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Preliminary Radiation Dose Assessment for the Palmerton Ore Storage Site, Palmerton, Pennsylvania

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NOTATION

The following is a list of the acronyms, initialisms, and abbreviations (including units of measure) used in this document.

ACRONYMS, INITIALISMS, AND ABBREVIATIONS

AEC	Atomic Energy Commission
DOE	U.S. Department of Energy
FUSRAP	Formerly Utilized Sites Remedial Action Program
ORNL	Oak Ridge National Laboratory
POSS	Palmerton ore storage site

UNITS OF MEASURE

cm	centimeter(s)
cm^3	cubic centimeter(s)
g	gram(s)
in.	inch(es)
m	meter(s)
m^2	square meter(s)
mrem	millirem(s)
pCi	picocurie(s)
yr	year(s)

PRELIMINARY RADIATION DOSE ASSESSMENT FOR THE PALMERTON ORE STORAGE SITE, PALMERTON, PENNSYLVANIA

by

Manjula Nimmagadda and Charley Yu

ABSTRACT

Potential maximum radiation dose rates were calculated for the Palmerton ore storage site in Palmerton, Pennsylvania. The RESRAD computer code, which implements the methodology described in the U.S. Department of Energy's manual for establishing residual radioactive material guidelines, was used in this evaluation. Four potential scenarios were considered for the Palmerton ore storage site. Two scenarios were developed on the basis of industrial use of the site, and two were developed on the basis of residential use of the site. The scenarios also vary with regard to time spent at the site, sources of food consumed, and source terms. The RESRAD code was used to analyze potential radiation doses from three exposure pathways. The results indicate that the basic dose limit of 100 mrem/yr would not be exceeded in Scenarios A (industrial use, hot spot), B (industrial use, homogenous contamination), and C (residential use, homogenous contamination), but would be exceeded in Scenario D (residential use, hot spot). The potential maximum dose rates for Scenarios A, B, C, and D are 1.0 mrem/yr, 0.23 mrem/yr, 0.66 mrem/yr, and 360 mrem/yr, respectively.

1 INTRODUCTION AND HISTORY

The former uranium ore storage site is located in the Palmerton, Pennsylvania, area, on New Jersey Zinc Company property. Between 1953 and 1954, approximately 300 tons of ore (0.21% uranium oxide) from the Lehigh Coal and Navigation Company were stored to support the development of eastern uranium mines and to meet the Atomic Energy Commission's (AEC's) goals for procurement and stockpiling of uranium ore. New Jersey Zinc Company accepted, sampled, and stored the ore as an agent of the AEC. The ore remained there until 1973 when, as an indirect result of the Grand Junction mill tailings legislation, the AEC initiated a program to evaluate and clean up its ore storage and stockpile locations.

The AEC cleanup plan for the Palmerton site called for the removal of the ore and the first 15 cm of soil. In June 1973, the ore and soil were transported to the AEC

Feed Materials Center in Fernald, Ohio, for disposal in the plant's raffinate pits. The area at the east end of the stockpile was excavated an additional 61 to 76 cm to remove some chunks of ore that were buried. This material was disposed of in New Jersey Zinc Company's slag dump. The site met the guidelines adopted by the AEC at that time and was released to the owner.

As part of the Formerly Utilized Sites Remedial Action Program (FUSRAP), the U.S. Department of Energy (DOE) is implementing a radiological survey program to determine the radiological conditions at sites that were used by agencies prior to the DOE. Although the final Palmerton site report indicated that the site met the criteria as defined at the time of cleanup, the DOE determined that supporting radiological data were not sufficient to demonstrate that contemporary standards were met throughout the site. Subsequent radiological criteria and guidelines have become more stringent for the release of such sites for unrestricted use.

At the request of DOE, Oak Ridge National Laboratory (ORNL) conducted a comprehensive survey of a portion of the site in July and August of 1988. The purpose of this report is to calculate potential maximum radiation dose rates for both present and possible future use conditions. The RESRAD computer code, which implements the methodology described in DOE's manual for establishing residual radioactive material guidelines (Gilbert et al. 1989), was used to perform a dose assessment for that portion of the site surveyed by ORNL.

