



Department of Energy
Washington, DC 20585

June 21, 2005

Mr. Jack Broadbent, Director
Air Division, A-1-1
U. S. Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, CA 94105

SUBJECT: Radionuclide Air Emission Annual Reports for Calendar Year 2004

Dear Mr. Broadbent:

Enclosed is a copy of Radionuclide Air Emission Report (Under Subpart H of 40 CFR 61) for Calendar Year 2004 for the Laboratory for Energy-Related Health Research.

Should you have any questions, please contact me at (510) 637-1637.

Sincerely,

A handwritten signature in cursive script that reads "Jay B. Tomlin".

Jay B. Tomlin
LEHR Project Manager
Oakland Projects Office

Enclosure

cc: Eleanor D. Thornton, EPA Headquarters Office of Radiation and Indoor Air, w/encl (CD)
Gustavo Vasquez, DOE/EH-412 w/encl (CD)
Mike Bandrowski, EPA Region IX, A-1-1 w/o encl





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

**FINAL
RADIONUCLIDE AIR EMISSION ANNUAL REPORT
(SUBPART H OF 40 CFR 61)
CALENDAR YEAR 2004**

for the

**LABORATORY FOR ENERGY-RELATED HEALTH RESEARCH
UNIVERSITY OF CALIFORNIA, DAVIS**

prepared for:

United States Department of Energy
Oakland Environmental Programs
1301 Clay Street, P.O. Box 54
Oakland, California 94612-5208

prepared by:

Weiss Associates
5801 Christie Avenue, Suite 600
Emeryville, California 94608-1827

June 24, 2005
Rev. 0

DOE Delivery Order No. DE-AD03-04NA99610

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Approvals Page

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Approved by:  Date: 6/24/2005
Dolores D. Loll, P.E.
Project Quality Assurance Manager
Weiss Associates

Approved by:  Date: 6/24/2005
Robert O. Devany, C.E.G., C.H.G.
Project Manager
Weiss Associates

CONTENTS

1. Facility Information	1-1
1.1 Site Description	1-1
1.2 Source Description	1-3
1.2.1 Point Sources	1-3
1.2.2 Non-Point Sources	1-3
1.2.3 Western and Eastern Dog Pens Areas	1-3
2. Air Emission Data	2-1
2.1 Point Sources	2-1
2.2 Non-Point Sources	2-1
2.3 Particulate Matter-10	2-3
3. Dose Assessments	3-1
3.1 Description of Dose Model	3-1
3.2 Summary of Input Parameters	3-2
4. Compliance Assessment	4-1
4.1 Certification	4-1
5. Additional Information	5-1
6. Supplemental DOE Information	6-1
7. References	7-1

TABLES

- Table 1. Results of National Emissions Standards for Hazardous Air Pollutants Reports for the Past Five Years
- Table 2. Summary of Potential Non-Point Diffuse Area Radionuclide Sources
- Table 3. Maximum Surface Soil Concentrations for Radionuclides Exceeding Background and PM₁₀ Emission Rates, LEHR Western Dog Pens Area
- Table 4. Maximum Surface Soil Concentrations for Radionuclides Exceeding Background and PM₁₀ Emission Rates, LEHR Eastern Dog Pens Area
- Table 5. On-Site Effective Dose Equivalent to Maximally Exposed Individual Resulting from Radionuclide Emissions from Each Potential Fugitive Dust Emission Non-Point Source
- Table 6. Estimated Collective Population Dose Resulting from Radionuclide Emissions from Non-Point Sources
- Table 7. CAP88-PC Input for the Western Dog Pens Area
- Table 8. CAP88-PC Input for the Eastern Dog Pens Area

FIGURES

- Figure 1. LEHR Facility Location Map, UC Davis, California
- Figure 2. LEHR Facility DOE Non-Point Source Areas and Location of Maximally Exposed Individuals

APPENDICES

- Appendix A. CAP88-PC Output Results

ACRONYMS AND ABBREVIATIONS

°C	degree(s) Celsius
°F	degree(s) Fahrenheit
Ac-228	actinium-228
Bi-212	bismuth-212
Bi-214	bismuth-214
CAP88-PC	atmospheric dispersion/radiation dose calculation computer code (US EPA)
C-14	carbon-14
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
Ci/yr	Curies per year
cm/s	centimeter(s) per second
cm/yr	centimeter(s) per year
Co-60	cobalt-60
Cs-137	cesium-137
DOE	United States Department of Energy
EDE	effective dose equivalent
EDPs	Eastern Dog Pens
emis.	emission
g/m ² -hr	gram(s) per square meter-hour(s)
hr	hour(s)
H-3	tritium
ID	identification (number)

K-40	potassium-40
km	kilometer(s)
km ²	square kilometer(s)
LEHR	Laboratory for Energy-Related Health Research
m	meter(s)
m/s	meter(s) per second
m ²	square meter(s)
max.	maximum
MEI	maximally exposed individual
mph	mile(s) per hour
mrem/yr	millirem(s) per year
mSv/yr	milliSievert(s) per year
No.	number
NESHAPs	National Emissions Standards for Hazardous Air Pollutants
Pb-210	lead-210
Pb-212	lead-212
Pb-214	lead-214
pCi/g	picoCurie(s) per gram
person-rem/yr	person – roentgen(s) equivalent man per year
PM ₁₀	particulate matter with an aerodynamic diameter less than or equal to 10 micrometers
RA	removal action
Ra-226	radium-226
Sr-90	strontium-90

Th-228	thorium-228
Th-232	thorium-232
Th-234	thorium-234
Tl-208	thallium-208
U-235	uranium-235
U-238	uranium-238
UC Davis	University of California, Davis
UCL	upper confidence limit
US EPA	United States Environmental Protection Agency
WDPs	Western Dog Pens
µm	micrometer(s)

US Department of Energy
Radionuclide Air Emission Annual Report
(Subpart H of 40 CFR 61)
Calendar Year 2004

Site Name: Laboratory for Energy-Related Health Research (LEHR)

Field Office Information

Office: U.S. Department of Energy
Oakland Environmental Programs

Address: 1301 Clay Street, P.O. Box 54
Oakland, CA 94612-5208

Contact: Jay Tomlin Phone: (510)-637-1637

Site Information

Operator: Weiss Associates

Address: 5801 Christie Avenue, Suite 600
Emeryville, CA 94608-1827

Contractor Contact: Robert Devany Phone: (510) 450-6000
Project Manager
Weiss Associates

1. FACILITY INFORMATION

In 2004, the Laboratory for Energy-Related Health Research (LEHR) complied with the requirements of Title 40 Code of Federal Regulations (CFR) Part 61 Subpart H - National Emissions Standards for Hazardous Air Pollutants (NESHAPs) for Emissions of Radionuclides from United States Department of Energy (DOE) Facilities. The NESHAPs regulations require that radionuclide emissions not exceed levels that would result in an effective dose equivalent (EDE) of 10 millirems per year (mrem/yr).

This Radionuclide Air Emission Annual Report applies only to the DOE areas at the LEHR facility on the University of California, Davis (UC Davis) campus. For purposes of this report, the DOE areas will be referred to as "the Site" and references to LEHR include the entire 15-acre property where both DOE and UC Davis conduct activities. There are currently no point sources of radionuclide emissions at the Site. Potential fugitive/area sources of radionuclide emissions were modeled using the United States Environmental Protection Agency (US EPA) atmospheric dispersion/radiation dose calculation computer code, CAP88-PC, Version 1.0. Based on results from this model, the total contribution to the maximum EDE from non-point source emissions for reporting year 2004 is estimated to be 1.6×10^{-3} mrem/yr (about 0.02% of the 10 mrem/yr standard). This result is similar to the results of the previous five years (Table 1).

1.1 Site Description

The LEHR facility is located in Solano County, California, in the southeast quadrant of Section 21, Township 8 North, Range 2 East, Mount Diablo Base and Meridian. It is approximately 1.5 miles south of the town of Davis (Figure 1), and occupies about 15 acres on the southeast portion of the UC Davis campus. The LEHR facility is bounded by UC Davis research facilities, private farmland and the South Fork of Putah Creek. The southern boundary of the LEHR facility is the northern levee of the South Fork of Putah Creek.

The local climate is Mediterranean with mild winters and dry summers. Precipitation and temperature data specific to 2004 were obtained from the Davis WSW weather station located approximately one mile northwest of the LEHR facility (Western Regional Climate Center, 2005). The average temperature for the month of September is not reported by this weather station due to an insufficient number of temperature measurements for that month. Therefore, in the calculation of the average 2004 temperature, the value used for the month of September was the long-term (1917 through 2003) average September temperature. The use of this estimated value will not have a significant impact on the CAP88-PC results since it is used to derive an average annual temperature. The resulting average temperature in the winter months (October through April) was 55 degrees

Fahrenheit (°F), and the average temperature in the summer months (May through September) was 72°F. The total precipitation for 2004 was approximately 18.97 inches (48.18 cm). The sun shines approximately 95% of the time during daylight hours in the summer and about 45% of the time during daylight hours in the winter.

The prevailing wind direction is from the south, reflecting frequent incursions of marine air through the Carquinez Strait into the Sacramento Valley. Changes in wind direction are common, with winds from the northwest occurring diurnally. Several times a year, strong winds blow from the north, generally following the passage of Pacific storm systems (DOE, 1994a). The weather station at the Sacramento Executive Airport recorded hourly wind speeds for 2004 (NCDC, 2005a). The 95% upper confidence limit (UCL) of the mean hourly wind speed was 3.3 meters per second (m/s) or 7.3 miles per hour (mph). The maximum sustained wind speed was 13.9 m/s (31 mph) and the median wind speed was 2.7 m/s (6 mph).

The land within a one-mile radius of the LEHR facility is owned both privately and by UC Davis, and is used for animal research, agriculture and recreation. Immediately to the north, east and west of the LEHR facility are UC Davis research facilities. Privately owned lands within one mile to the south and east of the LEHR facility include permanent residences and some crop land. Approximately 75% of the surrounding land in the general vicinity of the LEHR facility is used for agriculture. Major crops include fruits, nuts and grains. Approximately 40% of the agricultural land in the vicinity is irrigated and some of the nearby lands are used for cattle grazing (DOE, 1988).

