Boeing North American, Inc.
Rocketdyne Division
Energy Technology Engineering Center
Boeing Defense & Space Group
P.O. Box 7930
Canoga Park, CA 91309-7930

2479

June 4, 1997
In reply refer to 97ETEC DRF-0151

H. Joma
Mail Stop T038
DOE-ETEC Site Manager
U. S. Department of Energy
Energy Technology Engineering Center
P. O. Box 7929
Canoga Park, CA 91309-7929

BOEING

Subject: NESHAPs Report for 1996

Dear Mr. Joma:

Enclosed is the NESHAPs (National Emission Standards for Hazardous Air Pollutants - Radionuclides) Report for 1996 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 1996, 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 regulated point sources, RMHF and RIHL, treated separately, and for two unregulated area sources, treated in combination. The point sources, single ventilation exhaust stacks at the two facilities, were treated separately because the distance between them, 674 meters, is comparable to the distances to the maximally exposed individual location, 2867 and 2987 meters. The area sources are nearly as far apart, but as ground-level and below-ground-level diffuse sources, the airborne exposures are not expected to be as sensitive to distance as the elevated point sources.

The RIHL is a facility that was previously licensed by the NRC and the State of California, but DOE assumed operational responsibility on September 27, 1996, following the negotiated termination of the NRC license. Airborne releases from the RIHL were apportioned between NRC jurisdiction and DOE jurisdiction in proportion to the fraction of the year controlled by each agency. Emissions under NRC jurisdiction have been monitored, analyzed, and interpreted according to the NESHAPs regulations for licensed facilities.

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, provides a conservative overestimate of the releases.

The report still reflects Rockwell International Corp. as the parent of Rocketdyne, as it was through most of 1996. On December 6, 1996, The Boeing Company acquired a major portion of Rockwell International, including the Rocketdyne Division, operator of the Energy Technology Engineering Center. Rocketdyne is currently a division of Boeing North American, Inc., a wholly owned subsidiary of The Boeing Company.

BOEING

This report includes the Certification Statement to be signed by M. J. Gabler for ETEC 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 Bob Tuttle at 818/586-6135.

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-000784

DOEAIR96

U. S. Department of Energy
Radionuclide Air Emissions Annual Report
(under Subpart H of 40 CFR Part 61)
Calendar Year 1996

Site Name: Santa Susana Field Laboratory
(Prepared May 29, 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 Division, Rockwell International Corp.	
Address:	6633 Canoga Avenue	
	P. O. Box 7922	
	Canoga Park, CA 91309-7922	
Contact:	R. J. Tuttle (T100)	Phone: 818/586-6135

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 2668 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 seven 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. Two DOE operating point sources consist of facility ventilation exhaust stacks, while the area sources consist of a slightly contaminated soil area, 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 RIHL (Rockwell International Hot Laboratory) is in the process of demolition for decommissioning This facility was transferred from NRC-licensed operation to the DOE on September 27, 1996. 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 #2. Emissions from the RIHL, reported here as a new point source under DOE jurisdiction, were prorated for the year following termination of the NRC license. Emissions prorated for the prior portion of the year were monitored, analyzed, and interpreted according to the NESHAPs regulations for licensed facilities.

(Building T059, a former low-power reactor test facility, previously used in the development of nuclear reactors in the Systems for Nuclear Auxiliary Power (SNAP) program, where remaining activated steel and concrete structural material has been removed in a decommissioning operation, had been included in prior reports, but no radioactive materials were discharged from this facility in 1996. 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 1996. Therefore, in this NESHAPs report, this 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 1996, 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 contains some contaminated soil subject to remediation. These areas have been cleared of brush and so are 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 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 1996, 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.)

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	2.0E-05	740000
Co-60	5.5E-07	20330
Sr-90	1.5E-07	5532
Cs-137	2.9E-06	108400
Th-230	1.7E-10	64
Pu-238	7.8E-10	29
Pu-239	2.8E-09	104
Pu-240	1.6E-09	61

RIHL (#2)	Pre- and HEPA filters	99.97+%	2180 m SSE (approx.)

