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**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**

prepared for:

United States Department of Energy
Oakland Operations Office
1301 Clay Street
Oakland, California 94612-5208

prepared by:

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

May 25, 2001

Rev. 0

DOE Oakland Operations Contract DE-AC03-96SF20686

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Approvals Page

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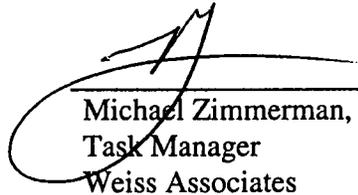
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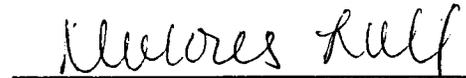
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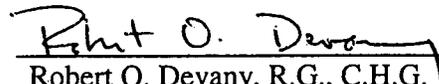
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ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
AM	Air Monitoring Station
cm/s	centimeters per second
COC	constituent of concern
Cs-137	cesium-137
cu yd	cubic yard
EDE	effective dose equivalent
ER/WM	Environmental Restoration/Waste Management
km	kilometers
LEHR	Laboratory for Energy-Related Health Research
m/s	meters per second
m ²	square meters
mCi	milliCuries
MEI	maximally exposed individual
MOU	Memorandum of Understanding
mph	miles per hour
mrem	millirem
mrem/yr	millirem per year
mSv/yr	milliSievert per year
NESHAPs	National Emissions Standards for Hazardous Air Pollutants
pCi/g	picoCuries per gram
PM ₁₀	particulate matter with an aerodynamic diameter less than or equal to 10 micrometers
RA	removal action
Ra/Sr	radium/strontium
Ra-226	radium-226

rem	roentgen equivalent man
Sr-90	strontium-90
Th-234	thorium-234
U-238	uranium-238
UC Davis	University of California, Davis
UCL	upper confidence limit
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
yr	year
$\mu\text{g}/\text{m}^3$	micrograms per cubic meter

US Department of Energy
Radionuclide Air Emission Annual Report
(Subpart H of 40 CFR 61)
Calendar Year 2000

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

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1. FACILITY INFORMATION

The Laboratory for Energy-Related Health Research (LEHR) Facility is in compliance with the requirements of 40 CFR Part 61 Subpart H - National Emissions Standards for Hazardous Air Pollutants (NESHAPs) for Emissions of Radionuclides from United States Department of Energy (USDOE) Facilities. The NESHAPs regulations require that radionuclide emissions not exceed levels that would result in an effective dose equivalent (EDE) of 10 millirem per year (mrem/yr).

This Radionuclide Air Emission Annual Report applies only to the USDOE areas at the LEHR Facility on the University of California, Davis (UC Davis) campus. For the purposes of this report, the USDOE areas will be referred to as the "Site" and references to the LEHR Facility are inclusive of the entire 15-acre property where both USDOE and UC Davis conduct activities. There are currently no point sources of radionuclide emission at the Site. Potential fugitive/area sources of radionuclide emissions were modeled using the United States Environmental Protection Agency (USEPA) atmospheric dispersion/radiation dose calculation computer code, CAP88-PC Version 1.0. Based on results from this model, the total estimated contribution to the maximum EDE from non-point source emissions for reporting year 2000 is estimated to be 7.52×10^{-4} mrem/yr (less than 0.01% of the 10 mrem/yr standard).

1.1 Site Description

The LEHR Facility is located in Solano County, California, in the southeast one-quarter 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 long summers. Based on the Site meteorological station data collected in 2000, the average winter (October through April) temperature was 54 degrees Fahrenheit (°F), and the average summer (May through September) temperature was 68°F. Precipitation data were also collected from the UC Davis climatological data center, located approximately one mile northwest of the LEHR Facility. Based on the UC Davis data, the total precipitation for 2000 was 16.07 inches (with totals of 10.53 inches, 24.1 inches and 17.9 inches recorded in 1999, 1998 and 1997, respectively). The sun shines approximately 95% of the time during daylight hours in the summer and about 45% of the time 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 (USDOE, 1994). The average 2000 wind speed recorded at the Site 3 meter tower was approximately 1.23 meters per second (m/s) or 2.75 miles per hour (mph), the maximum wind speed was 6.44 m/s (14.4 mph) and the median wind speed was 1.12 m/s (2.5 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 (USDOE, 1988).

The LEHR Facility encompasses approximately 15 acres and contains laboratory buildings and former animal-handling facilities (Figure 2). Of the 15 acres, approximately 45% are paved or covered by structures. Approximately 30% are unpaved and relatively free of vegetation. Five percent are covered by large, deep-rooted vegetation. Outdoor dog pens consisting of asphalt, gravel and soil occupy the remaining 20%, or 3 acres, of the LEHR Facility. The land is owned by the Regents of the University of California and USDOE owns the buildings on-site.

In the early 1950s, the Atomic Energy Commission (now USDOE) began conducting radiological studies at UC Davis on laboratory animals, particularly beagles. Initial studies were carried out on the main campus and involved the irradiation of beagles. USDOE 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, USDOE 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. USDOE-funded research at the LEHR Facility ended in 1989. The LEHR Facility is presently occupied by the UC Davis Institute of Toxicology and Environmental Health and LEHR Environmental Restoration/Waste Management (ER/WM) Project. UC Davis radionuclide emissions are not included in this report.

1.2 Source Description

The NESHAPs requirements primarily target point source/stack emissions. However, a Memorandum of Understanding (MOU) between USDOE and USEPA (USDOE, 1995) applies the same point source criteria to potential non-point diffuse area sources.

1.2.1 Point Sources

An evaluation of potential point sources of radionuclide emissions determined there were none at the Site in 2000. The two potential point sources of radionuclide emissions at the Site in 2000 included a fume hood within a laboratory in the Animal Hospital No.1 building and a glove box hood in the Geriatrics No.1 building (Figure 2). The fume hood is no longer operational and was not operated in 2000. Therefore, the fume hood was determined to not be a point source. The glove box hood was in operation for less than one day during 2000. While in operation, radionuclide emissions were monitored using a low-volume air sampler. Monitoring data indicated that radionuclide emissions were indistinguishable from background levels. Therefore, the glove box was determined to not be a point source.

1.2.2 Non-Point Sources

Non-point diffuse sources were limited to wind-blown fugitive dust from the following areas (see Table 1):

- Radium/Strontium (Ra/Sr) Treatment Systems Area II;
- Western Dog Pens Area; and,
- Eastern Dog Pens Area.

Ra/Sr Area I is not included in the Calendar Year 2000 *Radionuclide Air Emission Annual Report* because excavations in this area were backfilled and are no longer a non-point source. Ra/Sr Area I was included in the Calendar Year 1999 *Radionuclide Air Emission Annual Report*.

1.2.3 Radium/Strontium Treatment Systems Area

The Ra/Sr Treatment Systems are located between Animal Hospital Nos. 1 and 2 (Buildings H-219 and H-218) in the western portion of the LEHR Facility (Figure 2) and together comprise the Ra/Sr Treatment Systems Area. These systems were used to treat radiological liquid wastes generated from animal experiments. This area is a potential non-point diffuse source of radiological emissions.

The Ra Treatment System reportedly received low-level radioactive waste from the Ra-226 experiments. The system consisted of two septic tanks, each containing multiple compartments separated by weirs, a distribution box, three dry wells, two leach trenches and associated distribution pipelines. Solids settled out in the septic tanks and fluids were pumped from the tanks and fed through the distribution box to one of the three vertical dry wells or the leach trench.

The Sr-90 (Imhoff) Treatment System reportedly received low-level radioactive waste from Sr-90 experiments. Effluent was processed through the Imhoff Treatment System and then was

discharged to two leach fields. The Imhoff Treatment System used sedimentation, aeration, chemical clarification, and filtration to treat waste prior to passing the remaining wastewater through a cation exchange resin, and discharging the remaining fluid to the Sr-90 leach fields.

Ra/Sr Area II consists of the Ra-226 tank, Sr-90 tank, Sr-90 tank leach-field, and the Sr-90 and Ra-226 influent tank pipes. A removal action (RA) at Area II occurred from August to October 2000.

For this report, radionuclide concentrations for 2000 waste profile soil sampling from the Ra/Sr Treatment Systems Area II were used to calculate its fugitive dust emission rates. Radionuclide concentrations from 1997 and 1998 soil sampling for the Eastern and Western Dog Pens were used to calculate the dog pen fugitive dust emission rates.

