The Boeing Company
Rocketdyne Propulsion & Power
6633 Canoga Avenue
P.O. Box 7922
Canoga Park, CA 91309-7922

May 27, 1999
In reply refer to: 99RC-2444

BOEING

H. Joma
Manager, DOE Site Closure Office
U. S. Department of Energy
DOE Site Closure Office (SSFL, Mail Stop 4038)
P. O. Box 7929
Canoga Park, CA 91309-7929

Subject: NESHAPs Report for 1998

Dear Mr. Joma:

Enclosed is the NESHAPs (National Emission Standards for Hazardous Air Pollutants - Radionuclides) Report for 1998 for the DOE facilities at SSFL. This report reflects the results of detailed analyses of effluent samples from the radiological exhaust stacks in operation at a DOE facility during 1998, and estimates of emissions from the diffuse area sources. This submittal consists of the Radionuclide Air Emissions Annual Report with attached computer printouts from the CAP88PC calculations for one point source, RMHF, and includes exposure for three area sources, treated in combination and one area source treated separately and then summed into the combination sources. The area sources were treated in combination even though the distance between them is comparable to the distance to the maximally exposed individual because as ground level and below-ground-level diffuse sources, the airborne exposures are not expected to be sensitive to the separation distance. One area source had to be treated separately, with the results summed into the others, because CAP88PC did not have enough inputs for all of the areas to be done in combination this year.

The building at the hot lab, included in previous year's reports, was demolished in 1997. The need for facility ventilation ended and the unit was shut down the first week of May of 1997. Remediation of three of the area sources, the 4064 Sideyard and the 17th Street Drainage Area and the Hot Lab 4468 Excavation area, were also completed in 1998 and they are awaiting final survey and regulatory agency release. The 4024 portable exhauster, included in last year's report, was operated in 1998. Detailed analysis of the filters indicated no presence of man-made radioactive isotopes and the dose is assumed to be zero.

Because the point source, with HEPA filtration, releases so little radioactivity, and because the soil resuspension model of RESRAD, used to calculate the potential

airborne releases of area sources, provides a very conservative overestimate of the releases, the area sources show higher estimated doses than the point source.

This report includes the Certification Statement to be signed by M. E. Lee (or designee) for Rocketdyne and by you for the DOE Site Closure Office, required for the final report.

BOEING

If you have any questions or comments on this report, please contact Ray McGinnis at 818/586-6138.

Sincerely,

M. E. Lee, Program Manager
Doe Site Closure

Enclosure: Radionuclide Air Emissions Annual Report
(Individual Dose from Point Sources)

cc: S. Black, DOE/OAK

Shea-067494

DOEAIR98

U. S. Department of Energy
Radionuclide Air Emissions Annual Report
(under Subpart H of 40 CFR Part 61)
Calendar Year 1998

Site Name: Santa Susana Field Laboratory
(Prepared April 17, 1999)

Operations Office Information

Office:	Oakland Operations Office	
Address:	1301 Clay Street	Room 700N
	Oakland, CA 94612-5208	
Contact:	Steve Black	Phone: 510/637-1595

Site Information

Operator:	Rocketdyne Propulsion and Power, The Boeing Company.	
Address:	6633 Canoga Avenue	
	P. O. Box 7922	
	Canoga Park, CA 91309-7922	
Contact:	E. R. McGinnis (T487)	Phone: 818/586-6138

Section I. Facility Information

Site Description

The Santa Susana Field Laboratory is located in a mountainous wilderness region between the residential areas of the Simi and San Fernando Valleys, at the boundary of Ventura and Los Angeles Counties, in southern California (Figure 1). The site consists of approximately 2,850 acres, but DOE operations are limited to a designated area of about 90 acres (Figure 2). The climate is generally dry, with variable winds.

The facility formerly served as a test site for very low-power experimental nuclear reactors and for developmental fuel fabrication, and fuel decladding. For the past nine years, only decontamination and decommissioning operations have been performed and essentially all radioactive material, except for small amounts of residual contamination, has been removed from the site.

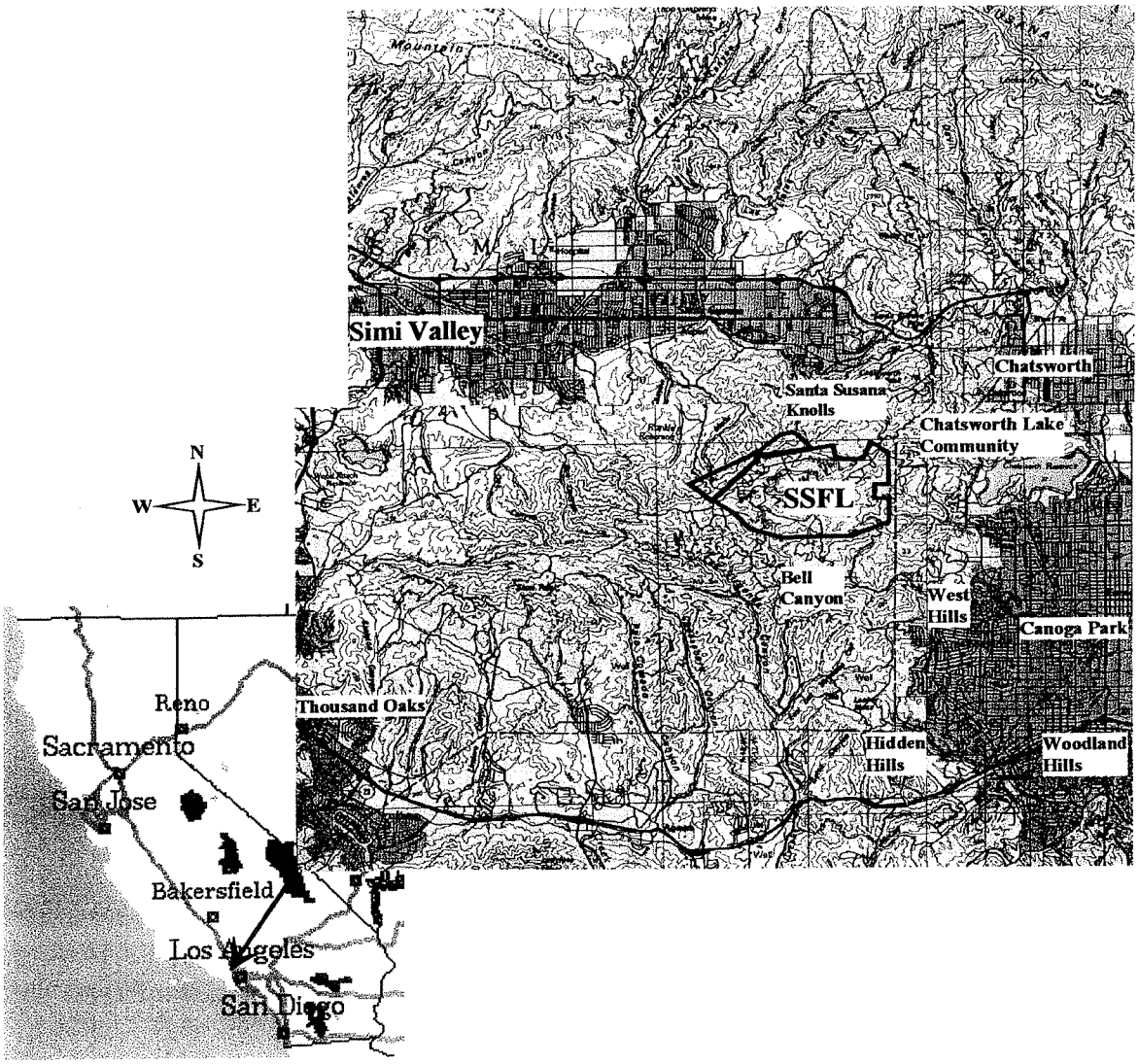

Figure 1. Map Showing Location of SSFL

Subdivisions			
Owner	**Jurisdiction**	**Acres**	**Subtotals**
Rocketdyne	Rocketdyne-Area IV	289.9	
	Rocketdyne	784.8	
	Rocketdyne (Undeveloped land)	1,324.6	2,399.3
Government	NASA (former AFP 57)	409.5	
	NASA (former AFP 64)	41.7	451.2
Total Acres			2,850.5

