Information, Space & Defense Systems
Rocketdyne Propulsion & Power
Energy Technology Engineering Center
P.O. Box 7930
Canoga Park, CA 91309-7930

June 12, 1998
In reply refer to 98ETEC DRF-0174

BOEING

H. Joma
Manager, ETEC Site Office
U. S. Department of Energy
ETEC Site Office (SSFL, Mail Stop T038)
P. O. Box 7929
Canoga Park, CA 91309-7929

Subject: NESHAPs Report for 1997

Dear Mr. Joma:

Enclosed is the NESHAPs (National Emission Standards for Hazardous Air Pollutants - Radionuclides) Report for 1997 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 1997, 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 two point sources, RMHF and T024, treated in combination, and includes exposure for three area sources, also treated in combination. The point sources, single ventilation exhaust stacks at the two facilities, were treated in combination because of their close proximity, 70 meters. 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.

The building at T020, included in previous years reports, was demolished in 1997. The need for facility ventilation ended and the unit was shut down the first week of May of 1997. Detailed analysis of the stack monitoring filters showed no manmade isotopes, so there was no exposure to calculate. Remediation of one of the area sources was also completed in 1997 and is awaiting final survey, sampling and release.

The area sources show much higher estimated doses than the point sources in part because the point sources, with HEPA filtration, release so little radioactivity, and in part because the soil resuspension model of RESRAD, used to calculate the potential airborne releases of area sources, provides a conservative overestimate of the releases.

This report includes the Certification Statement to be signed by M. J. Gabler (or designee) for Rocketdyne and by you for the ETEC Site Office, required for the final report.

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

Sincerely,

M. E. Lee, Program Manager
Environmental Programs
Energy Technology Engineering Center

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

cc: S. Lasell, DOE/OAK

Shea-015110

DOEAIR97

U. S. Department of Energy
Radionuclide Air Emissions Annual Report
(under Subpart H of 40 CFR Part 61)
Calendar Year 1997

Site Name: Santa Susana Field Laboratory
(Prepared April 17, 1997)

Operations Office Information

Office:	Oakland Operations Office	
Address:	1301 Clay Street	Room 700N
	Oakland, CA 94612-5208	
Contact:	Steve Lasell	Phone: 510/637-1602

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. The site consists of approximately 2,668 acres, but DOE operations are limited to a designated area of about 90 acres. 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.

Source Description

Potential sources of release of radionuclides at SSFL include both point and area (non-point) sources. Three DOE operating point sources consisted of one facility ventilation exhaust stack and two portable ventilation units, 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.

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.

The Hot Laboratory (T020) was in the process of demolition for decommissioning. Ventilation from work areas in this facility was exhausted through HEPA filters in a portable unit and released through the attached stack. The effluent was monitored to EPA standards and the filter media was sent to an outside radiochemical laboratory for detailed analysis. The results showed no detectable manmade radioactivity. For the purpose of this report, there were no calculable doses to the public and all off site exposures were zero.

Building T024, 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 and in this report, is identified as Point Source #2

(Building T059 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 1997. 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 1997. 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 1997, 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 Side Yard of Building T064 and adjacent areas still contained some contaminated soil which was remediated in 1997. These areas were cleared of brush and so were temporarily exposed to airborne resuspension by the wind. Excavation work was performed during part of the year. This source is identified as Area Source Number 2.

The Hot Laboratory building was demolished during 1997. Demolition operations resuspended some of the facility soil into the air. Four environmental air samplers were run during operation hours. Detailed analysis of the filters showed a trace of Cs-137 in the North filter set. This source is identified as Area Source Number 3.

(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 1997, 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.)

(In 1997, expanded sampling of the Area IV survey plan indicated a new area of low level soil contamination, designated the 17th Street Drainage Area . Throughout 1997, it also was covered with dense brush, and subsequently not considered to be a release point for radioactivity.)

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	1.4E-05	506700
Co-60	9.7E-07	35730
Sr-90	3.3E-07	12300
Y-90 (Sr-90 daughter in equilibrium)	3.3E-07	12300
Cs-137	3.0E-06	111100
Ba-137M (Cs-137 daughter in equilibrium)	2.8E-06	103690

T024 (#2)	Pre- and HEPA filters	99.97+%	2350 m SSE (approx.)