The LEHR facility contains laboratory buildings and former animal-handling facilities (Figure 2). Approximately 45% of the Site is paved or covered by structures. Approximately 45% is unpaved and relatively free of vegetation, and 5% is covered by large, deep-rooted vegetation. Former outdoor dog pens consisting of asphalt, gravel and soil occupy the remaining 5% of the Site. The Regents of the University of California own the land and DOE owns the buildings on site.

In the early 1950s, the Atomic Energy Commission (now DOE) began conducting radiological studies at UC Davis on laboratory animals, particularly beagles. Initial studies were carried out on the main campus and involved irradiation of beagles. DOE began operating in its present location in 1958 when full-scale experimental use of radioactive materials began. Research at the Site through the mid-1980s focused on the health effects from chronic exposure to radionuclides, primarily strontium-90 (Sr-90) and radium-226 (Ra-226). In the early 1970s, a cobalt-60 irradiator facility was constructed at the Site to study the effects of chronic exposure to gamma rays on bone marrow cells of beagles. In 1975, DOE initiated a program at the Site to study the potential health effects of combustion products from fossil fuel power plants. In 1983, the Toxic Pollutant Health Research Laboratory was established at the Site. DOE-funded research at the LEHR facility ended in 1989. The LEHR facility is presently occupied by the UC Davis Center for Health and the Environment. UC Davis radionuclide emissions are not included in this report.

1.2 Source Description

Applicable sources of radionuclide air emissions at LEHR are discussed below.

1.2.1 Point Sources

No potential point sources of radionuclide emissions existed at the Site in 2004.

1.2.2 Non-Point Sources

Non-point diffuse radionuclide emission sources in 2004 were limited to wind-blown fugitive dust from the Western Dog Pens (WDPs) and Eastern Dog Pens (EDPs) Areas (Table 2). The meteorological conditions were the only input parameters that changed for the WDPs and EDPs since 2002. No removal actions (RAs) were conducted at the Site in 2004.

1.2.3 Western and Eastern Dog Pens Areas

The WDPs and EDPs areas, located near the center of the LEHR facility (Figure 2), are a potential non-point diffuse source of radiological emissions. The dog pens were used to house dogs involved in the Ra-226 and Sr-90 research activities at the Site. Excreta from dogs housed in outdoor pens contained low levels of radiological constituents. Solids were removed from the pens on a daily basis. Urine evaporated and/or infiltrated into the gravel fill in the pens. Calculations by Marvin Goldman in a 1963 memorandum estimated that about 500 microCuries per year ($\mu\text{Ci}/\text{yr}$) of Sr-90 and about 50 $\mu\text{Ci}/\text{yr}$ of Ra-226 were eliminated in urine by the dogs housed in the pens (WA, 2000a).

The WDPs area originally contained 320 pens. In 1975, 64 pens were removed to construct the Cellular Biology Laboratory (Building H-294, Figure 2). The EDPs area contained 96 pens and overlies UC Davis Landfill Number (No.) 2.

In 1996, above-grade kennels and interior chain-link fencing were removed from the EDPs and WDPs. The kennel materials were properly packaged and shipped to the DOE Hanford site for disposal. In 1999, the interior chain-link fencing was released according to DOE Order 5400.5 and recycled (EMS, 1999).

Between May and August 2001, DOE removed concrete curbing, gravel, metal grating and fence posts from the existing 256 WDPs. This material was removed using an excavator and transported to the appropriate stockpile on site using a wheel loader. Following the 2001 WDPs Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) RA, the southern portion of the pens was backfilled to grade with clean imported fill. The waste material was temporarily stockpiled at the Site, but covered with plastic sheeting to prevent air emissions. Most of this stockpiled material was removed from the Site prior to 2003. However, remaining gravel was

removed for reuse off site between January 12 and February 18, 2004. Emissions from this event were not included in the calculations in this report due to the event's short duration and the extremely low radionuclide concentrations present. Dose calculations for this event (WA, 2003b) indicated that the maximally exposed radiation worker dose was 0.0283 mrem per year. During 2004, an additional stockpile consisting of about 400 cubic yards of soil from the RA at the Southwest Trenches area was stored in the southern portion of the WDPs. Though this material contains minor amounts of radioactive material, emissions were mitigated by a plastic cover.

The values used to represent the soil concentrations, for the purpose of calculating air emissions, are the maximum detected concentrations. These concentrations were not corrected by subtracting the ambient background concentrations. This ultimately results in a conservative estimate of the health risk to human receptors. The background concentrations were used, however, for screening which radionuclides would be considered in this report. If the maximum detected concentration of a radionuclide was less than the background concentration, that radionuclide was not identified as a constituent of concern in this report. Calculations of the WDPs area emissions are based on radionuclide concentrations in samples collected from the upper two feet of soil in the WDPs (Table 3). The emissions are assumed to be generated only from the northern portion of the WDPs (Figure 2), because the southern portion of the WDPs area was covered with clean imported fill. Calculations of the EDPs area emissions are based on the radionuclide concentrations (Table 4) in soil samples collected during the 1999 EDPs investigation, the only CERCLA investigation in this area.

2. AIR EMISSION DATA

2.1 Point Sources

As discussed in Section 1, there are currently no point sources of radionuclide emissions at the Site.

2.2 Non-Point Sources

As discussed in Section 1, two potential non-point diffuse sources of radionuclide emissions were present at the Site in 2004. These are wind-blown, fugitive dust emission of radionuclides from the WDPs and EDPs. For the purpose of estimating air emissions, surface contamination is conservatively assumed to exist across the entire area of each potential radionuclide non-point emissions source.

To calculate air emissions for this report, the surface area of each non-point source area (Figure 2) was determined, using a scaled map of the Site:

- WDPs surface area = 5,263 square meters (m²); and
- EDPs surface area = 3,900 m².

The particulate resuspension rate model was used to calculate the fugitive dust emission rate based on the US EPA's guidance document *Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination Sites* (Cowherd, 1985). Cowherd provides a methodology for the rapid, worst-case assessment of inhalation exposure to respirable particulate emissions, defined as airborne particles equal to or smaller than 10 micrometers (PM₁₀). PM₁₀ emission rates from site fugitive non-point sources were estimated using the equation developed by Cowherd for estimating respirable particle emissions from surfaces with an "unlimited reservoir" of wind-erodible particles, adjusted for site-specific data using the following formula:

$$E_{10} = 0.036 \times (1 - V) \times \left(\frac{[u]_{7m}}{u_t} \right)^3 \times F(x) \quad (\text{Eq. 1})$$

where,

E_{10} = annual average PM₁₀ emission rate per unit contaminated surface, grams per square meter-hour [g/(m²-hr)];

- V = fraction of contaminated surface vegetative cover (assumed zero for worst-case bare soil);
- $[u]_{7m}$ = calculated 95% UCL of the mean hourly wind speed at 7 meters height ($= [u]_{10m} \times \ln(700/z_o)/\ln(1000/z_o) = 3.07$ meters per second (m/s));
- $[u]_{10m}$ = 95% UCL of the mean hourly wind speed at Sacramento Executive Airport at a height of ten meters ($= 3.25$ m/s);
- z_o = emission source area roughness height ($= 2$ centimeters [cm]);
- u_t = threshold value of wind speed at 7 meters height $= u_{friction} / 0.4 \times \ln(700/z_o) = 7.3$ m/s;
- $u_{friction}$ = threshold friction velocity ($= 50$ cm per second [cm/s]);
- x = $0.866 u_t/[u]$ = dimensionless ratio; and
- $F(x)$ = function plotted in Figure 4-3 ($= 5.6 \times 10^{-2}$) of Cowherd, 1985.

The fraction of contaminated surface vegetative cover was conservatively assumed to be zero (i.e., bare soil) to calculate a worst-case value. The two centimeters roughness height represents a value between the ranges for a plowed field and grasslands (Cowherd, 1985). Cowherd recommends a procedure for determining the threshold friction velocity based upon surface soil sieve analysis data. Because no surface soil sieve analysis data were available for the Site, a conservative threshold friction velocity of 50 cm/s was selected, following Cowherd's example (Application No. 1), for a rural emergency response application (Cowherd, 1985).

Cowherd recommends using the mean annual wind speed data tabulated in Table 4-1 of the particulate emission rate guidance document (Cowherd, 1985). During previous years, site-specific data from the LEHR meteorological station were used to calculate the mean annual wind speed. The meteorological station was taken off line in mid-2003. Therefore, the 2004 hourly wind speed data from the Sacramento Executive Airport meteorological station were used to calculate the 95% UCL of the mean.

The 95% UCL of the mean wind speed was calculated using equations for characterizing confidence limits of the mean for lognormal populations (Gilbert, 1987, equation 13.13), as recommended by US EPA guidance (US EPA, 1992a). The resulting 95% UCL of the mean hourly wind speed for 2004 was 3.25 m/s. Because the height of the Sacramento Executive Airport meteorological tower is ten meters (NCDC, 2005b), this wind speed must be converted to the equivalent wind speed at a height of seven meters using a variation of Cowherd's Equation (see parameter $[u]$ above), which assumes a logarithmic velocity profile near the earth's surface.

Using Equation 1 and the data discussed above, the annual average PM_{10} emission rate per unit contaminated surface (E_{10}) was calculated as 1.49×10^{-4} g/m²-hr. This emission rate is used with the maximum radionuclide concentration measured above background in surface-soil concentrations for each potential emission source to calculate a particulate emission rate based on the following equation:

$$E_{area} = E_{10} \times A_{area} \times (24\text{-hr/day} \times 365 \text{ days/yr}) \times C_{Rad} \times (10^{-12} \text{ Curies per pCi})(\text{Eq. 2})$$

where,

- E_{area} = annual average PM_{10} emission rate for the potential radionuclide emission non-point source, Curies per year (Ci/yr);
 E_{10} = annual average PM_{10} emission rate per unit contaminated surface, $\text{g}/(\text{m}^2\text{-hr})$;
 A_{area} = surface area of potential radionuclide emission non-point source, m^2 ; and
 C_{Rad} = maximum value of the measured surface-soil radionuclide activities, pCi/g.