The driver constituents of concern (COCs) for the Area II RA were Ra-226, Sr-90, and nitrate. Both composite waste samples and confirmation samples were collected during the Area II RA. These samples were sent to an off-site laboratory and analyzed for a full suite of radionuclide analyses. Sr-90 at 261 picoCuries per gram (pCi/g) was the highest radionuclide concentration detected during the Area II RA. Table 2 summarizes the maximum radionuclide concentrations found in the waste soils removed from the Ra/Sr Treatment Systems Area II.

Ambient air samples were collected during the entire RA at the Ra/Sr Treatment Systems Area II from three stations around the perimeter of the LEHR Facility and one distant station serving as a background station (Air Monitoring Station-[AM]3, Figure 2). Details of the air monitoring results will be presented in the Ra/Sr Treatment Systems Area Confirmation Report to be completed by September 28, 2001. All detected radionuclides were either below their specific background values or below the Derived Concentration Guide (USDOE, 1993). Particulate matter emissions with an aerodynamic diameter less than or equal to 10 micrometers (PM₁₀) from the excavation activities were closely monitored. During the RA, PM₁₀ concentrations did not exceed the USEPA air quality standard of 150 micrograms per cubic meter (µg/m³). The maximum PM₁₀ concentration during the RA was 61.59 µg/m³ collected at AM-5 located west of the Western Dog Pens Area.

1.2.4 Eastern and Western Dog Pens Area

The Eastern and Western Dog Pens 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. The Western Dog Pens Area originally contained 320 pens. In 1975, 64 pens were removed to allow for construction of the Cellular Biology Lab (Building H-294, Figure 2). The Eastern Dog Pens Area contained 96 pens and overlies UC Davis Landfill No. 2. 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 the gravel fill in the pens. An estimated 2 milliCuries (mCi) of Sr-90 and 0.5 mCi of Ra-226 were potentially excreted in dog urine in these areas over the life of the project (WA, 1997b).

Between June and August 1996, fencing and concrete curbing for 256 Western and 96 Eastern Dog Pens, concrete support pedestals and some soil were removed from the dog pen areas. After removal of the support pedestals, 24 surface soil samples were collected from randomly selected locations and were submitted for radionuclide analysis. Only Sr-90, Ra-226 and cesium-137 (Cs-137) were detected above background in these 24 samples.

In 1997, additional investigation was performed in the Western Dog Pens as detailed in the *Final Technical Report: Results of Western Dog Pen, Background and Off-Site Investigations* (WA, 1998). Phase A of the investigation consisted of reviewing historical information and conducting a general gamma scan of the dog pens gravel. During Phase B, 46 gravel and 75 soil samples, including 4 gravel and 6 soil duplicates, were submitted to an off-site analytical laboratory for selected radionuclide analyses. Results of the analyses concluded that only Ra-226 (maximum activity of 1.94 pCi/g), Sr-90 (maximum activity in gravel of 3.59 pCi/g), Cs-137 (maximum activity of 0.115 pCi/g), thorium-234 (Th-234) (maximum activity less than 2 pCi/g), and uranium-238 (U-238) (maximum activity of 1.62 pCi/g) were present in gravel and soil in activities above background.

In 1998, Phase C of the Dog Pens Investigation was completed in the Western Dog Pens Area. This investigation included collecting a surface soil sample from each of 20 different dog pens. In addition, a soil boring with multiple samples was completed at each of the 20 dog pens. All of the soil samples were submitted to an off-site analytical laboratory for selected radionuclide analyses. Results concluded that only the following radionuclides were present at concentrations greater than background:

- Sr-90 (maximum concentration of 0.71 pCi/g)
- Cs-137 (maximum concentration of 0.072 pCi/g)
- Carbon-14 (maximum concentration of 2.02 pCi/g)
- Th-234 (maximum concentration of 2.4 pCi/g)
- U-235 (maximum concentration of 0.317 pCi/g)
- U-238 (maximum concentration of 2.4 pCi/g) and
- Lead-210 (maximum concentration of 4.53 pCi/g)

The Eastern and Western Dog Pens Areas emissions were based on the maximum surface soil concentrations for radionuclides exceeding background (Tables 3 and 4) and are summarized in Section 2.

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, three potential non-point diffuse sources of radionuclide emissions were present at the Site in 2000. These included wind-blown, fugitive dust emission of radionuclides from the Ra/Sr Treatment Systems Area and the Western and Eastern Dog Pens Areas. Based on the surface soil sampling results from the Western and Eastern Dog Pens, surface contamination is conservatively assumed to exist across the entire area of each potential radionuclide non-point emissions source. The 2000 Ra/Sr Area II RA was a significant change to Site conditions that could result in emissions different from those estimated in the *Radionuclide Air Emission Annual Report for Calendar Year 1998* (WA, 1999a). The source conditions at the Ra/Sr Treatment Systems Area changed as a result of the RA's extensive excavation of contaminated soil and subsurface structures. Thus, modeling assumptions were modified for the Ra/Sr Treatment Systems Area. Specifically, the maximum radionuclide activities from the excavated waste were used and the waste was assumed to be exposed to the atmosphere across the entire Ra/Sr Area II (Figure 2). Otherwise, the modeling assumptions are identical to those assumed in the *Radionuclide Air Emission Annual Report for Calendar Year 1998*.

To calculate air emissions for the *Radionuclide Air Emission Annual Report for Calendar Year 2000*, the surface area of each non-point source area was determined, using a scaled map of the Site, as follows:

- Ra/Sr Area II surface area = 604 square meters (m²)
- Western Dog Pens surface area = 9,500 m² and
- Eastern Dog Pens surface area = 3,900 m²

The particulate re-suspension rate model was used to calculate the fugitive dust emission rate based on the USEPA'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 PM_{10} . PM_{10} emission rates from Site fugitive non-point sources were estimated using the equation developed by Cowherd for estimating respirable particle emissions from wind erosion of surfaces with an "unlimited reservoir" of erodible particles, adjusted for site-specific data using the following formula:

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

where

- E_{10} = annual average PM_{10} emission rate per unit contaminated surface, $g/(m^2\text{-hr})$;
- V = fraction of contaminated surface vegetative cover (assumed zero for worst-case bare soil);
- $[u]$ = mean annual wind speed at 7 m height = $[u]_{\text{site}} \times \ln(700/z_o) / \ln(300/z_o) = 1.33$ m/s;
- $[u]_{\text{site}}$ = 95% UCL of LEHR site meteorological tower mean annual wind speed at a height of 3 meters (= 1.14 m/s);
- z_o = emission source area roughness height (= 2 cm);
- u_t = threshold value of wind speed at 7 m height = $u_{\text{friction}} / 0.4 \times \ln(700/z_o) = 7.3$ m/sec;
- u_{friction} = threshold friction velocity (= 50 centimeters per second [cm/sec]);
- x = $0.866 u_t / [u]$ = dimensionless ratio; and,
- $F(x)$ = function plotted in Figure 4-3 of the guidance document (= 5.6×10^{-2}).

The fraction of contaminated surface vegetative cover was conservatively assumed to be zero (i.e., bare soil) to calculate a worst-case value. The roughness height of 2 cm 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. However, since the tabulated values are based on 1977 meteorological data from Sacramento, and because site-specific data were available for 2000 from the LEHR on-site meteorological tower, the on-site data were selected as more representative of local site conditions. Therefore, the 95% upper confidence limit (UCL) of the mean annual wind speed data was calculated using meteorological data collected during 2000 from the Site meteorological tower.

The 95% UCL was calculated using equations for characterizing confidence limits of the mean for lognormal populations (Gilbert, 1987), as recommended by USEPA Guidance (USEPA,

1992a). The resulting 95% UCL of the LEHR site meteorological tower mean annual wind speed for 2000 was 1.25 m/s. Because the height of the on-site meteorological tower is three meters, the wind speed must be converted to the equivalent wind speed at a height of seven meters using a variation of Cowherd's Equation 4-3, which assumes a logarithmic velocity profile near the earth's surface.

Using Equation 1 and the data discussed above, the annual average PM₁₀ emission rate per unit contaminated surface was calculated as $E_{10} = 1.61 \times 10^{-5} \text{ g/m}^2\text{-hr}$. This emission rate is combined with the maximum radionuclide activity measured above background in surface soil activities for each potential emission source to calculate a particulate emission rate based on the following equation:

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

where,

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

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 three potential radionuclide emission sources, as presented in Tables 2 through 5.

