U.S. Department of Energy

Office of Legacy Management

RADIONUCLIDE AIR EMISSION ANNUAL REPORT CALENDAR YEAR 2007

for the

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

prepared for:

SM Stoller Corporation
2597 B ¾ Road
Grand Junction, Colorado 81503

prepared by:

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

June 24, 2008
Rev. 0

Weiss Associates
Environmental and Geologic Services

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ACRONYMS AND ABBREVIATIONS

°C	degree(s) Celsius
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	centimeter(s)
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
E	east
EDE	effective dose equivalent
EDPs	Eastern Dog Pens
Eq.	equation
g/m^2-hr	gram(s) per square meter-hour(s)
H-3	tritium
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
mg/m^3	milligrams per cubic meter
mrem/yr	millirem(s) per year

mSv/yr	millisievert(s) per year
N	north
NESHAPs	National Emissions Standards for Hazardous Air Pollutants
NNE	north-northwest
No.	number
NW	northwest
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
S	south
Sr-90	strontium-90
SWTs	Southwest Trenches
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
US EPA	United States Environmental Protection Agency
W	west
WDPs	Western Dog Pens
µm	micrometer(s)

US Department of Energy
Radionuclide Air Emission Annual Report
(Subpart H of 40 CFR 61)
Calendar Year 2007

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

Field Office Information

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Office of Legacy Management

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1. FACILITY INFORMATION

This Radionuclide Air Emission Annual Report documents that, in 2007, the United States Department of Energy (DOE) facilities at 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. The NESHAPs regulations require that radionuclide emissions not exceed levels that would result in an effective dose equivalent (EDE) to a member of the public of 10 millirems per year (mrem/yr).

LEHR is located on the campus of the University of California, Davis (UC Davis). This report, however, applies to only the DOE areas at LEHR. The DOE areas will be referred to as "the Site," whereas the entire 15-acre property where both DOE and UC Davis conducted activities will be referred to as "LEHR." There are currently no point sources of radionuclide emissions at the Site, but there was one potential diffuse source (i.e., surface soil) of radionuclide emissions during 2007. These 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 the results from this model, the total contribution to the maximum EDE to a member of the public from diffuse-source emissions for reporting year 2007 is estimated to be 8.1E-2 mrem/yr (about 0.8% of the 10 mrem/yr standard). This result is approximately 2E-2 mrem/yr higher than the result from the previous year, which was between one and two orders of magnitude greater than the results of the previous seven years (Table 1). The higher emissions during the past two years were due to emissions from short-term grading events conducted during the fall of 2006 and the fall of 2007.

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 (Figure 2).

The local climate is Mediterranean with mild winters and dry summers. Precipitation and temperature data specific to 2007 were obtained from the Davis WSW weather station located approximately one mile northwest of the LEHR facility (Western Regional Climate Center, 2008). The average temperature for 2007 was approximately 16.4 degrees Celsius (°C) (61.5 degrees Fahrenheit), and the total precipitation for 2007 was approximately 11.2 inches (28.5 cm). These

values are based on the reported monthly average temperatures and precipitation totals in 2007 for all months except December; the record for December was missing more than 26 days, so the long-term (89-year) average December temperature and the average December rainfall total were substituted in the calculations for 2007 average temperature and total precipitation. 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, due to frequent incursions of marine air through the Carquinez Strait into the Sacramento Valley. Changes in wind direction, however, 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 Davis WSW weather station does not report wind speed; therefore, wind data from the Sacramento Executive Airport is used instead to represent wind conditions at LEHR. The Sacramento Executive Airport is located approximately 15 miles east of LEHR. The average wind speed for the Sacramento Executive Airport in 2007 was 2.7 meters per second (6.0 miles per hour) (NCDC, 2008). The meteorological parameters data required for CAP88-PC are listed in Table 2.

The land within a one-mile radius of the LEHR facility is owned privately or by UC Davis, and is mainly used for animal research, agriculture and recreation. Immediately to the north, east and west of the LEHR facility are UC Davis research facilities. The privately owned lands within one mile to the south and east of the LEHR facility include rural residences and 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 agricultural data required for CAP88-PC are listed in Table 3.

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, concrete, gravel and soil occupied the remaining 5% of the Site. The Regents of the University of California own the land and the buildings on the 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, north of LEHR, and involved irradiation of beagles. DOE began operating at LEHR 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. In 1989, DOE-funded research ended at LEHR. The LEHR Site was listed on the US EPA National Priority list in May 1994. The LEHR facility is presently occupied by the UC Davis Center for Health and the Environment.

Current DOE activities at the Site are limited to environmental restoration under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA).

1.2 Source Description

The only source of radionuclide air emissions at the Site in 2007 was diffuse emissions from the Eastern Dog Pens (EDPs) area (Figure 2). In recent years, the Western Dog Pens (WDPs) area has also been a source of diffuse emissions, but the WDPs ceased to be a source of emissions in September 2006, when the WDPs were capped with a layer of clean imported soil. There are no point sources of radionuclide emissions at LEHR.

The EDPs area is located along the southern boundary of LEHR (Figure 2) and overlies UC Davis Landfill Number 2. Historically, this area contained 96 outdoor pens that were used to house dogs involved in the former Ra-226 and Sr-90 research activities at LEHR. The pens were constructed of concrete curbs and chain-link fencing, contained above-grade shelters, and were partly covered by asphalt and partly covered by gravel. In the floor areas covered by gravel, there was no impermeable barrier between the gravel and the underlying soil. Low levels of Sr-90 and Ra-226 are known to have been released at the EDPs in excreta from the dogs to the floor of the pens and to the concrete curbing.

Removal of the dog pens began in 1996, when the above-grade structures and interior chain-link fencing were removed, properly packaged, and shipped to the DOE Hanford site for disposal. In fall 2007 (September 13 through October 24), the exterior chain-link fencing was removed, the concrete curbing was removed, and the area was re-graded.

In 2007, the EDPs area was a potential source of airborne radionuclide emissions for three reasons:

- Entrainment by wind of soil particles from areas where soil was exposed;
- Emission of dust due to short-term disturbance of soil during concrete removal and subsequent re-grading; and
- Emission of dust during short-term concrete crushing (dust monitoring data was collected during the concrete removal and crushing and evaluated in this report, as discussed in Section 2.3).

The EDPs emissions are “fugitive” emissions, by definition, because they were not released through an actively ventilated air stream (US EPA, 2004). Compared to emissions in previous years, emissions in 2007 from the EDPs are expected to be greater due to the soil disturbance and concrete crushing that occurred in 2007 but not in previous years.

The radionuclides emitted from the EDPs, as assumed for this report, are listed in Tables 5 and 6. Table 5 lists all radionuclides that have been detected at activity concentrations greater than background in soil, and Table 6 lists those with activity concentrations greater than background in

concrete. Samples from the WDPs concrete curbs were included in the estimate of the activity concentrations in the EDP curbs, because similar processes would have contributed to the concentrations in both places. It is assumed that all radionuclides detected in soil and concrete at concentrations greater than background are also present in fugitive-dust.

Conservative assumptions are made to estimate the activity concentrations of the radionuclides in soil and concrete. The activity concentrations listed in Table 5 are the highest detected concentrations in soil at the EDPs; the activity concentrations listed in Table 6 are the highest detected concentrations in concrete at the EDPs and WDPs. Background activity concentrations were not subtracted from these measured activity concentrations even though part of the total concentrations can be attributed to background in most cases. The activity concentrations were also not corrected to account for attenuation due to radioactive decay, although all of the soil and concrete samples were collected before 2002. The activity concentrations of radionuclides in soil and concrete from the EDPs area are from samples collected during the 1999 EDPs investigation (Weiss, 1999), which is the only CERCLA investigation in this area. The activity concentrations of radionuclides in concrete from the WDPs were from samples collected for concrete characterization for disposal in 2001.

2. AIR EMISSION DATA

2.1 Point Sources

As discussed in Section 1, there were no point sources of radionuclide emissions at the Site in 2007.

2.2 Diffuse Sources

The EDPs were the only diffuse source of radionuclide emissions present at the Site in 2007. For most of the year, emissions from this area were due only to wind erosion of surface soil. From September 13 through October 24, emissions from this area were also due to two other processes: soil disturbance caused by removing the concrete curbs, and crushing concrete. The estimation of radionuclide emissions as respirable particles, defined as those particles 10 micrometers (PM_{10}) in diameter or smaller, is described separately below.

2.2.1 Estimating Radionuclide Emissions due to Wind Entrainment of Surface Soil

To estimate the emissions from wind erosion of radionuclides, a two-step calculation is used. First, a general emission rate for respirable particles is calculated for the area (Equation [Eq.] 1). The equation used for this calculation assumes that the source area is an "unlimited reservoir" of erodible soil, and that the emission rate is a function of percent of vegetation, soil conditions, and meteorological conditions. Secondly, specific emission rates for each radionuclide at each source area is calculated (Eq. 3).