Equations 1 and 2 and the methodology discussed above were used to estimate the non-point source fugitive dust radionuclide emission rate for each of the two potential radionuclide emission sources, as presented in Tables 3 and 4.

2.3 Particulate Matter-10

No excavation or other ground-disturbing activities were conducted at the DOE areas during calendar year 2004. Therefore, the site air monitoring stations were not in operation and no PM_{10} data were collected.

3. DOSE ASSESSMENTS

3.1 Description of Dose Model

Compliance with the NESHAPs requirements for diffuse, non-point source emissions was assessed using the US EPA atmospheric dispersion/radiation dose calculation computer code, CAP88-PC, Version 1.0. This code was used to calculate the EDE to individual receptors at various distances from the two potential site radionuclide emission non-point sources. A total of two "individual receptor" CAP88-PC runs were executed to model the fugitive dust emission sources described in Section 2. For each of the two potential radionuclide emission non-point sources, a human receptor was identified in each of the north, south, east and west quadrants relative to the potential source.

The area source algorithm employed by CAP88-PC, Version 1.0, assumes the distance from an area source to a receptor is measured as the distance from the centroid of the area source to the receptor (US EPA, 1992b). For the site CAP88-PC modeling, the distance from an area source to a receptor is measured as the approximate distance from the centroid of the area source to the building assumed to house the receptor. Each CAP88-PC run included receptor distances to the respective source's maximally exposed individual (MEI), as well as the distances to MEIs identified for the other potential radionuclide emission sources ("Location" column for each source in Table 5).

The reported EDE to an MEI at the LEHR facility includes contributions from the two potential site radionuclide emission non-point sources based on the CAP88-PC model output. Based on the combined non-point source exposures, the MEI at the LEHR facility is located in the Specimen Storage Building (Building H-216) (Figure 2, Table 5).

The collective population dose is calculated as the average radiation dose to an individual in a specified area, multiplied by the number of individuals in that area. Two "population" CAP88-PC runs were executed to model the two fugitive dust emission non-point sources. The CAP88-PC model output for each run is included in Appendix A. For each of the two potential radionuclide emission non-point sources, the CAP88-PC model was run with an updated population data file calculated from the United States Census Bureau 2004 population estimates for counties (US Census Bureau, 2005).

The population file includes receptors within a distance of 80 kilometers (km) from the Site, as specified by DOE guidance. Using geographical information system software (e.g., ArcView), the area within 80 km of the Site was split into 128 sectors by dividing that area into eight 10-km thick rings and sixteen compass directions. The population of each sector was calculated from the

population density of the county or counties occupied by that sector. The populations of the counties were obtained from the 2004 Population Estimates Program of the United States Census Bureau (US Census Bureau, 2005). The results of the CAP88-PC population runs based upon the combined source exposures are presented in Table 6 and Appendix A.

Supplemental information required by DOE (DOE, 1994b) is included in Section 6.

3.2 Summary of Input Parameters

The input parameters for the CAP88-PC runs are summarized for the WDPs and EDPs areas in Tables 7 and 8, respectively. As noted above, the areal extent of each non-point source was conservatively calculated assuming that the maximum concentration (not corrected for background) of the observed radiological surface and shallow soil contamination for the WDPs and EDPs areas were present across the entire potential radionuclide emission non-point source area. Conservative estimates of radionuclide emissions were calculated using the maximum of the soil radionuclide concentrations measured for each potential area non-point source and applying the US EPA-recommended particulate resuspension rate model to calculate the fugitive dust emission rates.

The Sacramento area wind file included with the CAP88-PC computer code was used for the modeling. The hourly wind speeds recorded at Sacramento Executive Airport were used to calculate particle emission rates. Use of the Sacramento wind data is appropriate because of the Site's proximity (approximately 15 miles) to Sacramento, the similar geography of the two areas, the lack of intervening geographical anomalies, and the absence of a compatible meteorological data file from a closer air station.

4. COMPLIANCE ASSESSMENT

Point Source Effective Dose Equivalent: None

Non-Point Source Maximum Effective Dose Equivalent: 1.6×10^{-3} millirem per year [mrem/yr]
 $(1.6 \times 10^{-5}$ milliSievert [mSv]/yr) (about
0.02% of the 10 mrem/yr standard).

Location of On-Site Maximally Exposed Individual: Specimen Storage Building (Building H-
216), 48m west of the WDP

4.1 Certification

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment (See 18 U. S. C. 1001).

Signature: Robert D. Devany Date: 6/23/04
Robert Devany
LEHR Site EM Completion Project Manager

Signature: Jay B. Tomlin Date: 6/21/05
Jay Tomlin
DOE-LEHR Project Manager

5. ADDITIONAL INFORMATION

In 2004, no construction or modifications were completed at the LEHR facility.

As required in the memorandum of understanding for facilities that were exempt from having to submit an application to the US EPA for construction or modifications, the following information is provided for the Site:

- **Provide a brief description of the construction or modification project and an estimate of potential doses to the public.**

There were no construction or modification projects completed at the LEHR Site in 2004.

- **Identify any unplanned releases of radionuclides to the atmosphere.**

There were no unplanned releases of radionuclides to the atmosphere during 2004.

- **Results of the dose assessment associated with the diffuse source emissions from the facility.**

As noted in Sections 1 and 2, there are currently no point sources of radionuclide emissions at the Site. The only potential sources of radionuclide emissions remaining at the Site are diffuse sources of fugitive dust. The results of the dose assessment associated with the diffuse non-point source emissions from the Site are presented in Section 3 and Table 5. The total EDE to the on-site MEI resulting from non-point source emissions was estimated to be 1.6×10^{-3} mrem/yr (1.6×10^{-5} mSv/yr), far below the 10 mrem/yr standard.

6. SUPPLEMENTAL DOE INFORMATION

- **Provide an estimate of collective dose equivalent for 2004 releases.**
 - The collective population dose for calendar year 2004 emissions to the population within an 80-km distance of the facility is estimated to be 5.91×10^{-5} person-rem/yr.
- **Provide information on the status of compliance with Subparts Q and T of 40 CFR Part 61.**
 - LEHR is in compliance with Subparts Q and T of 40 CFR part 61, based on a radon study conducted at the LEHR Facility by DOE (DOE, 1990).
- **Provide information on radon-220 emissions from sources containing uranium-232 and thorium-232, where emissions potentially can exceed 0.1 mrem/yr to the public or 10% of the non-radon dose to the public.**
 - There are no unencapsulated uranium-232 or thorium-232 sources stored at the facility. The emissions from radon-220 from encapsulated sources would not result in a dose to a member of the public in excess of 0.1 mrem/yr or exceed 10% of the non-radon dose to the public from the Site.
- **Provide information on radon-222 emissions from non-disposal/non-storage sources where emissions potentially can exceed 0.1 mrem/yr to the public or 10% of the non-radon dose to the public.**
 - There are no non-disposal or non-storage sources of radon-222 located at the facility.
- **Give the number of emission points subject to the continuous monitoring requirements of Section 61.93(b) of 40 CFR, the number of these emission points that do not comply with Section 61.93(b) requirements and the cost of upgrades. Describe site periodic confirmatory measurement plans. Indicate the status of the quality assurance program described by Appendix B, Method 114.**
 - There are no point source emissions that require continuous monitoring according to Subpart H of 40 CFR.

7. REFERENCES

- Cowherd, C., 1985, *Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination Sites*, U.S. Environmental Protection Agency, Washington, D.C. (USEPA/600/8-85/002).
- United States Department of Energy (DOE), 1988, *Environmental Survey Preliminary Report*, Laboratory for Energy-Related Health Research, Davis, California, Environment, Safety and Health Office of Environmental Audit.
- DOE, 1990, *Results of the U.S. Department of Energy Indoor Radon Study*, August 1990.
- DOE, 1994a, *Water Monitoring Plan*, LEHR Environmental Restoration, UC Davis, California.
- DOE, 1994b, *Memorandum—Calendar Year 1993 Radionuclide Air Emissions Annual Reports for DOE Sites*, March.
- Environmental Management Services (EMS), 1999, *Final Miscellaneous Metal Disposition Report for the Laboratory for Energy-Related Health Research*, University of California, Davis, Rev. 0, May.
- Gilbert, Richard O., 1987, *Statistical Methods for Environmental Pollution Monitoring; Section 13.2: Characterizing Lognormal Populations: Confidence Limits of the Mean*, Van Nostrand Reinhold, New York, 1987.
- National Climate Data Center (NCDC), 2005a, <http://hurricane.ncdc.noaa.gov/pls/plclimprod/poemain.accessrouter?datasetabbv=TD3505>.
- NCDC, 2005b, Personal Communication between Janet Wall, NCDC, and Michael Gaud, Weiss Associates, February 22.
- United States Census Bureau (US Census Bureau), 2005, http://factfinder.census.gov/jsp/saff/SAFFInfo.jsp?_pageId=sp3_pop_est
- United States Environmental Protection Agency (US EPA), 1992a, *Supplemental Guidance to RAGS: Calculating the Concentration Term*, U.S. Environmental Protection Agency (PB92-963373, May 1992).
- US EPA, 1992b, *User's Guide for CAP88-PC Version 1*, U.S. Environmental Protection Agency, (402-3-92-001, March 1992).