2.3 Particulate Matter-10

PM₁₀ data were calculated based on a volumetric flow rate. Glass fiber filters, prepared by a USEPA-approved commercial laboratory, were used to collect particulates greater than 10 micrometers at an average flow rate of 1.15 cubic meters per minute for 24 hours. The total air volume, V, was estimated to be 1,656 m³. The concentration of PM₁₀ was calculated by the equation below:

$$C_{\text{PM-10}} = \frac{M_{\text{ff}} - M_{\text{fi}}}{V} \quad (\text{Eq. 3})$$

where,

$$\begin{aligned} C_{\text{PM-10}} &= \text{concentration of PM}_{10}, \mu\text{g/m}^3 \\ M_{\text{ff}} &= \text{weight of the glass fiber filter after 24-hr reported by the laboratory; } \mu\text{g} \\ M_{\text{fi}} &= \text{weight of the glass fiber filter before sampling reported by the laboratory; } \mu\text{g} \text{ and} \\ V &= \text{total air volume, m}^3 \end{aligned}$$

3. DOSE ASSESSMENTS

3.1 Description of Dose Model

Compliance with the NESHAPs requirements for diffuse, non-point source emissions was assessed using the USEPA 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 three potential Site radionuclide emission non-point sources. A total of three "individual receptor" CAP88-PC runs were executed to model the fugitive dust emission sources described in Section 2. For each of the three potential radionuclide emission non-point sources, a human receptor was identified in each of the north, south, east and west quadrants in relationship to the 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 (USEPA, 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 two 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 all three 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 Animal Hospital Building No. 1 (H-219) (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. A total of three "population" CAP88-PC runs were executed to model the three fugitive dust emission non-point sources. The CAP88-PC model output for each run is included in Appendix A. For each of three potential radionuclide emission non-point sources, the CAP88-PC model was run with an updated population data file used in the *Radionuclide Air Emission Annual Report for Calendar Year 1998* (WA, 1999a), which includes the residential population in Davis and the student population at the UC Davis campus. The method used over the last three years has been to take the 1997 data and add 2.4% per year (the average annual population growth for the City of Davis based on the City's web page) for lack of more recently available data.

This population file includes receptors within a distance of 10 kilometers (km) from the Site, rather than 80 km as specified in USDOE guidance. This modification was necessary to avoid including the large number of receptors in the Sacramento area whose exposure to radionuclides resulting from the Site would be negligible, but whose population numbers would have a large effect on the collective population dose results. This approach is appropriate for calculating the collective population dose for the primarily rural LEHR Facility surroundings. The results of the CAP88-PC population runs based upon the combined source exposures are presented in Table 6 and Appendix A.

3.2 Summary of Input Parameters

The input parameters for the CAP88-PC runs are summarized for the Ra/Sr Treatment Systems Area, and the Eastern and Western Dog Pens Areas in Tables 7, 8, and 9, respectively. As noted above, the areal extent of each non-point source was conservatively calculated assuming that the maximum concentration of the observed radiological surface soil contamination for the Eastern and Western Dog Pens Areas and maximum radionuclide concentrations from 2000 waste profile soil sampling for the Ra/Sr Treatment Systems Area II were present across the entire potential radionuclide emission non-point source area. Conservative radionuclide emissions were calculated using the maximum of the soil radionuclide concentrations measured for each potential area non-point source and applying the USEPA-recommended particulate re-suspension 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. Site meteorological data were not utilized for the CAP88-PC modeling due to incompatible formats between on-site data (MET144) and the CAP88-PC requirement (CD144). Use of the Sacramento wind file 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: 7.52×10^{-4} mrem/yr (1.35×10^{-6} mSv/yr)

Location of On-site Maximally Exposed Individual: Animal Hospital Building No. 1 (H-219),
10 m north of the Ra/Sr Treatment
Systems (Figure 2)

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 O. Devany Date: 5/25/01
Robert Devany
LEHR Site ER/WM Project Manager

Signature: Richard N. Fallejo Date: 5/25/01
Richard N. Fallejo
USDOE-LEHR Project Manager

5. ADDITIONAL INFORMATION

The LEHR Facility completed construction or modifications in 2000 in the Ra/Sr Treatment System Area II. The Facility met the requirements in 40 CFR 61.96(b) and is therefore exempt from filing an application to construct or modify per the MOU (USDOE, 1995). The Facility is eligible for this exemption because the EDE caused by all emissions from the completed modifications and construction is less than 1% of the standard in 40 CFR 61.92, 10 mrem/yr, at the LEHR Facility.

As required in the MOU for facilities that were exempt from having to submit an application to USEPA 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 construction or modification projects completed within the 2000 calendar year at the LEHR Facility for which approval to construct or modify was required or waived under Section 61.96 of Subpart H of 40 CFR 61. In the summer of 2000 (August through November), contaminated soil, gravel and subsurface structures including two treatment/septic tanks from the Ra/Sr Treatment Systems Area II were excavated and removed for proper storage and disposal. The approximate amount of soil removed from the Ra/Sr Treatment Systems Area II was 1,600 cubic yards (cu yds); approximately 1,200 cu yds of this soil were classified as low-level waste.

The collective population equivalent dose to Davis residents was 2.63×10^{-5} person-roentgen equivalent man (rem)/yr, and the EDE for the off-site MEI was 8.65×10^{-6} mrem/yr, as estimated by CAP88-PC (Table 6). The predicted EDE for the off-site MEI is orders of magnitude below the 10 mrem/yr standard as required by 40 CFR Part 61 Subpart H.

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

There were no unplanned releases of radionuclides to the atmosphere during 2000.

- **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, and 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 contribution to the EDE to the on-site MEI resulting from non-point source emissions was estimated to be 7.52×10^{-4} mrem/yr (1.35×10^{-6} mSv/yr), far below the 10 mrem/yr standard.

6. REFERENCES

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- United States Department of Energy (USDOE), 1988, Environmental Survey Preliminary Report, Laboratory for Energy-Related Health Research, Davis, California, Environment, Safety and Health Office of Environmental Audit.
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- USDOE, 1996, Annual Site Environmental Report, Calendar Year 1995 Laboratory for Energy-Related Health Research, University of California, Davis, Report prepared for USDOE, Oakland, California.
- United States Environmental Protection Agency (USEPA), 1992a, Supplemental Guidance to RAGS: Calculating the Concentration Term, U.S. Environmental Protection Agency (PB92-963373, May 1992).
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- Weiss Associates (WA), 1997, Final Site Characterization Summary Report for the U.S. Department of Energy Areas at the Laboratory for Energy-Related Health Research, UC Davis, California, January.
- WA, 1998, Final Technical Report: Results of Western Dog Pens, Background, and Off-Site Investigations for Laboratory for Energy-Related Health Research, June.

WA, 1999a, Final Radionuclide Air Emission Annual Report (Subpart H of 40 CFR 61) Calendar Year 1998 for Laboratory for Energy-Related Health Research, June.

WA, 1999b, Draft Southwest Trenches Area 1998 Removal Action Confirmation Report, June.

TABLES

Table 1. Summary of LEHR Site Potential Non-Point Diffuse Area Radionuclide Sources

Potential Fugitive Source	Description
Radium/Strontium Treatment Systems Area II	Radium-226 treatment tank and influent piping, and the Strontium-90 treatment tanks and associated leach system
Dog Pens Areas	The Western and Eastern Dog Pens areas

Note

Radium/Strontium Treatment Systems Area I was included as a potential non-point diffuse area radionuclide source in the Calendar Year 1999 *Radionuclide Air Emission Annual Report*. The Radium/Strontium Treatment Systems Area I was remediated in 1999 and covered with clean fill; therefore, this area is no longer classified as a potential radionuclide source.

