survey, submittal of the closure report, and obtaining approval from regulatory agencies and DOE for release of the HCF site for unrestricted use.

Site and waste characterizations are being performed. Detailed characterization will include radiological surveys to determine the locations and concentrations of radiological contamination, hazardous material surveys to identify and locate hazardous materials and waste contamination, and asbestos surveys to identify uncontaminated and contaminated asbestos.

Decontamination operations at the HCF are currently scheduled to commence in FY 1995. The standard approach will be to use simpler and more passive methods first, advancing to more aggressive methods as needed. Passive decontamination techniques will be used when indicated by the results of radioactive surface characterization. These techniques include standard vacuuming, damp cloth wiping, and, to a limited degree, hand washing/scrubbing operations. When these passive methods fail to reduce surface contamination to releasable levels, more aggressive decontamination methods will be used. In order of preference, they are: (1) dry abrasive blasting with a vacuum; (2) scabbing and scarification;

and (3) washing with ultra-high-pressure water. If contamination is found within HCF structural elements, demolishing the building will be reconsidered. The current plan is for DOE to remove all contamination from in and around the HCF and return the facility to GA for unrestricted use. The costs of the HCF D & D will be split between DOE (76 percent) and GA (24 percent).

Estimates of future-generation waste streams from the HCF D & D include 2,250 m^3 of LLW (Categories 1 and 3) and MLLW and an undetermined amount of asbestos, lead, and other hazardous wastes.

5. Waste Management Activities

DOE-funded research activities under the HTGR and ICF programs conducted at GA are not currently part of the DOE Environmental Management program at GA. The NE and Defense programs fund all WM activities. No activities at the GA site are funded by EM-30.

Federal Facility Compliance Act (FFCA) Mixed Wastes

The current FFCA mixed wastes on-site consist of residual stored MLLW material from previous DOE activities. The current inventory of characterized mixed wastes totals 8.35 m^3 and includes 0.42 m^3 of inorganic debris, 1.88 m^3 of elemental lead, 4.17 m^3 of inorganic sludges and particulates, 0.42 m^3 of organic liquids, 1.46 m^3 of corrosives, and 0.001 m^3 of elemental mercury. No additional generation of these characterized mixed-waste streams is expected through FY 1997. Target treatment or shipment dates for most of these waste streams have not yet been determined. The target offsite shipment date for the the following mixed-waste streams is October 1995: all of the characterized inorganic debris; 0.63 m^3 of elemental lead in the form of lead scrap; and 2.704 m^3 of inorganic sludge and particulates in the form of paint sludge containing lead. Preferred treatment options for characterized mixed waste streams are: compaction and stabilization of inorganic debris at DOE Hanford; macroencapsulation of elemental lead at DOE Hanford; stabilization of inorganic sludge and particulates at DOE Hanford; incineration and stabilization of organic liquids at INEL; and onsite neutralization, filtration, and stabilization of corrosives. An onsite treatability study will be conducted concerning the elemental mercury; the DOE-OAK-recommended treatment option for the elemental mercury mixed waste stream is treatment at INEL. The estimated mixed waste volumes for onsite treatment and disposal at DOE Hanford are 1.46 m^3 and 6.89 m^3, respectively.

The estimated volume of uncharacterized mixed-waste streams is 32 m^3 and includes 21.22 m^3 of corrosives and ignitables, 0.02 m^3 of organic liquids, 8.10 m^3 of inorganic debris, and 2.71 m^3 of aqueous liquids. The target characterization date for all of these waste streams is January 1995 with treatment evaluations to be completed by June 1995. Future-generation estimates of waste streams are 20 m^3 of inorganic debris, which consists of miscellaneous scrap metal from the HCF D & D and HEPA filters from the NPR, and 5 m^3 of wastewater containing zinc and possibly other metals from the HCF D & D.

Mixed-waste generated at GA is stored at the MWMF, which is an interim-status waste storage facility under RCRA. The MWMF consists of three areas, MWMF1, MWMF2, and MWMF3, which are designated as container storage areas for mixed wastes. The total storage capacity in these three areas is approximately 580 m^3 (equivalent to 2,758 55-gallon drums), which far exceeds the current and projected mixed-waste inventory at GA.

6. Facility Stabilization, Maintenance, and Monitoring

No activities at the GA site are funded through the DOE Facility Transition Program.

7. Landlord Activities

The GA facility is privately owned and operated.