Point Source Radionuclides	Annual Quantity (Ci)	(Bq)
Cs-137	3.1E-08	1158
Ba-137M (Cs-137 daughter in equilibrium)	3.0E-08	1121

Area (Non-Point) Sources

Sump 614 (Number 1)

Area (Non-Point) Source Radionuclides	Annual Quantity (Ci)	(Bq)
Co-60	1.3E-07	4736
Sr-90	1.4E-07	5291
Y-90 (Sr-90 daughter in equilibrium)	1.4E-07	5291
Cs-137	4.1E-06	150700
Ba-137M (Cs-137 daughter in equilibrium)	3.9E-06	142560

T064 Area (Number 2)

Area (Non-Point) Source Radionuclides	Annual Quantity (Ci)	(Bq)
Sr-90	3.9E-06	142700
Y-90 (Sr-90 daughter in equilibrium)	3.9E-06	142700
Cs-137	1.0E-06	37850
Ba-137M (Cs-137 daughter in equilibrium)	9.5E-06	35810

T020 Area (Number 3)

Area (Non-Point) Source Radionuclides	Annual Quantity (Ci)	(Bq)
Sr-90	4.5E-07	16500
Y-90 (Sr-90 daughter in equilibrium)	4.5-07	16500
Cs-137	1.2E-06	42700
Ba-137M (Cs-137 daughter in equilibrium)	1.1E-06	40390

Section III. Dose Assessments

Description of Dose Model

The EPA computer program CAP88-PC is used.

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 and the T024 ventilation unit are used for the emission point locations, 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 for the RMHF stack only, analysis of evaporator water for tritium, which is assumed to pass through the filters, undiminished.

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

Compliance Assessment

Effective Dose Equivalent, for the point sources, which are the only regulated sources:
2.7E-06 mrem (2.7E-11 Sv).

Location of Maximally Exposed Individual: residence in Simi Valley, 2867 m NW of RMHF and T024.

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 155.0E-06 mrem (155.0E-11 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 greater number of days the RMHF sump was dry, and because of the addition of the T020 yard soil

release.. This area was in active remediation during 1997.

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).

Date: 6/12/98

M. J. Gabler
ETEC General Manager
Rocketdyne Propulsion and Power
The Boeing Company

Date: 6/12/98

H. Joma
ETEC Site Manager
Oakland Operations Office
U. S. Department of Energy

Section IV. Additional Information

There were no unplanned releases in 1997. The maximum estimated dose due to potential releases from the area sources in 1997 is 155.0E-06 mrem/year (155.0E-11 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.

Three new potential sources were added to the report this year; Building T024 staging/decontamination area, the 17th Street Drainage Area, and the Hot Laboratory contaminated soil area. See Section I of this report for descriptions.

Supplemental Information

The collective Effective Dose Equivalent estimated from DOE operations for releases from the monitored exhaust stack during 1997 is 6.8E-04 person-rem (6.8E-06 person-Sv). The presumed releases, estimated for the area sources, imply an additional collective dose of approximately 6.2E-03 person-rem (6.2E-05 person-Sv).

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, 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
May 8, 1998 8:44 pm

Facility: RMHF AND T024
Address: SSFL, Top of Woolsey Canyon Road, Simi Hills
City: Chatsworth
State: CA Zip: 91311

Effective Dose Equivalent
(mrem/year)

2.69E-06

At This Location: 2867 Meters Northwest
Source Category: DOE faciliies
Source Type: Stack
Emission Year: 1997

Comments: CAP88PC calculation for 1997 Annual Site Environmental Report, Maximum Exposed Individual

Dataset Name: DOEPOINT97IND
Dataset Date: May 8, 1998 8:41 pm
Wind File: WNDFILES\SSFLNRC.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 2867 Meters Northwest
Lifetime Fatal Cancer Risk: 6.49E-11

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	3.14E-06
BREAST	2.86E-06
R MAR	2.44E-06
LUNGS	2.46E-06
THYROID	2.97E-06
ENDOST	2.73E-06
RMNDR	2.40E-06
EFFEC	2.69E-06

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	Source #2 Ci/y	TOTAL Ci/y
CO-60	Y	1.00	9.7E-07	0.0E+00	9.7E-07
SR-90	D	1.00	3.3E-07	0.0E+00	3.3E-07
Y-90	Y	1.00	3.3E-07	0.0E+00	3.3E-07
CS-137	D	1.00	3.0E-06	3.1E-08	3.0E-06
BA-137M	D	1.00	2.8E-06	3.0E-08	2.9E-06
H-3	*	0.00	1.4E-05	0.0E+00	1.4E-05

SITE INFORMATION

Temperature:	17 degrees C
Precipitation:	40 cm/y
Mixing Height:	366 m

SOURCE INFORMATION

Source Number:	1	2
Stack Height (m):	39.60	0.50
Diameter (m):	0.92	0.30
Plume Rise Momentum (m/s): (Exit Velocity)	1.25E+01	0.00E+00

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

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 8, 1998 8:44 pm

Facility: RMHF AND T024
Address: SSFL, Top of Woolsey Canyon Road, Simi Hills
City: Chatsworth
State: CA Zip: 91311

Source Category: DOE faciliies
Source Type: Stack
Emission Year: 1997

Comments: CAP88PC calculation for 1997 Annual Site Environme
ntal Report, Maximum Exposed Individual

Dataset Name: DOEPOINT97IND
Dataset Date: May 8, 1998 8:41 pm
Wind File: WNDFILES\SSFLNRC.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	3.14E-06
BREAST	2.86E-06
R MAR	2.44E-06
LUNGS	2.46E-06
THYROID	2.97E-06
ENDOST	2.73E-06
RMNDR	2.40E-06
EFFEC	2.69E-06