Table 2. Summary of Maximum Excavated Soil and Debris Concentrations for Radionuclides Exceeding Background and Their Associated PM₁₀ Emission Rates, LEHR Ra/Sr Treatment Systems Area II

Radionuclide	Maximum Concentration (pCi/g)	Maximum PM ₁₀ Emission Rate (Ci/yr)
Am-241	0.04	3.41E-12
Bismuth-212	0.503	4.28E-11
Bismuth-214	0.557	4.74E-11
Carbon-14	0.132	1.12E-11
Cesium-137	0.286	2.44E-11
Cobalt-60	0.0151	1.29E-12
Lead-214	0.633	5.39E-11
Plutonium-241	0.878	7.48E-11
Strontium-90	261	2.22E-08
Thorium-230	0.685	5.83E-11
Thorium-234	0.856	7.29E-11

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

Radionuclide	Maximum Concentration (pCi/g)	Maximum PM ₁₀ Emission Rate (Ci/yr)
Bismuth-212	0.62	8.31E-10
Bismuth-214	0.84	1.13E-09
Carbon-14	11.3	1.51E-08
Cesium-137	0.159	2.13E-10
Cobalt-60	0.028	3.75E-11
Lead-210	3.3	4.42E-09
Lead-212	0.99	1.33E-09
Radium-223	0.32	4.29E-10
Radium-226	1.9	2.55E-09
Strontium-90	5.66	7.58E-09
Thallium-208	0.272	3.64E-10
Thorium-234	0.93	1.25E-09
Uranium-235	0.14	1.88E-10

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. Summary of Maximum Surface Soil Concentrations for Radionuclides Exceeding Background and Their Associated PM₁₀ Emission Rates, LEHR Eastern Dog Pens Area

Radionuclide	Maximum Concentration (pCi/g)	Maximum PM ₁₀ Emission Rate (Ci/yr)
Bismuth-212	0.49	2.70E-10
Carbon-14	11.3	6.22E-09
Cobalt-60	0.028	1.54E-11
Radium-223	0.32	1.76E-10
Radium-226	1.04	5.72E-10
Strontium-90	3.25	1.79E-09
Thorium-234	0.88	4.84E-10
Uranium-235	0.14	7.70E-11

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

MEI Receptor Description	Ra/Sr Treatment Systems Area II		Wern Dog Pens Area		Eern Dog Pens Area		Maximum Total Dose (mrem/yr) ³
	(mrem/yr) ¹	Location ²	(mrem/yr) ¹	Location ²	(mrem/yr) ¹	Location ²	
Reproductive Biology Laboratory (H-215)	5.70E-05	40 m S	2.00E-04	40 m W	1.50E-06	130 m W	2.59E-04
UC Davis Building E of LEHR Site	3.80E-05	340 m E	1.20E-05	300 m E	3.00E-07	180 m E	5.03E-05
Off-site Receptor S of Putah Creek	3.70E-05	1,400 m S	1.10E-05	1,200 m S	1.10E-07	1,000 m S	4.81E-05
Off-site Receptor W of LEHR Site	3.90E-05	250 m W	1.30E-05	400 m W	1.90E-07	500 m W	5.22E-05
Animal Hospital Building No. 1 (H-219)	6.80E-04	10 m N	7.10E-05	65 m W	9.50E-07	165 m W	7.52E-04
Animal Hospital Building E of OU-2	1.60E-04	15 m E	2.00E-04	40 m W	1.30E-06	140 m W	3.61E-04
Animal Hospital Building No. 2 (H-218)	3.20E-04	10 m S	7.10E-05	65 m W	9.50E-07	165 m W	3.92E-04
Cellular Biology Laboratory (H-294)	5.40E-05	60 m NNE	9.10E-05	65 m N	1.10E-06	150 m NNE	1.46E-04

Notes

- ¹ The EDE to the MEI is taken as the maximum modeled dose within a 22.5° sector in the direction and at the distance indicated in the "location" column. The dose 15 m north of the Ra/Sr Treatment Systems Area, for example, would be the maximum modeled dose at 15 m N, 15 m NNE and 15 m NNW.
- ² The distance from an area source to a receptor is defined by CAP88-PC as distance from the centroid of the area source to the receptor (USEPA, 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 area non-point source to the building assumed to house the receptor.
- ³ The Maximum Total Dose is the sum of EDEs modeled for each MEI receptor from the three potential radionuclide fugitive dust emission non-point sources. Value in boldface is the Maximum Total Dose for the site-wide MEI.

Abbreviations

EDE	Effective Dose Equivalent	NNE	north by northeast
E	east	NNW	north by northwest
m	meters	OU	operable unit
MEI	Maximally Exposed Individual	Ra/Sr	Radium/Strontium
mrem/yr	millirem per year	S	south
N	north	UC Davis	University of California, Davis

Table 6. Summary of Estimated Collective Population Dose Resulting from Radionuclide Emissions from Each Fugitive Dust Emission Non-Point Source

Potential Emission Source	Off-Site Maximally Exposed Individual		Collective Population Dose (person-rem/yr)
	(mrem/yr)	Location	
Ra/Sr Treatment Systems Area	1.60E-06	250 m North ¹	4.90E-06
Western Dog Pens Area	6.48E-06	250 m North ¹	1.97E-05
Eastern Dog Pens Area	5.74E-07	250 m North ¹	1.72E-06
Total LEHR Site	8.65E-06		2.63E-05

Notes

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

The collective population dose is for receptors within a 10-km radius.

¹The approximate location of UC Davis agricultural and primate research facilities.

Abbreviations

m meters
 mrem/yr millirem per year
 N north

Table 7. LEHR Facility NESHAPs—CAP88-PC Inputs: Ra/Sr Treatment Systems Area II

Run type (Dataset ID:OU2RECEP.SCR)	Individual	Receptor distances (m): 10, 15, 40, 60, 250, 340, 1400		
Run type (Dataset ID: OU2POP.SCR)	Population	Population file to use: 00LEHR.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				
Windfile to use:	SAC0320.WND (CAP88-PC supplied wind file)			
Annual precipitation (cm/yr):	40.82 (2000 Davis average)			
Annual ambient temperature (deg. C):	15.8 (2000 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):	604			
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)			

Table 7. LEHR Facility NESHAPs - CAP88-PC Inputs: Ra/Sr Treatment Systems Area
 (continued)

Radionuclide Release Data				
PM ₁₀ Emission rate (g/m ² -sec):	2.86E-08 (Using Cowherd, 1985, unlimited erosion potential.)			
Nuclide ID	Max. Soil (pCi/g)	Emis. Rate (Ci/yr)	Size ¹ (μm)	Class ¹
Am-241	0.04	3.41E-12	1	W
Bismuth-212	0.503	4.28E-11	1	W
Bismuth-214	0.557	4.74E-11	1	W
Carbon-14	0.132	1.12E-11	0	G
Cesium-137	0.286	2.44E-11	1	D
Cobalt-60	0.0151	1.29E-12	1	Y
Lead-214	0.633	5.39E-11	1	D
Plutonium-241	0.878	7.48E-11	1	W
Strontium-90	261	2.22E-08	1	D
Thorium-230	0.685	5.83E-11	1	Y
Thorium-234	0.856	7.29E-11	1	Y

Note

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

Abbreviations

- Ci/yr Curies per year
- Emis. emission
- g/m²-sec grams per meter squared minus seconds
- Max. maximum
- pCi/g picoCurie per gram
- PM₁₀ Particulate matter with an aerodynamic diameter less than or equal to 10 micrometers
- μm micrometer

Table 8. LEHR Facility NESHAPs—CAP88-PC Inputs: Western Dog Pens Area

Run type (Dataset ID: OU3aRECP.SCR)	Individual	Receptor distances (m): 40, 65, 300, 400, 1200			
Run type (Dataset ID: OU3aPOP.SCR)	Population	Population file to use: 00LEHR.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					
Windfile to use:	SAC0320.WND (CAP88-PC supplied wind file)				
Annual precipitation (cm/yr):	40.82 (2000 Davis average)				
Annual ambient temperature (deg. C):	15.8 (2000 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):	9,500				
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 -sec):	2.86E-08(Using Cowherd, 1985, unlimited erosion potential.)				
	Nuclide ID	Max. Soil (pCi/g)	Emis. Rate (Ci/yr)	Size ¹ (µm)	Class ¹
	Bi-212	0.62	8.31E-10	1	W
	Bi-214	0.84	1.13E-09	1	W
	C-14	11.3	1.51E-08	0	G
	Cs-137	0.159	2.13E-10	1	D
	Co-60	0.028	3.75E-11	1	Y
	Pb-210	3.3	4.42E-09	1	D
	Pb-212	0.99	1.33E-09	1	D
	Ra-223	0.32	4.29E-10	1	W
	Ra-226	1.9	2.55E-09	1	W
	Sr-90	5.66	7.58E-09	1	D
	Tl-208	0.272	3.64E-10	1	D
	Th-234	0.93	1.25E-09	1	Y
	U-235	0.14	1.88E-10	1	Y

Notes:

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

Abbreviations

Ci/yr	Curies per year	Max.	maximum
Emis.	emission	pCi/g	picoCurie per gram
g/m ² -sec	grams per meter squared minus seconds	µm	micro-meter