8. Program Management and Miscellaneous

Program management at the site supports the integration of ER activities at GA and includes: tracking, collecting, and reporting costs; preparation of programmatic documents; coordinating permitting and public involvement; liaison with external regulatory agencies; and establishing, documenting, and maintaining technical, cost, and schedule baselines.

Table 10

MAJOR ACTIVITY MILESTONES

Program	Project	Task	Completion Date
Environmental Restoration	**HCF D & D Phase I**	Ship Irradiated Fuel to ORNL for Interim Storage	FY 1995
		Site and Facility Characterization	FY 1995
	HCF D & D Phase II	Begin D & D	FY 1995
		Complete D & D	FY 1997
	HCF D & D Phase III	Complete Final Closure Report	FY 1998

ENERGY TECHNOLOGY ENGINEERING CENTER

1. Historic Mission

The Santa Susana Field Laboratory (SSFL) is a 2,700-acre site owned by Rockwell International (Rockwell) located in Ventura County. Part of Area IV at SSFL was set aside in the mid-1950s for use in nuclear reactor development and testing. Research was primarily related to sodium-cooled nuclear power plant development and the development of space power systems using sodium and potassium as coolants. The Energy Technology Engineering Center (ETEC) occupies 290 acres within Area IV and was formed in the mid-1960s as a DOE laboratory for development of liquid-metal heat-transfer systems in support of the Liquid-Metal Fast Breeder Reactor program. Operations at Building 20, the Rockwell International Hot Lab (Hot Lab) were in support of the Defense Program, while other facilities at ETEC supported other DOE research programs including the System for Nuclear Auxiliary Power (SNAP) program. By the mid-1970s, operations in all nuclear reactors and most other facilities in Area IV had ended.

Nuclear Energy (NE) operating programs at ETEC were terminated at the end of 1994. Currently, ETEC's primary mission under the Office of Energy Efficiency (EE) is applied engineering development of emerging energy technologies, including conservation, environmental, solar, geothermal, and fossil energy. Environmental restoration and decontamination and decommissioning (D & D) activities began at this site in the early 1970s. In 1980, DOE began a systematic decontamination of remaining facilities formerly used for reactor development activities.

2. Sources of Contamination

Nuclear research activities, past disposal and handling practices, and solvent use and disposal at ETEC resulted in contamination of former research buildings, several existing and former waste management facilities, and site soil and groundwater. Since environmental restoration activities have been conducted at the site since the early 1970's, many of the initially contaminated facilities have already been remediated.

Radioactive-contaminated sites resulted from nuclear activities performed primarily in the 1960s. These activities included the operation of ten reactors and seven criticality test facilities, fuel fabrication,

reactor and used fuel disassembly, small-scale laboratory work, and on-site storage of nuclear material. Over a period of 15 years prior to 1989, a nuclear D & D cleanup program at ETEC removed in excess of 99% of the man-made radioactivity generated at the site. Unconfined remaining radioactivity, calculated to be less than 0.1 curie, is present at low concentrations in the Radioactive Material Disposal Facility (RMDF). For perspective, the conservative estimate of the unconfined radioactivity (less than 0.1 curie) is much less than the radioactivity in the natural environment at SSFL. The top foot of soil over the 2700 acres of SSFL contains 300 curies of radioactivity from the natural uranium, thorium, and potassium in the soil and rocks. Confined radioactivity is estimated to be less than 10 curies and is controlled in activated or contaminated structures that are locked, fenced, and within a guarded perimeter.

The remaining contaminated buildings at ETEC currently in the EM program include Buildings 12, 20, 57, and 59 and are undergoing or are scheduled for D & D activities. Building 12, the SNAP Critical Facility, was contaminated as a result of its former use for critical tests and contains low-level radioactively contaminated structural material. Building 20 (the Hot Lab), which has been undergoing decontamination since 1987, was contaminated as a result of storage of radioactive material and other material used during research activities. Building 57, the Liquid Metal Development Laboratory, (LMDL), was contaminated with sodium and other hazardous material during research activities. Building 59, a SNAP reactor test facility, contains units above and below ground. The above-grade unit is referred to as the Large Leak Test Rig (LLTR) and the below-grade unit is referred to as Building 59 and both were contaminated as a result of research operations.