Point Source Radionuclides	Annual Quantity (Ci)	(Bq)
Sr-90	1.5E-07	5550
Cs-137	1.1E-06	40700
Th-230	4.5E-09	166
U-234	2.6E-10	10
U-235	8.9E-11	3
Pu-238	3.7E-10	14

Area (Non-Point) Sources

Sump 614 (Number 1)

Area (Non-Point) Source Radionuclides	Annual Quantity (Ci)	(Bq)
Co-60	9.1E-08	3367
Sr-90	1.0E-07	3700
Cs-137	2.9E-06	107300

T064 Area (Number 2)

Area (Non-Point) Source Radionuclides	Annual Quantity (Ci)	(Bq)
Sr-90	1.9E-05	70300
Cs-137	5.0E-06	185000

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 dose at this location differs from the dose to the MEI selected by CAP88-PC, and printed on the CAP88-PC Synopsis Report cover sheet, since the CAP88-PC selected maximum dose is at an unoccupied location.

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.

A dose estimate 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 contribution to the facility dose is not included in the total facility dose estimate.

Compliance Assessment

Effective Dose Equivalent: 4.6E-06 mrem (4.6E-11 Sv).

Location of Maximally Exposed Individual: residence in Simi Valley, 2867 m NW of RMHF, 2987 m NW of RIHL. Addition of the RIHL as a DOE point source increased the estimated dose for 1996 compared to prior years.

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 128.0E-06 mrem (128.0E-11 Sv). This estimate is higher than prior years because of the greater amount of activity calculated for airborne suspension from the T064 Side Yard. This area was in active remediation during 1996 and the area was extended compared to previous years.

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).

M. J. Gabler Date: 5/30/97
M. J. Gabler,
ETEC General Manager
Rocketdyne Division
Rockwell International

Philip R. Boehme
For Hannibal Joma Date:
H. Joma,
ETEC Site Manager
Oakland Operations Office
U. S. Department of Energy

Ref: Boehme Notebook, p. 77

Section IV. Additional Information

There were no unplanned releases in 1996. Emissions from the RIHL, as a new point source under DOE jurisdiction, were prorated for the year following termination of the NRC license on September 27, 1997. Emissions prorated for the prior portion of the year were monitored, analyzed, and interpreted according to the NESHAPs regulations for licensed facilities.

The maximum estimated dose due to potential releases from the area sources in 1996 is 128.0E-06 mrem/year (128.0E-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.

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 15, 1997 3:44 pm

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

Effective Dose Equivalent
(mrem/year)

2.91E-06

At This Location: 2867 Meters Northwest
Source Category: DOE facility
Source Type: Stack
Emission Year: 1996

Comments: CAP88PC calculation for 1996 Annual Environmental Report, maximum exposed individual.

Dataset Name: RMHF96IND
Dataset Date: May 15, 1997 3:36 pm
Wind File: WNDFILES\SSFLNRC.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 2867 Meters Northwest
Lifetime Fatal Cancer Risk: 6.79E-11

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	3.27E-06
BREAST	2.96E-06
R MAR	2.62E-06
LUNGS	2.98E-06
THYROID	3.08E-06
ENDOST	4.17E-06
RMNDR	2.53E-06
EFFEC	2.91E-06

RADIONUCLIDE EMISSIONS DURING THE YEAR 1996

Nuclide	Class	Size	Source #1 Ci/y	TOTAL Ci/y
CO-60	Y	1.00	5.5E-07	5.5E-07
SR-90	D	1.00	1.5E-07	1.5E-07
Y-90	Y	1.00	1.5E-07	1.5E-07
CS-137	D	1.00	2.9E-06	2.9E-06
BA-137M	D	1.00	2.5E-06	2.5E-06
TH-230	Y	1.00	1.7E-10	1.7E-10
PU-238	Y	1.00	7.8E-10	7.8E-10
PU-239	Y	1.00	2.8E-09	2.8E-09
PU-240	Y	1.00	1.6E-09	1.6E-09
H-3	*	0.00	2.0E-05	2.0E-05

SITE INFORMATION

Temperature:	17 degrees C
Precipitation:	57 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)	1.08E+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

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
May 15, 1997 3:44 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: 1996

Comments: CAP88PC calculation for 1996 Annual Environmental Report, maximum exposed individual.