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	6.61E-09
INHALATION	2.72E-08
AIR IMMERSION	1.10E-10
GROUND SURFACE	2.66E-06
INTERNAL	3.39E-08
EXTERNAL	2.66E-06
TOTAL	2.69E-06

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
CO-60	6.86E-07
SR-90	7.75E-09
Y-90	2.19E-10
CS-137	1.05E-08
BA-137M	1.99E-06
H-3	1.39E-10
TOTAL	2.69E-06

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	7.73E-12
BONE	4.80E-13
THYROID	1.35E-12
BREAST	1.12E-11
LUNG	1.23E-11
STOMACH	7.14E-12
BOWEL	3.56E-12
LIVER	7.80E-12
PANCREAS	4.69E-12
URINARY	2.93E-12
OTHER	5.73E-12
TOTAL	6.49E-11

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	1.49E-13
INHALATION	9.26E-13
AIR IMMERSION	2.65E-15
GROUND SURFACE	6.38E-11
INTERNAL	1.08E-12
EXTERNAL	6.38E-11
TOTAL	6.49E-11

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
CO-60	1.69E-11
SR-90	1.32E-13
Y-90	7.73E-15
CS-137	2.78E-13
BA-137M	4.76E-11
H-3	3.79E-15
TOTAL	6.49E-11

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

	Distance (m)
Direction	2867
N	5.0E-07
NNW	1.6E-06
NW	2.7E-06
WNW	1.6E-06
W	4.1E-07
WSW	5.9E-07
SW	6.7E-07
SSW	6.0E-07
S	5.3E-07
SSE	1.2E-06
SE	1.8E-06
ESE	1.1E-06
E	3.4E-07
ENE	4.0E-07
NE	4.5E-07
NNE	4.8E-07

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

	Distance (m)
Direction	2867
N	1.2E-11
NNW	3.9E-11
NW	6.5E-11
WNW	3.8E-11
W	9.8E-12
WSW	1.4E-11
SW	1.6E-11
SSW	1.4E-11
S	1.3E-11
SSE	2.8E-11
SE	4.2E-11
ESE	2.6E-11
E	8.1E-12
ENE	9.5E-12
NE	1.1E-11
NNE	1.1E-11

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 8, 1998 8:45 pm

Facility: RMHF AND T024
Address: SSFL, Top of Woolsey Canyon Road, Simi Hills
City: Chatsworth
State: CA Zip: 91311

Effective Dose Equivalent
(mrem/year)

1.24E-05

At This Location: 804 Meters Northwest
Source Category: DOE facilities
Source Type: Stack
Emission Year: 1997

Comments: CAP88PC calculation for 1997 Annual Site Environmental Report, Population Dose

Dataset Name: DOEPOINT97POP
Dataset Date: May 8, 1998 8:43 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: 2.98E-10

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)	Collective Population (person-rem/y)
GONADS	1.44E-05	7.90E-04
BREAST	1.31E-05	7.19E-04
R MAR	1.12E-05	6.16E-04
LUNGS	1.13E-05	6.22E-04
THYROID	1.37E-05	7.48E-04
ENDOST	1.26E-05	6.89E-04
RMNDR	1.10E-05	6.03E-04
EFFEC	1.24E-05	6.78E-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	2.31E-07	2.31E-07

RADIONUCLIDE EMISSIONS DURING THE YEAR 1997

Nuclide	Class	Size	Source #1 Ci/y	Source #2 Ci/y	TOTAL Ci/y
CO-60	Y	1.00	9.7E-07	0.0E+00	9.7E-07
SR-90	D	1.00	3.3E-07	0.0E+00	3.3E-07
Y-90	Y	1.00	3.3E-07	0.0E+00	3.3E-07
CS-137	D	1.00	3.0E-06	3.1E-08	3.0E-06
BA-137M	D	1.00	2.8E-06	3.0E-08	2.9E-06
H-3	*	0.00	1.4E-05	0.0E+00	1.4E-05

SITE INFORMATION

Temperature:	17 degrees C
Precipitation:	40 cm/y
Mixing Height:	366 m

SOURCE INFORMATION

Source Number:	1	2
Stack Height (m):	39.60	0.50
Diameter (m):	0.92	0.30
Plume Rise Momentum (m/s): (Exit Velocity)	1.25E+01	0.00E+00

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

Direction	Distance (m) 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

Direction	Distance (m) 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
May 8, 1998 8:45 pm

Facility: RMHF AND T024
Address: SSFL, Top of Woolsey Canyon Road, Simi Hills
City: Chatsworth
State: CA Zip: 91311

Source Category: DOE facilities
Source Type: Stack
Emission Year: 1997

Comments: CAP88PC calculation for 1997 Annual Site Environmental Report, Population Dose