The general-emission equation is found in the US EPA's guidance document *Rapid Assessment of Exposure to Particulate Emissions from Surface Contamination Sites* (Cowherd et al., 1985):

Error! Objects cannot be created from editing field codes. (Eq. 1)

where,

E_{10} = annual average PM_{10} emission rate per unit contaminated surface, grams per square meter-hour [g/(m^2-hr)];

V = fraction of contaminated surface vegetative cover (assumed zero for worst-case bare soil);

$[u]$ = mean annual wind speed (= 2.7 m/s at Sacramento Executive Airport);

u_t = threshold value of wind speed at height of wind instrument (= 715 cm/s);
$F(x)$ = function plotted in Figure 4-3 (= 1.16E-1) of Cowherd et al., 1985; and
x = 0.866 $u_t/[u]$ = dimensionless wind-speed ratio (= 2.29).

The fraction of contaminated surface vegetative cover was conservatively assumed to be zero (i.e., bare soil) to calculate a worst-case value. The mean annual wind speed is taken from the Sacramento Executive Airport (NCDC, 2008), which is the nearest meteorological station to LEHR with wind sensors.

The threshold value of wind speed at the height of the wind instrument is calculated by Eq. 2:

$$u_t = u_{friction} \times \left(\frac{1}{0.4}\right) \times \left(\ln \frac{z}{z_0}\right) \quad \text{(Eq. 2)}$$

where,

u_t = threshold value of wind speed at height of wind instrument;
$u_{friction}$ = threshold friction velocity (= 50 cm per second [cm/s]);
z = height of wind instrument (20 feet = 610 cm); and
z_o = emission source-area roughness height (= 2 centimeters [cm]).

Cowherd et al. recommend 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 the example in Cowherd et al. (1985) for a rural emergency response application (Application No. 1). This velocity is based on a particle-size mode of 500 μm. The two-cm roughness height represents a value between the ranges for a plowed field and grasslands (Cowherd et al., 1985). The resulting value of u_t is 715 cm/s.

The result of Eq. 1, using the site- and 2007-specific data, is 2.26E-04 g/m^2-hr.

To determine the specific emission rate for each radionuclide, the emission rate is multiplied by the area over which the radionuclide-bearing soil is exposed, the time during which the soil is exposed, and the concentration of the radionuclide in the soil:

$$E_{area} = E_{10} \times A_{area} \times \left(24\,{}^{hr}\!/_{day} \times 365\,{}^{days}\!/_{year}\right) \times C_{rad} \times \left(10^{-12}\,{}^{curies}\!/_{picocurie}\right) \quad \text{(Eq. 3)}$$

where,

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

The surface area of the source area, 3,900 square meters (m^2), was determined using a scaled map of the Site (Figure 2). The highest measured (non-decay-corrected) concentrations are conservatively assumed to be uniformly distributed across each area. The concentration in the

fugitive dust is assumed to be equal to the concentration measured in soil. Table 5 reports the concentrations of radionuclides in the soil and the resulting emission rates for each radionuclide as determined by Eq. 3.

2.2.2 Estimating Radionuclide Emissions due to Soil Disturbance during Concrete-Curb Removal

During the concrete removal and subsequent grading at the EDPs, entrainment of soil particulates into the air was also potentially caused by mechanical disturbance by earth-moving equipment. The US EPA guidance for estimating radionuclide emissions from diffuse sources (US EPA, 2004) recommends a method for estimating emissions from soil grading and shaping. This method uses the following equation to calculate the annual emissions:

$$E = (5.8\text{E}-2) \times M \times a \div (2.2\text{E}-3) \qquad \text{(Eq. 4)}$$

where,

E	=	annual emissions (pCi/yr);
5.8E-2	=	emission factor (pounds of particulate matter per ton);
M	=	mass of soil graded or shaped (tons per year);
a	=	activity concentration of soil (pCi/g); and
2.2E-3	=	conversion factor (pounds per gram).

The mass of soil disturbed during the concrete removal at the EDPs is calculated to be 1,114 tons. This assumes disturbance to a six-inch depth over the whole area (3,900 m^2), and a conservative bulk density of 1.7 grams per cm^3. The resulting emissions for each radionuclide are reported in Table 5.

2.2.3 Estimating Radionuclide Emissions due to Crushing of Concrete Curbs

To estimate emissions during concrete crushing, an equation was used that is recommended in the US EPA guidance (US EPA, 2004) for estimating radionuclide emissions during demolition activities:

$$E = (2.9\text{E}-2) \times M \times \left(1 - CE/100\right) \times a \div (1\text{E}-3) \qquad \text{(Eq. 4)}$$

where,

E	=	annual emissions (pCi/yr);
2.9E-2	=	emission factor (kilograms (kg) of particulate matter per megagram (Mg) of building material);
M	=	mass of building material (Mg);
CE	=	control efficiency of mitigation approach (percent);
a	=	activity concentration of building material (pCi/g); and

1E-3 = conversion factor (kg/g).

The mass of concrete removed from the EDPs can be estimated from the volume that was disposed, assuming a standard density of concrete (2,400 kg/m^3) and a conservative expansion factor of 1.2 for the crushed concrete. The volume of disposed concrete was 299.3 cubic meters, which conservatively estimated is a total mass of concrete of 458 Mg. The control efficiency refers to effectiveness with which dust control measures were employed during the concrete crushing. Workers applied abundant water during work at the site, which can have a control efficiency of up to 50% (i.e., 50% of the dust generated is suppressed) (US EPA, 2004). To be conservative, a control efficiency of 25% was assumed for the calculations of emissions from crushing concrete. The resulting emissions for each radionuclide in the concrete are reported in Table 6.

2.3 Particulate Matter-10

During the concrete removal and concrete crushing at the EDPs, two dust monitors were deployed to measure PM_{10} generated by those activities. The dust monitors were E-Samplers (manufactured by MetOne), and were mounted on tripods near the breathing zone down-wind of the concrete-removal and concrete-crushing activities. The E-Samplers logged average dust concentrations every five minutes during grading activities. The average PM_{10} concentration over the entire work period was 0.022 milligrams per cubic meter (mg/m^3) of air.

Prior to performing the concrete removal, the model RESRAD-OFFSITE (ANL, 2007) was run to calculate a dust concentration at which a receptor would be exposed to a dose of 10 mrem, assuming the dust that would be released had the same activity concentration as it did in either soil or concrete. The model result indicated that a dust concentration in air of 500 mg/m^3 would be required to provide a dose of 10 mrem to the nearest member of the public. To provide a factor of safety, the dust monitors were outfitted with alarms that would be triggered if the dust concentration reached 1 mg/m3, but these alarms were never triggered.

No excavation or other ground-disturbing activities were conducted at any other DOE areas during calendar year 2007.

3. DOSE ASSESSMENTS

3.1 Description of Dose Model

Compliance with the NESHAPs radiation-dose limits for diffuse-source emissions was assessed using the US EPA computer code CAP88-PC, Version 1.0. CAP88-PC calculates radiation dose from atmospheric diffusion, and was used to calculate dose from radionuclides in wind-emitted dust.

CAP88-PC was used to calculate the EDE to individual receptors at various distances from the EDPs. A total of three "individual receptor" CAP88-PC runs were executed to model the fugitive-dust emission sources described in Section 2: one for wind entrainment of soil during the normal course of the year, one for the disturbance of the EDPs soil during the grading operations, and one for the concrete-crushing operations. A human receptor was identified in each of the north, south, east and west quadrants relative to the potential source. Additionally, a short-term dose was calculated for a construction-worker receptor located in the center of the EDPs during the short-term concrete-removal operation.

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, 1992). 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 outdoor individual or building assumed to house the indoor receptor. Doses were calculated for potential receptors in buildings at LEHR, receptors immediately outside of LEHR, and construction workers during the grading operations at the EDPs (Table 8).

Based on the CAP88-PC model output, the maximally exposed individual (MEI) at the LEHR facility is the construction worker during concrete-removal and concrete-crushing operations at the EDPs with a effective dose equivalent of 8.1E-02 mrem/yr (Figure 2, Table 8).

The collective population dose is calculated as the average radiation dose to an individual in each sector, multiplied by the number of individuals in that sector, and summed for all sectors. A "population" CAP88-PC run was executed to model the fugitive dust emission from each of the three diffuse sources: wind entrainment of soil particles during the normal course of the year, mechanical disturbance of the EDPs soil during the concrete removal and grading operations, and crushing of concrete. The CAP88-PC model output for each run is included in Appendix A. For each of the three potential radionuclide-emission diffuse sources, the CAP88-PC model was run with an updated

population data file calculated from the United States Census Bureau 2007 population estimates for counties (US Census Bureau, 2008).