- Weiss Associates (WA), 2000a, *Draft Final Engineering Evaluation/Cost Analysis for the Western and Eastern Dog Pens at the Laboratory for Energy-Related Health Research, University of California, Davis*, November, Rev. E.
- WA, 2000b, *Final Radionuclide Air Emission Annual Report (Subpart H of 40 CFR 61) Calendar Year 1999 for the Laboratory for Energy-Related Health Research, University of California, Davis*, May, Rev. 0.
- WA, 2001, *Final Radionuclide Air Emission Annual Report (Subpart H of 40 CFR 61) Calendar Year 2000 for the Laboratory for Energy-Related Health Research, University of California, Davis*, May, Rev. 0.
- WA, 2002, *Final Radionuclide Air Emission Annual Report (Subpart H of 40 CFR 61) Calendar Year 2001 for the Laboratory for Energy-Related Health Research, University of California, Davis*, May, Rev. 0.
- WA, 2003a, *Final Radionuclide Air Emission Annual Report (Subpart H of 40 CFR 61) Calendar Year 2002 for the Laboratory for Energy-Related Health Research, University of California, Davis*, April, Rev. 0.
- WA, 2003b, *Application for Approval of Authorized Limits for the Release of Gravel Containing Slight Residual Radioactivity at the Laboratory for Energy-Related Health Research, University of California, Davis*, September, Rev. 1.
- WA, 2004, *Final Radionuclide Air Emission Annual Report (Subpart H of 40 CFR 61) Calendar Year 2003 for the Laboratory for Energy-Related Health Research, University of California, Davis*, April, Rev. 0.
- Western Regional Climate Center, 2005, <http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?cadavi+nca>.

TABLES

Table 1. Results of National Emissions Standards for Hazardous Air Pollutants Reports for the Past Five Years

Calendar Year	Effective Dose Equivalent to Maximally Exposed Individual (mrem/yr)	Reference
1999	1.35×10^{-3}	WA, 2000b
2000	7.52×10^{-4}	WA, 2001
2001	1.0×10^{-3}	WA, 2002
2002	3.8×10^{-4}	WA, 2003a
2003	1.4×10^{-3}	WA, 2004
2004	1.6×10^{-3}	This document

Abbreviation

mrem/yr millirem(s) per year

Table 2. Summary of Potential Non-Point Diffuse Area Radionuclide Sources

Potential Source	Description	Area (m ²)
Western Dog Pens Area	Former outdoor dog pens with potential radioactive surface releases.	5,263
Eastern Dog Pens Area	Former outdoor dog pens with potential radioactive surface releases.	3,900

Abbreviation

m² meters squared

Table 3. Maximum Surface Soil Concentrations for Radionuclides Exceeding Background and PM₁₀ Emission Rates, LEHR Western Dog Pens Area

Radionuclide	Maximum Concentration ¹ (pCi/g)	Maximum PM ₁₀ Emission Rate (Ci/yr)
Actinium-228	0.719	4.96E-09
Bismuth-212	0.628	4.33E-09
Bismuth-214	1.09	7.51E-09
Carbon-14	11.3	7.79E-08
Cesium-137	0.115	7.93E-10
Cobalt-60	0.028	1.93E-10
Lead-210	4.96	3.42E-08
Lead-212	0.744	5.13E-09
Lead-214	1.41	9.72E-09
Potassium-40	14.3	9.86E-08
Radium-226	1.9	1.31E-08
Strontium-90	0.675	4.65E-09
Thallium-208	0.272	1.87E-09
Thorium-234	1.62	1.12E-08
Uranium-235	0.232	1.60E-09
Uranium-238	1.62	1.12E-08

Note

¹Not corrected for background or decay.

Abbreviations

Ci/yr Curies per year
 pCi/g picoCuries per gram
 PM₁₀ particulate matter with an aerodynamic diameter less than or equal to 10 micrometers

Table 4. Maximum Surface Soil Concentrations for Radionuclides Exceeding Background and PM₁₀ Emission Rates, LEHR Eastern Dog Pens Area

Radionuclide	Maximum Concentration ¹ (pCi/g)	Maximum PM ₁₀ Emission Rate (Ci/yr)
Bismuth-212	0.415	2.12E-09
Bismuth-214	0.572	2.92E-09
Cesium-137	0.191	9.75E-10
Lead-214	0.607	3.10E-09
Strontium-90	0.164	8.38E-10
Thallium-208	0.219	1.12E-09
Thorium-228	1.54	7.86E-09
Thorium-232	1.26	6.43E-09
Thorium-234	0.89	4.55E-09
Tritium	1.21	6.18E-09
Uranium-235	0.383	1.96E-10

Note

¹Not corrected for background or decay.

Abbreviations

Ci/yr Curies per year
 pCi/g picoCuries per gram
 PM₁₀ particulate matter with an aerodynamic diameter less than or equal to 10 micrometers

Table 5. On-Site Effective Dose Equivalent to Maximally Exposed Individual Resulting from Radionuclide Emissions from Each Potential Fugitive Dust Emission Non-Point Source

Receptor Location	Western Dog Pens Area		Eastern Dog Pens Area		Maximum Total Dose (mrem/yr) ³
	(mrem/yr) ¹	Location ²	(mrem/yr) ¹	Location ²	
Specimen Storage Building (Building H-216)	1.4E-03	48 m W	2.2E-04	132 m W	1.6E-03
UC Davis Building E of LEHR Site	7.8E-05	300 m E	3.4E-05	180 m E	1.1E-04
Off-Site Receptor S of Putah Creek	6.9E-05	1,200 m S	3.4E-06	1,000 m S	7.2E-05
Off-Site Receptor W of LEHR Site	8.9E-05	400 m W	1.7E-05	500 m W	1.1E-04
Animal Hospital Building No. 1 (Building H-219)	8.4E-04	65 m W	1.4E-04	165 m W	9.8E-04
Inter-Regional Project No. 4 Building (Building H-217)	1.2E-03	52 m W	1.9E-04	143 m W	1.4E-03
Animal Hospital Building No. 2 (Building H-218)	8.4E-04	65 m W	1.4E-04	165 m W	9.8E-04
Cellular Biology Laboratory (Building H-294)	1.1E-03	65 m N	2.6E-04	150 m NNE	1.4E-03
Clinical Pathology (H-215)	4.0E-04	99 m W	1.7E-04	150 m W	5.7E-04
Main Office (H-213)	1.1E-03	65 m NW	1.5E-04	187 m NW	1.3E-03

Notes

¹The effective dose equivalent to the maximally exposed individual is taken as the maximum modeled dose within a 45° sector in the direction and at the distance indicated in the "Location" column. For example, the dose 65 m north of the Western Dog Pens Area would be the maximum modeled dose within the sector bounded by 65 m NNE and 65 m NNW.

²The distance from an area source to a receptor is defined by CAP88-PC as the distance from the centroid of the area source to the receptor (US EPA, 1992b). For the LEHR facility CAP88-PC modeling, the distance from an area non-point source to a receptor is measured as the approximate distance from the centroid of the non-point source to the centroid of the building assumed to house the receptor.

³The maximum total dose is the sum of the EDEs modeled for each MEI receptor from the two potential radionuclide fugitive dust emission non-point sources. Value in **bold face** is the maximum total dose for the site.

Abbreviations

E	east	NW	northwest
m	meters	No.	number
mrem/yr	millirem(s) per year	S	south
N	north	UC Davis	University of California, Davis
NNE	north by northeast	W	west
NNW	north by northwest		

Table 6. Estimated Collective Population Dose Resulting from Radionuclide Emissions from Non-Point Sources

Potential Source	Off-Site Maximally Exposed Individual		Collective Population Dose ¹ (person-rem/yr)
	(mrem/yr)	Location	
Western Dog Pens Area	4.1E-07	5,000 m north	2.8E-05
Eastern Dog Pens Area	4.6E-07	5,000 m north	2.3E-05
Total LEHR Site	8.7E-07		5.1E-05

Notes

Source of data: CAP88-PC, Version 1.0 modeling output files.

¹The collective population dose is for receptors within a 80-km radius.

Abbreviations

km kilometer(s)
 m meter(s)
 mrem/yr millirem per year
 person-rem/yr person-roentgen equivalent man per year

Table 7. CAP88-PC Input for the Western Dog Pens Area

Run type	Individual	Receptor distances (m): 48, 52, 65, 99, 300, 400, 1200			
Run type	Population	Population file to use: 04LEHRrv.POP			
Modeling Options	Generate genetic effects?	Yes			
	Create Dose and Risk Factor file?	Yes			
	Create Concentration Table file?	Yes			
	Create Chi/Q Table file?	Yes			
Meteorological Data					
Wind file to use:	SAC0320.WND (CAP88-PC supplied wind file)				
Annual precipitation (cm/yr):	48.18 (2004 Davis total)				
Annual ambient temperature (°C):	16.57 (2004 Davis average)				
Height of lid (m):	1,000 (CAP88-PC default)				
Source Data					
Source type:	AREA				
Number of source:	1				
Height (m):	0				
Area (m ²):	5,263				
Plume rise:	Zero (Plume rise is zero for each Pasquill stability category)				
Agricultural Data					
Source: Rural (CAP88-PC defaults)					
	Vegetable	Milk	Beef		
Fraction home produced:	0.7	0.399	0.442		
Fraction from assessment area:	0.3	0.601	0.558		
Fraction imported:	0	0	0		
Beef cattle density (#/km ²):	8.81E-02 (CAP88-PC default)				
Milk cattle density (#/km ²):	2.85E-02 (CAP88-PC default)				
Land fraction cultivated for vegetable crops:	0.25 (Site specific parameter per 1995 NESHAPs)				
Radionuclide Release Data					
PM ₁₀ emission rate (g/m ² -hr):	1.49E-04 (Using Cowherd, 1985, unlimited erosion potential)				
	Nuclide ID	Max. Soil (pCi/g)	Emis. Rate (Ci/yr)	Size ¹ (µm)	Class ¹
	Ac-228	0.719	4.96E-09	1	Y
	Bi-212	0.628	4.33E-09	1	W
	Bi-214	1.09	7.51E-09	1	W
	C-14	11.3	7.79E-08	0	G
	Cs-137	0.115	7.93E-10	1	D
	Co-60	0.028	1.93E-10	1	Y
	Pb-210	4.96	3.42E-08	1	D
	Pb-212	0.744	5.13E-09	1	D
	Pb-214	1.41	9.72E-09	1	D
	K-40	14.3	9.86E-08	1	D
	Ra-226	1.9	1.31E-08	1	W
	Sr-90	0.675	4.65E-09	1	D
	Tl-208	0.272	1.87E-09	1	D
	Th-234	1.62	1.12E-08	1	Y
	U-235	0.232	1.60E-09	1	Y
	U-238	1.62	1.12E-08	1	Y

Table 7. CAP88-PC Input for the Western Dog Pens Area (continued)

Note

¹CAP88-PC default particle size and lung retention class.