Past radioactive and hazardous material handling and disposal practices have also resulted in contamination at several existing or former disposal units. Those facilities in the EM ER program include the Sodium Disposal Facility (SDF, Building 886), the Building 56 landfill, the Hazardous Waste Management Facility (HWMF, Buildings 29 and 133), and the RMDF. Previous operations at some of these facilities has also resulted in contamination of adjacent soils. The SDF, which is currently undergoing remediation as part of RCRA closure, was contaminated as a result of storage of radioactive materials. The Building 56 landfill contains contamination due to past disposal activities. The HWMF contains contamination due to handling of hazardous wastes and alkali metal treatment activities. The buildings that make up the RMDF (Buildings 21, 22, and 75) contain radioactivity due to storage activities.

Use of solvents at the site has resulted in groundwater contamination. Release of unknown quantities of cleaning solvents in the mid-1960s has resulted in VOC contamination of groundwater.

Groundwater has also been contaminated in certain areas with tritium, gross alpha and beta radioactivities, and radium (226 and 228). Groundwater extraction and pumping at ETEC has limited the lateral extent of degraded groundwater movement, but complete site characterization and remediation of groundwater contamination is continuing.

3. Site Assumptions

Mission

- ETEC's former mission was research and development for the energy, power conversion, liquid-metal development, and space and defense programs and ended in FY 1994. The current mission under Energy Efficiency (EE) is applied engineering development of energy technologies. The future mission starting in FY 1996, when ETEC will transition to Environmental Management (EM), will be site restoration.

Future Use

- As D & D activities are completed and buildings are certified for release, they will be released to Rockwell for unrestricted use.
- Current long-term plans are to have private-sector companies use a small number of the facilities through 1998, at which time only surveillance and maintenance (S & M) and D & D activities will remain.

Treatment, Storage and Disposal

- Groundwater VOC remediation will use Rockwell-owned pump-and-treat systems.
- Temporary on-site storage of D & D waste will be in the RMDF and Building 29 of the HWMF prior to ultimate disposal.
- Hot Laboratory radioactive waste will be disposed at the Nevada Test Site.
- All other radioactive wastes will be disposed at DOE Hanford.
- Hazardous wastes will be disposed of at permitted Treatment, Storage, and Disposal (TSD) facilities.
- The new sodium cleaning unit at the Component Handling and Cleaning Facility (CHCF) will be completed by the end of FY96, allowing the subsequent closure of Building 133 (the thermal oxidation unit) at the existing HWHF.

4. Restoration Activities

The Environmental Restoration program at ETEC currently consists of those facilities accepted for remediation in the former Surplus Facilities Management Program (SFMP) and any soil and groundwater remediation that may be required as a results of those facilities operations. Environmental restoration operations currently consist of remedial actions and D & D activities. The facilities in the ER program will change over time as facilities are transitioned to the ER program. The cost summary tables do not include ER activities at surplus facilities that are not currently within the ER program.

Remedial action includes site-wide assessment, development of a remedial action plan (RAP), and remediation of contaminated media and the Building 56 Landfill. An integrated site-wide soil and groundwater assessment will be used to develop a site-wide RAP which is scheduled for completion in FY 1995. The RAP will identify all activities required to remediate the site for eventual release for unrestricted use. Soil remediation at contaminated buildings will be conducted as part of D & D activities. ETEC Area IV Solid Waste Management Units (SWMUs) identified in the RCRA Facility Assessment (RFA) will also be remediated, including the Building 56 Landfill which is scheduled to start closure in FY 1996 and complete closure in FY 1999. Remedial actions will be conducted in accordance with requirements of the ETEC RCRA permit. The principal concern of remedial action to date is contaminated groundwater. Groundwater at the site has been contaminated with organic solvents, particularly trichloroethene (TCE) and cis 1,2-dichloroethylene, as well as tritium, gross alpha and beta radioactivities, and radium. Groundwater extraction and pumping at SSFL has limited the extent of contaminated groundwater, but complete site characterization and remediation of ETEC groundwater contamination is continuing.

D & D programs include the D & D of DOE-owned surplus facilities identified under the SFMP and RCRA closure of the SDF, the HWMF, and the RMDF. Given that the facility land is owned by Rockwell, all cleanup is to levels sufficient for unrestricted use. The D & D program also includes S & M of facilities turned over to Environmental Restoration and awaiting funding for D & D. Additional work includes the packaging, shipment, and disposal of both hazardous and non-hazardous waste generated as a result of D & D. D & D activities have been completed at many of the former nuclear research sites. D & D activities are currently underway at Buildings 12, 20, and 59 (below-grade) with completion expected in FY 1996 for Buildings 12 and 59, and in FY 1998 for Building 20. D & D activities are scheduled to begin at Building 57 and the LLTR in Building 59 (above-grade) in FY 1998. RCRA closure of the former SDF is scheduled for completion by the end of FY 1995. RCRA closure

activities at the HWMF are scheduled to commence in FY 1998. D & D-related disposal tasks include the disposal of a moderator cask (a former onsite transport cask) and wastes from the closure of the SDF, both scheduled to occur in FY 1995.

