Energy Technology Engineering Center
Rocketdyne Division
Rockwell International Corporation
P.O. Box 7930
Canoga Park, California 91309-7930

(818) 586-5326

Operator for
U.S. Department of Energy

Rockwell International

May 21, 1993 In reply refer to 93ETEC-DRF-0837

R. Le Chevalier
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

Subject: Final 1992 NESHAPS Report

References: 1) DOE Letter, "National Emission Standards for Hazardous Air Pollutants (NESHAPS)", R. Le Chevalier to D. C. Gibbs, dated 23 April 1993 (DRF-0730)

2) DOE Letter, "DOE Comments to the Draft 1992 NESHAPS Report", R. Le Chevalier to D. C. Gibbs, dated 6 May 1993.

Dear Mr. Le Chevalier:

Enclosed is the Final 1992 NESHAPS Report for 1992 for the ETEC portion of the Santa Susana Field Laboratory. This report addresses DOE comments made on the draft NESHAPS Report (Reference 2). If you have any questions concerning this transmittal contact Mr. Phil Rutherford at (818) 586-6140.

Very truly yours,

G. G. Gaylord
Program Manager
Facility Programs

Distribution

J. Juetten
G. Butner (2)

w/o encl

J. Pagliaro
R. Liddle

82-27

U. S. Department of Energy
Radionuclide Air Emissions Annual Report
(under Subpart H of 40 CFR Part 61)
Calendar Year 1992

Site Name: Santa Susana Field Laboratory

Field Office Information

Office: San Francisco Operations Office
Address: 1301 Clay Street Room 700N
Oakland, CA 94612-5208

Contact: Steve Lasell Phone: 415/273-7967

Site Information

Operator: Rocketdyne Division, Rockwell International Corp.
Address: 6633 Canoga Avenue
P. O. Box 7922
Canoga Park, CA 91309-7922

Contact: P. D. Rutherford (T100) Phone: 818/586-6140

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 five 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. The point sources consist of ventilation exhaust stacks, while the area sources consist of slightly contaminated dirt areas and a water retention sump bottom.

The RMDF (Radioactive Materials Disposal 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.

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, where remaining activated steel and concrete structural material is being removed in a decommissioning operation. Ventilation from work areas in this facility is exhausted through HEPA filters and released from a stack.

Building T023 is a research laboratory in which occasional samples are analyzed for elemental content. Only very low levels of radioactivity are permitted at this lab. Process air from an inductively coupled plasma analytical unit is exhausted, without filtration, and released from a blower under the outside roof overhang.

The RMDF Pond (Sump 614) is a collection sump for rainfall runoff from the RMDF. As it is dry much of the year, some sediment is subject to airborne resuspension by the wind.

The RMDF North Slope is an identified area of low-level soil contamination. Radioactivity in this soil may become airborne by the wind.

The T886 Sodium Disposal Facility includes approximately 3 acres of land, small portions of which are contaminated with low levels of radioactivity. It is currently being remediated under DOE funding. Radioactivity in the soil may become airborne by the wind.

Section II. Air Emissions Data

Point Source	Type Control	Efficiency	Distance to Nearest Receptor
RMDF	Pre- and HEPA filters	99.995%	2320 m SSE
T059	Pre- and HEPA filters	99.998%	2238 m SSE
T023*	none	0.0%	2290 m SSE

Point Source Radionuclides	Annual Quantity (Ci)	(Bq)
Co-60	3.2E-07	12000
Cs-137	4.8E-07	18000
Pu-239	3.0E-09	100
Am-241	5.0E-10	200

Area (Non-Point) Source Radionuclides	Annual Quantity (Ci)	(Bq)
Co-60	9.4E-11	4
Sr-90	5.9E-09	220
Cs-137	5.9E-09	220

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. The dose at this location differs from that selected by CAP88-PC, since the program selects the maximum calculated dose regardless of the distance and direction, and in the case of these calculations, identifies an unoccupied location.

The most significant stack (RMDF) is used for the emission point location. Point sources are calculated in combination, and the resulting estimate of the facility Effective Dose Equivalent is compared with the NESHAPs standard to demonstrate compliance.
A dose estimate for the area sources is also calculated in combination. The area (non-point) source contribution to the facility dose is not included in the total facility dose estimate.

Compliance Assessment

Effective Dose Equivalent: 1.6E-06 (mrem) (1.6E-11 Sv)

Location of Maximally Exposed Individual: residence in Simi Valley (2867 m NW)

This estimated dose is well below the NESHAPs standard of 10 mrem (1.0E-04 Sv).