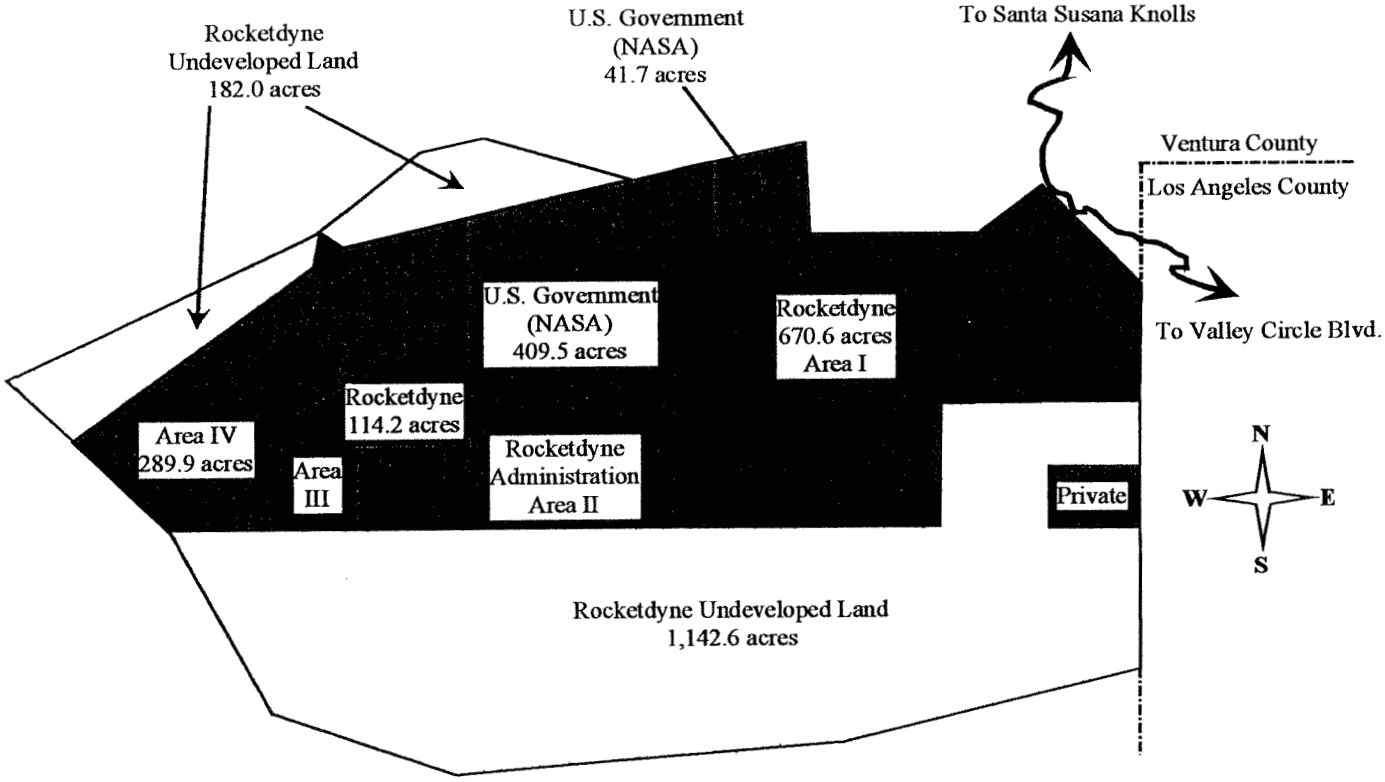

Figure 2-1. Santa Susana Field Laboratory Site Arrangement

Source Description

Potential sources of release of radionuclides at SSFL include both point and area (non-point) sources. Two DOE operating point sources consisted of one facility ventilation exhaust stack and one portable ventilation unit, while the area sources consist of slightly contaminated soil areas, and a seasonally dry water retention sump. Analytical results from effluent and material sampling, identifying and quantifying radionuclides, have been used in preparing this report. Figure 3 shows the locations of the sources.

The RMHF (Radioactive Materials Handling Facility) is used for storage of waste packages waiting shipment to a DOE waste disposal site, evaporation of radioactively contaminated water generated in decontamination operations, and decontamination, size-reduction, and packaging in support of the decontamination operations. Ventilation from work areas in this facility is exhausted through HEPA filters and released from a stack. In the NESHAPs report, this release point is identified as Point Source #1.

Building 4024 was used as a staging and decontamination area for the Hot Laboratory concrete blocks, earlier extracted from the building during remediation activities. A Sprung portable tent was set up with a portable HEPA ventilation system applying negative pressure inside the tent for engineering controls during block decontamination. This unit exhausted to the outside environment. Detailed analysis of the sample filters indicated no man-made radioactive isotopes, therefore, dose calculations were not required for 1998.

Building 4059 is a former low-power reactor test facility, previously used in the development of nuclear reactors in the Systems for Nuclear Auxiliary Power (SNAP) program. Remaining activated steel and concrete structural material have been removed in past decommissioning operations, and effluents were included in prior reports, but no radioactive materials were discharged from this facility in 1998. Ventilation from work areas in this facility is exhausted through HEPA filters and released from a stack, only as needed to provide a breathable atmosphere in the workplace. This ventilation was not required during 1998. Therefore, in this report, the stack is not considered to be a release point for radioactivity.

The RMHF Pond (Sump 614) is a collection sump for rainfall runoff from the RMHF. As it is sometimes dry, sediment may be subject to airborne resuspension by the wind. During 1998, this sump was temporarily dry, and so was subject to windborne dispersal of radioactive material for part of the year. This source is identified as Area Source Number 1.

The 4064 sideyard had two small low-level soil contamination areas that were remediated in 1998. The soil was subject to airborne resuspension and windborne dispersal during the excavation for disposal. This source is identified as Area Source Number 2.

The 17th Street Drainage Area was remediated in 1998. The area consists of the main area (~130 m^2) and 2 hot spots (0.09 m^2 each). The soil was subject to airborne resuspension and windborne dispersal during the excavation for disposal. This source is identified as Area Source Number 3.

During the excavation of the Hot Laboratory Liquid Waste Holdup building, 4468, 4 environmental air samplers were operated. Detailed analysis of the filters showed a small quantity of Cs-137 (equivalent to 0.0006 DCGs) so even though the pre-remediation samples showed the soil to be below site-wide release limits, dose calculations were performed. This excavation site is identified as Area Source Number 4.

The RMHF North Slope is an identified area of low-level soil contamination. Radioactivity in this soil may become airborne by the wind when the soil surface is exposed. However, throughout 1998, the area was covered with dense brush, and no release has been assumed. Therefore, in this NESHAPs report, this area is not considered to be a release point for radioactivity.