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, the area within 80 km of the Site was split into 128 sectors by dividing the area into eight 10-km-wide 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 2007 Annual Population Estimates Program of the Unites States Census Bureau (US Census Bureau, 2008). The results of the CAP88-PC population runs based upon the combined source exposures are presented in Table 9 and Appendix A. The estimated collective population dose for 2007 was 2.7E-04 person – roentgen(s) equivalent man per year (person-rem/year).

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 in Tables 2 through 7. As noted above, each diffuse source was conservatively calculated assuming the maximum concentrations (not corrected for background) of the observed radiological surface- and shallow-soil contamination for the EDPs area was present across the entire potential radionuclide emission diffuse source area. The US EPA-recommended particulate-resuspension rate model was used 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 average annual wind speeds recorded at Sacramento Executive Airport were used to calculate particle-emission rates, as described above. Use of the Sacramento wind data is appropriate because the Site is near Sacramento (approximately 15 miles), the geography is similar, there are no intervening geographical anomalies, and a compatible meteorological data file from a closer air station is not available.

4. COMPLIANCE ASSESSMENT

Point-Source Effective Dose Equivalent: None

Diffuse-Source Maximum Effective Dose Equivalent: 8.1E-02 millirem per year [mrem/yr] (8.1E-04 millisieverts [mSv]per yr) (about 0.8% of the 10 mrem/yr standard).

Location of On-Site Maximally Exposed Individual: Center of EDPs area

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: Robt D. Devany Date: 6/24/08
Robert Devany
Principal Hydrogeologist

Signature: M. Kothari Date: 6/24/08
Vijendra Kothari
DOE-LEHR Project Manager

5. ADDITIONAL INFORMATION

In 2007, concrete-removal and grading operations occurred at the EDPs; no other 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.**

  Concrete removal operations and grading occurred at the EDPs to remove curbs from the former pens that housed dogs involved with historical radiation experiments. This occurred in September and October of 2007. There were no other construction or modification projects completed at the LEHR Site in 2007.

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

  There were no unplanned releases of radionuclides to the atmosphere during 2007.

- **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-source emissions from the Site are presented in Section 3 and Table 8. The total EDE to the on-site MEI from diffuse-source emissions was estimated to be 8.1E-02 mrem/yr (8.1E-04 mSv/yr), far below the 10 mrem/yr standard.

6. SUPPLEMENTAL DOE INFORMATION

- **Provide an estimate of collective dose equivalent for 2007 releases.**

  The collective population dose for calendar year 2007 emissions to the population within an 80-km distance of the facility is estimated to be 2.7E-04 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 uranium-232 or thorium-232 sources stored at the facility.

- **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 at the site that require continuous monitoring according to Subpart H of 40 CFR.

7. REFERENCES

Argonne National Laboratory (ANL), 2007, RESRAD-OFFSITE for Windows Version 2.0, August 15.

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TABLES

Table 1. Results of National Emissions Standards for Hazardous Air Pollutants Reports for the Previous Nine Years

Calendar Year	Effective Dose Equivalent to Maximally Exposed Individual (millirem(s) per year)	Document Reference
1999	1.35E-3	Weiss, 2000
2000	7.52E-4	Weiss, 2001a
2001	1.0E-3	Weiss, 2002a
2002	3.8E-4	Weiss, 2003
2003	1.4E-3	Weiss, 2004
2004	1.6E-3	Weiss, 2005
2005	5.9E-4	Weiss, 2006
2006	5.8E-2	Weiss, 2007
2007	8.1E-2	This document

Table 2. Meteorological Input Parameters for CAP88-PC

Parameter	Value	Notes
Wind file	SAC0320.WND	supplied with CAP88-PC
Annual precipitation (centimeters)	28.5	total precipitation in Davis, California in 2007[1]
Temperature (degrees Celsius)	16.4	average temperature in Davis, California in 2007[1]
Height of lid (meters)	1,000	CAP88-PC default

Note
[1] Davis WSW weather station

Table 3. Agricultural Input Parameters for CAP88-PC

Parameter	Value	Notes
Source type	Rural	CAP88-PC default
Food production		
Vegetable		
Fraction home produced	0.7	CAP88-PC default
Fraction from assessment area	0.3	CAP88-PC default
Fraction imported	0	CAP88-PC default
Milk		
Fraction home produced	0.399	CAP88-PC default
Fraction from assessment area	0.601	CAP88-PC default
Fraction imported	0	CAP88-PC default
Beef		
Fraction home produced	0.442	CAP88-PC default
Fraction from assessment area	0.558	CAP88-PC default
Fraction imported	0	CAP88-PC default
Beef cattle density (number per square kilometer)	8.81E-02	CAP88-PC default for California
Milk cattle density (number per square kilometer)	2.85E-02	CAP88-PC default for California
Land fraction cultivated for vegetable crops	0.25	Site-specific parameter per 1995 NESHAPs

Table 4. Source Input Parameters for CAP88-PC

Parameter	Value	Notes
Source type	Area	
Number of sources	1	Eastern Dog Pens are composed of one contiguous area
Height (meters)	0	The area is relatively flat
Area (square meters)	3,900	Calculated from scaled map (Figure 2)
Plume rise	Zero	Plume rise is zero for each Pasquill stability category

Table 5. Radionuclides Potentially Released from Soil to Air, Eastern Dog Pens Area

Radionuclide[2]	Highest Measured Activity Concentration (pCi/g)	Potential emission rate based on highest measured activity concentration[1] (Ci/yr)		Size[3] (μm)	Class[4]
		Entrainment by wind	Emission due to excavations and grading		
Bismuth-212	0.415	3.20E-09	1.22E-08	1	Week
Bismuth-214	0.572	4.41E-09	1.68E-08	1	Week
Cesium-137[5]	0.191	1.47E-09	5.61E-09	1	Day
Lead-214	0.607	4.68E-09	1.78E-08	1	Day
Strontium-90	0.164	1.26E-09	4.82E-09	1	Day
Thallium-208	0.219	1.69E-09	6.43E-09	1	Day
Thorium-228	1.54	1.19E-08	4.52E-08	1	Year
Thorium-230	1.26	9.71E-09	3.70E-08	1	Year
Thorium-232[5]	1.39	1.07E-08	4.08E-08	1	Year
Thorium-234	0.89	6.86E-09	2.61E-08	1	Year
Tritium	1.21	9.33E-09	3.55E-08	0	Gas
Uranium-235	0.0383	2.95E-10	1.12E-09	1	Year

Notes
[1]See discussion in text for calculations of emission rate.
[2]The radionuclides included on this list are those for which at least one detected result in soil from the Eastern Dog Pens was at an activity concentration greater than background.
[3]CAP88-PC default particle size.
[4]CAP88-PC default lung-retention class.
[5]Did not include whole decay chain in CAP88-PC model because nuclides were measured directly.

Abbreviations

Ci/yr	curies per year
pCi/g	picocuries per gram
μm	micrometer

Table 6. Radionuclides Potentially Released from Concrete to Air, Eastern Dog Pens Area

Radionuclide[1]	Highest Measured Activity Concentration (pCi/g)	Potential emission rate due to concrete crushing, based on highest measured activity concentration[2] (Ci/yr)	Size[3] (μm)	Class[4]
Carbon-14	0.167	1.66E-09	0	Gas
Lead-210[5]	3.93	3.91E-08	1	Day
Radium-226	1.68	1.67E-08	1	Week
Strontium-90	8.3	8.26E-08	1	Day

Notes
[1]The radionuclides included on this list are those for which at least one detected result in concrete from the Eastern Dog Pens and Western Dog Pens was at an activity concentration greater than background.
[2]See discussion in text for calculation of emission rate.
[3]CAP88-PC default particle size.
[4]CAP88-PC default lung-retention class.
[5]Did not include whole decay chain in CAP88-PC model because nuclides were measured directly.