The RMDF is used in support of D & D activities and contains a decontamination facility and storage area for radioactive and mixed waste prior to their shipment to an approved disposal site. A small amount of transuranic (TRU) waste is temporarily stored at the RMDF from a previous D & D program. Following completion of other D & D activities requiring continuing operation of the RMDF, the RMDF itself will be decommissioned. D & D activities at the RMDF are currently estimated to begin in FY 1999.

5. Waste Management Activities

Waste Management (WM) operations at ETEC include the disposal of hazardous, radioactive, and mixed waste, corrective activities at the Sodium Components Test Installation (SCTI), Tiger Team waste management-related activity, and continuity of operations at the RMDF and the HWMF. Waste management of the Federal Facilities Compliance Act (FFCA) mixed wastes will include on-site treatment of several mixed waste streams and on-site storage of mixed wastes prior to off-site disposal. Wastes handled by WM at ETEC in the past included operations waste from the various research units. Presently, much of the waste handled by WM is residual material from former research activities, and D & D- or ER- generated wastes from facility closures and remediation.

ETEC is a hazardous waste generator operating under State of California Environmental Protection Agency (EPA) permit CA3890090001. ETEC manages and operates the HWMF under TSD permit CAD000629972 for the handling, treatment, and disposal of non-radioactive surplus and alkali metal wastes. ETEC is proceeding with preparation of a Part B Operation Plan for RCRA permitting of the RMDF. A RCRA Part A Permit application has been submitted to the EPA and State of California Department of Toxic Substance Control (DTSC) and the RMDF is currently operating under interim status.

Continuity of operations, performed in compliance with RCRA permitting operations, includes waste characterization and certification, waste minimization, waste packaging, and off-site disposal. Tiger Team waste management corrective actions consist of developing a waste minimization plan, upgrading the RMDF stack sampling system, and designing and installing a hazardous waste collection system.

Waste Treatment

On-site treatment is currently performed on surplus sodium and three mixed waste streams. Sodium is currently treated at the thermal oxidation unit in Building 133 of the HWMF, which results in an end product that must be disposed of as a hazardous waste. To replace this system, WM will design and construct a new sodium cleaning unit at the existing CHCF, and construction is scheduled to be completed in FY 1996. Operations at Building 133 will be phased out starting in FY 1998, and the building will undergo RCRA closure by the ER program.

All radioactive wastes at ETEC are stored and process in the RMDF prior to disposal. FFCA mixed wastes generated during D & D activities to date that have been characterized include: 0.110 m^3 of electropolish solution containing chromium which will be treated on-site by neutralization with sodium hydroxide, conversion of chromium from a hexavalent to a trivalent form, and stabilization with "aqua set"; and 3.45 m^3 of HEPA System bag filters containing lead, which will be packaged and disposed of at the Envirocare facility in Utah. Two FFCA mixed wastes will be recycled: approximately 0.01 m^3 of sodium metal slightly contaminated with radioactive manganese will be converted from sodium to sodium hydroxide and then be used as a reagent to neutralize the electropolish solution; and 8.9 m^3 of lead shielding with low-level radioactivity which will be treated on-site by crystalline ice blasting and chelating treatment, with the resultant lead material, free of radioactivity then being recycled. The RMDF will undergo D & D by the ER program once it is no longer needed to support other D & D activities at ETEC. D & D activities are currently scheduled to start at the RMDF in FY 1999.

Treatment and/or disposal options of uncharacterized and future potential mixed wastes will be evaluated after characterization is complete.

Waste Storage/Handling

Temporary on-site storage of D & D waste prior to disposal is in the RMDF and Building 29 of the HWMF. All radioactive and mixed wastes generated at ETEC are stored at the RMDF and hazardous wastes are stored in Building 29.