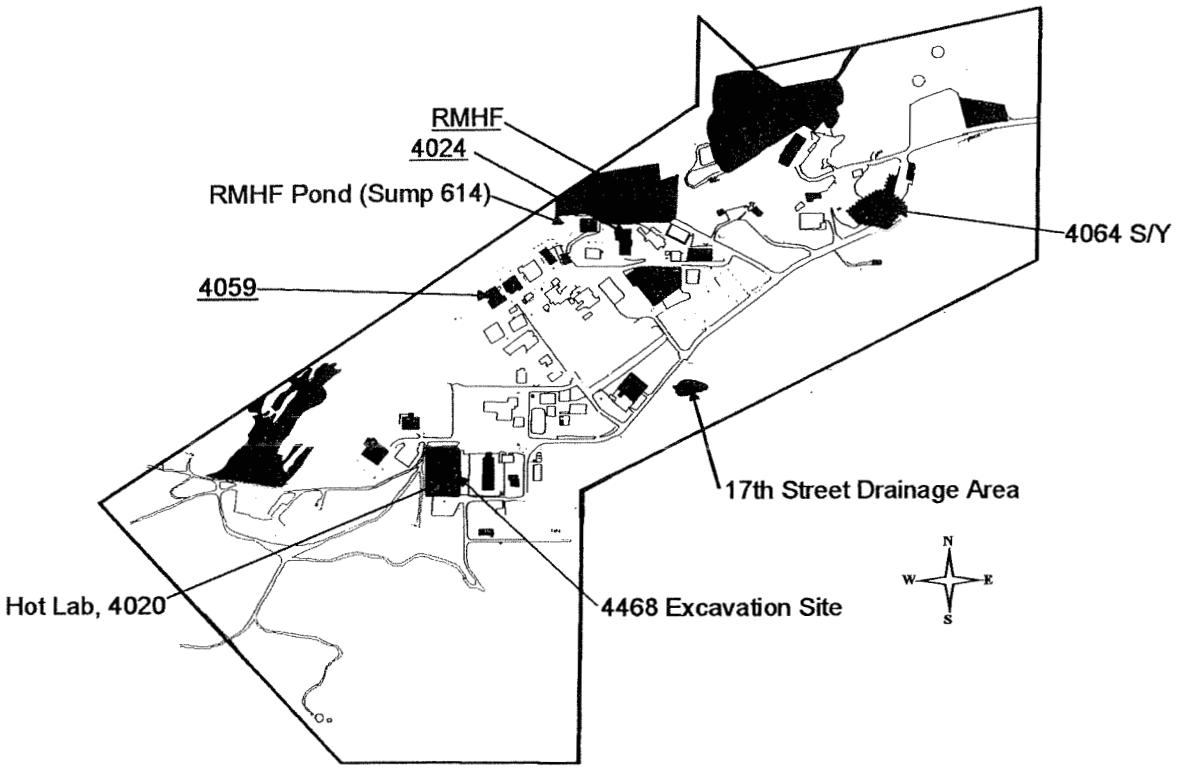

Figure 3. SSFL, Area IV, Source Locations

Section II. Air Emissions Data

Point Source	Type Control	Efficiency	Distance to Nearest Receptor
RMHF (#1)	Pre- and HEPA filters	99.97+%	2320 m SSE

Point Source Radionuclides	Annual Quantity (Ci)	(Bq)
H-3	1.9E-05	703000
Co-60	3.5E-07	12950
Cs-137	8.7E-07	32190
Ba-137M (Cs-137 daughter in equilibrium)	8.2E-07	30452
Pu-239	2.5E-09	93
Pu-240	1.1E-09	40

Area (Non-Point) Sources

Sump 614 (Number 1)

Area (Non-Point) Source Radionuclides	Annual Quantity (Ci)	(Bq)
Co-60	6.8E-09	253
Cs-137	2.6E-07	9720
Ba-137M (Cs-137 daughter in equilibrium)	2.5E-07	9195
Pu-239	8.3E-09	308
Pu-240	3.6E-09	132

4064 Area (Number 2)

Area (Non-Point) Source Radionuclides Location 1	Annual Quantity (Ci)	(Bq)
Sr-90	1.5E-05	570695
Y-90 (Sr-90 daughter in equilibrium)	1.5E-05	570695
Cs-137	4.2E-06	155087
Ba-137M (Cs-137 daughter in equilibrium)	4.0E-06	146713

4064 Location 2

	Annual Quantity (Ci)	(Bq)
Sr-90	3.7E-06	136800
Y-90 (Sr-90 daughter in equilibrium)	3.7E-06	136800
Cs-137	1.0E-06	37000
Ba-137M (Cs-137 daughter in equilibrium)	9.5E-07	35167

17th Street Area (Number 3)

Area (Non-Point) Source Radionuclides Main Area	Annual Quantity (Ci)	(Bq)
Sr-90	1.4E-06	50690
Y-90 (Sr-90 daughter in equilibrium)	1.4E-06	50690
Cs-137	1.9E-05	693439
Ba-137M (Cs-137 daughter in equilibrium)	1.8E-05	655993
Th-228	8.5E-06	314278
Th-232	2.2E-06	81104

17th Street Hot Spot 1	Annual Quantity (Ci)	(Bq)
Sr-90	4.0E-09	131
Y-90 (Sr-90 daughter in equilibrium)	4.0E-09	131
Cs-137	4.9E-08	1795
Ba-137M (Cs-137 daughter in equilibrium)	4.6E-08	1698
Th-228	9.0E-09	341
Th-230	6.0E-09	223
Th-232	3.9E-09	144
U-234	4.6E-09	171
U-235	3.0E-10	12
U-238	3.3E-09	121

17th Street Hot Spot 2	Annual Quantity (Ci)	(Bq)
Sr-90	3.5E-09	131
Y-90 (Sr-90 daughter in equilibrium)	3.5E-09	131
Cs-137	5.3E-08	1955
Ba-137M (Cs-137 daughter in equilibrium)	5.0E-08	1849
Th-228	1.0E-08	380
Th-230	1.2E-09	45
Th-232	2.9E-09	108
U-234	4.3E-09	157
U-235	3.0E-10	10
U-238	4.3E-09	157
Pu-238	2.2E-08	827
Pu-239	2.2E-09	83
Pu-240	1.0E-09	35
Pu-241	1.2E-07	4461
Am-241	1.0E-09	35

Hot Lab 4468 Area (Number 4)

Area (Non-Point) Source Radionuclides	Annual Quantity (Ci)	(Bq)
Sr-90	6.5E-09	241
Y-90 (Sr-90 daughter in equilibrium)	6.5E-09	241
Cs-137	4.5E-08	1651
Ba-137M (Cs-137 daughter in equilibrium)	4.2E-08	1562

Section III. Dose Assessments

Description of Dose Model

The downwind concentration of radioactive material emissions to the atmosphere during 1998 has been calculated with EPA's CAP88-PC computer code, using representative input data, including wind speed, directional frequency, and stability (using meteorological data developed for the SSFL site by the NRC and Argonne National Laboratory [ANL]) plus facility-specific data such as stack heights and exhaust air velocity.

Dose calculations performed to demonstrate compliance with the NESHAPs standard are based on determining the maximum estimated dose to an offsite individual located at a residence, school, business or office. For this purpose, the nearest such locations have been identified by review of maps, aerial photographs, and direct observation. The locations selected are in the nearest residential area of Simi Valley, the Brandeis-Bardin Institute, the Santa Monica Mountains Conservancy Sage Ranch office, the closest residence in Black Canyon, and the closest residence in Bell Canyon. The location with the greatest estimated annual dose calculated for these locations is considered to be the location of the Maximally Exposed Individual (MEI).

The RMHF stack is used for the emission point location, and the resulting estimate of the facility Effective Dose Equivalent is compared with the NESHAPs standard to demonstrate compliance. The CAP88-PC calculation is based on laboratory analysis of an annual composite sample of the effluent, and analysis of evaporator water for tritium, which is assumed to pass through the filters, undiminished.

Dose estimates for the area sources are also calculated. The CAP88-PC calculation uses conservative estimates for the presumed, but unmeasurable, releases from the area sources. The area (non-point) sources' contribution to the facility dose is not included in the total facility dose estimates.

Compliance Assessment

Effective Dose Equivalent, for the point source, which is the only regulated source:
1.3E-06 mrem (1.3E-11 Sv).

Location of Maximally Exposed Individual: residence in Simi Valley, 2867 m NW of RMHF.
This estimated dose is well below the NESHAPs standard of 10 mrem (1.0E-04 Sv).