Dataset Name: DOEPOINT97POP
Dataset Date: May 8, 1998 8:43 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	1.44E-05	7.90E-04
BREAST	1.31E-05	7.19E-04
R MAR	1.12E-05	6.16E-04
LUNGS	1.13E-05	6.22E-04
THYROID	1.37E-05	7.48E-04
ENDOST	1.26E-05	6.89E-04
RMNDR	1.10E-05	6.03E-04
EFFEC	1.24E-05	6.78E-04

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)	Collective Population (person-rem/y)
INGESTION	3.00E-08	1.68E-06
INHALATION	1.41E-07	7.88E-06
AIR IMMERSION	6.12E-10	3.18E-08
GROUND SURFACE	1.22E-05	6.68E-04
INTERNAL	1.71E-07	9.56E-06
EXTERNAL	1.22E-05	6.68E-04
TOTAL	1.24E-05	6.78E-04

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclides	Selected Individual (mrem/y)	Collective Population (person-rem/y)
CO-60	3.02E-06	1.77E-04
SR-90	3.74E-08	2.18E-06
Y-90	1.11E-09	5.93E-08
CS-137	5.51E-08	2.82E-06
BA-137M	9.26E-06	4.96E-04
H-3	6.92E-10	5.95E-08
TOTAL	1.24E-05	6.78E-04

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk	Total Collective Population Fatal Cancer Risk (Deaths/y)
LEUKEMIA	3.55E-11	2.75E-08
BONE	2.21E-12	1.71E-09
THYROID	6.21E-12	4.81E-09
BREAST	5.14E-11	3.98E-08
LUNG	5.66E-11	4.40E-08
STOMACH	3.28E-11	2.54E-08
BOWEL	1.63E-11	1.27E-08
LIVER	3.58E-11	2.77E-08
PANCREAS	2.15E-11	1.67E-08
URINARY	1.35E-11	1.04E-08
OTHER	2.63E-11	2.04E-08
TOTAL	2.98E-10	2.31E-07

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk	Total Collective Population Fatal Cancer Risk (Deaths/y)
INGESTION	6.80E-13	5.33E-10
INHALATION	4.77E-12	3.80E-09
AIR IMMERSION	1.48E-14	1.09E-11
GROUND SURFACE	2.93E-10	2.27E-07
INTERNAL	5.45E-12	4.33E-09
EXTERNAL	2.93E-10	2.27E-07
TOTAL	2.98E-10	2.31E-07

PATHWAY GENETIC RISK SUMMARY
(Collective Population)

Pathway	Genetic Risk (person-rem/y)
INGESTION	9.56E-07
INHALATION	2.11E-06
AIR IMMERSION	3.14E-08
GROUND SURFACE	6.61E-04
INTERNAL	3.07E-06
EXTERNAL	6.61E-04
TOTAL	6.64E-04

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk	Total Collective Population Fatal Cancer Risk (Deaths/y)
CO-60	7.43E-11	6.17E-08
SR-90	6.37E-13	5.24E-10
Y-90	3.90E-14	2.96E-11
CS-137	1.45E-12	1.05E-09
BA-137M	2.22E-10	1.68E-07
H-3	1.89E-14	2.30E-11
TOTAL	2.98E-10	2.31E-07