The total volume of characterized mixed low level radioactive waste (MLLW) currently stored at ETEC is 3.58 m^3 and includes the electropolish solution and HEPA System bag filters mentioned above. One uncharacterized mixed waste stream exists—paint chips potentially containing lead—but the

current volume stored at ETEC has yet to be determined. Mixed transuranic waste stored at the site consists of one brick (0.001 m^3) of lead shielding. Future potential mixed waste streams include salt cores containing chromium, analytical waste, various wastes resulting from D & D of Building 20 (HEPA pre-filters, HEPA bag filters, drain line debris, vacuum catch barrels, and spray paint cans), and various wastes from other future remedial and D & D activities. These wastes are not fully characterized and no estimate of total volume is available.

Building 29 is scheduled for RCRA Closure in FY 1998 and the RMDF is scheduled to undergo D & D starting in FY 1999.

Waste Disposal

Hot Laboratory radioactive D & D waste will be disposed of at the Nevada Test Site, with the exception of HEPA bag filters which will be disposed of at the Envirocare Facility in Utah. All other radioactive (except the mixed TRU) wastes will be disposed of at the Hanford, Washington, site. Disposal of the one brick of lead shielding contaminated with TRU elements is scheduled to be at the Waste Isolation Pilot Project (WIPP). Hazardous wastes will be disposed of at permitted TSD facilities.

6. Facility Stabilization, Maintenance, Monitoring

Transition

In FY 1996, ETEC is scheduled to transition to the EM Facility Transition Program (EM-60). S & M will be performed to ensure than any contamination that may exist remains contained within the facility and that the facility does not deteriorate prior to D & D and restoration activities by the ER program. Repairs will be made when necessary to maintain the governments's investment in the facility. S & M and facility infrastructure costs are currently estimated at approximately $3.4 million per year.

7. Landlord Activities

EE is currently the landlord for ETEC. It is anticipated that the facility landlord responsibilities, including infrastructure management and S & M of current EE facilities, will be the responsibility of EM-60 beginning in FY 1996 and will continue until EM-40 can start the D & D process for specific buildings.

8. Program Management/Miscellaneous

Program management tasks supporting the ER program at ETEC include the following: personnel management; maintenance of site-wide environmental data; strategic planning; financial management; interaction with DOE, external regulatory agencies and the public; permitting; monitoring of project progress; provision of a technical advisory board; coordination of Independent Verification Contractors (IVCs); and administrative support. Program management tasks supporting the WM program at ETEC include the following: facility management; personnel management and training; administrative support; document, guidance, and procedure preparation and revision; database and waste-tracking management; liaison with DOE and external regulatory agencies; audits; budget preparation and control; and waste minimization planning. Waste minimization planning includes evaluation, training, and implementation of the following programs: recycling; substitution of less hazardous or nonhazardous raw materials; volume and/or toxicity reductions; and source process modifications. The waste minimization program is carried out in compliance with the California Hazardous Waste Source Reduction and Management Review Act.

Costs for program management in Table 1 reflect only those management tasks supporting the ER program. Costs for program management tasks supporting the WM program are included in the waste management summary totals in Table 1 and are intrinsic to the cost line items in Table 9.

DOE Oakland and the State of California have an Agreement-in-Principal providing for technical and financial support to the State for its activities at ETEC and five other DOE sites in California in environmental oversight, monitoring, access, emergency preparedness, and other initiatives to ensure compliance with applicable Federal, state, and local regulations at the site.

Table 10

MAJOR ACTIVITY MILESTONES

Program	Activity		Estimated Target Date
Environmental Restoration	Assessment & Remediation	Final Site-wide Remedial Action Plan	FY 1995
	D & D (Non-Defense)	Begin D & D of Building 12 Begin preparations for D & D of RMDF Complete RCRA Closure of the SDF Disposal of SDF Waste and Moderator Cask	FY 1995
		Begin RCRA Closure of Building 56 Landfill Complete D & D of Buildings 12 and 59 (below-grade)	FY 1996
		Begin RCRA closure of HWMF Begin D & D of Building 57 and LLTR in Building 59 (above-grade)	FY 1998
		Begin D & D of RMDF Complete RCRA Closure of Building 56 Landfill	FY 1999
	D & D (Defense)	D & D of Building 20 Support Rooms and Outside Area	FY 1996
		D & D of Building 20 Storage and Airlock and Basement Treatment and Disposal of Building 20 Mixed Waste	FY 1997
		D & D of Building 20 Operating Gallery and Mockup Demolition of Building 20	FY 1998
		Release of Building 20 to Rockwell	FY 1999
Waste Management	Design of new sodium cleaning unit for the CHCF		FY 1995
	Construction of new sodium cleaning unit for the CHCF		FY 1996