The estimate dose due to the area (non-point) sources is 2.5E-08 mrem (2.5E-13 Sv).

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:

D. C. Gibbs,
ETEC General Manager
Rocketdyne Division
Rockwell International

Date: 5/20/93

R. LeChevalier,
ETEC Site Manager
San Francisco Operations Office
U. S. Department of Energy

Section IV. Additional Information

An Inductively Coupled Plasma (ICP) analytical unit was used in T023 for analysis of molten salt oxidation unit materials. An evaluation prior to use showed an expected maximum offsite dose of less than 4.5E-06 mrem/year (4.5E-11 Sv/year), with no pollution control equipment installed. This is below the threshold of 1% of the standard requiring the monitoring prescribed in 40CFR61.93(b). The dose estimated from actual operation in 1992 is 6.9E-07 mrem/year (6.9E-12 Sv/year).

There were no unplanned releases in 1992. The maximum estimated dose due to potential releases from the area sources in 1992 is 2.5E-08 mrem/year (2.5E-13 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.

Supplemental Information

The collective Effective Dose Equivalent estimated from DOE operations for 1992 is 2.2E-04 person-rem (2.2E-06 person-Sv). This was 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.

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). Stack effluents at RMDF and T059 are continuously sampled, counted for gross alpha and beta activity weekly, and composited (separately) annually for detailed radiochemical analysis. Feed stock for the molten salt oxidation process is analyzed and these results are used to estimate releases from the ICP unit. Ambient air is continuously sampled on a daily 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.

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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 10, 1993 11:47 am

Facility: Santa Susana Field Laboratory
Address: SSFL, Top of Woolsey Canyon Road, Simi Hills
City: Chatsworth
State: CA Zip: 91311

Effective Dose Equivalent (mrem/year)
2.10E-06

At This Location: 2318 Meters Northwest
Source Category: DOE facility
Source Type: Stack
Emission Year: 92

Comments: CAP88 calculation for 1992 Annual Environmental Report, combined stack sources.

Dataset Name: SSFLDOES
Dataset Date: May 10, 1993 11:47 am
Wind File: WNDFILES\SSFLNRC.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 2318 Meters Northwest
Lifetime Fatal Cancer Risk: 3.51E-11

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	1.51E-06
BREAST	1.25E-06
R MAR	2.01E-06
LUNGS	3.52E-06
THYROID	1.31E-06
ENDOST	1.24E-05
RMNDR	1.54E-06
EFFEC	2.10E-06

RADIONUCLIDE EMISSIONS DURING THE YEAR 92

Nuclide	Class	Size	RMDF Source #1 Ci/y	T059 Source #2 Ci/y	T023 Source #3 Ci/y	TOTAL Ci/y
CO-60	Y	1.00	3.1E-07	0.0E+00	4.0E-09	3.2E-07
SR-90	D	1.00	4.6E-08	0.0E+00	4.0E-08	8.6E-08
CS-137	D	1.00	4.3E-07	9.0E-09	4.0E-08	4.8E-07
BA-137M	D	1.00	4.3E-07	9.0E-09	4.0E-08	4.8E-07
PU-239	Y	1.00	2.0E-09	0.0E+00	1.0E-09	3.0E-09
Y-90	Y	1.00	4.6E-08	0.0E+00	4.0E-08	8.6E-08
EU-154	W	1.00	0.0E+00	0.0E+00	5.0E-10	5.0E-10
EU-155	W	1.00	0.0E+00	0.0E+00	2.0E-11	2.0E-11
CS-134	D	1.00	0.0E+00	0.0E+00	1.0E-11	1.0E-11
AM-241	W	1.00	0.0E+00	0.0E+00	5.0E-10	5.0E-10
PU-238	Y	1.00	0.0E+00	0.0E+00	2.0E-10	2.0E-10
PU-240	Y	1.00	0.0E+00	0.0E+00	5.0E-10	5.0E-10
PU-241	Y	1.00	0.0E+00	0.0E+00	1.0E-08	1.0E-08
U-238	Y	1.00	0.0E+00	0.0E+00	3.0E-10	3.0E-10

SITE INFORMATION

Temperature:	17 degrees C
Precipitation:	79 cm/y
Mixing Height:	366 m

SOURCE INFORMATION

Source Number:	1	2	3
Stack Height (m):	39.60	5.18	3.00
Diameter (m):	0.92	0.31	0.21
Plume Rise Momentum (m/s): (Exit Velocity)	9.37E+00	1.03E+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

2318 2370 2867 3393 4167

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Version 1.00

Clean Air Act Assessment Package - 1988

D O S E A N D R I S K E Q U I V A L E N T S U M M A R I E S

Non-Radon Individual Assessment
May 10, 1993 11:47 am

Facility: Santa Susana Field Laboratory
Address: SSFL, Top of Woolsey Canyon Road, Simi Hills
City: Chatsworth
State: CA Zip: 91311

Source Category: DOE facility
Source Type: Stack
Emission Year: 92

Comments: CAP88 calculation for 1992 Annual Environmental Report, combined stack sources.