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

	Distance (m)						
Direction	804	2414	4023	5632	7242	8851	10460
N	2.4E-06	0.0E+00	3.8E-07	2.8E-07	2.3E-07	0.0E+00	0.0E+00
NNW	7.4E-06	0.0E+00	1.2E-06	8.9E-07	7.1E-07	5.9E-07	0.0E+00
NW	1.2E-05	0.0E+00	2.0E-06	1.5E-06	1.2E-06	9.9E-07	0.0E+00
WNW	7.1E-06	0.0E+00	0.0E+00	8.7E-07	7.0E-07	5.8E-07	4.9E-07
W	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.7E-07	1.4E-07
WSW	2.7E-06	0.0E+00	0.0E+00	3.2E-07	2.6E-07	2.1E-07	1.8E-07
SW	3.7E-06	0.0E+00	0.0E+00	3.4E-07	2.8E-07	2.3E-07	1.9E-07
SSW	3.0E-06	0.0E+00	0.0E+00	0.0E+00	2.6E-07	2.1E-07	1.8E-07
S	2.3E-06	0.0E+00	4.0E-07	0.0E+00	2.4E-07	2.0E-07	0.0E+00
SSE	5.3E-06	1.3E-06	8.5E-07	0.0E+00	4.9E-07	4.1E-07	3.4E-07
SE	8.3E-06	0.0E+00	1.3E-06	9.2E-07	7.4E-07	6.1E-07	5.2E-07
ESE	5.0E-06	1.2E-06	0.0E+00	5.7E-07	4.6E-07	3.8E-07	3.2E-07
E	1.6E-06	3.9E-07	2.6E-07	1.9E-07	1.6E-07	1.3E-07	1.1E-07
ENE	1.9E-06	4.6E-07	0.0E+00	0.0E+00	1.8E-07	1.5E-07	1.3E-07
NE	2.3E-06	5.3E-07	0.0E+00	2.5E-07	2.0E-07	0.0E+00	0.0E+00
NNE	2.3E-06	0.0E+00	3.6E-07	2.7E-07	2.2E-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	6.1E-08	5.2E-08
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.3E-07	0.0E+00	1.6E-07
NW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.8E-07	3.2E-07	2.7E-07
WNW	4.2E-07	3.7E-07	3.3E-07	2.8E-07	2.2E-07	1.9E-07	1.6E-07
W	1.2E-07	1.1E-07	9.4E-08	7.9E-08	6.4E-08	5.3E-08	4.5E-08
WSW	1.5E-07	1.3E-07	1.2E-07	1.0E-07	8.2E-08	6.8E-08	5.8E-08
SW	1.7E-07	1.5E-07	1.3E-07	1.1E-07	9.1E-08	7.7E-08	6.6E-08
SSW	1.5E-07	1.3E-07	1.2E-07	1.0E-07	8.3E-08	6.9E-08	6.0E-08
S	1.4E-07	1.3E-07	0.0E+00	9.3E-08	7.6E-08	0.0E+00	0.0E+00
SSE	3.0E-07	2.6E-07	2.3E-07	1.9E-07	1.6E-07	1.3E-07	0.0E+00
SE	4.4E-07	3.9E-07	3.4E-07	2.9E-07	2.4E-07	2.0E-07	1.7E-07
ESE	2.7E-07	2.4E-07	2.1E-07	1.8E-07	1.5E-07	1.2E-07	1.1E-07
E	9.8E-08	8.5E-08	7.5E-08	6.3E-08	5.2E-08	4.3E-08	3.6E-08
ENE	1.1E-07	9.7E-08	8.5E-08	7.2E-08	5.9E-08	4.9E-08	4.2E-08
NE	0.0E+00	1.1E-07	0.0E+00	0.0E+00	6.6E-08	5.5E-08	4.7E-08
NNE	1.3E-07	0.0E+00	0.0E+00	0.0E+00	7.0E-08	5.8E-08	5.0E-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	2.8E-08	0.0E+00	1.6E-08	1.2E-08
NNW	0.0E+00	0.0E+00	0.0E+00	6.9E-08	0.0E+00	3.9E-08
NW	2.4E-07	1.9E-07	1.5E-07	1.2E-07	0.0E+00	6.6E-08
WNW	1.4E-07	1.1E-07	8.7E-08	6.7E-08	5.0E-08	3.8E-08
W	3.9E-08	3.2E-08	2.4E-08	1.8E-08	1.3E-08	9.9E-09
WSW	5.1E-08	4.2E-08	3.2E-08	0.0E+00	0.0E+00	1.5E-08
SW	5.9E-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	5.0E-08	3.8E-08	3.0E-08
SE	1.5E-07	1.2E-07	9.7E-08	7.7E-08	5.9E-08	4.6E-08
ESE	9.3E-08	7.6E-08	5.9E-08	4.7E-08	3.5E-08	2.7E-08
E	3.2E-08	2.5E-08	1.9E-08	1.5E-08	1.1E-08	7.9E-09
ENE	3.6E-08	2.9E-08	2.2E-08	1.7E-08	1.3E-08	9.5E-09
NE	4.1E-08	3.3E-08	2.5E-08	2.0E-08	1.5E-08	1.1E-08
NNE	4.3E-08	3.5E-08	2.7E-08	2.1E-08	1.5E-08	1.2E-08