Abbreviations

µm	micrometer
#	number
km ²	square kilometer
°C	degrees Celsius
Ac-228	actinium-228
Bi-212	bismuth-212
Bi-214	bismuth-214
C-14	carbon-14
Ci/yr	Curies per year
cm/yr	centimeter(s) per year
Co-60	cobalt-60
Cs-137	cesium-137
Emis.	emission
g/m ² -hr	grams per square meter-hour(s)
ID	identification (number)
K-40	potassium-40
m	meters
m ²	square meter(s)
Max.	maximum (concentration)
NESHAPs	National Emissions Standards for Hazardous Air Pollutants
Pb-210	lead-210
Pb-212	lead-212
Pb-214	lead-214
pCi/g	picoCurie per gram
PM ₁₀	particulate matter with an aerodynamic diameter less than or equal to 10 micrometers
Ra-226	radium-226
Sr-90	strontium-90
Th-234	thorium-234
Tl-208	thallium-208
U-235	uranium-235
U-238	uranium-238

Table 8. CAP88-PC Input for the Eastern Dog Pens Area

Run type	Individual	Receptor distances (m): 132, 143, 150, 165, 180, 187, 500, 1000			
Run type	Population	Population file to use: 04LEHRrv.POP			
Modeling Options	Generate genetic effects?	Yes			
	Create Dose and Risk Factor file?	Yes			
	Create Concentration Table file?	Yes			
	Create Chi/Q Table file?	Yes			
Meteorological Data					
Wind file to use:	SAC0320.WND (CAP88-PC supplied wind file)				
Annual precipitation (cm/yr):	48.18 (2004 Davis total)				
Annual ambient temperature (°C):	16.57 (2004 Davis average)				
Height of lid (m):	1,000 (CAP88-PC default)				
Source Data					
Source type:	AREA				
Number of source:	1				
Height (m):	0				
Area (m ²):	3,900				
Plume rise:	Zero (Plume rise is zero for each Pasquill stability category)				
Agricultural Data					
Source: Rural (CAP88-PC defaults)					
	Vegetable	Milk	Beef		
Fraction home produced:	0.7	0.399	0.442		
Fraction from assessment area:	0.3	0.601	0.558		
Fraction imported:	0	0	0		
Beef cattle density (#/km ²):	8.81E-02 (CAP88-PC default)				
Milk cattle density (#/km ²):	2.85E-02 (CAP88-PC default)				
Land fraction cultivated for vegetable crops:	0.25 (Site specific parameter per 1995 NESHAPs)				
Radionuclide Release Data					
PM ₁₀ emission Rate (g/m ² -hr):	1.49E-04 (Using Cowherd, 1985, unlimited erosion potential)				
	Nuclide ID	Max. Soil (pCi/g)	Emis. Rate (Ci/yr)	Size ¹ (µm)	Class ¹
	Bi-212	0.415	2.12E-09	1	W
	Bi-214	0.572	2.92E-09	1	W
	Cs-137	0.191	9.75E-10	1	D
	Pb-214	0.607	3.10E-09	1	D
	Sr-90	0.164	8.38E-10	1	D
	Tl-208	0.219	1.12E-09	1	D
	Th-228	1.54	7.86E-09	1	Y
	Th-232	1.26	6.43E-09	1	Y
	Th-234	0.89	4.55E-09	1	Y
	H-3	1.21	6.18E-09	0	G
	U-235	0.0383	1.96E-10	1	Y

Note

¹ CAP88-PC default particle size and lung retention class.

Abbreviations

µm micrometer
 # number
 km² square kilometer

Table 8. CAP88-PC Input for the Eastern Dog Pens Area (continued)

°C	degrees Celsius
Bi-212	bismuth-212
Bi-214	bismuth-214
Ci/yr	Curies per year
cm/yr	centimeter(s) per year
Cs-137	cesium-137
Emis.	emission
g/m ² -hr	grams per square meter-hour(s)
H-3	tritium
ID	identification (number)
m	meter(s)
m ²	square meter(s)
Max.	maximum (concentration)
NESHAPs	National Emissions Standards for Hazardous Air Pollutants
Pb-214	lead-214
pCi/g	picoCurie per gram
PM ₁₀	particulate matter with an aerodynamic diameter less than or equal to 10 micrometers
Sr-90	strontium-90
Th-228	thorium-228
Th-232	thorium-232
Th-234	thorium-234
Tl-208	thallium-208
U-235	uranium-235