Abbreviations

Ci/yr	curies per year
pCi/g	picocuries per gram
μm	micrometer

Table 7. CAP88-PC Model Run Specifications and Options

Run type	Specifications
Individual	Distances between source and receptors, in meters, are 1, 132, 143, 150, 165, 180, 187, 500, 1000
Population	Population file is 07LEHR.POP
Options	**Value**
Generate genetic effects?	Yes
Create Dose and Risk Factor file?	Yes
Create Concentration Table file?	Yes
Create Chi/Q Table file?	Yes

Table 8. On-Site Effective Dose Equivalent to Maximally Exposed Individual Resulting from Radionuclide Emissions from Each Potential Fugitive-Dust-Emission Diffuse Source

Receptor Location		Effective dose equivalent[1] due to emissions (mrem/yr)			
Description	Distance and direction from Eastern Dog Pens[2]	Entrainment by wind	Excavations and grading	Concrete crushing	Total dose to MEI[3]
Equipment Operator (center of Eastern Dog Pens area)	1 m[4]	1.64E-03[5]	7.50E-02	4.80E-03	**8.14E-02**
Specimen Storage Building (Building H-216)	132 m W	4.90E-04	1.90E-03	2.90E-04	2.68E-03
UC Davis Building E of LEHR Site	180 m E	8.20E-05	3.10E-04	2.00E-04	5.92E-04
Off-Site Receptor S of Putah Creek	1,000 m S	1.50E-05	5.50E-05	1.80E-04	2.50E-04
Off-Site Receptor W of LEHR Site	500 m W	4.30E-05	1.60E-04	1.90E-04	3.93E-04
Animal Hospital Building No. 1 (Building H-219)	165 m W	3.20E-04	1.20E-03	2.50E-04	1.77E-03
Inter-Regional Project No. 4 Building (Building H-217)	143 m W	4.20E-04	1.60E-03	2.80E-04	2.30E-03
Animal Hospital Building No. 2 (Building H-218)	165 m W	3.20E-04	1.20E-03	2.50E-04	1.77E-03
Cellular Biology Laboratory (Building H-294)	150 m NNE	5.70E-04	2.20E-03	3.20E-04	3.09E-03
Clinical Pathology (H-215)	150 m W	3.80E-04	1.50E-03	2.70E-04	2.15E-03
Main Office (H-213)	187 m NW	3.30E-04	1.20E-03	2.60E-04	1.79E-03

Notes

[1]The 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. For example, the dose 65 m north of the Eastern Dog Pens area would be the maximum modeled dose within the sector bounded by 65 m NNE and 65 m NNW.

[2]The 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, 1992). For the LEHR facility CAP88-PC modeling, the distance from an area diffuse source to a receptor is measured as the approximate distance from the centroid of the diffuse source to the centroid of the building assumed to house the receptor.

[3]The total dose is the sum of the Effective Dose Equivalents modeled for each MEI receptor from the all potential radionuclide fugitive-dust-emission diffuse sources. Value in **bold face** is the maximum total dose to the MEI.

[4]One meter is the shortest distance available in CAP88-PC.

[5]The dose due to entrainment by wind for the equipment operator was reduced from that reported in the original model results, because the operator was exposed during working days for only 6 weeks of the year (30 days/365 days per year) instead of 52 weeks assumed by the model.

Abbreviations

°	degrees
E	east
LEHR	Laboratory for Energy-Related Health Research
NW	northwest
MEI	maximally exposed individual
mrem/yr	millirem(s) per year
NNE	north by northeast
m	meters
No.	number
S	south
UC Davis	University of California, Davis
W	west

Table 9. Estimated Collective Population Dose Resulting from Radionuclide Emissions from Diffuse Sources

Potential Source	Collective Population Dose[1] (person-rem/yr)
EDPs, soil particles entrained by wind	5.22E-05
EDPs, excavations and grading of soil	1.99E-04
EDPs, particulates released due to concrete crushing	2.06E-05
Total	**2.7E-04**

Notes
Source of data: CAP88-PC, Version 1.0 modeling output files.
[1]The collective population dose is for receptors within an 80-km radius.

Abbreviations

EDPs	Eastern Dog Pens area
km	kilometer(s)
mrem/yr	millirem per year
person-rem/yr	person-roentgen equivalent man per year