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

	Distance (m)						
Direction	804	2414	4023	5632	7242	8851	10460
N	4.9E-08	0.0E+00	3.5E-07	2.2E-06	1.7E-06	0.0E+00	0.0E+00
NNW	1.5E-07	0.0E+00	2.5E-06	8.5E-06	4.3E-06	1.2E-07	0.0E+00
NW	1.2E-07	0.0E+00	1.3E-05	1.3E-05	1.3E-05	1.7E-06	0.0E+00
WNW	7.1E-08	0.0E+00	0.0E+00	5.9E-06	4.5E-06	1.4E-06	1.3E-07
W	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.8E-07	1.7E-07
WSW	5.4E-08	0.0E+00	0.0E+00	1.3E-09	1.2E-07	8.2E-07	1.2E-07
SW	7.3E-08	0.0E+00	0.0E+00	9.6E-07	3.1E-07	1.7E-07	1.2E-06
SSW	1.2E-07	0.0E+00	0.0E+00	0.0E+00	8.8E-07	1.6E-06	1.1E-06
S	1.2E-07	0.0E+00	7.9E-10	0.0E+00	4.9E-08	2.3E-07	0.0E+00
SSE	1.1E-07	2.3E-07	3.0E-07	0.0E+00	9.1E-07	9.3E-07	6.2E-07
SE	2.5E-07	0.0E+00	1.4E-06	1.3E-06	5.3E-06	5.2E-06	5.0E-06
ESE	2.0E-07	5.0E-08	0.0E+00	9.9E-07	3.9E-06	5.3E-06	6.4E-06
E	2.4E-08	2.0E-08	5.1E-08	2.6E-07	4.8E-07	7.7E-07	1.9E-06
ENE	3.8E-07	1.8E-08	0.0E+00	0.0E+00	1.1E-07	5.1E-07	1.2E-06
NE	1.1E-07	5.4E-07	0.0E+00	1.8E-06	6.6E-07	0.0E+00	0.0E+00
NNE	5.9E-08	0.0E+00	1.3E-07	1.9E-06	5.3E-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	3.7E-08	1.6E-10
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.7E-07	0.0E+00	4.1E-09
NW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.5E-08	5.2E-07	3.0E-06
WNW	5.0E-08	6.4E-07	3.9E-06	3.2E-06	1.6E-07	2.1E-07	1.6E-08
W	7.3E-07	1.0E-06	8.1E-07	6.3E-07	5.0E-08	6.4E-07	5.1E-07
WSW	6.5E-07	1.3E-06	9.3E-07	1.4E-06	1.2E-06	7.5E-07	1.9E-09
SW	6.4E-07	9.3E-07	7.9E-07	4.5E-07	8.7E-09	9.8E-08	2.8E-08
SSW	6.0E-08	7.4E-08	3.1E-08	5.9E-09	3.6E-08	3.3E-07	8.6E-08
S	3.8E-07	1.7E-08	0.0E+00	7.6E-08	2.6E-07	0.0E+00	0.0E+00
SSE	6.7E-07	2.4E-07	1.6E-07	1.9E-07	5.4E-07	3.6E-07	0.0E+00
SE	4.9E-06	3.2E-06	1.7E-06	1.2E-06	6.9E-07	2.0E-06	4.6E-06
ESE	7.1E-06	4.2E-06	4.6E-06	1.0E-05	4.1E-06	7.3E-06	6.3E-06
E	1.8E-06	1.5E-06	1.6E-06	4.0E-06	3.6E-06	5.5E-06	4.5E-06
ENE	9.1E-07	4.4E-07	7.0E-07	1.4E-06	1.3E-06	1.8E-06	2.2E-06
NE	0.0E+00	1.0E-07	0.0E+00	0.0E+00	7.7E-07	1.7E-06	5.9E-07
NNE	1.1E-08	0.0E+00	0.0E+00	0.0E+00	1.2E-07	8.7E-08	5.9E-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	7.7E-09	0.0E+00	1.3E-08	1.0E-09
NNW	0.0E+00	0.0E+00	0.0E+00	9.1E-09	0.0E+00	2.1E-07
NW	2.1E-07	1.1E-06	2.8E-09	4.8E-08	0.0E+00	1.6E-08
WNW	4.2E-08	3.2E-06	1.4E-07	8.8E-07	8.4E-07	6.4E-07
W	1.1E-06	4.5E-07	5.0E-06	8.0E-07	1.6E-08	5.1E-10
WSW	7.8E-08	1.3E-08	5.4E-07	0.0E+00	0.0E+00	3.0E-11
SW	3.3E-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	4.5E-07	1.9E-06	3.9E-07
SE	2.0E-05	4.0E-05	3.8E-05	4.9E-05	3.2E-05	3.9E-05
ESE	5.8E-06	2.7E-05	5.2E-05	3.3E-05	2.1E-05	2.8E-05
E	3.1E-06	3.9E-06	2.1E-06	2.1E-06	8.5E-07	1.4E-06
ENE	2.0E-07	3.3E-08	2.4E-08	4.0E-08	2.7E-08	4.6E-07
NE	1.8E-06	5.4E-07	1.9E-07	8.9E-08	1.8E-07	1.6E-06
NNE	2.0E-07	7.7E-08	2.9E-10	3.8E-08	1.3E-08	3.0E-08