FIGURES

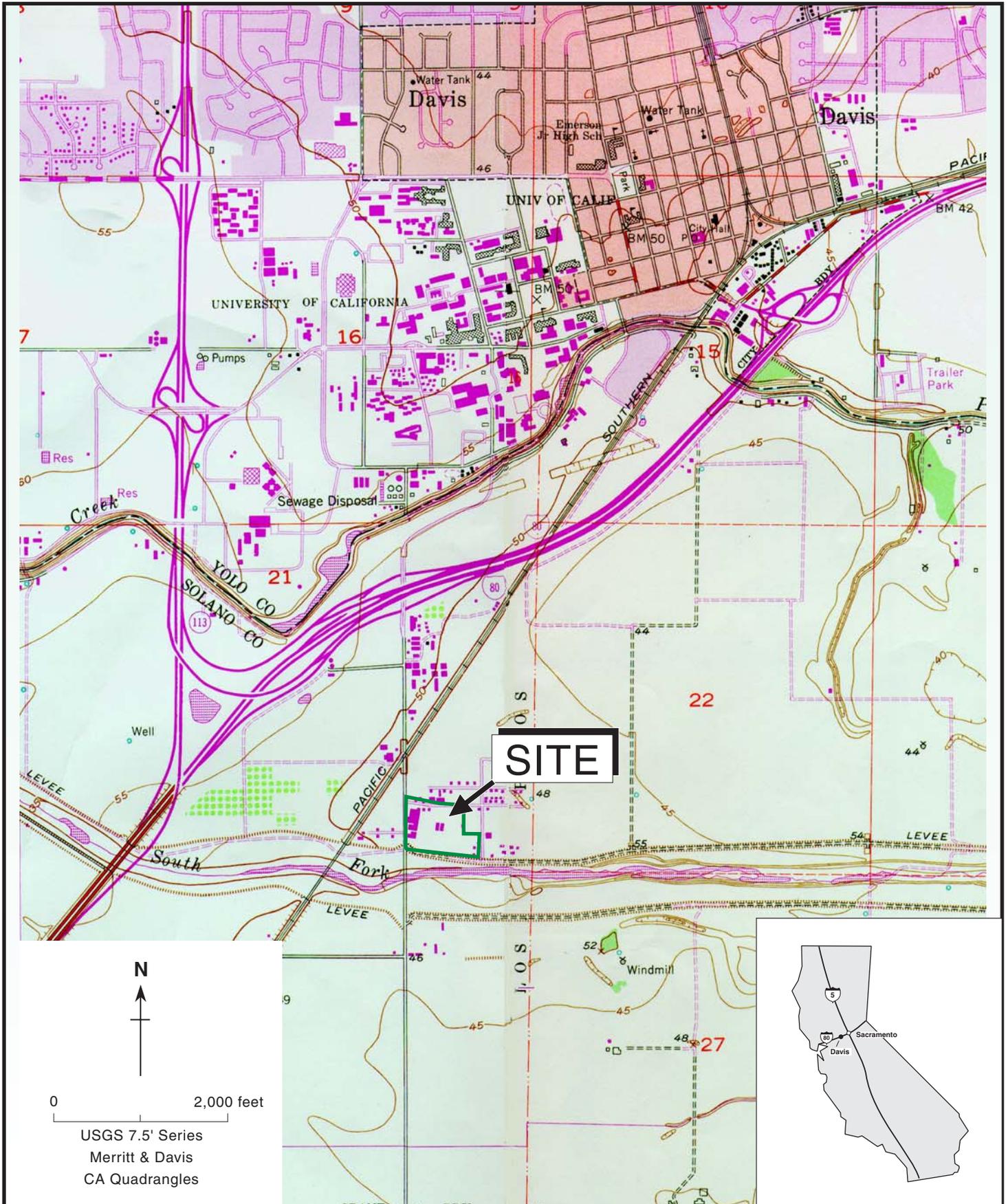


Figure 1. LEHR Facility Location Map, UC Davis, California

Weiss Associates

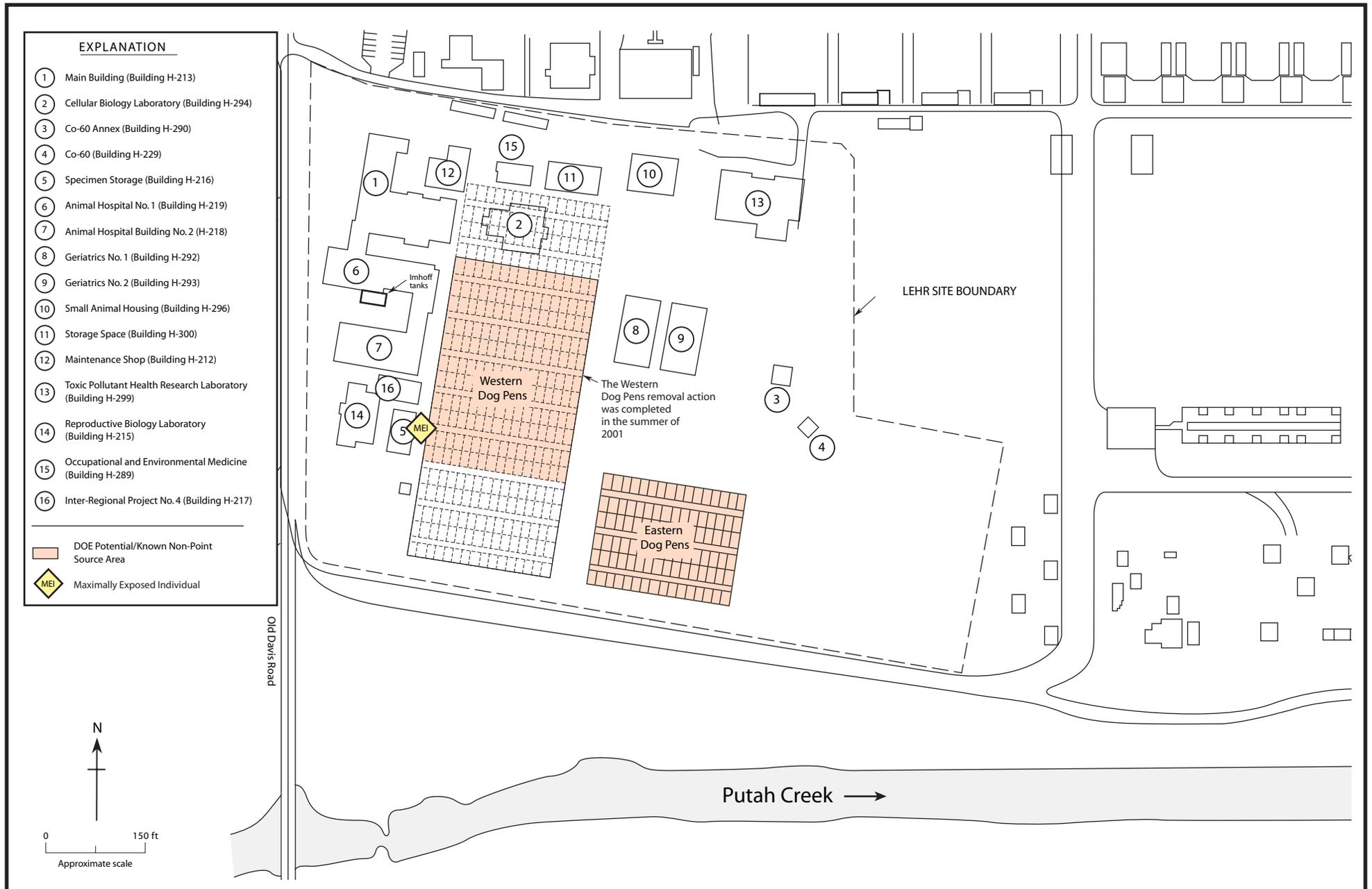


Figure 2. LEHR Facility DOE Non-Point Source Areas and Location of Maximally Exposed Individual

APPENDIX A

CAP88-PC OUTPUT RESULTS

B. SUM

C A P 8 8 - P C

Versi on 1. 00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Jun 1, 2005 5: 33 pm

Facility: LEHR
Address: Old Davis Road
City: Davis
State: CA Zip: 95616

Source Category: nonpoint
Source Type: Area
Emission Year: 2004

Comments: Western Dog Pens area

Dataset Name: WDPind
Dataset Date: Jun 1, 2005 5: 32 pm
Wind File: WNDFILES\SAC0320.WND

Jun 1, 2005 5: 33 pm

SUMMARY
Page 1

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	2.98E-04
BREAST	2.87E-04
R MAR	1.20E-03
LUNGS	6.82E-03
THYROID	2.90E-04
ENDOST	1.39E-02
RMNDR	1.27E-03

EFFEC B. SUM 1. 89E-03

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	7. 49E-04
INHALATION	1. 03E-03
AIR IMMERSION	1. 34E-08
GROUND SURFACE	1. 05E-04
INTERNAL	1. 78E-03
EXTERNAL	1. 05E-04
TOTAL	1. 89E-03

Jun 1, 2005 5: 33 pm

SUMMARY Page 2

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
AC-228	2. 13E-07
BI -212	7. 30E-08
BI -214	5. 22E-09
C-14	1. 24E-06
CS-137	3. 48E-07
CO-60	5. 55E-07
PB-210	8. 00E-04
PB-212	4. 29E-07
PB-214	5. 26E-09
K-40	1. 85E-04
RA-226	1. 09E-04
SR-90	6. 73E-06
TL-208	2. 01E-09
TH-234	4. 03E-07
U-235	1. 03E-04
U-238	6. 78E-04
TOTAL	1. 89E-03

Jun 1, 2005 5: 33 pm

SUMMARY Page 3

CANCER RISK SUMMARY

Cancer Selected Individual Total Lifetime Fatal Cancer Risk
Page 2

B. SUM

LEUKEMI A	1. 75E-09
BONE	7. 69E-10
THYROI D	1. 04E-10
BREAST	8. 77E-10
LUNG	1. 22E-08
STOMACH	5. 53E-10
BOWEL	2. 93E-10
LI VER	3. 84E-09
PANCREAS	4. 64E-10
URI NARY	8. 82E-10
OTHER	5. 68E-10
TOTAL	2. 23E-08

PATHWAY RI SK SUMMARY

Pathway	Sel ected Indi vi dual	
	Total	Li fetime
	Fatal	Cancer Ri sk
INGESTI ON	6. 84E-09	
INHALATI ON	1. 29E-08	
AIR IMMERSI ON	3. 24E-13	
GROUND SURFACE	2. 53E-09	
INTERNAL	1. 98E-08	
EXTERNAL	2. 53E-09	
TOTAL	2. 23E-08	

Jun 1, 2005 5: 33 pm

SUMMARY
Page 4

NUCLI DE RI SK SUMMARY

Nucl i de	Sel ected Indi vi dual	
	Total	Li fetime
	Fatal	Cancer Ri sk
AC-228	4. 30E-12	
BI -212	9. 39E-13	
BI -214	6. 05E-13	
C-14	3. 02E-11	
CS-137	9. 09E-12	
CO-60	1. 39E-11	
PB-210	5. 71E-09	
PB-212	7. 34E-12	
PB-214	9. 00E-13	
K-40	4. 65E-09	
RA-226	1. 55E-09	
SR-90	1. 13E-10	
TL-208	4. 92E-14	
TH-234	1. 38E-11	
U-235	1. 36E-09	
U-238	8. 85E-09	

B. SUM

TOTAL

2. 23E-08

Jun 1, 2005 5: 33 pm

SUMMARY
Page 5

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

Di recti on	Di stance (m)						
	48	52	65	99	300	400	1200
N	1. 8E-03	1. 5E-03	9. 9E-04	5. 0E-04	1. 3E-04	1. 0E-04	7. 2E-05
NNW	1. 9E-03	1. 6E-03	1. 1E-03	4. 8E-04	1. 1E-04	9. 2E-05	7. 0E-05
NW	1. 7E-03	1. 5E-03	9. 5E-04	4. 6E-04	1. 2E-04	9. 6E-05	7. 1E-05
WNW	1. 4E-03	1. 2E-03	8. 4E-04	4. 0E-04	1. 1E-04	8. 9E-05	7. 0E-05
W	1. 1E-03	9. 0E-04	5. 8E-04	2. 9E-04	9. 3E-05	8. 2E-05	6. 9E-05
WSW	7. 1E-04	5. 9E-04	3. 7E-04	1. 9E-04	7. 8E-05	7. 3E-05	6. 8E-05
SW	5. 2E-04	4. 2E-04	2. 4E-04	1. 4E-04	7. 4E-05	7. 1E-05	6. 8E-05
SSW	5. 8E-04	4. 8E-04	3. 0E-04	1. 6E-04	7. 5E-05	7. 1E-05	6. 8E-05
S	7. 1E-04	6. 2E-04	4. 3E-04	2. 3E-04	8. 7E-05	7. 9E-05	6. 9E-05
SSE	7. 6E-04	6. 7E-04	4. 9E-04	2. 6E-04	9. 5E-05	8. 3E-05	6. 9E-05
SE	7. 1E-04	6. 1E-04	4. 1E-04	2. 1E-04	8. 3E-05	7. 6E-05	6. 8E-05
ESE	5. 7E-04	4. 8E-04	3. 0E-04	1. 6E-04	7. 6E-05	7. 2E-05	6. 8E-05
E	5. 6E-04	4. 5E-04	2. 7E-04	1. 5E-04	7. 7E-05	7. 3E-05	6. 8E-05
ENE	7. 6E-04	6. 4E-04	4. 1E-04	2. 0E-04	7. 8E-05	7. 4E-05	6. 8E-05
NE	1. 1E-03	9. 3E-04	5. 8E-04	3. 0E-04	9. 8E-05	8. 5E-05	6. 9E-05
NNE	1. 5E-03	1. 3E-03	9. 0E-04	4. 1E-04	1. 0E-04	8. 8E-05	7. 0E-05

Jun 1, 2005 5: 33 pm

SUMMARY
Page 6

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Di recti on	Di stance (m)						
	48	52	65	99	300	400	1200
N	2. 1E-08	1. 8E-08	1. 2E-08	5. 8E-09	1. 4E-09	1. 1E-09	7. 4E-10
NNW	2. 2E-08	1. 9E-08	1. 3E-08	5. 6E-09	1. 2E-09	9. 8E-10	7. 2E-10
NW	2. 1E-08	1. 7E-08	1. 1E-08	5. 4E-09	1. 3E-09	1. 0E-09	7. 3E-10
WNW	1. 7E-08	1. 5E-08	9. 9E-09	4. 7E-09	1. 1E-09	9. 5E-10	7. 2E-10
W	1. 3E-08	1. 1E-08	6. 8E-09	3. 3E-09	1. 0E-09	8. 6E-10	7. 1E-10
WSW	8. 4E-09	6. 9E-09	4. 3E-09	2. 1E-09	8. 1E-10	7. 6E-10	7. 0E-10
SW	6. 1E-09	4. 9E-09	2. 7E-09	1. 5E-09	7. 7E-10	7. 4E-10	6. 9E-10
SSW	6. 7E-09	5. 6E-09	3. 4E-09	1. 8E-09	7. 7E-10	7. 4E-10	6. 9E-10
S	8. 3E-09	7. 2E-09	5. 0E-09	2. 6E-09	9. 3E-10	8. 2E-10	7. 1E-10
SSE	8. 9E-09	7. 9E-09	5. 7E-09	3. 0E-09	1. 0E-09	8. 8E-10	7. 1E-10
SE	8. 3E-09	7. 1E-09	4. 8E-09	2. 4E-09	8. 7E-10	8. 0E-10	7. 0E-10
ESE	6. 7E-09	5. 5E-09	3. 4E-09	1. 8E-09	7. 9E-10	7. 5E-10	7. 0E-10