FIGURES

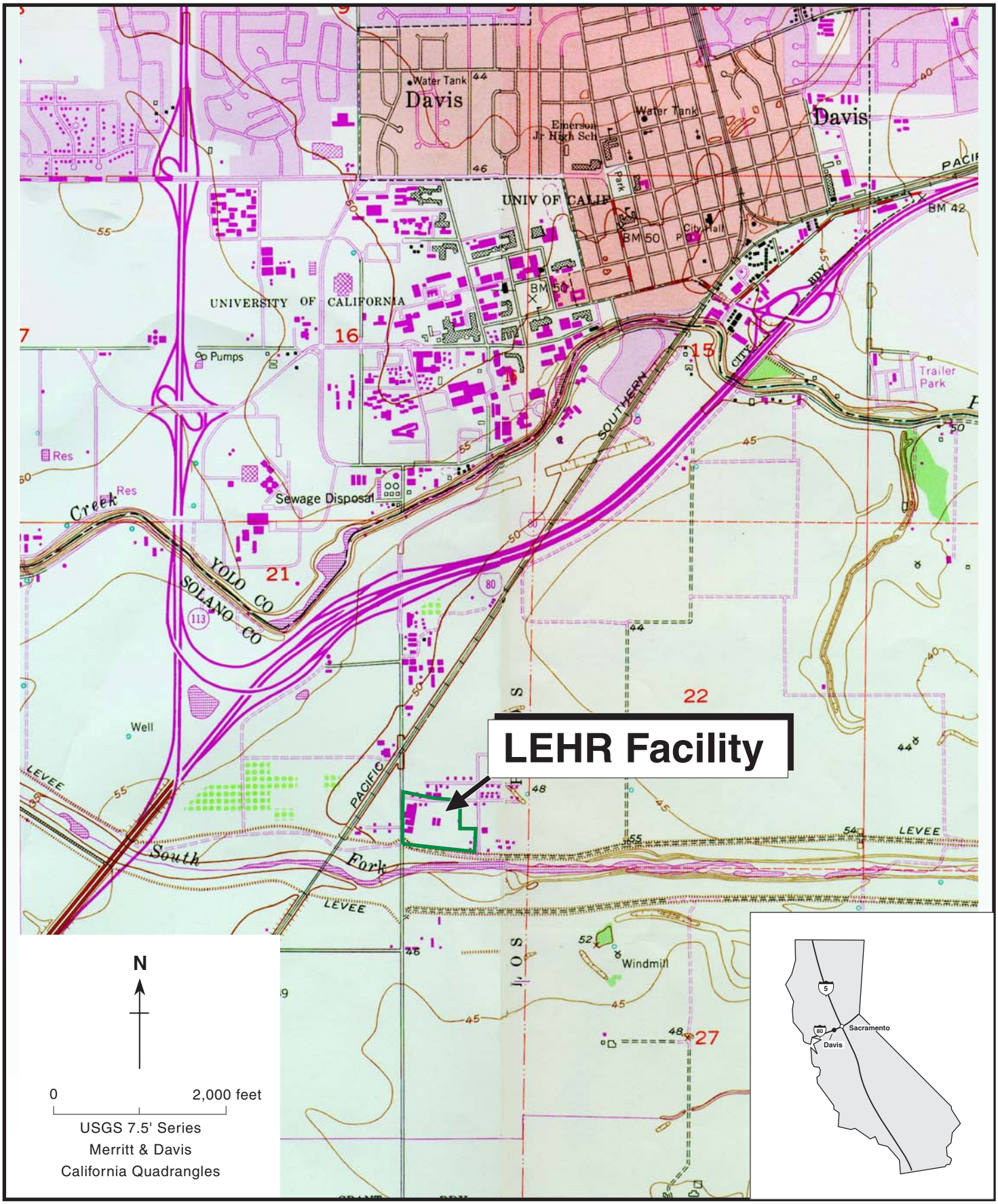

Figure 1. LEHR Facility Location Map, University of California, Davis

Weiss Associates

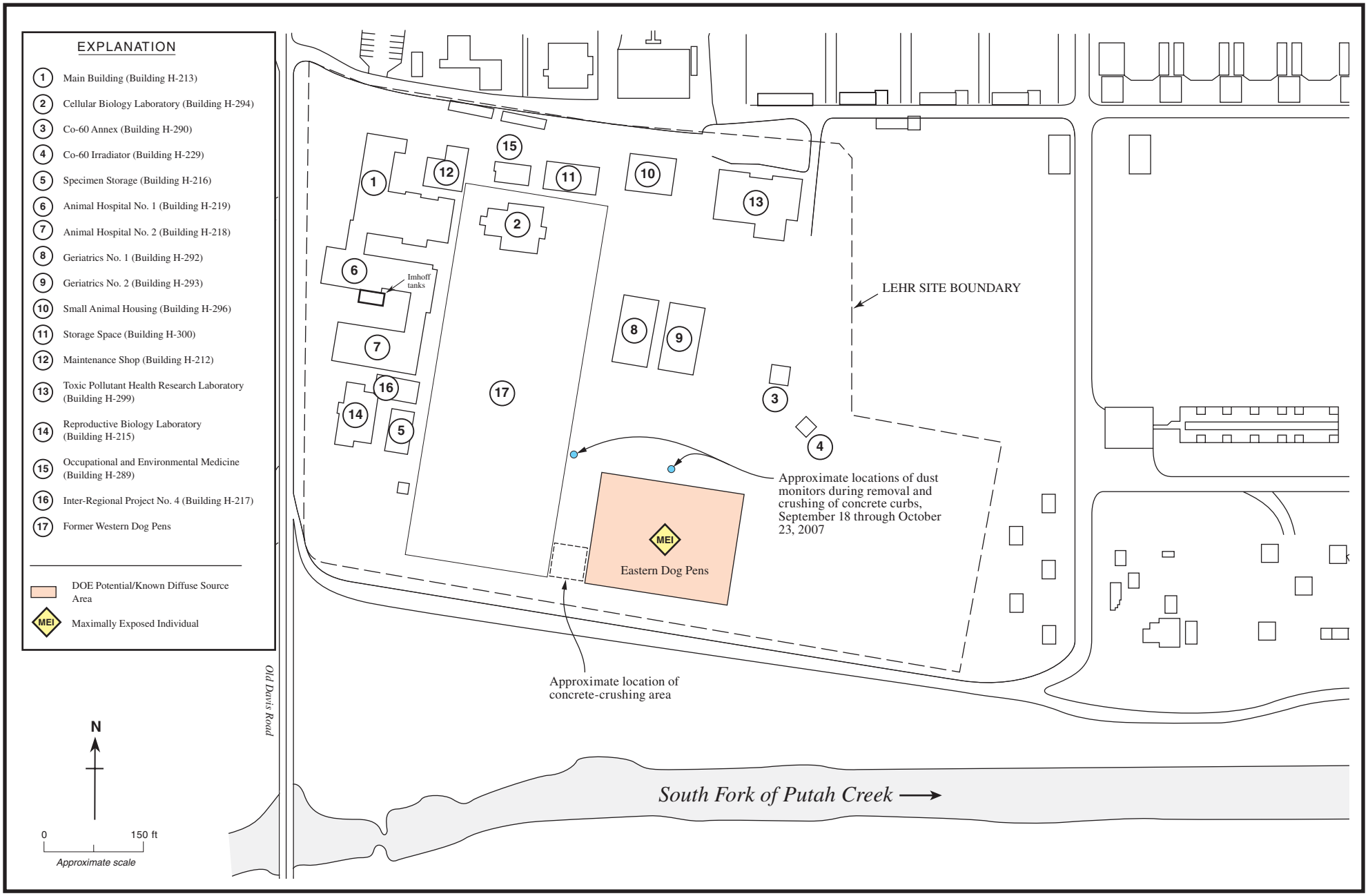

Figure 2. LEHR Facility DOE Diffuse-Source Area and Location of Maximally Exposed Individual

APPENDIX A

CAP88-PC OUTPUT RESULTS

A.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 26, 2008 5:08 pm

Facility: LEHR
Address:
City: Davis
State: CA Zip:

Source Category: area
Source Type: Area
Emission Year: 2007

Comments: wind-entrained dust, individual run

Dataset Name: EDPind
Dataset Date: May 26, 2008 5:05 pm
Wind File: WNDFILES\SAC0320.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	6.58E-05
BREAST	6.81E-05
R MAR	1.15E-02
LUNGS	1.16E-01
THYROID	6.60E-05
ENDOST	1.43E-01
RMNDR	1.91E-04

EFFEC	1.97E-02

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	1.55E-04
INHALATION	1.95E-02
AIR IMMERSION	1.98E-08
GROUND SURFACE	2.13E-06
INTERNAL	1.97E-02
EXTERNAL	2.15E-06
TOTAL	1.97E-02

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
BI-212	2.30E-07
BI-214	1.32E-08
CS-137	2.56E-06
PB-214	1.08E-08
SR-90	7.41E-06
TL-208	8.34E-09
TH-228	6.32E-03
TH-230	5.14E-03
TH-232	8.12E-03
TH-234	1.03E-06
H-3	1.37E-08
U-235	8.03E-05
TOTAL	1.97E-02

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	1.01E-08
BONE	6.57E-09

	A.SUM
THYROID	1.20E-11
BREAST	1.05E-10
LUNG	1.99E-07
STOMACH	8.53E-11
BOWEL	1.20E-10
LIVER	4.33E-10
PANCREAS	5.95E-11
URINARY	4.85E-11
OTHER	7.27E-11
TOTAL	2.16E-07

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	6.88E-10
INHALATION	2.15E-07
AIR IMMERSION	4.82E-13
GROUND SURFACE	4.89E-11
INTERNAL	2.16E-07
EXTERNAL	4.93E-11
TOTAL	2.16E-07

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
BI-212	2.95E-12
BI-214	1.52E-12
CS-137	6.68E-11
PB-214	1.85E-12
SR-90	1.25E-10
TL-208	2.04E-13
TH-228	1.27E-07
TH-230	4.22E-08
TH-232	4.58E-08
TH-234	3.56E-11
H-3	3.71E-13
U-235	1.06E-09
TOTAL	2.16E-07

A.SUM
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1	132	143	150	165	180	187
N	2.0E-02	7.0E-04	6.2E-04	5.7E-04	4.9E-04	4.1E-04	3.8E-04
NNW	2.0E-02	5.7E-04	4.8E-04	4.3E-04	3.5E-04	3.0E-04	2.8E-04
NW	2.0E-02	6.2E-04	5.4E-04	5.0E-04	4.2E-04	3.5E-04	3.3E-04
WNW	2.0E-02	4.9E-04	4.2E-04	3.8E-04	3.2E-04	2.7E-04	2.5E-04
W	2.0E-02	3.4E-04	2.9E-04	2.6E-04	2.2E-04	1.9E-04	1.7E-04
WSW	2.0E-02	1.6E-04	1.3E-04	1.2E-04	9.6E-05	8.2E-05	7.6E-05
SW	2.0E-02	1.0E-04	8.7E-05	7.9E-05	6.6E-05	5.6E-05	5.3E-05
SSW	2.0E-02	1.1E-04	9.4E-05	8.3E-05	6.7E-05	5.8E-05	5.4E-05
S	2.0E-02	2.5E-04	2.2E-04	2.0E-04	1.7E-04	1.4E-04	1.3E-04
SSE	2.0E-02	3.3E-04	2.9E-04	2.7E-04	2.3E-04	1.9E-04	1.8E-04
SE	2.0E-02	2.1E-04	1.8E-04	1.6E-04	1.3E-04	1.1E-04	1.1E-04
ESE	2.0E-02	1.3E-04	1.1E-04	9.6E-05	7.9E-05	6.8E-05	6.4E-05
E	2.0E-02	1.3E-04	1.1E-04	1.0E-04	8.8E-05	7.5E-05	7.1E-05
ENE	2.0E-02	1.6E-04	1.3E-04	1.2E-04	9.6E-05	8.2E-05	7.6E-05
NE	2.0E-02	3.7E-04	3.2E-04	3.0E-04	2.5E-04	2.1E-04	2.0E-04
NNE	2.0E-02	4.7E-04	4.0E-04	3.6E-04	3.0E-04	2.5E-04	2.3E-04

	Distance (m)	
Direction	500	1000
N	6.3E-05	2.2E-05
NNW	4.8E-05	1.8E-05
NW	5.5E-05	2.0E-05
WNW	4.3E-05	1.7E-05
W	3.2E-05	1.4E-05
WSW	1.8E-05	1.0E-05
SW	1.4E-05	9.4E-06
SSW	1.4E-05	9.5E-06
S	2.7E-05	1.3E-05
SSE	3.4E-05	1.5E-05
SE	2.2E-05	1.2E-05
ESE	1.6E-05	9.9E-06
E	1.7E-05	1.0E-05
ENE	1.8E-05	1.0E-05
NE	3.6E-05	1.5E-05
NNE	4.2E-05	1.7E-05

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

	Distance (m)

A.SUM

Direction	1	132	143	150	165	180	187
N	2.2E-07	7.7E-09	6.7E-09	6.2E-09	5.3E-09	4.5E-09	4.1E-09
NNW	2.2E-07	6.2E-09	5.2E-09	4.7E-09	3.8E-09	3.2E-09	3.0E-09
NW	2.2E-07	6.8E-09	5.9E-09	5.4E-09	4.5E-09	3.8E-09	3.6E-09
WNW	2.2E-07	5.3E-09	4.5E-09	4.1E-09	3.4E-09	2.9E-09	2.7E-09
W	2.2E-07	3.6E-09	3.1E-09	2.9E-09	2.4E-09	2.0E-09	1.9E-09
WSW	2.2E-07	1.7E-09	1.4E-09	1.2E-09	1.0E-09	8.5E-10	7.9E-10
SW	2.2E-07	1.1E-09	9.1E-10	8.2E-10	6.8E-10	5.7E-10	5.3E-10
SSW	2.2E-07	1.2E-09	9.8E-10	8.7E-10	6.9E-10	5.9E-10	5.5E-10
S	2.2E-07	2.7E-09	2.4E-09	2.2E-09	1.8E-09	1.5E-09	1.4E-09
SSE	2.2E-07	3.5E-09	3.1E-09	2.9E-09	2.5E-09	2.1E-09	1.9E-09
SE	2.2E-07	2.2E-09	1.9E-09	1.7E-09	1.4E-09	1.2E-09	1.1E-09
ESE	2.2E-07	1.3E-09	1.1E-09	1.0E-09	8.2E-10	7.0E-10	6.5E-10
E	2.2E-07	1.4E-09	1.2E-09	1.1E-09	9.3E-10	7.8E-10	7.3E-10
ENE	2.2E-07	1.8E-09	1.4E-09	1.3E-09	1.0E-09	8.5E-10	7.9E-10
NE	2.2E-07	4.0E-09	3.5E-09	3.2E-09	2.7E-09	2.3E-09	2.1E-09
NNE	2.2E-07	5.2E-09	4.3E-09	3.9E-09	3.2E-09	2.7E-09	2.5E-09