Dataset Name: RMHF96IND
Dataset Date: May 15, 1997 3:36 pm
Wind File: WNDFILES\SSFLNRC.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	3.27E-06
BREAST	2.96E-06
R MAR	2.62E-06
LUNGS	2.98E-06
THYROID	3.08E-06
ENDOST	4.17E-06
RMNDR	2.53E-06
EFFEC	2.91E-06

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	6.38E-09
INHALATION	1.53E-07
AIR IMMERSION	6.67E-11
GROUND SURFACE	2.75E-06
INTERNAL	1.59E-07
EXTERNAL	2.75E-06
TOTAL	2.91E-06

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
CO-60	4.79E-07
SR-90	3.90E-09
Y-90	1.05E-10
CS-137	1.08E-08
BA-137M	2.28E-06
TH-230	3.22E-09
PU-238	1.84E-08
PU-239	7.14E-08
PU-240	4.19E-08
H-3	2.16E-10
TOTAL	2.91E-06

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	8.02E-12
BONE	5.49E-13
THYROID	1.40E-12
BREAST	1.16E-11
LUNG	1.32E-11
STOMACH	7.38E-12
BOWEL	3.67E-12
LIVER	8.23E-12
PANCREAS	4.83E-12
URINARY	3.03E-12
OTHER	5.91E-12
TOTAL	6.79E-11

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	1.42E-13
INHALATION	1.72E-12
AIR IMMERSION	1.61E-15
GROUND SURFACE	6.60E-11
INTERNAL	1.86E-12
EXTERNAL	6.60E-11
TOTAL	6.79E-11

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
CO-60	1.17E-11
SR-90	6.63E-14
Y-90	3.70E-15
CS-137	2.84E-13
BA-137M	5.47E-11
TH-230	2.66E-14
PU-238	1.62E-13
PU-239	5.78E-13
PU-240	3.39E-13
H-3	5.91E-15
TOTAL	6.79E-11

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

	Distance (m)
Direction	2867
N	5.5E-07
NNW	1.7E-06
NW	2.9E-06
WNW	1.7E-06
W	4.5E-07
WSW	6.4E-07
SW	7.3E-07
SSW	6.5E-07
S	5.8E-07
SSE	1.2E-06
SE	1.9E-06
ESE	1.1E-06
E	3.8E-07
ENE	4.4E-07
NE	5.0E-07
NNE	5.3E-07

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

	Distance (m)
Direction	2867
N	1.3E-11
NNW	4.1E-11
NW	6.8E-11
WNW	3.9E-11
W	1.1E-11
WSW	1.5E-11
SW	1.7E-11
SSW	1.5E-11
S	1.3E-11
SSE	2.9E-11
SE	4.4E-11
ESE	2.7E-11
E	8.8E-12
ENE	1.0E-11
NE	1.2E-11
NNE	1.2E-11

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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 Individual Assessment
May 15, 1997 3:31 pm

Facility: RIHL (DOE)
Address: SSFL, Top of Woolsey Canyon Road, Simi Hills
City: Chatsworth
State: CA Zip: 91311

Effective Dose Equivalent (mrem/year)
1.74E-06

At This Location: 2987 Meters Northwest
Source Category: DOE License-exempt facility
Source Type: Stack
Emission Year: 1996

Comments: CAP88PC calculation for 1996 Annual Environmental Report, maximum exposed individual, part year.

Dataset Name: RIHL96IND(DOE)
Dataset Date: May 15, 1997 3:31 pm
Wind File: WNDFILES\SSFLNRC.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 2987 Meters Northwest
Lifetime Fatal Cancer Risk: 3.68E-11

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	1.67E-06
BREAST	1.52E-06
R MAR	1.63E-06
LUNGS	2.62E-06
THYROID	1.58E-06
ENDOST	5.16E-06
RMNDR	1.28E-06
EFFEC	1.74E-06