	B. SUM						
E	6.5E-09	5.3E-09	3.1E-09	1.7E-09	8.1E-10	7.6E-10	7.0E-10
ENE	9.0E-09	7.5E-09	4.7E-09	2.3E-09	8.2E-10	7.6E-10	7.0E-10
NE	1.3E-08	1.1E-08	6.8E-09	3.5E-09	1.1E-09	9.0E-10	7.1E-10
NNE	1.8E-08	1.6E-08	1.1E-08	4.8E-09	1.1E-09	9.4E-10	7.2E-10

C. SYN

C A P 8 8 - P C

Versi on 1.00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Popul ati on Assessment
Jun 1, 2005 5:43 pm

Facility: LEHR
Address: Old Davis Road
City: Davis
State: CA Zip: 95616

Effecti ve Dose Equi val ent
(mrem/year)

4.11E-07

At Thi s Locati on: 5000 Meters North
Source Category: nonpoi nt
Source Type: Area
Emi ssi on Year: 2004

Comments: Western Dog Pens area

Dataset Name: WDPpop
Dataset Date: Jun 1, 2005 5:43 pm
Wind File: WNDFILES\SAC0320.WND
Popul ati on File: POPFILES\04LEHRRV.POP

Jun 1, 2005 5:43 pm

SYNOPSIS
Page 1

MAXI MALLY EXPOSED I NDI VI DUAL

Locati on Of The Indi vi dual : 5000 Meters North
Li fetime Fatal Cancer Ri sk: 4.80E-12
Page 1

C. SYN

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)	Collective Population (person-rem/y)
GONADS	6.46E-08	4.97E-06
BREAST	6.18E-08	4.81E-06
R MAR	2.66E-07	2.21E-05
LUNGS	1.45E-06	7.31E-05
THYROID	6.26E-08	4.85E-06
ENDOST	3.10E-06	2.59E-04
RMNDR	2.82E-07	2.32E-05
EFFEC	4.11E-07	2.83E-05

FREQUENCY DISTRIBUTION OF LIFETIME FATAL CANCER RISKS

Risk Range	Number of People	Number of People In This Risk Range Or Higher	Deaths/Year In This Risk Range	Deaths/Year In This Risk Range Or Higher
1.0E+00 TO 1.0E-01	0	0	0.00E+00	0.00E+00
1.0E-01 TO 1.0E-02	0	0	0.00E+00	0.00E+00
1.0E-02 TO 1.0E-03	0	0	0.00E+00	0.00E+00
1.0E-03 TO 1.0E-04	0	0	0.00E+00	0.00E+00
1.0E-04 TO 1.0E-05	0	0	0.00E+00	0.00E+00
1.0E-05 TO 1.0E-06	0	0	0.00E+00	0.00E+00
LESS THAN 1.0E-06	3554446	3554446	4.41E-09	4.41E-09

Jun 1, 2005 5:43 pm

SYNOPSIS
Page 2

RADIONUCLIDE EMISSIONS DURING THE YEAR 2004

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
AC-228	Y	1.00	5.0E-09	5.0E-09
BI-212	W	1.00	4.3E-09	4.3E-09
BI-214	W	1.00	7.5E-09	7.5E-09
C-14	*	0.00	7.8E-08	7.8E-08
CS-137	D	1.00	7.9E-10	7.9E-10
CO-60	Y	1.00	1.9E-10	1.9E-10
PB-210	D	1.00	3.4E-08	3.4E-08
PB-212	D	1.00	5.1E-09	5.1E-09
PB-214	D	1.00	9.7E-09	9.7E-09
K-40	D	1.00	9.9E-08	9.9E-08
RA-226	W	1.00	1.3E-08	1.3E-08
SR-90	D	1.00	4.6E-09	4.6E-09
TL-208	D	1.00	1.9E-09	1.9E-09
TH-234	Y	1.00	1.1E-08	1.1E-08

U-235 Y 1.00 1.6E-09 1.6E-09
 U-238 Y 1.00 1.1E-08 1.1E-08

C. SYN

SITE INFORMATION

Temperature: 17 degrees C
 Precipitation: 48 cm/y
 Mixing Height: 1000 m

Jun 1, 2005 5:43 pm

SYNOPSIS
 Page 3

SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
 Area (sq m): 5.26E+03

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Zero:	0.00	0.00	0.00	0.00	0.00	0.00	0.00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000

Beef Cattle Density: 8.81E-02
 Milk Cattle Density: 2.85E-02
 Land Fraction Cultivated
 for Vegetable Crops: 2.50E-01

Jun 1, 2005 5:43 pm

SYNOPSIS
 Page 4

POPULATION DATA

Direction	Distance (m)						
	5000	15000	25000	35000	45000	55000	65000
N	1398	4092	6818	8815	9527	9565	13539
NNW	1392	4087	6810	9534	10557	2425	1870

	C. SYN						
NW	1430	4087	6809	9533	12264	13505	8739
WNW	1615	4099	6809	9386	11686	13978	11425
W	3648	8867	10707	9671	11430	13964	18891
WSW	3678	11033	18381	13743	12495	13964	26384
SW	3678	11033	18383	23956	32346	29377	42305
SSW	3678	11033	18385	25739	31491	48634	123765
S	3682	11046	18410	25943	48702	110353	132364
SSE	3675	7199	16660	52687	65865	55773	58588
SE	2799	4087	25481	69516	58883	39856	44594
ESE	2126	4658	39687	71885	92495	108022	71157
E	2011	7998	49920	71883	92498	112999	42151
ENE	1820	4118	45474	71885	80967	68596	11990
NE	1552	4140	48955	35741	14296	17017	20106
NNE	1418	4087	12956	7633	9907	11417	11505

Distance (m)

Di recti on 75000

N	15748
NNW	2490
NW	3721
WNW	7540
W	29537
WSW	33611
SW	54440
SSW	152518
S	152732
SSE	61285
SE	51451
ESE	21435
E	8768
ENE	11180
NE	18864
NNE	11440

D. SUM

C A P 8 8 - P C

Versi on 1. 00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
Jun 2, 2005 8:27 am

Facility: LEHR
Address: Old Davis Road
City: Davis
State: CA Zip: 95616

Source Category: nonpoint
Source Type: Area
Emission Year: 2004

Comments: Eastern Dog Pens area

Dataset Name: EDPind
Dataset Date: Jun 2, 2005 8:27 am
Wind File: WNDFILES\SAC0320.WND

Jun 2, 2005 8:27 am

SUMMARY
Page 1

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	1.18E-06
BREAST	1.21E-06
R MAR	1.39E-04
LUNGS	2.11E-03
THYROID	1.18E-06
ENDOST	1.72E-03
RMNDR	3.46E-06

EFFEC D. SUM 3. 23E-04

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	2. 28E-06
INHALATION	3. 20E-04
AIR IMMERSION	4. 07E-10
GROUND SURFACE	4. 36E-08
INTERNAL	3. 22E-04
EXTERNAL	4. 40E-08
TOTAL	3. 22E-04

Jun 2, 2005 8: 27 am

SUMMARY
Page 2

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
BI -212	5. 30E-09
BI -214	2. 95E-10
CS-137	6. 71E-08
PB-214	2. 46E-10
SR-90	1. 88E-07
TL-208	1. 48E-10
TH-228	1. 48E-04
TH-232	1. 73E-04
TH-234	2. 49E-08
H-3	3. 19E-10
U-235	1. 89E-06
TOTAL	3. 22E-04

Jun 2, 2005 8: 27 am

SUMMARY
Page 3

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	1. 25E-10
BONE	8. 12E-11
THYROID	2. 26E-13

	D. SUM
BREAST	1.95E-12
LUNG	3.74E-09
STOMACH	1.62E-12
BOWEL	2.47E-12
LIVER	6.87E-12
PANCREAS	1.12E-12
URINARY	1.02E-12
OTHER	1.37E-12
TOTAL	3.97E-09

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	1.23E-11
INHALATION	3.95E-09
AIR IMMERSION	9.88E-15
GROUND SURFACE	1.01E-12
INTERNAL	3.96E-09
EXTERNAL	1.02E-12
TOTAL	3.97E-09

Jun 2, 2005 8:27 am

SUMMARY
Page 4

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
BI-212	6.82E-14
BI-214	3.41E-14
CS-137	1.75E-12
PB-214	4.20E-14
SR-90	3.16E-12
TL-208	3.63E-15
TH-228	2.96E-09
TH-232	9.73E-10
TH-234	8.43E-13
H-3	8.64E-15
U-235	2.49E-11
TOTAL	3.97E-09

Jun 2, 2005 8:27 am

SUMMARY
Page 5

INDIVIDUAL EFFECTIVE DOSE EQUIVALENT RATE (mrem/y)
(All Radionuclides and Pathways)

D. SUM

Distance (m)