	Distance (m)	
Direction	500	1000
N	6.5E-10	2.0E-10
NNW	4.8E-10	1.5E-10
NW	5.6E-10	1.7E-10
WNW	4.3E-10	1.4E-10
W	3.0E-10	1.1E-10
WSW	1.5E-10	6.6E-11
SW	1.1E-10	5.7E-11
SSW	1.1E-10	5.8E-11
S	2.4E-10	9.2E-11
SSE	3.2E-10	1.1E-10
SE	2.0E-10	8.1E-11
ESE	1.3E-10	6.2E-11
E	1.4E-10	6.5E-11
ENE	1.5E-10	6.8E-11
NE	3.5E-10	1.2E-10
NNE	4.1E-10	1.4E-10

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 26, 2008 5:38 pm

Facility: LEHR
Address:
City: Davis
State: CA Zip:

Effective Dose Equivalent
(mrem/year)

9.95E-07

At This Location: 5000 Meters North
Source Category: area
Source Type: Area
Emission Year: 2007

Comments: wind-entrained dust, population run

Dataset Name: EDPpop
Dataset Date: May 26, 2008 5:37 pm
Wind File: WNDFILES\SAC0320.WND
Population File: POPFILES\07LEHR.POP

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 5000 Meters North
Lifetime Fatal Cancer Risk: 1.09E-11

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)	Collective Population (person-rem/y)
GONADS	3.29E-09	1.82E-07
BREAST	3.41E-09	1.89E-07
R MAR	5.84E-07	3.11E-05
LUNGS	5.86E-06	3.05E-04
THYROID	3.29E-09	1.82E-07
ENDOST	7.24E-06	3.85E-04
RMNDR	9.70E-09	5.95E-07
EFFEC	9.95E-07	5.22E-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	3629774	3629774	8.06E-09	8.06E-09

RADIONUCLIDE EMISSIONS DURING THE YEAR 2007

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
BI-212	W	1.00	3.2E-09	3.2E-09
BI-214	W	1.00	4.4E-09	4.4E-09
CS-137	D	1.00	1.5E-09	1.5E-09
PB-214	D	1.00	4.7E-09	4.7E-09
SR-90	D	1.00	1.3E-09	1.3E-09
TL-208	D	1.00	1.7E-09	1.7E-09
TH-228	Y	1.00	1.2E-08	1.2E-08
TH-230	Y	1.00	9.7E-09	9.7E-09
TH-232	Y	1.00	1.1E-08	1.1E-08
TH-234	Y	1.00	6.9E-09	6.9E-09
H-3	*	0.00	9.3E-09	9.3E-09
U-235	Y	1.00	2.9E-10	2.9E-10

B.SYN

SITE INFORMATION

Temperature: 17 degrees C
Precipitation: 29 cm/y
Mixing Height: 1000 m

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

POPULATION DATA

	Distance (m)						
Direction	5000	15000	25000	35000	45000	55000	65000
N	1481	4346	7242	9360	10107	10143	14363
NNW	1475	4341	7234	10128	11212	2556	1960
NW	1511	4341	7233	10126	13027	14279	9229
WNW	1687	4353	7233	9850	11934	14014	11448
W	3611	8866	10922	9722	11450	13988	18866
WSW	3639	10916	18187	13675	12496	13988	26193

B.SYN

SW	3639	10916	18188	23714	32008	29137	42288
SSW	3639	10916	18190	25467	31157	48919	125030
S	3643	10929	18215	25678	49011	111948	133741
SSE	3636	7287	16841	53636	67566	56984	60025
SE	2807	4341	26272	71284	60494	41129	46043
ESE	2170	4924	40758	73704	94835	110774	73105
E	2061	8330	51191	73702	94839	115858	43175
ENE	1881	4373	46658	73704	83136	70756	12480
NE	1626	4396	50207	36890	15456	18453	21803
NNE	1500	4341	13491	8098	10533	12314	12719

	Distance (m)
Direction	75000
N	16764
NNW	2616
NW	3828
WNW	7551
W	29336
WSW	33333
SW	54943
SSW	154104
S	154321
SSE	62949
SE	53123
ESE	22083
E	8934
ENE	11391
NE	20107
NNE	12700

C.SUM

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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 26, 2008 5:27 pm

Facility: LEHR
Address:
City: Davis
State: CA Zip:

Source Category: area
Source Type: Area
Emission Year: 2007

Comments: ground disturbance, individual run

Dataset Name: EDPgdInd
Dataset Date: May 26, 2008 5:22 pm
Wind File: WNDFILES\SAC0320.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	2.51E-04
BREAST	2.59E-04
R MAR	4.40E-02
LUNGS	4.41E-01
THYROID	2.51E-04
ENDOST	5.45E-01
RMNDR	7.26E-04

	C.SUM
EFFEC	7.49E-02

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	5.89E-04
INHALATION	7.43E-02
AIR IMMERSION	7.56E-08
GROUND SURFACE	8.10E-06
INTERNAL	7.49E-02
EXTERNAL	8.18E-06
TOTAL	7.49E-02

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
BI-212	8.76E-07
BI-214	5.01E-08
CS-137	9.75E-06
PB-214	4.13E-08
SR-90	2.84E-05
TL-208	3.17E-08
TH-228	2.40E-02
TH-230	1.96E-02
TH-232	3.10E-02
TH-234	3.91E-06
H-3	5.21E-08
U-235	3.05E-04
TOTAL	7.49E-02

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	3.83E-08
BONE	2.50E-08

	C.SUM
THYROID	4.57E-11
BREAST	4.00E-10
LUNG	7.55E-07
STOMACH	3.25E-10
BOWEL	4.55E-10
LIVER	1.65E-09
PANCREAS	2.26E-10
URINARY	1.84E-10
OTHER	2.77E-10
TOTAL	8.22E-07

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	2.62E-09
INHALATION	8.19E-07
AIR IMMERSION	1.83E-12
GROUND SURFACE	1.86E-10
INTERNAL	8.22E-07
EXTERNAL	1.88E-10
TOTAL	8.22E-07

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
BI-212	1.13E-11
BI-214	5.81E-12
CS-137	2.55E-10
PB-214	7.05E-12
SR-90	4.78E-10
TL-208	7.77E-13
TH-228	4.82E-07
TH-230	1.61E-07
TH-232	1.75E-07
TH-234	1.35E-10
H-3	1.41E-12
U-235	4.02E-09
TOTAL	8.22E-07

C.SUM
(All Radionuclides and Pathways)

	Distance (m)						
Direction	1	132	143	150	165	180	187
N	7.5E-02	2.7E-03	2.4E-03	2.2E-03	1.8E-03	1.6E-03	1.5E-03
NNW	7.5E-02	2.2E-03	1.8E-03	1.6E-03	1.3E-03	1.1E-03	1.1E-03
NW	7.5E-02	2.4E-03	2.0E-03	1.9E-03	1.6E-03	1.3E-03	1.2E-03
WNW	7.5E-02	1.9E-03	1.6E-03	1.5E-03	1.2E-03	1.0E-03	9.5E-04
W	7.5E-02	1.3E-03	1.1E-03	1.0E-03	8.5E-04	7.1E-04	6.6E-04
WSW	7.5E-02	6.0E-04	5.0E-04	4.5E-04	3.6E-04	3.1E-04	2.9E-04
SW	7.5E-02	3.9E-04	3.3E-04	3.0E-04	2.5E-04	2.1E-04	2.0E-04
SSW	7.5E-02	4.3E-04	3.6E-04	3.2E-04	2.6E-04	2.2E-04	2.1E-04
S	7.5E-02	9.6E-04	8.3E-04	7.7E-04	6.5E-04	5.5E-04	5.1E-04
SSE	7.5E-02	1.2E-03	1.1E-03	1.0E-03	8.7E-04	7.3E-04	6.8E-04
SE	7.5E-02	7.9E-04	6.7E-04	6.1E-04	5.1E-04	4.3E-04	4.0E-04
ESE	7.5E-02	4.8E-04	4.1E-04	3.7E-04	3.0E-04	2.6E-04	2.4E-04
E	7.5E-02	5.1E-04	4.4E-04	4.0E-04	3.4E-04	2.9E-04	2.7E-04
ENE	7.5E-02	6.2E-04	5.1E-04	4.5E-04	3.6E-04	3.1E-04	2.9E-04
NE	7.5E-02	1.4E-03	1.2E-03	1.1E-03	9.6E-04	8.1E-04	7.6E-04
NNE	7.5E-02	1.8E-03	1.5E-03	1.4E-03	1.1E-03	9.6E-04	8.9E-04