The estimated dose due to the area (non-point) source is 2.5E-03 mrem (2.5E-8 Sv). Reporting these sources is not a regulatory requirement, however we are reporting them in the interest of providing complete information. The estimate is higher than prior years because of the elevated levels of Thorium found at the 17th Street Drainage Area site (6.2 pCi/g max) (our site-wide release limit is 5.0 pCi/g). The numbers were reran with normal natural levels of Thorium (~ 1 pCi/g), which would not be required, and the exposure decreased to 7.5E-04 mrem (7.5E-09 Sv). With no Thorium the number would have been 6.2E-05 mrem (6.2E-10 Sv). This shows that a small amount of Thorium, even at natural levels, greatly influence the dose calculated.

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).

Maxille Lee Date: 5/27/99
M. E. Lee
DOE Site Closure Program Manager
Rocketdyne Propulsion and Power
The Boeing Company

for Michael Joyce Date: 5/27/99
H. Joma
DOE Site Closure Manager
Oakland Operations Office
U. S. Department of Energy

Section IV. Additional Information

There were no unplanned releases in 1998. The maximum estimated dose due to potential releases from the area sources in 1998 is 2.5E-03 mrem/year (2.5E-8 Sv/year). Since releases from the area sources are too small and diffuse to permit accurate measurements, potential releases were estimated using the same method used in the RESRAD computer program (ANL/ES-160), for calculation of airborne radioactivity due to resuspension of soil by the wind. These estimated releases were used as input in the CAP88-PC program to perform the area source dose assessments. Releases from these sources have not been detectable by onsite continuous ambient air sampling except for the Sump 614 air sampling monitor which indicated Pu-238/239/240, the sum of fractions equal to 0.013 DCGs when compared to the limits of DOE Order 5400.5 (limit = 1.0). The other exception would be the previously mentioned Cs-137 found on the Hot Laboratory, 4468 excavation samples (Section I., Page 6).

One new potential source was added to the report this year. The 17th Street Drainage Area was included as an area source this year because of soil disturbance during remediation activities. See Section I of this report for a description. No new, regulated point sources were added in 1998.

Supplemental Information

The collective Effective Dose Equivalent estimated from DOE operations for releases from the monitored exhaust stack during 1998 is 2.9E-04 person-rem (2.9E-06 person-Sv). The presumed releases, estimated for the area sources, imply an additional collective dose of approximately 8.5E-02 person-rem (8.8E-04 person-Sv). Reducing the 17th Street Drainage Area Thorium to natural levels and totally eliminating the Thorium yields 2.6E-02 person-rem (2.6E-06 person-Sv), and 2.7E-03 person-rem (2.7E-07 person-rem) respectively.

These estimates were calculated by using CAP88-PC in the "POPULATION" mode with a site-specific population distribution, based on 1990 census data, supplemented by estimates of personnel onsite. The population distribution is presented in a structure utilizing 16 directions, coinciding with the wind directions, and 20 radial zones, with the distances chosen to represent the center-of-area for each zone. These zones include the population within 80 km of the site. Doses due to both point and area sources are included, as described above.

No operations are conducted that are regulated by Subparts Q and T, nor are there any emissions of Rn-220 from sources containing U-232 and Th-232. There are no non-disposal/non-storage sources of Rn-222 emission.

Based on evaluation of each source with the assumption of no pollution control equipment installed, none of the sources requires monitoring as prescribed in 40CFR61.93(b). The stack effluent at RMHF is continuously sampled, counted for gross alpha and beta activity weekly, and composited annually for detailed radiochemical analysis. In addition, a sample of the evaporator feedwater is analyzed for tritium, and this measured concentration is used to calculate the release. Ambient air is continuously sampled on a weekly basis, with weekly determination of gross alpha and beta activity, and these samples are composited (separately by location) annually for detailed radiochemical analysis. Aspects of the QA program described by Appendix B, Method 114 are implemented as appropriate for the low level of this surveillance effort.

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 Individual Assessment
Apr 29, 1999 1:35 pm

Facility: RMHF
Address: SSFL, Top of Woolsey Canyon Road, Simi Hills
City: Chatsworth
State: CA Zip: 91311

Effective Dose Equivalent (mrem/year)
1.32E-06

At This Location: 2867 Meters Northwest
Source Category: DOE facility
Source Type: Stack
Emission Year: 1998

Comments: CAP88PC calculation for 1998 Annual Site Environmental Report, Maximum Exposed Individual

Dataset Name: RMHF98IND
Dataset Date: Apr 29, 1999 1:22 pm
Wind File: WNDFILES\SSFLNRC.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 2867 Meters Northwest
Lifetime Fatal Cancer Risk: 3.04E-11

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	1.46E-06
BREAST	1.31E-06
R MAR	1.18E-06
LUNGS	1.43E-06
THYROID	1.37E-06
ENDOST	2.14E-06
RMNDR	1.14E-06
EFFEC	1.32E-06

RADIONUCLIDE EMISSIONS DURING THE YEAR 1998

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
CO-60	Y	1.00	3.5E-07	3.5E-07
CS-137	D	1.00	8.7E-07	8.7E-07
BA-137M	D	1.00	8.2E-07	8.2E-07
H-3	*	0.00	1.9E-05	1.9E-05
PU-239	Y	1.00	2.5E-09	2.5E-09
PU-240	Y	1.00	1.1E-09	1.1E-09

SITE INFORMATION

Temperature:	17 degrees C
Precipitation:	85 cm/y
Mixing Height:	366 m

SOURCE INFORMATION

Source Number: 1

Stack Height (m): 39.60
Diameter (m): 0.92

Plume Rise
Momentum (m/s): 1.11E+01
(Exit Velocity)

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.020	0.000	0.000
Fraction From Assessment Area:	0.000	0.000	0.000
Fraction Imported:	0.980	1.000	1.000

Food Arrays were not generated for this run.
Default Values used.

DISTANCES USED FOR MAXIMUM INDIVIDUAL ASSESSMENT

2867

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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
Apr 29, 1999 1:35 pm

Facility: RMHF
Address: SSFL, Top of Woolsey Canyon Road, Simi Hills
City: Chatsworth
State: CA Zip: 91311

Source Category: DOE facility
Source Type: Stack
Emission Year: 1998

Comments: CAP88PC calculation for 1998 Annual Site Environme
ntal Report, Maximum Exposed Individual

Dataset Name: RMHF98IND
Dataset Date: Apr 29, 1999 1:22 pm
Wind File: WNDFILES\SSFLNRC.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	1.46E-06
BREAST	1.31E-06
R MAR	1.18E-06
LUNGS	1.43E-06
THYROID	1.37E-06
ENDOST	2.14E-06
RMNDR	1.14E-06
EFFEC	1.32E-06

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	2.26E-09
INHALATION	9.72E-08
AIR IMMERSION	4.13E-11
GROUND SURFACE	1.22E-06
INTERNAL	9.95E-08
EXTERNAL	1.22E-06
TOTAL	1.32E-06

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
CO-60	3.80E-07
CS-137	3.47E-09
BA-137M	8.48E-07
H-3	1.98E-10
PU-239	6.30E-08
PU-240	2.70E-08
TOTAL	1.32E-06

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	3.56E-12
BONE	2.53E-13
THYROID	6.21E-13
BREAST	5.14E-12
LUNG	6.10E-12
STOMACH	3.28E-12
BOWEL	1.64E-12
LIVER	3.71E-12
PANCREAS	2.15E-12
URINARY	1.35E-12
OTHER	2.64E-12
TOTAL	3.04E-11

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	4.95E-14
INHALATION	1.02E-12
AIR IMMERSION	9.98E-16
GROUND SURFACE	2.94E-11
INTERNAL	1.07E-12
EXTERNAL	2.94E-11
TOTAL	3.04E-11

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
CO-60	9.29E-12
CS-137	9.13E-14
BA-137M	2.03E-11
H-3	5.41E-15
PU-239	5.10E-13
PU-240	2.18E-13
TOTAL	3.04E-11

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

	Distance (m)
Direction	2867
N	2.5E-07
NNW	7.9E-07
NW	1.3E-06
WNW	7.7E-07
W	2.1E-07
WSW	2.9E-07
SW	3.3E-07
SSW	3.0E-07
S	2.6E-07
SSE	5.6E-07
SE	8.5E-07
ESE	5.2E-07
E	1.8E-07
ENE	2.0E-07
NE	2.3E-07
NNE	2.4E-07