Dataset Name: SSFLDOES
Dataset Date: May 10, 1993 11:47 am
Wind File: WNDFILES\SSFLNRC.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	1.51E-06
BREAST	1.25E-06
R MAR	2.01E-06
LUNGS	3.52E-06
THYROID	1.31E-06
ENDOST	1.24E-05
RMNDR	1.54E-06
EFFEC	2.10E-06

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	6.67E-09
INHALATION	9.42E-07
AIR IMMERSION	5.17E-11
GROUND SURFACE	1.15E-06
INTERNAL	9.49E-07
EXTERNAL	1.15E-06
TOTAL	2.10E-06

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
CO-60	4.23E-07
SR-90	1.22E-08
CS-137	3.87E-09
BA-137M	7.36E-07
PU-239	3.77E-07
Y-90	3.84E-10
EU-154	2.38E-09
EU-155	3.96E-12
CS-134	1.68E-11
AM-241	2.51E-07
PU-238	5.88E-08
PU-240	1.58E-07
PU-241	4.81E-08
U-238	3.26E-08
TOTAL	2.10E-06

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	4.22E-12
BONE	6.91E-13
THYROID	5.89E-13
BREAST	4.86E-12
LUNG	9.29E-12
STOMACH	3.11E-12
BOWEL	1.56E-12
LIVER	4.97E-12
PANCREAS	2.05E-12
URINARY	1.28E-12
OTHER	2.50E-12
TOTAL	3.51E-11

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	1.04E-13
INHALATION	7.28E-12
AIR IMMERSION	1.25E-15
GROUND SURFACE	2.77E-11
INTERNAL	7.39E-12
EXTERNAL	2.77E-11
TOTAL	3.51E-11

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
CO-60	1.04E-11
SR-90	2.08E-13
CS-137	1.02E-13
BA-137M	1.76E-11
PU-239	3.05E-12
Y-90	1.36E-14
EU-154	5.81E-14
EU-155	9.18E-17
CS-134	4.04E-16
AM-241	1.29E-12
PU-238	5.18E-13
PU-240	1.28E-12
PU-241	1.84E-13
U-238	4.37E-13
TOTAL	3.51E-11

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

Direction	Distance (m) 2318	2370	2867	3393	4167
N	4.3E-07	4.1E-07	3.2E-07	2.6E-07	1.9E-07
NNW	1.3E-06	1.2E-06	9.5E-07	7.7E-07	5.8E-07
NW	2.1E-06	2.0E-06	1.6E-06	1.3E-06	9.7E-07
WNW	1.3E-06	1.2E-06	9.4E-07	7.6E-07	5.8E-07
W	3.9E-07	3.8E-07	2.9E-07	2.3E-07	1.8E-07
WSW	4.4E-07	4.3E-07	3.3E-07	2.7E-07	2.0E-07
SW	4.6E-07	4.5E-07	3.5E-07	2.8E-07	2.1E-07
SSW	4.5E-07	4.3E-07	3.3E-07	2.7E-07	2.0E-07
S	4.4E-07	4.2E-07	3.3E-07	2.6E-07	2.0E-07
SSE	8.6E-07	8.4E-07	6.5E-07	5.2E-07	4.0E-07
SE	1.3E-06	1.2E-06	9.6E-07	7.8E-07	5.9E-07
ESE	8.0E-07	7.8E-07	6.0E-07	4.9E-07	3.7E-07
E	3.1E-07	3.0E-07	2.3E-07	1.9E-07	1.4E-07
ENE	3.4E-07	3.3E-07	2.5E-07	2.1E-07	1.5E-07
NE	3.7E-07	3.6E-07	2.8E-07	2.3E-07	1.7E-07
NNE	4.0E-07	3.9E-07	3.0E-07	2.4E-07	1.8E-07