GEOTHERMAL TEST FACILITY (GTF)

1. Historic Mission

The East Mesa Geothermal Test Facility (GTF), an inactive DOE geothermal research facility, is in the Imperial Valley, Imperial County, California, about 20 miles east of El Centro and 1.5 miles north of Interstate Highway 8. In 1968, the U.S. Bureau of Reclamation constructed the facility for the investigation and development of geothermal resources in the East Mesa area. DOE became the site operator in 1978 and continued the site's energy research mission. The 82-acre site includes a 6-acre, PVC-lined holding pond installed in 1972 to temporarily store and evaporate brine blowdown water as well as untreated brine extracted in the geothermal exploration process. Geothermal research activities at the site were discontinued in 1987 as commercial-scale geothermal power developed in the region. The site's current DOE mission is to minimize potential exposure to humans, eliminate any threat to groundwater, and release the site for unrestricted use.

2. Sources of Contamination

No active processes or experiments involving DOE research are currently operating or planned at GTF; Sources of contamination are related to past operations at the site, and hazardous wastes may be generated during site restoration.

During an asbestos survey conducted by Dames & Moore on August 24, 1992, three types of materials were identified as containing asbestos: a joint compound used around pipe joints and flanges, cooling tower millboard, and floor tile and mastic inside the yellow lab building. Several other areas contained asbestos that had a potential to become airborne, and these areas were remediated.

Untreated brine extracted during geothermal exploration and brine blowdown were stored in a holding pond. Storage of brine in the holding pond resulted in contamination of sediments due to the concentration of water-soluble salts and the precipitation of minerals. The volume of contaminated sediments is estimated at 9,150 cubic yards meters. On the basis of previous sampling, the quantity of hazardous waste that will be generated from restoration activities is expected to be minimal.

3. Site Assumptions

Mission

- Use of the facility for research was discontinued in 1987. The current DOE mission at GTF is site restoration.

Future Use

- Once restoration activities are complete, the facility will be turned over to the U.S. Bureau of Reclamation for unrestricted use.

Treatment, Storage, and Disposal

- It is anticipated that a limited amount of hazardous waste will be generated during decontamination and disposed at a permitted Class I or II landfill.

4. Restoration Activities

A field investigation report on the brine holding pond was prepared in 1992 by Bechtel Environmental, Inc., for the Office of Energy Efficiency. A site characterization study of the balance of the site was conducted by Dames & Moore in 1993.

The brine pond has been contaminated with salts and minerals concentrated in sediment by evaporation. Decontamination activities will generate two waste streams: nonaqueous soil/debris contaminated with arsenic and nonaqueous, nonhazardous debris contaminated with salts and minerals.

Three types of materials were identified at the site as containing asbestos: a joint compound used around pipe joints and flanges, cooling tower millboard, and floor tile and mastic inside the yellow laboratory building. These asbestos-containing materials will be removed and disposed at an appropriate disposal facility.

Under the terms of the lease agreement between the DOE and the U.S. Bureau of Land Management, the site will have to be restored to its original condition. This restoration will require the removal of a few structures and debris and materials currently onsite.

5. Waste Management Activities

All DOE activities at GTF including waste management activities will be transferred to and managed by the Environmental Restoration (ER) program. These activities were discussed in Section 4.

6. Facility Stabilization, Maintenance, and Monitoring

This site has been proposed for transition to ER from its current landlord, the Office of Energy Efficiency. Prior to any remediation by ER, the site will require initial review and transition through the Office of Facility Transition.

7. Landlord Activities

The Office of Energy Efficiency is currently the landlord at GTF. It is anticipated that the facility landlord responsibilities including infrastructure and surveillance and monitoring will transition directly to ER.

8. Program Management and Miscellaneous

Because GTF is an inactive site and no restoration activities are underway, there are no current site management tasks other than planning for future potential restoration efforts. Once funding is available for restoration, program management will include typical management tasks such as strategic planning, liaison with DOE and external regulatory agencies, scheduling, document preparation, budget control, and financial forecasting.

Table 10

MAJOR ACTIVITY MILESTONES

Program	Task	Completion Date
Environmental Restoration	Complete Site Characterization	FY 1997
	Begin ER Activities	FY 1997
	Start Site Remediation Activities	FY 1998
	Complete D & D and Site Remediation Activities	FY 2000