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

	Distance (m)						
Direction	804	2414	4023	5632	7242	8851	10460
N	5.9E-11	0.0E+00	9.0E-12	6.7E-12	5.5E-12	0.0E+00	0.0E+00
NNW	1.8E-10	0.0E+00	2.9E-11	2.1E-11	1.7E-11	1.4E-11	0.0E+00
NW	3.0E-10	0.0E+00	4.9E-11	3.6E-11	2.9E-11	2.4E-11	0.0E+00
WNW	1.7E-10	0.0E+00	0.0E+00	2.1E-11	1.7E-11	1.4E-11	1.2E-11
W	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.0E-12	3.4E-12
WSW	6.5E-11	0.0E+00	0.0E+00	7.8E-12	6.2E-12	5.1E-12	4.3E-12
SW	8.8E-11	0.0E+00	0.0E+00	8.3E-12	6.6E-12	5.5E-12	4.7E-12
SSW	7.2E-11	0.0E+00	0.0E+00	0.0E+00	6.1E-12	5.1E-12	4.3E-12
S	5.5E-11	0.0E+00	9.5E-12	0.0E+00	5.7E-12	4.8E-12	0.0E+00
SSE	1.3E-10	3.2E-11	2.0E-11	0.0E+00	1.2E-11	9.8E-12	8.3E-12
SE	2.0E-10	0.0E+00	3.1E-11	2.2E-11	1.8E-11	1.5E-11	1.2E-11
ESE	1.2E-10	3.0E-11	0.0E+00	1.4E-11	1.1E-11	9.1E-12	7.7E-12
E	3.8E-11	9.4E-12	6.2E-12	4.7E-12	3.9E-12	3.2E-12	2.8E-12
ENE	4.6E-11	1.1E-11	0.0E+00	0.0E+00	4.4E-12	3.7E-12	3.1E-12
NE	5.4E-11	1.3E-11	0.0E+00	6.0E-12	4.9E-12	0.0E+00	0.0E+00
NNE	5.7E-11	0.0E+00	8.6E-12	6.4E-12	5.2E-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	1.5E-12	1.3E-12
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.5E-12	0.0E+00	3.9E-12
NW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.2E-12	7.6E-12	6.5E-12
WNW	1.0E-11	8.9E-12	7.9E-12	6.6E-12	5.4E-12	4.5E-12	3.8E-12
W	3.0E-12	2.6E-12	2.3E-12	1.9E-12	1.6E-12	1.3E-12	1.1E-12
WSW	3.7E-12	3.2E-12	2.9E-12	2.4E-12	2.0E-12	1.6E-12	1.4E-12
SW	4.0E-12	3.5E-12	3.1E-12	2.7E-12	2.2E-12	1.8E-12	1.6E-12
SSW	3.7E-12	3.3E-12	2.9E-12	2.4E-12	2.0E-12	1.7E-12	1.4E-12
S	3.5E-12	3.0E-12	0.0E+00	2.2E-12	1.8E-12	0.0E+00	0.0E+00
SSE	7.1E-12	6.2E-12	5.5E-12	4.7E-12	3.8E-12	3.2E-12	0.0E+00
SE	1.1E-11	9.4E-12	8.3E-12	7.0E-12	5.8E-12	4.8E-12	4.2E-12
ESE	6.6E-12	5.8E-12	5.1E-12	4.3E-12	3.6E-12	3.0E-12	2.5E-12
E	2.4E-12	2.1E-12	1.8E-12	1.5E-12	1.2E-12	1.0E-12	8.7E-13
ENE	2.7E-12	2.3E-12	2.1E-12	1.7E-12	1.4E-12	1.2E-12	1.0E-12
NE	0.0E+00	2.6E-12	0.0E+00	0.0E+00	1.6E-12	1.3E-12	1.1E-12
NNE	3.2E-12	0.0E+00	0.0E+00	0.0E+00	1.7E-12	1.4E-12	1.2E-12

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

	Distance (m)					
Direction	30577	36210	44257	52303	60350	72420
N	0.0E+00	0.0E+00	6.7E-13	0.0E+00	3.8E-13	2.9E-13
NNW	0.0E+00	0.0E+00	0.0E+00	1.7E-12	0.0E+00	9.4E-13
NW	5.7E-12	4.7E-12	3.6E-12	2.8E-12	0.0E+00	1.6E-12
WNW	3.4E-12	2.7E-12	2.1E-12	1.6E-12	1.2E-12	9.2E-13
W	9.5E-13	7.7E-13	5.8E-13	4.4E-13	3.2E-13	2.4E-13
WSW	1.2E-12	1.0E-12	7.8E-13	0.0E+00	0.0E+00	3.6E-13
SW	1.4E-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	1.2E-12	9.2E-13	7.2E-13
SE	3.7E-12	3.0E-12	2.3E-12	1.9E-12	1.4E-12	1.1E-12
ESE	2.2E-12	1.8E-12	1.4E-12	1.1E-12	8.5E-13	6.6E-13
E	7.6E-13	6.1E-13	4.6E-13	3.5E-13	2.6E-13	1.9E-13
ENE	8.7E-13	7.1E-13	5.4E-13	4.1E-13	3.0E-13	2.3E-13
NE	9.9E-13	8.0E-13	6.1E-13	4.7E-13	3.5E-13	2.7E-13
NNE	1.0E-12	8.4E-13	6.4E-13	5.0E-13	3.7E-13	2.8E-13