2 SCENARIO DEFINITION

Four potential exposure scenarios are considered in the dose assessment. In all scenarios, unrestricted use, at some time within 1000 years, is assumed for the Palmerton ore storage site (POSS) areas. Potential radiation doses resulting from three exposure pathways are analyzed: (1) direct exposure to external radiation from the contaminated soil material, (2) internal radiation from inhalation of contaminated dust, and (3) internal radiation from ingestion of plant foods grown in the contaminated area and irrigated with water drawn from a well adjacent to the contaminated area. On-site well water is not used for drinking because of the poor quality of shallow well water (Cottrell 1990). For Scenario D, however, it is assumed that the shallow well water is used for irrigation of garden vegetables. Also, for all scenarios, it is assumed that the worker or resident does not ingest fish, meat, or milk, from the site area.

In Scenario A (industrial use, hot spot), industrial use of the site is assumed. A hypothetical person is assumed to work in the POSS loading and unloading operations 15 minutes per week, 50 weeks per year, in the vicinity of the hot spot. Industrial use is also assumed in Scenario B (industrial use, homogeneous contamination). A hypothetical person is assumed to work in the POSS area 8 hours per day (6 hours outdoors and 2 hours indoors), 5 days per week, 50 weeks per year. It is also assumed

in Scenario B that the site is uniformly contaminated. For Scenarios A and B, the worker does not ingest plant foods.

Unlike Scenarios A and B, in Scenarios C (residential use, homogeneous contamination) and D (residential use, hot spot), nonindustrial use of the site is assumed. In Scenarios C and D, a hypothetical person takes up residence in the immediate vicinity of the site. The differences between Scenarios C and D are the source of contamination and the consumption of plant food. In Scenario C, the site is assumed to be uniformly contaminated, and the resident does not consume plant food grown on-site; in Scenario D, the resident builds a home immediately adjacent to the hot spot and consumes plant food grown in the garden located directly over the hot spot. The resident spends 4 months per year, 2 hours per day, 6 days per week in the vicinity of the hot spot (garden).

The RESRAD computer code (Gilbert et al. 1989) was used to calculate the radiation doses to the hypothetical future resident or worker for the four scenarios, on the basis of the following assumptions:

- Scenario A
  - The worker spends 15 minutes per week, 50 weeks per year, on-site, in the vicinity of the hot spot.
  - The worker does not consume any meat, milk, water, aquatic food, or vegetables from the site.
- Scenario B
  - The worker spends 2000 hours per year on-site.
  - The walls, floor, and foundation of the industrial building reduce external exposure by 30%; the indoor dust level is 40% of the outdoor dust level (Gilbert et al. 1989).
  - The worker does not consume any plant foods, meat, milk, aquatic food, or water from the site.
  - The site is covered with a 6-in. thick crust that has a concrete-like consistency.
- Scenario C
  - The resident spends 50% of his or her time indoors on the site, 25% outdoors on the site, and 25% away from the site.

- The walls, floor, and foundation of the house reduce external exposure by 30%; the indoor dust level is 40% of the outdoor dust level.

- The resident does not consume any plant foods, meat, milk, aquatic food, or water from the site.

- The site is covered with a 6-in. thick crust that has a concrete-like consistency.

• Scenario D

- The resident spends 50% of his or her time indoors on the site, 25% outdoors on the site (2.3% in the vicinity of the garden), and 25% away from the site.

- The resident spends 4 months per year, 2 hours per day, 6 days per week in the vicinity of the garden.

- The walls, floor, and foundation of the house reduce external exposure by 30%; the indoor dust level is 40% of the outdoor dust level.

- The external on-site outdoor radiation level away from the garden is assumed to be 80% of the radiation level in the garden. The on-site outdoor dust level is assumed to be the same as in the vicinity of the garden.

- Approximately 0.15% of the plant-food diet consumed by the resident is grown in a garden on the area of the hot spot.

- The hot spot area (3 m^2) is not adequate to provide any meat or milk for the resident from livestock raised (i.e., foraging) on-site.

- Vegetables are irrigated with water drawn from a shallow well located adjacent to the contaminated area.

All pathways considered for Scenarios A, B, C, and D are summarized in Table 1.