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

Direction	Distance (m) 2318	2370	2867	3393	4167
N	7.0E-12	6.8E-12	5.4E-12	4.5E-12	3.5E-12
NNW	2.1E-11	2.1E-11	1.6E-11	1.4E-11	1.1E-11
NW	3.5E-11	3.4E-11	2.7E-11	2.3E-11	1.8E-11
WNW	2.1E-11	2.0E-11	1.6E-11	1.3E-11	1.1E-11
W	6.2E-12	6.0E-12	4.9E-12	4.0E-12	3.1E-12
WSW	7.4E-12	7.3E-12	5.8E-12	4.8E-12	3.8E-12
SW	8.2E-12	7.9E-12	6.3E-12	5.2E-12	4.1E-12
SSW	7.6E-12	7.4E-12	5.9E-12	4.9E-12	3.8E-12
S	7.2E-12	7.0E-12	5.6E-12	4.6E-12	3.6E-12
SSE	1.5E-11	1.4E-11	1.1E-11	9.4E-12	7.3E-12
SE	2.2E-11	2.1E-11	1.7E-11	1.4E-11	1.1E-11
ESE	1.4E-11	1.3E-11	1.1E-11	8.7E-12	6.8E-12
E	5.0E-12	4.9E-12	3.9E-12	3.2E-12	2.5E-12
ENE	5.6E-12	5.5E-12	4.4E-12	3.6E-12	2.8E-12
NE	6.2E-12	6.1E-12	4.8E-12	4.0E-12	3.1E-12
NNE	6.6E-12	6.5E-12	5.1E-12	4.3E-12	3.3E-12

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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 17, 1993 7:29 am

Facility: Santa Susana Field Laboratory
Address: SSFL, Top of Woolsey Canyon Road, Simi Hills
City: Chatsworth
State: CA Zip: 91311

Effective Dose Equivalent
(mrem/year)

2.64E-08

At This Location: 2318 Meters Northwest
Source Category: DOE facility
Source Type: Area
Emission Year: 92

Comments: CAP88 calculation for 1992 Annual Environmental Report, combined area sources.

Dataset Name: SSFLDOEA
Dataset Date: May 17, 1993 7:29 am
Wind File: WNDFILES\SSFLNRC.WND

MAXIMALLY EXPOSED INDIVIDUAL

Location Of The Individual: 2318 Meters Northwest
Lifetime Fatal Cancer Risk: 6.25E-13

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Dose Equivalent (mrem/y)
GONADS	2.96E-08
BREAST	2.70E-08
R MAR	2.91E-08
LUNGS	2.26E-08
THYROID	2.79E-08
ENDOST	3.96E-08
RMNDR	2.25E-08
EFFEC	2.64E-08

RADIONUCLIDE EMISSIONS DURING THE YEAR 92

Nuclide	Class	Size	Pond Source #1 Ci/y	Slope Source #2 Ci/y	T886 Source #3 Ci/y	TOTAL Ci/y
CO-60	Y	1.00	9.0E-12	8.5E-11	0.0E+00	9.4E-11
SR-90	D	1.00	3.5E-10	2.2E-10	5.2E-09	5.8E-09
CS-137	D	1.00	3.5E-10	2.2E-10	5.2E-09	5.8E-09
BA-137M	D	1.00	3.5E-10	2.2E-10	5.2E-09	5.8E-09
Y-90	Y	1.00	3.5E-10	2.2E-10	5.2E-09	5.8E-09

SITE INFORMATION

Temperature:	17 degrees C
Precipitation:	79 cm/y
Mixing Height:	366 m

SOURCE INFORMATION

Source Number:	1	2	3
Source Height (m):	-2.00	0.00	-2.00
Area (sq m):	5.80E+01	1.04E+03	4.00E+03

Plume Rise Pasquill Cat:	A	B	C	D	E	F	G
Zero:	0.00	0.00	0.00	0.00	0.00	0.00	0.00

AGRICULTURAL DATA

	Vegetable	Milk	Meat
Fraction Home Produced:	0.020	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

2318 2370 2867 3393 4167

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 17, 1993 7:29 am

Facility: Santa Susana Field Laboratory
Address: SSFL, Top of Woolsey Canyon Road, Simi Hills
City: Chatsworth
State: CA Zip: 91311

Source Category: DOE facility
Source Type: Area
Emission Year: 92

Comments: CAP88 calculation for 1992 Annual Environmental Report, combined area sources.