	Distance (m)	
Direction	500	1000
N	2.4E-04	8.5E-05
NNW	1.8E-04	6.9E-05
NW	2.1E-04	7.6E-05
WNW	1.6E-04	6.4E-05
W	1.2E-04	5.3E-05
WSW	6.7E-05	3.9E-05
SW	5.5E-05	3.6E-05
SSW	5.5E-05	3.6E-05
S	1.0E-04	4.8E-05
SSE	1.3E-04	5.5E-05
SE	8.5E-05	4.4E-05
ESE	6.1E-05	3.8E-05
E	6.5E-05	3.9E-05
ENE	6.8E-05	4.0E-05
NE	1.4E-04	5.8E-05
NNE	1.6E-04	6.4E-05

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

	Distance (m)

C.SUM

Direction	1	132	143	150	165	180	187
N	8.2E-07	2.9E-08	2.6E-08	2.4E-08	2.0E-08	1.7E-08	1.6E-08
NNW	8.2E-07	2.3E-08	2.0E-08	1.8E-08	1.5E-08	1.2E-08	1.1E-08
NW	8.2E-07	2.6E-08	2.2E-08	2.1E-08	1.7E-08	1.5E-08	1.4E-08
WNW	8.2E-07	2.0E-08	1.7E-08	1.6E-08	1.3E-08	1.1E-08	1.0E-08
W	8.2E-07	1.4E-08	1.2E-08	1.1E-08	9.1E-09	7.7E-09	7.1E-09
WSW	8.2E-07	6.4E-09	5.3E-09	4.7E-09	3.8E-09	3.2E-09	3.0E-09
SW	8.2E-07	4.1E-09	3.5E-09	3.1E-09	2.6E-09	2.2E-09	2.0E-09
SSW	8.2E-07	4.6E-09	3.7E-09	3.3E-09	2.6E-09	2.2E-09	2.1E-09
S	8.2E-07	1.0E-08	9.0E-09	8.2E-09	6.9E-09	5.8E-09	5.4E-09
SSE	8.2E-07	1.3E-08	1.2E-08	1.1E-08	9.3E-09	7.9E-09	7.3E-09
SE	8.2E-07	8.5E-09	7.2E-09	6.5E-09	5.4E-09	4.6E-09	4.3E-09
ESE	8.2E-07	5.1E-09	4.3E-09	3.8E-09	3.1E-09	2.7E-09	2.5E-09
E	8.2E-07	5.4E-09	4.6E-09	4.2E-09	3.5E-09	3.0E-09	2.8E-09
ENE	8.2E-07	6.7E-09	5.4E-09	4.8E-09	3.8E-09	3.2E-09	3.0E-09
NE	8.2E-07	1.5E-08	1.3E-08	1.2E-08	1.0E-08	8.8E-09	8.2E-09
NNE	8.2E-07	2.0E-08	1.7E-08	1.5E-08	1.2E-08	1.0E-08	9.6E-09

Distance (m)

Direction	500	1000
N	2.5E-09	7.5E-10
NNW	1.8E-09	5.8E-10
NW	2.1E-09	6.6E-10
WNW	1.6E-09	5.3E-10
W	1.2E-09	4.1E-10
WSW	5.6E-10	2.5E-10
SW	4.2E-10	2.2E-10
SSW	4.3E-10	2.2E-10
S	9.3E-10	3.5E-10
SSE	1.2E-09	4.3E-10
SE	7.6E-10	3.1E-10
ESE	4.9E-10	2.4E-10
E	5.3E-10	2.5E-10
ENE	5.7E-10	2.6E-10
NE	1.3E-09	4.6E-10
NNE	1.6E-09	5.2E-10

D.SYN

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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 26, 2008 5:27 pm

Facility: LEHR
Address:
City: Davis
State: CA Zip:

Effective Dose Equivalent
(mrem/year)

3.79E-06

At This Location: 5000 Meters North
Source Category: area
Source Type: Area
Emission Year: 2007

Comments: ground disturbance, population run

Dataset Name: EDPgdPop
Dataset Date: May 26, 2008 5:26 pm
Wind File: WNDFILES\SAC0320.WND
Population File: POPFILES\07LEHR.POP

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 5000 Meters North
Lifetime Fatal Cancer Risk: 4.16E-11

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)	Collective Population (person-rem/y)
GONADS	1.25E-08	6.92E-07
BREAST	1.30E-08	7.19E-07
R MAR	2.22E-06	1.19E-04
LUNGS	2.23E-05	1.16E-03
THYROID	1.25E-08	6.93E-07
ENDOST	2.76E-05	1.47E-03
RMNDR	3.69E-08	2.26E-06
EFFEC	3.79E-06	1.99E-04

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	3629774	3629774	3.07E-08	3.07E-08

RADIONUCLIDE EMISSIONS DURING THE YEAR 2007

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
BI-212	W	1.00	1.2E-08	1.2E-08
BI-214	W	1.00	1.7E-08	1.7E-08
CS-137	D	1.00	5.6E-09	5.6E-09
PB-214	D	1.00	1.8E-08	1.8E-08
SR-90	D	1.00	4.8E-09	4.8E-09
TL-208	D	1.00	6.4E-09	6.4E-09
TH-228	Y	1.00	4.5E-08	4.5E-08
TH-230	Y	1.00	3.7E-08	3.7E-08
TH-232	Y	1.00	4.1E-08	4.1E-08
TH-234	Y	1.00	2.6E-08	2.6E-08
H-3	*	0.00	3.6E-08	3.6E-08
U-235	Y	1.00	1.1E-09	1.1E-09

D.SYN

SITE INFORMATION

Temperature: 17 degrees C
Precipitation: 29 cm/y
Mixing Height: 1000 m

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

POPULATION DATA

	Distance (m)						
Direction	5000	15000	25000	35000	45000	55000	65000
N	1481	4346	7242	9360	10107	10143	14363
NNW	1475	4341	7234	10128	11212	2556	1960
NW	1511	4341	7233	10126	13027	14279	9229
WNW	1687	4353	7233	9850	11934	14014	11448
W	3611	8866	10922	9722	11450	13988	18866
WSW	3639	10916	18187	13675	12496	13988	26193

D.SYN

SW	3639	10916	18188	23714	32008	29137	42288
SSW	3639	10916	18190	25467	31157	48919	125030
S	3643	10929	18215	25678	49011	111948	133741
SSE	3636	7287	16841	53636	67566	56984	60025
SE	2807	4341	26272	71284	60494	41129	46043
ESE	2170	4924	40758	73704	94835	110774	73105
E	2061	8330	51191	73702	94839	115858	43175
ENE	1881	4373	46658	73704	83136	70756	12480
NE	1626	4396	50207	36890	15456	18453	21803
NNE	1500	4341	13491	8098	10533	12314	12719

	Distance (m)
Direction	75000
N	16764
NNW	2616
NW	3828
WNW	7551
W	29336
WSW	33333
SW	54943
SSW	154104
S	154321
SSE	62949
SE	53123
ESE	22083
E	8934
ENE	11391
NE	20107
NNE	12700

E.SUM

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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 26, 2008 5:32 pm

Facility: LEHR
Address:
City: Davis
State: CA Zip:

Source Category: area
Source Type: Area
Emission Year: 2007

Comments: concrete crushing, individual run

Dataset Name: EDPccInd
Dataset Date: May 26, 2008 5:32 pm
Wind File: WNDFILES\SAC0320.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	4.50E-04
BREAST	4.53E-04
R MAR	6.93E-03
LUNGS	2.54E-03
THYROID	4.49E-04
ENDOST	6.74E-02
RMNDR	4.98E-03

	E.SUM
EFFEC	4.84E-03

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	3.37E-03
INHALATION	1.47E-03
AIR IMMERSION	2.10E-10
GROUND SURFACE	5.51E-06
INTERNAL	4.84E-03
EXTERNAL	5.51E-06
TOTAL	4.85E-03

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
C-14	1.18E-07
PB-210	3.78E-03
RA-226	5.80E-04
SR-90	4.86E-04
TOTAL	4.85E-03

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	1.17E-08
BONE	4.07E-09
THYROID	7.38E-11
BREAST	6.05E-10
LUNG	7.31E-09
STOMACH	4.58E-10
BOWEL	4.49E-10
LIVER	1.54E-08
PANCREAS	3.61E-10
URINARY	2.60E-09

	E.SUM
OTHER	4.42E-10
TOTAL	4.35E-08

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	2.78E-08
INHALATION	1.56E-08
AIR IMMERSION	4.67E-15
GROUND SURFACE	1.24E-10
INTERNAL	4.33E-08
EXTERNAL	1.24E-10
TOTAL	4.35E-08