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

	Distance (m)						
Direction	804	2414	4023	5632	7242	8851	10460
N	1.7E-11	0.0E+00	1.2E-10	7.4E-10	5.7E-10	0.0E+00	0.0E+00
NNW	5.0E-11	0.0E+00	8.6E-10	2.9E-09	1.5E-09	4.1E-11	0.0E+00
NW	4.2E-11	0.0E+00	4.4E-09	4.4E-09	4.3E-09	5.7E-10	0.0E+00
WNW	2.4E-11	0.0E+00	0.0E+00	2.0E-09	1.5E-09	4.8E-10	4.3E-11
W	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.3E-10	5.7E-11
WSW	1.8E-11	0.0E+00	0.0E+00	4.4E-13	4.3E-11	2.8E-10	4.2E-11
SW	2.5E-11	0.0E+00	0.0E+00	3.3E-10	1.1E-10	5.8E-11	4.1E-10
SSW	4.1E-11	0.0E+00	0.0E+00	0.0E+00	3.0E-10	5.6E-10	3.9E-10
S	3.9E-11	0.0E+00	2.7E-13	0.0E+00	1.7E-11	7.9E-11	0.0E+00
SSE	3.6E-11	7.9E-11	1.0E-10	0.0E+00	3.1E-10	3.2E-10	2.1E-10
SE	8.5E-11	0.0E+00	4.8E-10	4.4E-10	1.8E-09	1.8E-09	1.7E-09
ESE	6.8E-11	1.7E-11	0.0E+00	3.4E-10	1.3E-09	1.8E-09	2.2E-09
E	8.0E-12	6.7E-12	1.8E-11	8.8E-11	1.6E-10	2.6E-10	6.6E-10
ENE	1.3E-10	6.3E-12	0.0E+00	0.0E+00	3.7E-11	1.7E-10	4.1E-10
NE	3.8E-11	1.9E-10	0.0E+00	6.1E-10	2.3E-10	0.0E+00	0.0E+00
NNE	2.0E-11	0.0E+00	4.5E-11	6.4E-10	1.8E-10	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	1.2E-11	5.3E-14
NNW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.3E-10	0.0E+00	1.4E-12
NW	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.2E-11	1.8E-10	1.0E-09
WNW	1.7E-11	2.2E-10	1.3E-09	1.1E-09	5.5E-11	7.2E-11	5.5E-12
W	2.5E-10	3.5E-10	2.8E-10	2.1E-10	1.7E-11	2.2E-10	1.7E-10
WSW	2.2E-10	4.4E-10	3.2E-10	4.9E-10	4.1E-10	2.5E-10	6.3E-13
SW	2.2E-10	3.2E-10	2.7E-10	1.5E-10	3.0E-12	3.3E-11	9.6E-12
SSW	2.1E-11	2.5E-11	1.0E-11	2.0E-12	1.2E-11	1.1E-10	2.9E-11
S	1.3E-10	5.8E-12	0.0E+00	2.6E-11	8.8E-11	0.0E+00	0.0E+00
SSE	2.3E-10	8.2E-11	5.5E-11	6.5E-11	1.8E-10	1.2E-10	0.0E+00
SE	1.7E-09	1.1E-09	5.9E-10	4.1E-10	2.3E-10	6.7E-10	1.6E-09
ESE	2.4E-09	1.4E-09	1.6E-09	3.5E-09	1.4E-09	2.5E-09	2.1E-09
E	6.0E-10	5.2E-10	5.4E-10	1.4E-09	1.2E-09	1.9E-09	1.5E-09
ENE	3.1E-10	1.5E-10	2.4E-10	4.9E-10	4.5E-10	6.3E-10	7.4E-10
NE	0.0E+00	3.5E-11	0.0E+00	0.0E+00	2.6E-10	5.8E-10	2.0E-10
NNE	3.7E-12	0.0E+00	0.0E+00	0.0E+00	3.9E-11	3.0E-11	2.0E-10

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

Direction	Distance (m)					
	30577	36210	44257	52303	60350	72420
N	0.0E+00	0.0E+00	2.6E-12	0.0E+00	4.5E-12	3.4E-13
NNW	0.0E+00	0.0E+00	0.0E+00	3.1E-12	0.0E+00	7.3E-11
NW	7.2E-11	3.7E-10	9.6E-13	1.6E-11	0.0E+00	5.6E-12
WNW	1.4E-11	1.1E-09	4.7E-11	3.0E-10	2.9E-10	2.2E-10
W	3.8E-10	1.5E-10	1.7E-09	2.7E-10	5.4E-12	1.7E-13
WSW	2.7E-11	4.6E-12	1.8E-10	0.0E+00	0.0E+00	1.0E-14
SW	1.1E-11	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	1.5E-10	6.4E-10	1.3E-10
SE	6.7E-09	1.4E-08	1.3E-08	1.7E-08	1.1E-08	1.3E-08
ESE	2.0E-09	9.3E-09	1.8E-08	1.1E-08	7.1E-09	9.5E-09
E	1.1E-09	1.3E-09	7.3E-10	7.0E-10	2.9E-10	4.9E-10
ENE	6.9E-11	1.1E-11	8.2E-12	1.4E-11	9.3E-12	1.6E-10
NE	6.2E-10	1.8E-10	6.4E-11	3.0E-11	6.1E-11	5.4E-10
NNE	6.7E-11	2.6E-11	1.0E-13	1.3E-11	4.5E-12	1.0E-11