Table 9. LEHR Facility NESHAPs—CAP88-PC Inputs: Eastern Dog Pens Area

Run type (Dataset ID: OU3bRECP.SCR)	Individual	Receptor distances (m): 130, 140, 150, 165, 180, 500, 1000			
Run type (Dataset ID: OU3bPOP.SCR)	Population	Population file to use: 00LEHR.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					
Windfile to use:	SAC0320.WND (CAP88-PC supplied wind file)				
Annual precipitation (cm/yr):	40.82 (2000 Davis average)				
Annual ambient temperature (deg. C):	15.8 (2000 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 -sec):	2.86E-08 (Using Cowherd, 1985, unlimited erosion potential.)				
	Nuclide ID	Max. Soil (pCi/g)	Emis. Rate (Ci/yr)	Size ¹ (µm)	Class ¹
	Bi-212	0.49	2.70E-10	1	W
	C-14	11.3	6.22E-09	0	*
	Co-60	0.028	1.54E-11	1	Y
	Ra-223	0.32	1.76E-10	1	W
	Ra-226	1.04	5.72E-10	1	W
	Sr-90	3.25	1.79E-09	1	D
	Th-234	0.88	4.84E-10	1	Y
	U-235	0.14	7.70E-11	1	Y

Note

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

Abbreviations

Ci/yr Curies per year
 Emis. emission
 g/m²-sec grams per meter squared minus seconds
 Max. maximum
 pCi/g picroCurie per gram
 µm micro-meter

FIGURES

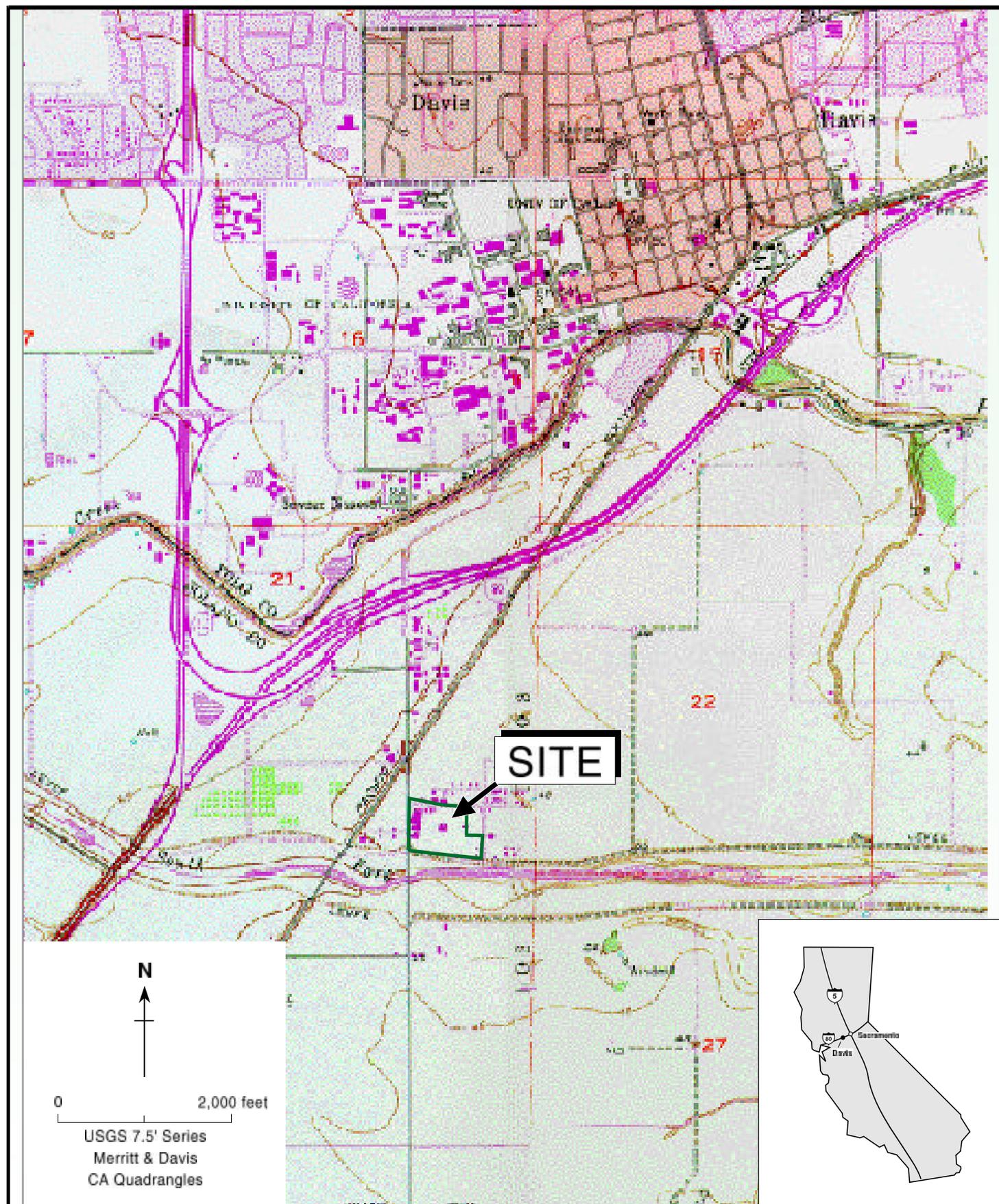


Figure 1. LEHR Facility Location Map, UC Davis

Weiss Associates



Figure 2. Potential and Known DOE Non-Point Source Areas, LEHR Facility, UC Davis

APPENDIX A

CAP88-PC OUTPUT RESULTS

B.syn

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

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

Non-Radon Population Assessment
May 4, 2001 10:41 am

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

Effective Dose Equivalent
(mrem/year)

6.48E-06

At This Location: 250 Meters North
Source Category: Non-point source
Source Type: Area
Emission Year: 2000

Comments:

Dataset Name: WDP POP
Dataset Date: May 4, 2001 10:00 am
Wind File: WNDFILES\SAC0320.WND
Population File: POPFILES\00LEHR.POP

May 4, 2001 10:41 am

SYNOPSIS
Page 1

MAXIMALLY EXPOSED INDIVIDUAL

Page 1

B.syn

Location Of The Individual: 250 Meters North
Lifetime Fatal Cancer Risk: 6.24E-11

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)	Collective Population (person-rem/y)
GONADS	5.90E-07	1.80E-06
BREAST	5.99E-07	1.83E-06
R MAR	7.68E-06	2.36E-05
LUNGS	9.05E-06	2.66E-05
THYROID	5.89E-07	1.80E-06
ENDOST	8.08E-05	2.47E-04
RMNDR	5.96E-06	1.82E-05
EFFEC	6.48E-06	1.97E-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	108624	108624	2.66E-09	2.66E-09

□ May 4, 2001 10:41 am

SYNOPSIS
Page 2

RADIONUCLIDE EMISSIONS DURING THE YEAR 2000

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
BI-212	W	1.00	8.3E-10	8.3E-10
BI-214	W	1.00	1.1E-09	1.1E-09
C-14	*	0.00	1.5E-08	1.5E-08
CS-137	D	1.00	2.1E-10	2.1E-10
CO-60	Y	1.00	3.7E-11	3.7E-11
PB-210	D	1.00	4.4E-09	4.4E-09

B. syn

PB-212	D	1.00	1.3E-09	1.3E-09
RA-223	W	1.00	4.3E-10	4.3E-10
RA-226	W	1.00	2.5E-09	2.5E-09
SR-90	D	1.00	7.6E-09	7.6E-09
TL-208	D	1.00	3.6E-10	3.6E-10
TH-234	Y	1.00	1.2E-09	1.2E-09
U-235	Y	1.00	1.9E-10	1.9E-10

SITE INFORMATION

Temperature: 16 degrees C
 Precipitation: 41 cm/y
 Mixing Height: 1000 m

□ May 4, 2001 10:41 am

SYNOPSIS
Page 3

SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
 Area (sq m): 9.50E+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

□ May 4, 2001 10:41 am

SYNOPSIS
Page 4

POPULATION DATA

B. syn
Distance (m)

Direction	250	750	1500	2500	3500	4500	6523
N	419	419	2180	2180	3831	1136	4297
NNW	419	419	2180	4360	2523	2243	281
NW	419	419	2180	2180	2180	6120	2300
WNW	419	419	2180	2180	2180	4360	327
W	419	105	10	10	10	10	10
WSW	0	0	5	5	5	5	1
SW	0	0	2	2	2	2	2
SSW	0	0	2	2	2	2	2
S	0	0	2	2	2	2	1
SSE	0	0	2	2	2	2	0
SE	0	0	2	2	2	2	1
ESE	0	0	2	2	2	2	2
E	0	0	0	218	218	1664	1991
ENE	110	110	545	1308	1417	4469	14651
NE	419	314	109	1259	7856	4161	314
NNE	419	419	3039	3052	3039	10	13