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
C-14	2.88E-12
PB-210	2.69E-08
RA-226	8.33E-09
SR-90	8.19E-09
TOTAL	4.35E-08

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

	Distance (m)						
Direction	1	132	143	150	165	180	187
N	4.8E-03	3.5E-04	3.3E-04	3.2E-04	2.9E-04	2.8E-04	2.7E-04
NNW	4.8E-03	3.1E-04	2.9E-04	2.8E-04	2.6E-04	2.5E-04	2.4E-04
NW	4.8E-03	3.3E-04	3.1E-04	3.0E-04	2.8E-04	2.6E-04	2.6E-04
WNW	4.8E-03	2.9E-04	2.8E-04	2.7E-04	2.5E-04	2.4E-04	2.4E-04
W	4.8E-03	2.6E-04	2.5E-04	2.4E-04	2.3E-04	2.2E-04	2.2E-04
WSW	4.8E-03	2.2E-04	2.1E-04	2.1E-04	2.0E-04	2.0E-04	2.0E-04
SW	4.8E-03	2.0E-04	2.0E-04	2.0E-04	1.9E-04	1.9E-04	1.9E-04

E.SUM

SSW	4.8E-03	2.1E-04	2.0E-04	2.0E-04	1.9E-04	1.9E-04	1.9E-04
S	4.8E-03	2.4E-04	2.3E-04	2.3E-04	2.2E-04	2.1E-04	2.1E-04
SSE	4.8E-03	2.6E-04	2.5E-04	2.4E-04	2.3E-04	2.2E-04	2.2E-04
SE	4.8E-03	2.3E-04	2.2E-04	2.2E-04	2.1E-04	2.1E-04	2.0E-04
ESE	4.8E-03	2.1E-04	2.0E-04	2.0E-04	2.0E-04	2.0E-04	1.9E-04
E	4.8E-03	2.1E-04	2.1E-04	2.0E-04	2.0E-04	2.0E-04	2.0E-04
ENE	4.8E-03	2.2E-04	2.1E-04	2.1E-04	2.0E-04	2.0E-04	2.0E-04
NE	4.8E-03	2.7E-04	2.6E-04	2.5E-04	2.4E-04	2.3E-04	2.3E-04
NNE	4.8E-03	2.9E-04	2.7E-04	2.6E-04	2.5E-04	2.4E-04	2.3E-04

Distance (m)

Direction	500	1000
N	1.9E-04	1.8E-04
NNW	1.9E-04	1.8E-04
NW	1.9E-04	1.8E-04
WNW	1.9E-04	1.8E-04
W	1.9E-04	1.8E-04
WSW	1.8E-04	1.8E-04
SW	1.8E-04	1.8E-04
SSW	1.8E-04	1.8E-04
S	1.9E-04	1.8E-04
SSE	1.9E-04	1.8E-04
SE	1.8E-04	1.8E-04
ESE	1.8E-04	1.8E-04
E	1.8E-04	1.8E-04
ENE	1.8E-04	1.8E-04
NE	1.9E-04	1.8E-04
NNE	1.9E-04	1.8E-04

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

Distance (m)

Direction	1	132	143	150	165	180	187
N	4.3E-08	3.0E-09	2.8E-09	2.7E-09	2.6E-09	2.4E-09	2.3E-09
NNW	4.3E-08	2.7E-09	2.5E-09	2.4E-09	2.3E-09	2.2E-09	2.1E-09
NW	4.3E-08	2.8E-09	2.7E-09	2.6E-09	2.4E-09	2.3E-09	2.2E-09
WNW	4.3E-08	2.6E-09	2.4E-09	2.3E-09	2.2E-09	2.1E-09	2.1E-09
W	4.3E-08	2.2E-09	2.1E-09	2.1E-09	2.0E-09	1.9E-09	1.9E-09
WSW	4.3E-08	1.9E-09	1.8E-09	1.8E-09	1.7E-09	1.7E-09	1.7E-09
SW	4.3E-08	1.7E-09	1.7E-09	1.7E-09	1.7E-09	1.6E-09	1.6E-09
SSW	4.3E-08	1.8E-09	1.7E-09	1.7E-09	1.7E-09	1.6E-09	1.6E-09
S	4.3E-08	2.1E-09	2.0E-09	2.0E-09	1.9E-09	1.8E-09	1.8E-09
SSE	4.3E-08	2.2E-09	2.1E-09	2.1E-09	2.0E-09	1.9E-09	1.9E-09
SE	4.3E-08	2.0E-09	1.9E-09	1.9E-09	1.8E-09	1.8E-09	1.8E-09
ESE	4.3E-08	1.8E-09	1.8E-09	1.7E-09	1.7E-09	1.7E-09	1.7E-09

E.SUM

E	4.3E-08	1.8E-09	1.8E-09	1.8E-09	1.7E-09	1.7E-09	1.7E-09
ENE	4.3E-08	1.9E-09	1.8E-09	1.8E-09	1.7E-09	1.7E-09	1.7E-09
NE	4.3E-08	2.3E-09	2.2E-09	2.2E-09	2.1E-09	2.0E-09	2.0E-09
NNE	4.3E-08	2.5E-09	2.4E-09	2.3E-09	2.2E-09	2.1E-09	2.0E-09

Distance (m)

Direction	500	1000
N	1.7E-09	1.6E-09
NNW	1.6E-09	1.6E-09
NW	1.6E-09	1.6E-09
WNW	1.6E-09	1.6E-09
W	1.6E-09	1.6E-09
WSW	1.6E-09	1.5E-09
SW	1.6E-09	1.5E-09
SSW	1.6E-09	1.5E-09
S	1.6E-09	1.6E-09
SSE	1.6E-09	1.6E-09
SE	1.6E-09	1.6E-09
ESE	1.6E-09	1.5E-09
E	1.6E-09	1.5E-09
ENE	1.6E-09	1.5E-09
NE	1.6E-09	1.6E-09
NNE	1.6E-09	1.6E-09

F.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 26, 2008 5:34 pm

Facility: LEHR
Address:
City: Davis
State: CA Zip:

Effective Dose Equivalent
(mrem/year)

2.50E-07

At This Location: 5000 Meters North
Source Category: area
Source Type: Area
Emission Year: 2007

Comments: concrete crushing, population run

Dataset Name: EDPccPop
Dataset Date: May 26, 2008 5:34 pm
Wind File: WNDFILES\SAC0320.WND
Population File: POPFILES\07LEHR.POP

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 5000 Meters North
Lifetime Fatal Cancer Risk: 2.23E-12

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)	Collective Population (person-rem/y)
GONADS	2.33E-08	1.94E-06
BREAST	2.35E-08	1.95E-06
R MAR	3.54E-07	3.10E-05
LUNGS	1.29E-07	7.43E-06
THYROID	2.33E-08	1.94E-06
ENDOST	3.49E-06	2.93E-04
RMNDR	2.59E-07	2.14E-05
EFFEC	2.50E-07	2.06E-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	3629774	3629774	2.53E-09	2.53E-09

RADIONUCLIDE EMISSIONS DURING THE YEAR 2007

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
C-14	*	0.00	1.7E-09	1.7E-09
PB-210	D	1.00	3.9E-08	3.9E-08
RA-226	W	1.00	1.7E-08	1.7E-08
SR-90	D	1.00	8.3E-08	8.3E-08

SITE INFORMATION

Temperature: 17 degrees C
Precipitation: 29 cm/y
Mixing Height: 1000 m

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

POPULATION DATA

	Distance (m)						
Direction	5000	15000	25000	35000	45000	55000	65000
N	1481	4346	7242	9360	10107	10143	14363
NNW	1475	4341	7234	10128	11212	2556	1960
NW	1511	4341	7233	10126	13027	14279	9229
WNW	1687	4353	7233	9850	11934	14014	11448
W	3611	8866	10922	9722	11450	13988	18866
WSW	3639	10916	18187	13675	12496	13988	26193
SW	3639	10916	18188	23714	32008	29137	42288
SSW	3639	10916	18190	25467	31157	48919	125030
S	3643	10929	18215	25678	49011	111948	133741
SSE	3636	7287	16841	53636	67566	56984	60025
SE	2807	4341	26272	71284	60494	41129	46043
ESE	2170	4924	40758	73704	94835	110774	73105
E	2061	8330	51191	73702	94839	115858	43175
ENE	1881	4373	46658	73704	83136	70756	12480

			F.SYN				
NE	1626	4396	50207	36890	15456	18453	21803
NNE	1500	4341	13491	8098	10533	12314	12719

	Distance (m)
Direction	75000
N	16764
NNW	2616
NW	3828
WNW	7551
W	29336
WSW	33333
SW	54943
SSW	154104
S	154321
SSE	62949
SE	53123
ESE	22083
E	8934
ENE	11391
NE	20107
NNE	12700