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

	Distance (m)
Direction	2867
N	5.9E-12
NNW	1.8E-11
NW	3.0E-11
WNW	1.8E-11
W	4.9E-12
WSW	6.7E-12
SW	7.6E-12
SSW	6.8E-12
S	6.1E-12
SSE	1.3E-11
SE	1.9E-11
ESE	1.2E-11
E	4.1E-12
ENE	4.7E-12
NE	5.3E-12
NNE	5.6E-12

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
Apr 29, 1999 1:35 pm

Facility: RMHF
Address: SSFL, Top of Woolsey Canyon Road, Simi Hills
City: Chatsworth
State: CA Zip: 91311

Effective Dose Equivalent (mrem/year)
5.49E-06

At This Location: 804 Meters Northwest
Source Category: DOE facility
Source Type: Stack
Emission Year: 1998

Comments: CAP88PC calculation for 1998 Annual Site Environmental Report, Population Dose

Dataset Name: RMHF98POP
Dataset Date: Apr 29, 1999 1:24 pm
Wind File: WNDFILES\SSFLNRC.WND
Population File: POPFILES\SSFL91.POP

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 804 Meters Northwest
Lifetime Fatal Cancer Risk: 1.25E-10

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)	Collective Population (person-rem/y)
GONADS	5.97E-06	3.18E-04
BREAST	5.38E-06	2.87E-04
R MAR	4.89E-06	2.60E-04
LUNGS	6.15E-06	3.27E-04
THYROID	5.60E-06	2.98E-04
ENDOST	9.48E-06	5.03E-04
RMNDR	4.71E-06	2.51E-04
EFFEC	5.49E-06	2.92E-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	9452296	9452296	9.44E-08	9.44E-08

RADIONUCLIDE EMISSIONS DURING THE YEAR 1998

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
CO-60	Y	1.00	3.5E-07	3.5E-07
CS-137	D	1.00	8.7E-07	8.7E-07
BA-137M	D	1.00	8.2E-07	8.2E-07
H-3	*	0.00	1.9E-05	1.9E-05
PU-239	Y	1.00	2.5E-09	2.5E-09
PU-240	Y	1.00	1.1E-09	1.1E-09

SITE INFORMATION

Temperature:	17 degrees C
Precipitation:	85 cm/y
Mixing Height:	366 m

SOURCE INFORMATION

Source Number:	1
Stack Height (m):	39.60
Diameter (m):	0.92
Plume Rise Momentum (m/s): (Exit Velocity)	1.11E+01

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.020	0.000	0.000
Fraction From Assessment Area:	0.000	0.000	0.000
Fraction Imported:	0.980	1.000	1.000

Beef Cattle Density:	8.81E-02
Milk Cattle Density:	2.85E-02
Land Fraction Cultivated for Vegetable Crops:	1.18E-02

POPULATION DATA

	Distance (m)						
Direction	804	2414	4023	5632	7242	8851	10460
N	20	0	937	7718	7403	0	0
NNW	20	0	2084	9596	6032	205	0
NW	10	0	6469	8790	10481	1695	0
WNW	10	0	0	6789	6465	2442	254
W	0	0	0	0	0	4061	1173
WSW	20	0	0	4	483	3822	688
SW	20	0	0	2792	1132	739	6224
SSW	40	0	0	0	3463	7784	6358
S	50	0	2	0	206	1172	0
SSE	20	173	350	0	1851	2295	1787
SE	30	0	1108	1411	7181	8457	9638
ESE	40	40	0	1744	8666	13984	20110
E	15	50	200	1332	3016	5725	16870
ENE	200	40	0	0	605	3329	9258
NE	50	1019	0	7142	3247	0	0
NNE	25	0	368	7010	2437	0	0

	Distance (m)						
Direction	12070	13679	15288	17702	20921	24140	27359
N	0	0	0	0	0	603	3
NNW	0	0	0	0	1635	0	25
NW	0	0	0	0	248	1644	11229
WNW	119	1726	12090	11775	716	1138	102
W	5955	9698	8621	7928	777	12119	11249
WSW	4207	9590	7823	14405	14554	11007	32
SW	3846	6341	6091	4101	95	1275	426
SSW	390	547	256	58	432	4758	1435
S	2652	137	0	816	3384	0	0
SSE	2249	932	705	990	3405	2753	0
SE	10936	8224	5002	4144	2861	9760	26457
ESE	25856	17396	21594	56312	27613	59748	59470
E	17877	17870	21024	63449	69399	128854	122881
ENE	8166	4495	8163	19988	22563	38060	52168
NE	0	937	0	0	11727	31265	12500
NNE	82	0	0	0	1649	1508	11866

	Distance (m)					
Direction	30577	36210	44257	52303	60350	72420
N	0	0	277	0	836	84
NNW	0	0	0	132	0	5484
NW	888	5605	19	413	0	248
WNW	305	27887	1595	12992	16770	16872
W	28461	14184	207750	43913	1217	52
WSW	1527	321	16801	0	0	2
SW	562	0	0	0	0	0
SSW	0	0	0	0	0	0
S	0	0	0	0	0	0
SSE	0	0	0	8868	49248	13112
SE	129817	322872	388476	630029	539551	830783
ESE	62668	358441	878007	705203	587799	1011657
E	97754	151766	111367	140956	79777	180797
ENE	5559	1125	1077	2326	2169	48582
NE	44283	16296	7404	4543	12320	141034
NNE	4539	2187	11	1827	860	2577

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 Population Assessment
Apr 29, 1999 1:35 pm

Facility: RMHF
Address: SSFL, Top of Woolsey Canyon Road, Simi Hills
City: Chatsworth
State: CA Zip: 91311

Source Category: DOE facility
Source Type: Stack
Emission Year: 1998

Comments: CAP88PC calculation for 1998 Annual Site Environmental Report, Population Dose

Dataset Name: RMHF98POP
Dataset Date: Apr 29, 1999 1:24 pm
Wind File: WNDFILES\SSFLNRC.WND
Population File: POPFILES\SSFL91.POP

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)	Collective Population (person-rem/y)
GONADS	5.97E-06	3.18E-04
BREAST	5.38E-06	2.87E-04
R MAR	4.89E-06	2.60E-04
LUNGS	6.15E-06	3.27E-04
THYROID	5.60E-06	2.98E-04
ENDOST	9.48E-06	5.03E-04
RMNDR	4.71E-06	2.51E-04
EFFEC	5.49E-06	2.92E-04

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)	Collective Population (person-rem/y)
INGESTION	9.28E-09	4.98E-07
INHALATION	4.75E-07	2.51E-05
AIR IMMERSION	2.17E-10	1.05E-08
GROUND SURFACE	5.01E-06	2.67E-04
INTERNAL	4.84E-07	2.56E-05
EXTERNAL	5.01E-06	2.67E-04
TOTAL	5.49E-06	2.92E-04

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclides	Selected Individual (mrem/y)	Collective Population (person-rem/y)
CO-60	1.56E-06	8.31E-05
CS-137	1.58E-08	8.34E-07
BA-137M	3.47E-06	1.85E-04
H-3	9.47E-10	8.37E-08
PU-239	3.08E-07	1.62E-05
PU-240	1.32E-07	6.94E-06
TOTAL	5.49E-06	2.92E-04

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk	Total Collective Population Fatal Cancer Risk (Deaths/y)
LEUKEMIA	1.46E-11	1.10E-08
BONE	1.06E-12	8.00E-10
THYROID	2.55E-12	1.92E-09
BREAST	2.10E-11	1.58E-08
LUNG	2.55E-11	1.92E-08
STOMACH	1.34E-11	1.01E-08
BOWEL	6.70E-12	5.05E-09
LIVER	1.53E-11	1.15E-08
PANCREAS	8.83E-12	6.65E-09
URINARY	5.52E-12	4.16E-09
OTHER	1.08E-11	8.13E-09
TOTAL	1.25E-10	9.44E-08