RADIONUCLIDE EMISSIONS DURING THE YEAR 1996

Nuclide	Class	Size	Source #1 Ci/y	Source #2 Ci/y	TOTAL Ci/y
SR-90	D	1.00	2.8E-08	5.1E-08	7.9E-08
Y-90	Y	1.00	2.8E-08	5.1E-08	7.9E-08
CS-137	D	1.00	1.5E-07	2.8E-07	4.4E-07
BA-137M	D	1.00	1.3E-07	2.4E-07	3.7E-07
TH-230	Y	1.00	6.4E-10	1.2E-09	1.8E-09
U-234	Y	1.00	3.6E-11	6.7E-11	1.0E-10
U-235	Y	1.00	1.3E-11	2.3E-11	3.6E-11
PU-238	Y	1.00	5.3E-11	9.7E-11	1.5E-10

SITE INFORMATION

Temperature:	17 degrees C
Precipitation:	57 cm/y
Mixing Height:	366 m

SOURCE INFORMATION

Source Number:	1	2
Stack Height (m):	5.18	5.18
Diameter (m):	0.31	0.40
Plume Rise Momentum (m/s): (Exit Velocity)	1.29E+01	6.67E+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

2987

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 15, 1997 3:31 pm

Facility: RIHL (DOE)
Address: SSFL, Top of Woolsey Canyon Road, Simi Hills
City: Chatsworth
State: CA Zip: 91311

Source Category: DOE License-exempt facility
Source Type: Stack
Emission Year: 1996

Comments: CAP88PC calculation for 1996 Annual Environmental Report, maximum exposed individual, part year.

Dataset Name: RIHL96IND(DOE)
Dataset Date: May 15, 1997 3:31 pm
Wind File: WNDFILES\SSFLNRC.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	1.67E-06
BREAST	1.52E-06
R MAR	1.63E-06
LUNGS	2.62E-06
THYROID	1.58E-06
ENDOST	5.16E-06
RMNDR	1.28E-06
EFFEC	1.74E-06

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	5.77E-09
INHALATION	3.30E-07
AIR IMMERSION	8.75E-13
GROUND SURFACE	1.41E-06
INTERNAL	3.35E-07
EXTERNAL	1.41E-06
TOTAL	1.74E-06

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
SR-90	1.35E-08
Y-90	4.38E-10
CS-137	1.05E-08
BA-137M	1.41E-06
TH-230	2.72E-07
U-234	8.08E-09
U-235	2.65E-09
PU-238	2.82E-08
TOTAL	1.74E-06

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	4.46E-12
BONE	4.31E-13
THYROID	7.16E-13
BREAST	5.96E-12
LUNG	8.43E-12
STOMACH	3.77E-12
BOWEL	1.87E-12
LIVER	4.15E-12
PANCREAS	2.46E-12
URINARY	1.54E-12
OTHER	3.01E-12
TOTAL	3.68E-11

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	1.18E-13
INHALATION	3.04E-12
AIR IMMERSION	2.09E-17
GROUND SURFACE	3.37E-11
INTERNAL	3.16E-12
EXTERNAL	3.37E-11
TOTAL	3.68E-11

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
SR-90	2.30E-13
Y-90	1.55E-14
CS-137	2.78E-13
BA-137M	3.37E-11
TH-230	2.25E-12
U-234	1.08E-13
U-235	3.61E-14
PU-238	2.49E-13
TOTAL	3.68E-11

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

	Distance (m)
Direction	2987
N	3.6E-07
NNW	1.1E-06
NW	1.7E-06
WNW	1.1E-06
W	3.6E-07
WSW	3.5E-07
SW	3.3E-07
SSW	3.5E-07
S	3.7E-07
SSE	6.9E-07
SE	1.0E-06
ESE	6.5E-07
E	2.7E-07
ENE	2.9E-07
NE	3.1E-07
NNE	3.4E-07

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

Direction	Distance (m) 2987
N	7.6E-12
NNW	2.2E-11
NW	3.7E-11
WNW	2.2E-11
W	7.6E-12
WSW	7.4E-12
SW	7.1E-12
SSW	7.4E-12
S	7.9E-12
SSE	1.5E-11
SE	2.1E-11
ESE	1.4E-11
E	5.8E-12
ENE	6.2E-12
NE	6.6E-12
NNE	7.1E-12