Distance (m)

Direction	9023
N	1134
NNW	109
NW	82
WNW	109
W	55
WSW	0
SW	0
SSW	0
S	0
SSE	2
SE	2
ESE	2
E	1
ENE	438
NE	163
NNE	2

C.sum

C A P 8 8 - P C

Version 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
May 4, 2001 10:41 am

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

Source Category: Non-point source
Source Type: Area
Emission Year: 2000

Comments:

Dataset Name: WDP IND
Dataset Date: May 4, 2001 9:48 am
Wind File: WNDFILES\SAC0320.WND

May 4, 2001 10:41 am

SUMMARY
Page 1

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	2.11E-05
BREAST	2.15E-05
R MAR	2.82E-04
LUNGS	3.03E-04

	C. sum
THYROID	2.11E-05
ENDOST	2.89E-03
RMNDR	2.12E-04
EFFEC	2.30E-04

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	1.44E-04
INHALATION	8.50E-05
AIR IMMERSION	1.73E-09
GROUND SURFACE	7.97E-07
INTERNAL	2.29E-04
EXTERNAL	7.98E-07
TOTAL	2.30E-04

□ May 4, 2001 10:41 am

SUMMARY
Page 2

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
BI-212	2.16E-08
BI-214	1.21E-09
C-14	3.64E-07
CS-137	1.41E-07
CO-60	1.66E-07
PB-210	1.58E-04
PB-212	1.71E-07
RA-223	3.01E-06
RA-226	3.26E-05
SR-90	1.67E-05
TL-208	6.22E-10
TH-234	6.88E-08
U-235	1.86E-05
TOTAL	2.30E-04

□ May 4, 2001 10:41 am

SUMMARY
Page 3

C.sum

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	4.54E-10
BONE	1.71E-10
THYROID	3.72E-12
BREAST	3.18E-11
LUNG	7.04E-10
STOMACH	2.34E-11
BOWEL	2.06E-11
LIVER	6.47E-10
PANCREAS	1.79E-11
URINARY	1.13E-10
OTHER	2.19E-11
TOTAL	2.21E-09

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	1.15E-09
INHALATION	1.04E-09
AIR IMMERSION	4.18E-14
GROUND SURFACE	1.85E-11
INTERNAL	2.19E-09
EXTERNAL	1.86E-11
TOTAL	2.21E-09

□ May 4, 2001 10:41 am

SUMMARY
Page 4

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
BI-212	2.78E-13
BI-214	1.41E-13
C-14	8.89E-12
CS-137	3.68E-12
CO-60	4.15E-12
PB-210	1.13E-09
PB-212	2.93E-12

	C. sum				
NW	2.1E-09	8.0E-10	1.3E-10	1.1E-10	9.3E-11
WNW	1.9E-09	6.7E-10	1.2E-10	1.1E-10	9.2E-11
W	1.6E-09	5.1E-10	1.1E-10	1.0E-10	9.2E-11
WSW	1.4E-09	3.6E-10	9.8E-11	9.5E-11	9.1E-11
SW	1.2E-09	2.8E-10	9.6E-11	9.3E-11	9.1E-11
SSW	1.0E-09	3.0E-10	9.6E-11	9.3E-11	9.1E-11
S	8.8E-10	3.6E-10	1.1E-10	9.9E-11	9.1E-11
SSE	8.4E-10	3.8E-10	1.1E-10	1.0E-10	9.2E-11
SE	9.0E-10	3.6E-10	1.0E-10	9.7E-11	9.1E-11
ESE	1.1E-09	3.0E-10	9.7E-11	9.4E-11	9.1E-11
E	1.3E-09	3.0E-10	9.8E-11	9.5E-11	9.1E-11
ENE	1.5E-09	3.8E-10	9.8E-11	9.5E-11	9.1E-11
NE	1.7E-09	5.3E-10	1.1E-10	1.0E-10	9.2E-11
NNE	1.9E-09	7.1E-10	1.2E-10	1.1E-10	9.2E-11

D.sum

C A P 8 8 - P C

Version 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
May 4, 2001 10:40 am

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

Source Category: Non-point source
Source Type: Area
Emission Year: 2000

Comments:

Dataset Name: EDP IND
Dataset Date: May 4, 2001 9:59 am
Wind File: WNDFILES\SAC0320.WND

May 4, 2001 10:40 am

SUMMARY
Page 1

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	1.77E-07
BREAST	1.91E-07
R MAR	2.86E-06
LUNGS	9.54E-06

	D. sum
THYROID	1.77E-07
ENDOST	1.35E-05
RMNDR	3.12E-07
EFFEC	2.07E-06

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	8.04E-07
INHALATION	1.24E-06
AIR IMMERSION	6.21E-12
GROUND SURFACE	2.60E-08
INTERNAL	2.04E-06
EXTERNAL	2.60E-08
TOTAL	2.07E-06

□ May 4, 2001 10:40 am

SUMMARY
Page 2

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
BI-212	6.92E-10
C-14	1.64E-08
CO-60	6.85E-09
RA-223	1.24E-07
RA-226	7.43E-07
SR-90	4.10E-07
TH-234	2.71E-09
U-235	7.62E-07
TOTAL	2.07E-06

□ May 4, 2001 10:40 am

SUMMARY
Page 3

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
--------	--

D.sum

LEUKEMIA	6.70E-12
BONE	1.14E-12
THYROID	4.61E-14
BREAST	4.43E-13
LUNG	2.09E-11
STOMACH	2.91E-13
BOWEL	3.68E-13
LIVER	3.21E-13
PANCREAS	2.20E-13
URINARY	2.32E-13
OTHER	2.70E-13
TOTAL	3.09E-11

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	8.89E-12
INHALATION	2.14E-11
AIR IMMERSION	1.48E-16
GROUND SURFACE	6.13E-13
INTERNAL	3.03E-11
EXTERNAL	6.13E-13
TOTAL	3.09E-11

□

May 4, 2001 10:40 am

SUMMARY
Page 4

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
BI-212	8.91E-15
C-14	4.00E-13
CO-60	1.72E-13
RA-223	2.83E-12
RA-226	1.05E-11
SR-90	6.91E-12
TH-234	9.19E-14
U-235	1.00E-11
TOTAL	3.09E-11

□

May 4, 2001 10:40 am

SUMMARY

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

Direction	Distance (m)						
	130	140	150	165	180	500	1000
N	2.1E-06	1.8E-06	1.7E-06	1.4E-06	1.2E-06	2.5E-07	1.4E-07
NNW	1.7E-06	1.4E-06	1.3E-06	1.0E-06	9.0E-07	2.1E-07	1.2E-07
NW	1.8E-06	1.6E-06	1.4E-06	1.2E-06	1.0E-06	2.3E-07	1.3E-07
WNW	1.5E-06	1.3E-06	1.1E-06	9.5E-07	8.1E-07	1.9E-07	1.2E-07
W	1.0E-06	9.1E-07	8.1E-07	6.9E-07	5.9E-07	1.6E-07	1.1E-07
WSW	5.2E-07	4.5E-07	4.0E-07	3.4E-07	3.0E-07	1.2E-07	1.0E-07
SW	3.6E-07	3.2E-07	2.9E-07	2.6E-07	2.3E-07	1.1E-07	1.0E-07
SSW	4.0E-07	3.5E-07	3.0E-07	2.6E-07	2.3E-07	1.1E-07	1.0E-07
S	7.9E-07	7.0E-07	6.3E-07	5.4E-07	4.7E-07	1.5E-07	1.1E-07
SSE	1.0E-06	9.0E-07	8.1E-07	7.0E-07	6.1E-07	1.7E-07	1.1E-07
SE	6.7E-07	5.8E-07	5.2E-07	4.4E-07	3.9E-07	1.4E-07	1.1E-07
ESE	4.4E-07	3.8E-07	3.4E-07	2.9E-07	2.6E-07	1.2E-07	1.0E-07
E	4.5E-07	4.0E-07	3.6E-07	3.2E-07	2.8E-07	1.2E-07	1.0E-07
ENE	5.4E-07	4.7E-07	4.0E-07	3.4E-07	3.0E-07	1.2E-07	1.0E-07
NE	1.1E-06	1.0E-06	9.0E-07	7.7E-07	6.7E-07	1.8E-07	1.2E-07
NNE	1.4E-06	1.2E-06	1.1E-06	9.0E-07	7.7E-07	1.9E-07	1.2E-07