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk	Total Collective Population Fatal Cancer Risk (Deaths/y)
INGESTION	2.03E-13	1.54E-10
INHALATION	5.01E-12	3.74E-09
AIR IMMERSION	5.25E-15	3.60E-12
GROUND SURFACE	1.20E-10	9.05E-08
INTERNAL	5.21E-12	3.90E-09
EXTERNAL	1.20E-10	9.05E-08
TOTAL	1.25E-10	9.44E-08

PATHWAY GENETIC RISK SUMMARY
(Collective Population)

Pathway	Genetic Risk (person-rem/y)
INGESTION	3.64E-07
INHALATION	7.09E-07
AIR IMMERSION	1.04E-08
GROUND SURFACE	2.64E-04
INTERNAL	1.07E-06
EXTERNAL	2.64E-04
TOTAL	2.65E-04

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk	Total Collective Population Fatal Cancer Risk (Deaths/y)
CO-60	3.82E-11	2.88E-08
CS-137	4.15E-13	3.10E-10
BA-137M	8.32E-11	6.26E-08
H-3	2.59E-14	3.23E-11
PU-239	2.49E-12	1.85E-09
PU-240	1.07E-12	7.95E-10
TOTAL	1.25E-10	9.44E-08

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

	Distance (m)						
Direction	804	2414	4023	5632	7242	8851	10460
N	1.1E-06	0.0E+00	1.9E-07	1.4E-07	1.1E-07	0.0E+00	0.0E+00
NNW	3.3E-06	0.0E+00	5.9E-07	4.3E-07	3.4E-07	2.8E-07	0.0E+00
NW	5.5E-06	0.0E+00	9.8E-07	7.1E-07	5.6E-07	4.6E-07	0.0E+00
WNW	3.1E-06	0.0E+00	0.0E+00	4.2E-07	3.3E-07	2.7E-07	2.3E-07
W	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.9E-08	6.7E-08
WSW	1.2E-06	0.0E+00	0.0E+00	1.5E-07	1.2E-07	1.0E-07	8.3E-08
SW	1.6E-06	0.0E+00	0.0E+00	1.7E-07	1.3E-07	1.1E-07	9.2E-08
SSW	1.3E-06	0.0E+00	0.0E+00	0.0E+00	1.2E-07	1.0E-07	8.4E-08
S	1.0E-06	0.0E+00	2.0E-07	0.0E+00	1.1E-07	9.3E-08	0.0E+00
SSE	2.3E-06	6.5E-07	4.1E-07	0.0E+00	2.3E-07	1.9E-07	1.6E-07
SE	3.6E-06	0.0E+00	6.1E-07	4.4E-07	3.5E-07	2.8E-07	2.4E-07
ESE	2.2E-06	6.0E-07	0.0E+00	2.7E-07	2.1E-07	1.8E-07	1.5E-07
E	7.2E-07	2.0E-07	1.3E-07	9.7E-08	7.8E-08	6.4E-08	5.4E-08
ENE	8.6E-07	2.4E-07	0.0E+00	0.0E+00	8.8E-08	7.2E-08	6.1E-08
NE	1.0E-06	2.7E-07	0.0E+00	1.2E-07	9.9E-08	0.0E+00	0.0E+00
NNE	1.1E-06	0.0E+00	1.8E-07	1.3E-07	1.0E-07	0.0E+00	0.0E+00

	Distance (m)						
Direction	12070	13679	15288	17702	20921	24140	27359
N	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.7E-08	2.3E-08
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.0E-07	0.0E+00	7.0E-08
NW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.7E-07	1.4E-07	1.2E-07
WNW	1.9E-07	1.7E-07	1.5E-07	1.2E-07	9.9E-08	8.1E-08	6.8E-08
W	5.7E-08	4.9E-08	4.3E-08	3.6E-08	2.9E-08	2.3E-08	1.9E-08
WSW	7.1E-08	6.2E-08	5.4E-08	4.5E-08	3.7E-08	3.0E-08	2.6E-08
SW	7.9E-08	6.9E-08	6.1E-08	5.1E-08	4.2E-08	3.5E-08	3.0E-08
SSW	7.2E-08	6.3E-08	5.5E-08	4.6E-08	3.8E-08	3.1E-08	2.7E-08
S	6.6E-08	5.7E-08	0.0E+00	4.2E-08	3.4E-08	0.0E+00	0.0E+00
SSE	1.4E-07	1.2E-07	1.0E-07	8.7E-08	7.1E-08	5.8E-08	0.0E+00
SE	2.0E-07	1.8E-07	1.6E-07	1.3E-07	1.1E-07	8.9E-08	7.6E-08
ESE	1.3E-07	1.1E-07	9.6E-08	8.1E-08	6.6E-08	5.4E-08	4.6E-08
E	4.6E-08	3.9E-08	3.4E-08	2.9E-08	2.3E-08	1.9E-08	1.6E-08
ENE	5.2E-08	4.5E-08	3.9E-08	3.3E-08	2.6E-08	2.1E-08	1.8E-08
NE	0.0E+00	5.0E-08	0.0E+00	0.0E+00	3.0E-08	2.4E-08	2.1E-08
NNE	6.1E-08	0.0E+00	0.0E+00	0.0E+00	3.1E-08	2.6E-08	2.2E-08

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

	Distance (m)					
Direction	30577	36210	44257	52303	60350	72420
N	0.0E+00	0.0E+00	1.1E-08	0.0E+00	6.0E-09	4.3E-09
NNW	0.0E+00	0.0E+00	0.0E+00	2.7E-08	0.0E+00	1.4E-08
NW	1.0E-07	8.1E-08	6.0E-08	4.6E-08	0.0E+00	2.5E-08
WNW	5.9E-08	4.7E-08	3.5E-08	2.6E-08	1.9E-08	1.4E-08
W	1.7E-08	1.3E-08	9.6E-09	7.0E-09	4.9E-09	3.5E-09
WSW	2.2E-08	1.8E-08	1.4E-08	0.0E+00	0.0E+00	6.0E-09
SW	2.6E-08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
SSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
SSE	0.0E+00	0.0E+00	0.0E+00	2.1E-08	1.5E-08	1.2E-08
SE	6.6E-08	5.4E-08	4.1E-08	3.2E-08	2.4E-08	1.8E-08
ESE	4.0E-08	3.2E-08	2.5E-08	1.9E-08	1.4E-08	1.1E-08
E	1.3E-08	1.0E-08	7.6E-09	5.6E-09	4.0E-09	2.8E-09
ENE	1.6E-08	1.2E-08	9.0E-09	6.7E-09	4.8E-09	3.5E-09
NE	1.8E-08	1.4E-08	1.0E-08	7.8E-09	5.7E-09	4.2E-09
NNE	1.9E-08	1.5E-08	1.1E-08	8.1E-09	5.9E-09	4.3E-09

COLLECTIVE EFFECTIVE DOSE EQUIVALENT (person rem/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	804	2414	4023	5632	7242	8851	10460
N	2.2E-08	0.0E+00	1.8E-07	1.1E-06	8.2E-07	0.0E+00	0.0E+00
NNW	6.6E-08	0.0E+00	1.2E-06	4.1E-06	2.0E-06	5.6E-08	0.0E+00
NW	5.5E-08	0.0E+00	6.3E-06	6.2E-06	5.9E-06	7.8E-07	0.0E+00
WNW	3.1E-08	0.0E+00	0.0E+00	2.8E-06	2.1E-06	6.6E-07	5.8E-08
W	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.2E-07	7.8E-08
WSW	2.4E-08	0.0E+00	0.0E+00	6.2E-10	5.9E-08	3.8E-07	5.7E-08
SW	3.2E-08	0.0E+00	0.0E+00	4.7E-07	1.5E-07	8.1E-08	5.7E-07
SSW	5.3E-08	0.0E+00	0.0E+00	0.0E+00	4.2E-07	7.8E-07	5.4E-07
S	5.2E-08	0.0E+00	3.9E-10	0.0E+00	2.3E-08	1.1E-07	0.0E+00
SSE	4.7E-08	1.1E-07	1.4E-07	0.0E+00	4.3E-07	4.3E-07	2.8E-07
SE	1.1E-07	0.0E+00	6.8E-07	6.2E-07	2.5E-06	2.4E-06	2.3E-06
ESE	8.7E-08	2.4E-08	0.0E+00	4.7E-07	1.9E-06	2.5E-06	3.0E-06
E	1.1E-08	1.0E-08	2.6E-08	1.3E-07	2.3E-07	3.7E-07	9.1E-07
ENE	1.7E-07	9.4E-09	0.0E+00	0.0E+00	5.3E-08	2.4E-07	5.6E-07
NE	5.0E-08	2.7E-07	0.0E+00	8.8E-07	3.2E-07	0.0E+00	0.0E+00
NNE	2.6E-08	0.0E+00	6.6E-08	9.2E-07	2.6E-07	0.0E+00	0.0E+00