Di recti on	132	143	150	165	180	187	500
N	3. 2E-04	2. 8E-04	2. 6E-04	2. 2E-04	1. 9E-04	1. 7E-04	2. 6E-05
NNW	2. 6E-04	2. 2E-04	2. 0E-04	1. 6E-04	1. 3E-04	1. 2E-04	1. 9E-05
NW	2. 8E-04	2. 5E-04	2. 3E-04	1. 9E-04	1. 6E-04	1. 5E-04	2. 2E-05
WNW	2. 2E-04	1. 9E-04	1. 7E-04	1. 4E-04	1. 2E-04	1. 1E-04	1. 7E-05
W	1. 5E-04	1. 3E-04	1. 2E-04	9. 9E-05	8. 3E-05	7. 7E-05	1. 1E-05
WSW	7. 0E-05	5. 7E-05	5. 1E-05	4. 1E-05	3. 4E-05	3. 2E-05	4. 8E-06
SW	4. 4E-05	3. 7E-05	3. 3E-05	2. 7E-05	2. 3E-05	2. 1E-05	3. 3E-06
SSW	4. 9E-05	4. 0E-05	3. 5E-05	2. 8E-05	2. 3E-05	2. 2E-05	3. 3E-06
S	1. 1E-04	9. 8E-05	9. 0E-05	7. 5E-05	6. 3E-05	5. 9E-05	8. 9E-06
SSE	1. 5E-04	1. 3E-04	1. 2E-04	1. 0E-04	8. 6E-05	8. 0E-05	1. 2E-05
SE	9. 3E-05	7. 9E-05	7. 1E-05	5. 9E-05	4. 9E-05	4. 6E-05	7. 0E-06
ESE	5. 5E-05	4. 6E-05	4. 1E-05	3. 3E-05	2. 8E-05	2. 6E-05	4. 0E-06
E	5. 8E-05	5. 0E-05	4. 5E-05	3. 8E-05	3. 2E-05	2. 9E-05	4. 5E-06
ENE	7. 2E-05	5. 9E-05	5. 2E-05	4. 1E-05	3. 4E-05	3. 2E-05	4. 9E-06
NE	1. 7E-04	1. 5E-04	1. 4E-04	1. 1E-04	9. 6E-05	8. 9E-05	1. 4E-05
NNE	2. 2E-04	1. 8E-04	1. 6E-04	1. 3E-04	1. 1E-04	1. 1E-04	1. 6E-05

Distance (m)

Di recti on	1000
N	6. 9E-06
NNW	5. 0E-06
NW	5. 9E-06
WNW	4. 4E-06
W	3. 1E-06
WSW	1. 4E-06
SW	1. 0E-06
SSW	1. 0E-06
S	2. 5E-06
SSE	3. 4E-06
SE	2. 0E-06
ESE	1. 2E-06
E	1. 3E-06
ENE	1. 5E-06
NE	3. 7E-06
NNE	4. 4E-06

Jun 2, 2005 8:27 am

SUMMARY
Page 6

INDIVIDUAL LIFETIME RISK (deaths)
(All Radionuclides and Pathways)

Di recti on	132	143	150	165	180	187	500

D. SUM

N	4.0E-09	3.5E-09	3.2E-09	2.7E-09	2.3E-09	2.1E-09	3.2E-10
NNW	3.2E-09	2.7E-09	2.4E-09	2.0E-09	1.7E-09	1.5E-09	2.3E-10
NW	3.5E-09	3.0E-09	2.8E-09	2.3E-09	2.0E-09	1.8E-09	2.7E-10
WNW	2.7E-09	2.3E-09	2.1E-09	1.8E-09	1.5E-09	1.4E-09	2.0E-10
W	1.9E-09	1.6E-09	1.5E-09	1.2E-09	1.0E-09	9.5E-10	1.4E-10
WSW	8.5E-10	7.0E-10	6.3E-10	5.0E-10	4.2E-10	3.9E-10	5.7E-11
SW	5.4E-10	4.5E-10	4.1E-10	3.3E-10	2.8E-10	2.6E-10	3.9E-11
SSW	6.1E-10	4.9E-10	4.3E-10	3.4E-10	2.9E-10	2.7E-10	4.0E-11
S	1.4E-09	1.2E-09	1.1E-09	9.3E-10	7.8E-10	7.2E-10	1.1E-10
SSE	1.8E-09	1.6E-09	1.5E-09	1.3E-09	1.1E-09	9.8E-10	1.5E-10
SE	1.1E-09	9.7E-10	8.7E-10	7.2E-10	6.1E-10	5.6E-10	8.5E-11
ESE	6.8E-10	5.7E-10	5.0E-10	4.1E-10	3.4E-10	3.2E-10	4.8E-11
E	7.1E-10	6.1E-10	5.6E-10	4.6E-10	3.9E-10	3.6E-10	5.4E-11
ENE	8.9E-10	7.2E-10	6.3E-10	5.0E-10	4.2E-10	3.9E-10	5.9E-11
NE	2.1E-09	1.8E-09	1.7E-09	1.4E-09	1.2E-09	1.1E-09	1.7E-10
NNE	2.7E-09	2.2E-09	2.0E-09	1.7E-09	1.4E-09	1.3E-09	2.0E-10

Distance (m)

Di recti on	1000
N	8.4E-11
NNW	6.1E-11
NW	7.1E-11
WNW	5.3E-11
W	3.6E-11
WSW	1.6E-11
SW	1.1E-11
SSW	1.1E-11
S	2.9E-11
SSE	4.0E-11
SE	2.3E-11
ESE	1.3E-11
E	1.5E-11
ENE	1.6E-11
NE	4.4E-11
NNE	5.3E-11

E. SYN

C A P 8 8 - P C

Versi on 1. 00

Clean Air Act Assessment Package - 1988

S Y N O P S I S R E P O R T

Non-Radon Popul ati on Assessment
Jun 2, 2005 8: 30 am

Facility: LEHR
Address: Old Davis Road
City: Davis
State: CA Zip: 95616

Effecti ve Dose Equi val ent
(mrem/year)

4. 58E-07

At Thi s Locati on: 5000 Meters North
Source Category: nonpoi nt
Source Type: Area
Emi ssi on Year: 2004

Comments: Eastern Dog Pens area

Dataset Name: EDPpop
Dataset Date: Jun 2, 2005 8: 29 am
Wind File: WNDFILES\SAC0320. WND
Popul ati on File: POPFILES\04LEHRRV. POP

Jun 2, 2005 8: 30 am

SYNOPSIS
Page 1

MAXI MALLY EXPOSED I NDI VI DUAL

Locati on Of The Indi vi dual : 5000 Meters North
Li fetime Fatal Cancer Ri sk: 5. 63E-12
Page 1

E. SYN

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)	Collective Population (person-rem/y)
GONADS	1.65E-09	8.83E-08
BREAST	1.70E-09	9.13E-08
R MAR	1.98E-07	1.00E-05
LUNGS	2.99E-06	1.47E-04
THYROID	1.65E-09	8.86E-08
ENDOST	2.45E-06	1.24E-04
RMNDR	4.94E-09	3.00E-07
EFFEC	4.58E-07	2.27E-05

FREQUENCY DISTRIBUTION OF LIFETIME FATAL CANCER RISKS

Risk Range	Number of People	Number of People In This Risk Range Or Higher	Deaths/Year In This Risk Range	Deaths/Year In This Risk Range Or Higher
1.0E+00 TO 1.0E-01	0	0	0.00E+00	0.00E+00
1.0E-01 TO 1.0E-02	0	0	0.00E+00	0.00E+00
1.0E-02 TO 1.0E-03	0	0	0.00E+00	0.00E+00
1.0E-03 TO 1.0E-04	0	0	0.00E+00	0.00E+00
1.0E-04 TO 1.0E-05	0	0	0.00E+00	0.00E+00
1.0E-05 TO 1.0E-06	0	0	0.00E+00	0.00E+00
LESS THAN 1.0E-06	3554446	3554446	3.93E-09	3.93E-09

Jun 2, 2005 8:30 am

SYNOPSIS
Page 2

RADIONUCLIDE EMISSIONS DURING THE YEAR 2004

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
BI-212	W	1.00	2.1E-09	2.1E-09
BI-214	W	1.00	2.9E-09	2.9E-09
CS-137	D	1.00	9.7E-10	9.7E-10
PB-214	D	1.00	3.1E-09	3.1E-09
SR-90	D	1.00	8.4E-10	8.4E-10
TL-208	D	1.00	1.1E-09	1.1E-09
TH-228	Y	1.00	7.9E-09	7.9E-09
TH-232	Y	1.00	6.4E-09	6.4E-09
TH-234	Y	1.00	4.5E-09	4.5E-09
H-3	*	0.00	6.2E-09	6.2E-09
U-235	Y	1.00	2.0E-10	2.0E-10

E. SYN
SITE INFORMATION

Temperature: 17 degrees C
Precipitation: 48 cm/y
Mixing Height: 1000 m

Jun 2, 2005 8:30 am

SYNOPSIS
Page 3

SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
Area (sq m): 3.90E+03

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Zero:	0.00	0.00	0.00	0.00	0.00	0.00	0.00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.700	0.399	0.442
Fraction From Assessment Area:	0.300	0.601	0.558
Fraction Imported:	0.000	0.000	0.000
Beef Cattle Density:	8.81E-02		
Milk Cattle Density:	2.85E-02		
Land Fraction Cultivated for Vegetable Crops:	2.50E-01		

Jun 2, 2005 8:30 am

SYNOPSIS
Page 4

POPULATION DATA

Direction	Distance (m)						
	5000	15000	25000	35000	45000	55000	65000
N	1398	4092	6818	8815	9527	9565	13539
NNW	1392	4087	6810	9534	10557	2425	1870
NW	1430	4087	6809	9533	12264	13505	8739
WNW	1615	4099	6809	9386	11686	13978	11425
W	3648	8867	10707	9671	11430	13964	18891
WSW	3678	11033	18381	13743	12495	13964	26384
SW	3678	11033	18383	23956	32346	29377	42305

	E. SYN						
SSW	3678	11033	18385	25739	31491	48634	123765
S	3682	11046	18410	25943	48702	110353	132364
SSE	3675	7199	16660	52687	65865	55773	58588
SE	2799	4087	25481	69516	58883	39856	44594
ESE	2126	4658	39687	71885	92495	108022	71157
E	2011	7998	49920	71883	92498	112999	42151
ENE	1820	4118	45474	71885	80967	68596	11990
NE	1552	4140	48955	35741	14296	17017	20106
NNE	1418	4087	12956	7633	9907	11417	11505

Di stance (m)

Di recti on 75000

N	15748
NNW	2490
NW	3721
WNW	7540
W	29537
WSW	33611
SW	54440
SSW	152518
S	152732
SSE	61285
SE	51451
ESE	21435
E	8768
ENE	11180
NE	18864
NNE	11440