□ May 4, 2001 10:40 am

SUMMARY
Page 6

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

Direction	Distance (m)						
	130	140	150	165	180	500	1000
N	3.1E-11	2.7E-11	2.5E-11	2.1E-11	1.8E-11	3.5E-12	1.7E-12
NNW	2.5E-11	2.2E-11	1.9E-11	1.6E-11	1.3E-11	2.8E-12	1.6E-12
NW	2.7E-11	2.4E-11	2.1E-11	1.8E-11	1.6E-11	3.1E-12	1.6E-12
WNW	2.2E-11	1.9E-11	1.7E-11	1.4E-11	1.2E-11	2.6E-12	1.5E-12
W	1.5E-11	1.3E-11	1.2E-11	1.0E-11	8.6E-12	2.1E-12	1.4E-12
WSW	7.6E-12	6.5E-12	5.7E-12	4.8E-12	4.2E-12	1.5E-12	1.2E-12
SW	5.2E-12	4.6E-12	4.1E-12	3.5E-12	3.2E-12	1.4E-12	1.2E-12
SSW	5.7E-12	4.9E-12	4.3E-12	3.6E-12	3.2E-12	1.4E-12	1.2E-12
S	1.2E-11	1.0E-11	9.2E-12	7.9E-12	6.8E-12	1.9E-12	1.3E-12
SSE	1.5E-11	1.3E-11	1.2E-11	1.0E-11	8.8E-12	2.2E-12	1.4E-12
SE	9.7E-12	8.5E-12	7.5E-12	6.4E-12	5.6E-12	1.7E-12	1.3E-12
ESE	6.3E-12	5.5E-12	4.8E-12	4.1E-12	3.6E-12	1.5E-12	1.2E-12

	D. sum						
E	6.5E-12	5.8E-12	5.2E-12	4.5E-12	4.0E-12	1.5E-12	1.2E-12
ENE	7.9E-12	6.7E-12	5.8E-12	4.8E-12	4.2E-12	1.5E-12	1.2E-12
NE	1.7E-11	1.5E-11	1.3E-11	1.1E-11	9.7E-12	2.3E-12	1.4E-12
NNE	2.1E-11	1.8E-11	1.6E-11	1.3E-11	1.1E-11	2.6E-12	1.5E-12

E.syn

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

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

Non-Radon Population Assessment
May 4, 2001 10:40 am

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

Effective Dose Equivalent
(mrem/year)

5.74E-07

At This Location: 250 Meters North
Source Category: Non-point source
Source Type: Area
Emission Year: 2000

Comments:

Dataset Name: EDP POP
Dataset Date: May 4, 2001 10:03 am
Wind File: WNDFILES\SAC0320.WND
Population File: POPFILES\00LEHR.POP

May 4, 2001 10:40 am

SYNOPSIS
Page 1

MAXIMALLY EXPOSED INDIVIDUAL

Page 1

E.syn

Location Of The Individual: 250 Meters North
Lifetime Fatal Cancer Risk: 8.68E-12

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)	Collective Population (person-rem/y)
GONADS	4.73E-08	1.45E-07
BREAST	4.95E-08	1.52E-07
R MAR	7.02E-07	2.18E-06
LUNGS	2.84E-06	8.34E-06
THYROID	4.71E-08	1.44E-07
ENDOST	3.48E-06	1.07E-05
RMNDR	8.00E-08	2.47E-07
EFFEC	5.74E-07	1.72E-06

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	108624	108624	3.65E-10	3.65E-10

□ May 4, 2001 10:40 am

SYNOPSIS
Page 2

RADIONUCLIDE EMISSIONS DURING THE YEAR 2000

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
BI-212	W	1.00	2.7E-10	2.7E-10
C-14	*	0.00	6.2E-09	6.2E-09
CO-60	Y	1.00	1.5E-11	1.5E-11
RA-223	W	1.00	1.8E-10	1.8E-10
RA-226	W	1.00	5.7E-10	5.7E-10
SR-90	D	1.00	1.8E-09	1.8E-09

TH-234 Y 1.00 4.8E-10 4.8E-10 E.syn
 U-235 Y 1.00 7.7E-11 7.7E-11

SITE INFORMATION

Temperature: 16 degrees C
 Precipitation: 41 cm/y
 Mixing Height: 1000 m

May 4, 2001 10:40 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

May 4, 2001 10:40 am

SYNOPSIS
 Page 4

POPULATION DATA

	Distance (m)						
Direction	250	750	1500	2500	3500	4500	6523

E. syn

N	419	419	2180	2180	3831	1136	4297
NNW	419	419	2180	4360	2523	2243	281
NW	419	419	2180	2180	2180	6120	2300
WNW	419	419	2180	2180	2180	4360	327
W	419	105	10	10	10	10	10
WSW	0	0	5	5	5	5	1
SW	0	0	2	2	2	2	2
SSW	0	0	2	2	2	2	2
S	0	0	2	2	2	2	1
SSE	0	0	2	2	2	2	0
SE	0	0	2	2	2	2	1
ESE	0	0	2	2	2	2	2
E	0	0	0	218	218	1664	1991
ENE	110	110	545	1308	1417	4469	14651
NE	419	314	109	1259	7856	4161	314
NNE	419	419	3039	3052	3039	10	13

Distance (m)

Direction 9023

N	1134
NNW	109
NW	82
WNW	109
W	55
WSW	0
SW	0
SSW	0
S	0
SSE	2
SE	2
ESE	2
E	1
ENE	438
NE	163
NNE	2

G.sum

C A P 8 8 - P C

Version 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
May 4, 2001 10:40 am

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

Source Category: Non-point source
Source Type: Area
Emission Year: 2000

Comments:

Dataset Name: RASR IND
Dataset Date: May 4, 2001 10:20 am
Wind File: WNDFILES\SAC0320.WND

May 4, 2001 10:40 am

SUMMARY
Page 1

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	2.69E-05
BREAST	2.30E-05
R MAR	2.82E-03
LUNGS	5.59E-04

	G. sum	
THYROID		2.29E-05
ENDOST		7.79E-03
RMNDR		9.83E-05
EFFEC		6.80E-04

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	4.96E-04
INHALATION	1.84E-04
AIR IMMERSION	5.32E-10
GROUND SURFACE	7.62E-08
INTERNAL	6.80E-04
EXTERNAL	7.67E-08
TOTAL	6.80E-04

□ May 4, 2001 10:40 am

SUMMARY
Page 2

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
BI-212	1.25E-08
BI-214	5.74E-10
C-14	3.51E-09
CS-137	1.75E-07
CO-60	6.33E-08
SR-90	5.35E-04
TH-234	4.44E-08
AM-241	1.63E-05
PB-214	5.07E-10
PU-241	3.58E-06
TH-230	1.25E-04
TOTAL	6.80E-04

□ May 4, 2001 10:40 am

SUMMARY
Page 3

CANCER RISK SUMMARY

Cancer	G.sum Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	7.60E-09
BONE	9.22E-10
THYROID	9.89E-12
BREAST	8.39E-11
LUNG	9.70E-10
STOMACH	4.63E-11
BOWEL	2.29E-10
LIVER	1.32E-10
PANCREAS	5.22E-11
URINARY	2.68E-11
OTHER	6.39E-11
TOTAL	1.01E-08

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	8.31E-09
INHALATION	1.83E-09
AIR IMMERSION	1.28E-14
GROUND SURFACE	1.79E-12
INTERNAL	1.01E-08
EXTERNAL	1.80E-12
TOTAL	1.01E-08

□ May 4, 2001 10:40 am

SUMMARY
Page 4

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
BI-212	1.60E-13
BI-214	6.66E-14
C-14	8.57E-14
CS-137	4.57E-12
CO-60	1.59E-12
SR-90	9.01E-09
TH-234	1.53E-12
AM-241	8.32E-11
PB-214	8.67E-14