	Distance (m)						
Direction	12070	13679	15288	17702	20921	24140	27359
N	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.6E-08	6.8E-11
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.6E-07	0.0E+00	1.7E-09
NW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.2E-08	2.3E-07	1.3E-06
WNW	2.3E-08	2.9E-07	1.8E-06	1.4E-06	7.1E-08	9.2E-08	7.0E-09
W	3.4E-07	4.8E-07	3.7E-07	2.8E-07	2.2E-08	2.8E-07	2.2E-07
WSW	3.0E-07	5.9E-07	4.2E-07	6.5E-07	5.3E-07	3.3E-07	8.2E-10
SW	3.0E-07	4.4E-07	3.7E-07	2.1E-07	4.0E-09	4.5E-08	1.3E-08
SSW	2.8E-08	3.4E-08	1.4E-08	2.7E-09	1.6E-08	1.5E-07	3.8E-08
S	1.8E-07	7.8E-09	0.0E+00	3.4E-08	1.1E-07	0.0E+00	0.0E+00
SSE	3.1E-07	1.1E-07	7.3E-08	8.6E-08	2.4E-07	1.6E-07	0.0E+00
SE	2.2E-06	1.5E-06	7.8E-07	5.5E-07	3.1E-07	8.7E-07	2.0E-06
ESE	3.3E-06	1.9E-06	2.1E-06	4.6E-06	1.8E-06	3.2E-06	2.7E-06
E	8.2E-07	7.0E-07	7.2E-07	1.8E-06	1.6E-06	2.4E-06	1.9E-06
ENE	4.2E-07	2.0E-07	3.2E-07	6.5E-07	5.9E-07	8.1E-07	9.4E-07
NE	0.0E+00	4.7E-08	0.0E+00	0.0E+00	3.5E-07	7.6E-07	2.6E-07
NNE	5.0E-09	0.0E+00	0.0E+00	0.0E+00	5.2E-08	3.9E-08	2.6E-07

COLLECTIVE EFFECTIVE DOSE EQUIVALENT (person rem/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	30577	36210	44257	52303	60350	72420
N	0.0E+00	0.0E+00	3.1E-09	0.0E+00	5.0E-09	3.6E-10
NNW	0.0E+00	0.0E+00	0.0E+00	3.6E-09	0.0E+00	7.9E-08
NW	9.0E-08	4.5E-07	1.1E-09	1.9E-08	0.0E+00	6.1E-09
WNW	1.8E-08	1.3E-06	5.6E-08	3.4E-07	3.2E-07	2.4E-07
W	4.7E-07	1.9E-07	2.0E-06	3.1E-07	6.0E-09	1.8E-10
WSW	3.4E-08	5.8E-09	2.3E-07	0.0E+00	0.0E+00	1.2E-11
SW	1.5E-08	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
SSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
SSE	0.0E+00	0.0E+00	0.0E+00	1.8E-07	7.6E-07	1.5E-07
SE	8.6E-06	1.7E-05	1.6E-05	2.0E-05	1.3E-05	1.5E-05
ESE	2.5E-06	1.2E-05	2.2E-05	1.3E-05	8.3E-06	1.1E-05
E	1.3E-06	1.6E-06	8.5E-07	7.9E-07	3.2E-07	5.1E-07
ENE	8.6E-08	1.4E-08	9.7E-09	1.6E-08	1.0E-08	1.7E-07
NE	7.8E-07	2.3E-07	7.7E-08	3.6E-08	7.0E-08	5.9E-07
NNE	8.4E-08	3.2E-08	1.2E-10	1.5E-08	5.1E-09	1.1E-08

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

	Distance (m)						
Direction	804	2414	4023	5632	7242	8851	10460
N	2.5E-11	0.0E+00	4.4E-12	3.2E-12	2.5E-12	0.0E+00	0.0E+00
NNW	7.5E-11	0.0E+00	1.3E-11	9.7E-12	7.7E-12	6.3E-12	0.0E+00
NW	1.3E-10	0.0E+00	2.2E-11	1.6E-11	1.3E-11	1.0E-11	0.0E+00
WNW	7.2E-11	0.0E+00	0.0E+00	9.5E-12	7.5E-12	6.2E-12	5.2E-12
W	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.8E-12	1.5E-12
WSW	2.7E-11	0.0E+00	0.0E+00	3.5E-12	2.8E-12	2.3E-12	1.9E-12
SW	3.6E-11	0.0E+00	0.0E+00	3.9E-12	3.1E-12	2.5E-12	2.1E-12
SSW	3.0E-11	0.0E+00	0.0E+00	0.0E+00	2.8E-12	2.3E-12	1.9E-12
S	2.4E-11	0.0E+00	4.5E-12	0.0E+00	2.6E-12	2.1E-12	0.0E+00
SSE	5.3E-11	1.5E-11	9.3E-12	0.0E+00	5.3E-12	4.3E-12	3.6E-12
SE	8.2E-11	0.0E+00	1.4E-11	1.0E-11	7.9E-12	6.5E-12	5.4E-12
ESE	5.0E-11	1.4E-11	0.0E+00	6.2E-12	4.9E-12	4.0E-12	3.4E-12
E	1.6E-11	4.7E-12	3.0E-12	2.2E-12	1.8E-12	1.5E-12	1.2E-12
ENE	2.0E-11	5.5E-12	0.0E+00	0.0E+00	2.0E-12	1.7E-12	1.4E-12
NE	2.3E-11	6.2E-12	0.0E+00	2.8E-12	2.3E-12	0.0E+00	0.0E+00
NNE	2.4E-11	0.0E+00	4.2E-12	3.0E-12	2.4E-12	0.0E+00	0.0E+00

	Distance (m)						
Direction	12070	13679	15288	17702	20921	24140	27359
N	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.1E-13	5.2E-13
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.3E-12	0.0E+00	1.6E-12
NW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.8E-12	3.2E-12	2.7E-12
WNW	4.4E-12	3.8E-12	3.3E-12	2.8E-12	2.3E-12	1.8E-12	1.6E-12
W	1.3E-12	1.1E-12	9.8E-13	8.1E-13	6.5E-13	5.3E-13	4.4E-13
WSW	1.6E-12	1.4E-12	1.2E-12	1.0E-12	8.4E-13	6.9E-13	5.9E-13
SW	1.8E-12	1.6E-12	1.4E-12	1.2E-12	9.7E-13	8.1E-13	6.9E-13
SSW	1.6E-12	1.4E-12	1.3E-12	1.1E-12	8.6E-13	7.1E-13	6.1E-13
S	1.5E-12	1.3E-12	0.0E+00	9.6E-13	7.7E-13	0.0E+00	0.0E+00
SSE	3.1E-12	2.7E-12	2.4E-12	2.0E-12	1.6E-12	1.3E-12	0.0E+00
SE	4.6E-12	4.0E-12	3.6E-12	3.0E-12	2.5E-12	2.0E-12	1.7E-12
ESE	2.9E-12	2.5E-12	2.2E-12	1.8E-12	1.5E-12	1.2E-12	1.1E-12
E	1.0E-12	9.0E-13	7.9E-13	6.6E-13	5.2E-13	4.3E-13	3.6E-13
ENE	1.2E-12	1.0E-12	9.0E-13	7.5E-13	6.0E-13	4.9E-13	4.1E-13
NE	0.0E+00	1.1E-12	0.0E+00	0.0E+00	6.8E-13	5.6E-13	4.7E-13
NNE	1.4E-12	0.0E+00	0.0E+00	0.0E+00	7.2E-13	5.8E-13	4.9E-13