Dataset Name: SSFLDOEA
Dataset Date: May 17, 1993 7:29 am
Wind File: WNDFILES\SSFLNRC.WND

ORGAN DOSE EQUIVALENT SUMMARY

Organ	Selected Individual (mrem/y)
GONADS	2.96E-08
BREAST	2.70E-08
R MAR	2.91E-08
LUNGS	2.26E-08
THYROID	2.79E-08
ENDOST	3.96E-08
RMNDR	2.25E-08
EFFEC	2.64E-08

PATHWAY EFFECTIVE DOSE EQUIVALENT SUMMARY

Pathway	Selected Individual (mrem/y)
INGESTION	3.44E-10
INHALATION	1.18E-09
AIR IMMERSION	1.46E-13
GROUND SURFACE	2.49E-08
INTERNAL	1.53E-09
EXTERNAL	2.49E-08
TOTAL	2.64E-08

NUCLIDE EFFECTIVE DOSE EQUIVALENT SUMMARY

Nuclide	Selected Individual (mrem/y)
CO-60	4.54E-10
SR-90	1.29E-09
CS-137	1.81E-10
BA-137M	2.45E-08
Y-90	4.17E-11
TOTAL	2.64E-08

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	8.98E-14
BONE	6.50E-15
THYROID	1.27E-14
BREAST	1.06E-13
LUNG	1.13E-13
STOMACH	6.69E-14
BOWEL	3.35E-14
LIVER	7.29E-14
PANCREAS	4.38E-14
URINARY	2.74E-14
OTHER	5.35E-14
TOTAL	6.25E-13

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	6.20E-15
INHALATION	2.27E-14
AIR IMMERSION	3.53E-18
GROUND SURFACE	5.97E-13
INTERNAL	2.89E-14
EXTERNAL	5.97E-13
TOTAL	6.25E-13

CANCER RISK SUMMARY

Cancer	Selected Individual Total Lifetime Fatal Cancer Risk
LEUKEMIA	8.98E-14
BONE	6.50E-15
THYROID	1.27E-14
BREAST	1.06E-13
LUNG	1.13E-13
STOMACH	6.69E-14
BOWEL	3.35E-14
LIVER	7.29E-14
PANCREAS	4.38E-14
URINARY	2.74E-14
OTHER	5.35E-14
TOTAL	6.25E-13

PATHWAY RISK SUMMARY

Pathway	Selected Individual Total Lifetime Fatal Cancer Risk
INGESTION	6.20E-15
INHALATION	2.27E-14
AIR IMMERSION	3.53E-18
GROUND SURFACE	5.97E-13
INTERNAL	2.89E-14
EXTERNAL	5.97E-13
TOTAL	6.25E-13

NUCLIDE RISK SUMMARY

Nuclide	Selected Individual Total Lifetime Fatal Cancer Risk
CO-60	1.13E-14
SR-90	2.20E-14
CS-137	4.78E-15
BA-137M	5.86E-13
Y-90	1.47E-15
TOTAL	6.25E-13

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

	Distance (m)				
Direction	2318	2370	2867	3393	4167
N	5.2E-09	5.0E-09	3.6E-09	2.7E-09	1.8E-09
NNW	1.6E-08	1.5E-08	1.1E-08	8.2E-09	5.6E-09
NW	2.6E-08	2.5E-08	1.8E-08	1.4E-08	9.5E-09
WNW	1.6E-08	1.5E-08	1.1E-08	8.2E-09	5.6E-09
W	5.2E-09	5.0E-09	3.5E-09	2.6E-09	1.7E-09
WSW	5.2E-09	5.0E-09	3.5E-09	2.7E-09	1.8E-09
SW	5.1E-09	4.9E-09	3.5E-09	2.6E-09	1.8E-09
SSW	5.2E-09	5.0E-09	3.6E-09	2.7E-09	1.9E-09
S	5.5E-09	5.3E-09	3.7E-09	2.8E-09	1.9E-09
SSE	1.1E-08	1.0E-08	7.3E-09	5.5E-09	3.8E-09
SE	1.6E-08	1.5E-08	1.1E-08	8.3E-09	5.8E-09
ESE	9.9E-09	9.6E-09	6.8E-09	5.2E-09	3.6E-09
E	4.0E-09	3.8E-09	2.7E-09	2.0E-09	1.3E-09
ENE	4.3E-09	4.1E-09	2.9E-09	2.2E-09	1.5E-09
NE	4.6E-09	4.4E-09	3.1E-09	2.3E-09	1.6E-09
NNE	4.9E-09	4.7E-09	3.3E-09	2.5E-09	1.7E-09