	G.sum
PU-241	1.36E-11
TH-230	1.03E-09
TOTAL	1.01E-08

□ May 4, 2001 10:40 am

SUMMARY
Page 5

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

Direction	Distance (m)						
	10	15	40	60	250	340	1400
N	6.6E-04	3.2E-04	8.9E-05	6.4E-05	3.9E-05	3.8E-05	3.7E-05
NNW	6.8E-04	3.4E-04	8.4E-05	5.7E-05	3.9E-05	3.8E-05	3.7E-05
NW	6.5E-04	3.2E-04	8.4E-05	6.0E-05	3.9E-05	3.8E-05	3.7E-05
WNW	5.8E-04	2.6E-04	7.6E-05	5.5E-05	3.9E-05	3.8E-05	3.7E-05
W	5.0E-04	2.0E-04	6.4E-05	5.0E-05	3.8E-05	3.8E-05	3.7E-05
WSW	4.4E-04	1.5E-04	5.1E-05	4.3E-05	3.8E-05	3.8E-05	3.7E-05
SW	3.9E-04	1.2E-04	4.6E-05	4.1E-05	3.8E-05	3.8E-05	3.7E-05
SSW	3.2E-04	1.2E-04	4.7E-05	4.1E-05	3.8E-05	3.8E-05	3.7E-05
S	2.8E-04	1.4E-04	5.7E-05	4.7E-05	3.8E-05	3.8E-05	3.7E-05
SSE	2.7E-04	1.5E-04	6.1E-05	5.0E-05	3.8E-05	3.8E-05	3.7E-05
SE	2.9E-04	1.5E-04	5.4E-05	4.5E-05	3.8E-05	3.8E-05	3.7E-05
ESE	3.5E-04	1.3E-04	4.8E-05	4.2E-05	3.8E-05	3.8E-05	3.7E-05
E	4.1E-04	1.3E-04	4.8E-05	4.2E-05	3.8E-05	3.8E-05	3.7E-05
ENE	4.8E-04	1.6E-04	5.2E-05	4.3E-05	3.8E-05	3.8E-05	3.7E-05
NE	5.3E-04	2.2E-04	6.5E-05	5.1E-05	3.8E-05	3.8E-05	3.7E-05
NNE	6.1E-04	2.8E-04	7.6E-05	5.4E-05	3.8E-05	3.8E-05	3.7E-05

□ May 4, 2001 10:40 am

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

Direction	Distance (m)						
	10	15	40	60	250	340	1400
N	9.8E-09	4.9E-09	1.4E-09	1.0E-09	6.5E-10	6.4E-10	6.3E-10
NNW	1.0E-08	5.1E-09	1.3E-09	9.2E-10	6.5E-10	6.4E-10	6.3E-10
NW	9.6E-09	4.7E-09	1.3E-09	9.7E-10	6.5E-10	6.4E-10	6.3E-10
WNW	8.7E-09	3.9E-09	1.2E-09	8.9E-10	6.4E-10	6.4E-10	6.3E-10
W	7.4E-09	3.1E-09	1.0E-09	8.1E-10	6.4E-10	6.3E-10	6.3E-10
WSW	6.6E-09	2.2E-09	8.3E-10	7.1E-10	6.3E-10	6.3E-10	6.3E-10

	G. sum						
SW	5.8E-09	1.8E-09	7.5E-10	6.8E-10	6.3E-10	6.3E-10	6.3E-10
SSW	4.9E-09	1.9E-09	7.7E-10	6.8E-10	6.3E-10	6.3E-10	6.3E-10
S	4.2E-09	2.2E-09	9.1E-10	7.6E-10	6.4E-10	6.3E-10	6.3E-10
SSE	4.0E-09	2.3E-09	9.8E-10	8.1E-10	6.4E-10	6.3E-10	6.3E-10
SE	4.4E-09	2.2E-09	8.7E-10	7.3E-10	6.3E-10	6.3E-10	6.3E-10
ESE	5.2E-09	1.9E-09	7.8E-10	6.9E-10	6.3E-10	6.3E-10	6.3E-10
E	6.2E-09	1.9E-09	7.8E-10	7.0E-10	6.3E-10	6.3E-10	6.3E-10
ENE	7.1E-09	2.4E-09	8.4E-10	7.0E-10	6.3E-10	6.3E-10	6.3E-10
NE	7.9E-09	3.3E-09	1.0E-09	8.3E-10	6.4E-10	6.4E-10	6.3E-10
NNE	9.1E-09	4.2E-09	1.2E-09	8.7E-10	6.4E-10	6.4E-10	6.3E-10

H.syn

C A P 8 8 - P C

Version 1.00

Clean Air Act Assessment Package - 1988

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

Non-Radon Population Assessment
May 4, 2001 10:40 am

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

Effective Dose Equivalent
(mrem/year)

1.60E-06

At This Location: 250 Meters North
Source Category: Non-point source
Source Type: Area
Emission Year: 2000

Comments:

Dataset Name: RASR POP
Dataset Date: May 4, 2001 10:40 am
Wind File: WNDFILES\SAC0320.WND
Population File: POPFILES\00LEHR.POP

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SYNOPSIS
Page 1

MAXIMALLY EXPOSED INDIVIDUAL

Page 1

H.syn

Location Of The Individual: 250 Meters North
Lifetime Fatal Cancer Risk: 2.35E-11

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)	Collective Population (person-rem/y)
GONADS	6.27E-08	1.93E-07
BREAST	5.23E-08	1.62E-07
R MAR	6.47E-06	2.00E-05
LUNGS	1.49E-06	4.36E-06
THYROID	5.22E-08	1.62E-07
ENDOST	1.84E-05	5.64E-05
RMNDR	2.27E-07	7.01E-07
EFFEC	1.60E-06	4.90E-06

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	108624	108624	1.02E-09	1.02E-09

□

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SYNOPSIS
Page 2

RADIONUCLIDE EMISSIONS DURING THE YEAR 2000

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
BI-212	W	1.00	4.3E-11	4.3E-11
BI-214	W	1.00	4.7E-11	4.7E-11
C-14	*	0.00	1.1E-11	1.1E-11
CS-137	D	1.00	2.4E-11	2.4E-11
CO-60	Y	1.00	1.3E-12	1.3E-12
SR-90	D	1.00	2.2E-08	2.2E-08

				H.syn
TH-234	Y	1.00	7.3E-11	7.3E-11
AM-241	W	1.00	3.4E-12	3.4E-12
PB-214	D	1.00	5.4E-11	5.4E-11
PU-241	Y	1.00	7.5E-11	7.5E-11
TH-230	Y	1.00	5.8E-11	5.8E-11

SITE INFORMATION

Temperature: 16 degrees C
 Precipitation: 41 cm/y
 Mixing Height: 1000 m

□ May 4, 2001 10:40 am

SYNOPSIS
 Page 3

SOURCE INFORMATION

Source Number: 1

Source Height (m): 0.00
 Area (sq m): 6.04E+02

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

□ May 4, 2001 10:40 am

SYNOPSIS
 Page 4

POPULATION DATA

Distance (m)

Direction	H. syn						
	250	750	1500	2500	3500	4500	6523
N	419	419	2180	2180	3831	1136	4297
NNW	419	419	2180	4360	2523	2243	281
NW	419	419	2180	2180	2180	6120	2300
WNW	419	419	2180	2180	2180	4360	327
W	419	105	10	10	10	10	10
WSW	0	0	5	5	5	5	1
SW	0	0	2	2	2	2	2
SSW	0	0	2	2	2	2	2
S	0	0	2	2	2	2	1
SSE	0	0	2	2	2	2	0
SE	0	0	2	2	2	2	1
ESE	0	0	2	2	2	2	2
E	0	0	0	218	218	1664	1991
ENE	110	110	545	1308	1417	4469	14651
NE	419	314	109	1259	7856	4161	314
NNE	419	419	3039	3052	3039	10	13

Distance (m)	
Direction	9023
N	1134
NNW	109
NW	82
WNW	109
W	55
WSW	0
SW	0
SSW	0
S	0
SSE	2
SE	2
ESE	2
E	1
ENE	438
NE	163
NNE	2

APPENDIX B

DOE SUPPLEMENTAL INFORMATION

DOE SUPPLEMENTAL INFORMATION

- **Provide an estimate of collective dose equivalent for 2000 releases.**
 - The collective population dose for calendar year 2000 emissions to the population within an 10-km distance of the facility is estimated to be 2.63×10^{-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 USDOE (USDOE, 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 nonradon 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 nonradon dose to the public from the Site.
- **Provide information on radon-222 emissions from nondisposal/nonstorage sources where emissions potentially can exceed 0.1 mrem/yr to the public or 10% of the nonradon dose to the public.**
 - There are no nondisposal or nonstorage 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 QA program described by Appendix B, Method 114.**
 - There are no point source emissions that require continuous monitoring according to Subpart H of 40 CFR.