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

	Distance (m)					
Direction	30577	36210	44257	52303	60350	72420
N	0.0E+00	0.0E+00	2.6E-13	0.0E+00	1.4E-13	1.0E-13
NNW	0.0E+00	0.0E+00	0.0E+00	6.2E-13	0.0E+00	3.3E-13
NW	2.3E-12	1.8E-12	1.4E-12	1.0E-12	0.0E+00	5.6E-13
WNW	1.3E-12	1.1E-12	7.9E-13	6.0E-13	4.4E-13	3.2E-13
W	3.8E-13	3.0E-13	2.2E-13	1.6E-13	1.1E-13	8.0E-14
WSW	5.1E-13	4.1E-13	3.1E-13	0.0E+00	0.0E+00	1.4E-13
SW	6.1E-13	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
SSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
SSE	0.0E+00	0.0E+00	0.0E+00	4.7E-13	3.5E-13	2.7E-13
SE	1.5E-12	1.2E-12	9.4E-13	7.3E-13	5.5E-13	4.2E-13
ESE	9.2E-13	7.4E-13	5.6E-13	4.3E-13	3.2E-13	2.4E-13
E	3.1E-13	2.4E-13	1.7E-13	1.3E-13	9.1E-14	6.4E-14
ENE	3.6E-13	2.8E-13	2.1E-13	1.5E-13	1.1E-13	8.0E-14
NE	4.1E-13	3.2E-13	2.4E-13	1.8E-13	1.3E-13	9.6E-14
NNE	4.3E-13	3.4E-13	2.5E-13	1.9E-13	1.4E-13	9.8E-14

COLLECTIVE FATAL CANCER RATE (deaths/y)
(All Radionuclides and Pathways)

	Distance (m)						
Direction	804	2414	4023	5632	7242	8851	10460
N	7.1E-12	0.0E+00	5.8E-11	3.5E-10	2.6E-10	0.0E+00	0.0E+00
NNW	2.1E-11	0.0E+00	4.0E-10	1.3E-09	6.6E-10	1.8E-11	0.0E+00
NW	1.8E-11	0.0E+00	2.1E-09	2.0E-09	1.9E-09	2.5E-10	0.0E+00
WNW	1.0E-11	0.0E+00	0.0E+00	9.2E-10	6.9E-10	2.1E-10	1.9E-11
W	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.0E-10	2.5E-11
WSW	7.8E-12	0.0E+00	0.0E+00	2.0E-13	1.9E-11	1.2E-10	1.9E-11
SW	1.0E-11	0.0E+00	0.0E+00	1.5E-10	4.9E-11	2.6E-11	1.9E-10
SSW	1.7E-11	0.0E+00	0.0E+00	0.0E+00	1.4E-10	2.5E-10	1.7E-10
S	1.7E-11	0.0E+00	1.3E-13	0.0E+00	7.5E-12	3.5E-11	0.0E+00
SSE	1.5E-11	3.7E-11	4.6E-11	0.0E+00	1.4E-10	1.4E-10	9.1E-11
SE	3.5E-11	0.0E+00	2.2E-10	2.0E-10	8.0E-10	7.7E-10	7.4E-10
ESE	2.8E-11	7.8E-12	0.0E+00	1.5E-10	6.0E-10	7.9E-10	9.6E-10
E	3.5E-12	3.3E-12	8.6E-12	4.2E-11	7.6E-11	1.2E-10	2.9E-10
ENE	5.6E-11	3.1E-12	0.0E+00	0.0E+00	1.7E-11	7.8E-11	1.8E-10
NE	1.6E-11	9.0E-11	0.0E+00	2.9E-10	1.0E-10	0.0E+00	0.0E+00
NNE	8.5E-12	0.0E+00	2.2E-11	3.0E-10	8.3E-11	0.0E+00	0.0E+00

	Distance (m)						
Direction	12070	13679	15288	17702	20921	24140	27359
N	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.2E-12	2.2E-14
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.3E-11	0.0E+00	5.6E-13
NW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-11	7.3E-11	4.2E-10
WNW	7.4E-12	9.3E-11	5.7E-10	4.6E-10	2.3E-11	3.0E-11	2.2E-12
W	1.1E-10	1.5E-10	1.2E-10	9.1E-11	7.2E-12	9.0E-11	7.1E-11
WSW	9.6E-11	1.9E-10	1.4E-10	2.1E-10	1.7E-10	1.1E-10	2.7E-13
SW	9.8E-11	1.4E-10	1.2E-10	6.8E-11	1.3E-12	1.5E-11	4.2E-12
SSW	9.1E-12	1.1E-11	4.6E-12	8.7E-13	5.3E-12	4.8E-11	1.2E-11
S	5.7E-11	2.5E-12	0.0E+00	1.1E-11	3.7E-11	0.0E+00	0.0E+00
SSE	9.8E-11	3.5E-11	2.4E-11	2.8E-11	7.8E-11	5.2E-11	0.0E+00
SE	7.2E-10	4.7E-10	2.5E-10	1.8E-10	9.9E-11	2.8E-10	6.5E-10
ESE	1.0E-09	6.1E-10	6.7E-10	1.5E-09	5.9E-10	1.0E-09	8.9E-10
E	2.6E-10	2.3E-10	2.3E-10	5.9E-10	5.1E-10	7.7E-10	6.2E-10
ENE	1.4E-10	6.5E-11	1.0E-10	2.1E-10	1.9E-10	2.6E-10	3.0E-10
NE	0.0E+00	1.5E-11	0.0E+00	0.0E+00	1.1E-10	2.5E-10	8.3E-11
NNE	1.6E-12	0.0E+00	0.0E+00	0.0E+00	1.7E-11	1.2E-11	8.3E-11

COLLECTIVE FATAL CANCER RATE (deaths/y)
(All Radionuclides and Pathways)

	Distance (m)					
Direction	30577	36210	44257	52303	60350	72420
N	0.0E+00	0.0E+00	1.0E-12	0.0E+00	1.6E-12	1.2E-13
NNW	0.0E+00	0.0E+00	0.0E+00	1.1E-12	0.0E+00	2.5E-11
NW	2.9E-11	1.5E-10	3.7E-13	6.1E-12	0.0E+00	2.0E-12
WNW	5.8E-12	4.2E-10	1.8E-11	1.1E-10	1.0E-10	7.6E-11
W	1.5E-10	6.0E-11	6.4E-10	1.0E-10	1.9E-12	5.9E-14
WSW	1.1E-11	1.9E-12	7.4E-11	0.0E+00	0.0E+00	3.9E-15
SW	4.8E-12	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
SSW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
S	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
SSE	0.0E+00	0.0E+00	0.0E+00	5.9E-11	2.5E-10	5.0E-11
SE	2.8E-09	5.6E-09	5.1E-09	6.5E-09	4.2E-09	5.0E-09
ESE	8.1E-10	3.7E-09	6.9E-09	4.3E-09	2.7E-09	3.5E-09
E	4.2E-10	5.1E-10	2.7E-10	2.6E-10	1.0E-10	1.6E-10
ENE	2.8E-11	4.5E-12	3.1E-12	5.1E-12	3.4E-12	5.5E-11
NE	2.5E-10	7.4E-11	2.5E-11	1.2E-11	2.3E-11	1.9E-10
NNE	2.7E-11	1.0E-11	3.9E-14	4.8E-12	1.6E-12	3.6E-12