3 SOURCE TERMS

The source terms used in the RESRAD computer code were calculated primarily on the basis of data in Cottrell, Quillen, and Crutcher (1990). For Scenarios A and D, the hot spot uranium-238 and radium-226 concentration values provided by ORNL (Cottrell 1990) were used as an upper bound estimate. In Scenarios B and C, it was assumed that

TABLE 1 Summary of Pathways for Scenarios A, B, C, and D at POSS

Pathway	Scenarios A, B, and C	Scenario D
External exposure	Yes	Yes
Inhalation	Yes	Yes
Ingestion of plant foods	No	Yes
Ingestion of meat	No	No
Ingestion of milk	No	No
Ingestion of fish	No	No
Ingestion of water	No	No

TABLE 2 Radionuclide Concentrations Used in the RESRAD Computer Code for Scenarios A, B, C, and D at POSS

Radionuclide	Scenarios A and D Concentration (pCi/g)	Scenarios B and C Concentration (pCi/g)
Radium-226	499.2	2.53
Uranium-238	499.4	4.2
Uranium-234	499.4	4.2
Uranium-235	23.0	0.19
Actinium-227	23.0	0.19
Protactinium-231	23.0	0.19
Lead-210	499.2	2.53
Thorium-230	499.4	4.2

the construction of a house or industrial building would result in excavation and mixing of soil on-site. Thus, the weighted average radionuclide concentration values for the entire site were used for Scenarios B and C. In deriving the maximum dose rates, it was assumed that uranium-238, uranium-234, and uranium-235 were present in their natural activity concentration ratio of 1:1:0.046. To obtain the concentrations of associated daughters, it was assumed that the uranium series was in secular equilibrium. The radionuclide concentrations for each scenario used in the RESRAD computer code are presented in Table 2. A detailed description of the source term calculations is provided in Appendix A.

4 RESULTS

The RESRAD computer code was used to calculate the maximum dose rates for Scenarios A through D. The time frame considered in this analysis was 1000 years. Radioactive decay and ingrowth were considered in the calculation of the maximum dose rates. The various parameters used in the RESRAD code for this analysis are listed in Appendix B. The calculated maximum dose rates for Scenarios A, B, C, and D are presented in Table 3. The RESRAD code summary results are presented in Appendix C.

For all scenarios, the maximum dose rates occur at time 0 (the year the radiological survey was conducted). In Scenarios A and B (industrial use) and C (residential use), the maximum dose rates would not exceed 100 mrem per year. For Scenario A (industrial use, hot spot), the maximum dose rate of 1.0 mrem per year would result from inhalation and external exposure. The maximum dose rates for Scenarios B (industrial use, homogeneous contamination) and C (residential use, homogeneous contamination) would be 0.23 and 0.66 mrem/yr, respectively. For these two scenarios, the dose to the individual would result from external exposure. The potential maximum dose rates would exceed the DOE limit of 100 mrem/yr for Scenario D (residential use, hot spot). In Scenario D, the maximum dose rate of 360 mrem/yr would result from external exposure, inhalation, and ingestion of plant foods.

TABLE 3 Summary of Potential Maximum Dose Rates for Scenarios A, B, C, and D at POSS[a]

	Industrial Use		Residential Use	
Pathway	Scenario A Hot Spot (mrem/yr)	Scenario B Homogeneous Contamination (mrem/yr)	Scenario C Homogeneous Contamination (mrem/yr)	Scenario D Hot Spot (mrem/yr)
External exposure	0.56	0.23	0.66	210
Inhalation	0.45	0	0	130
Ingestion of plant foods	0	0	0	20
Ingestion of meat	0	0	0	0
Ingestion of milk	0	0	0	0
Ingestion of fish	0	0	0	0
Ingestion of water	0	0	0	0
Total	1.0	0.23	0.66	360

[a]The maximum dose rate occurs at time 0 (the year the radiological survey was conducted for all scenarios).

5 REFERENCES

Cottrell, W.D., 1990, "Source Term Information, Palmerton Ore Storage Site, Palmerton, Pennsylvania," letter from W.D. Cottrell (Oak Ridge National Laboratory) to C. Yu (Argonne National Laboratory), Sept. 6.

Cottrell, W.D., J.L. Quillen, and J.W. Crutcher, 1990, *Results of the Radiological Survey at the Former Ore Storage Site, Palmerton, Pennsylvania (PP001)*, Oak Ridge National Laboratory, ORNL/TM-11218, Dec.

Gilbert, T.L., et al., 1989, *A Manual for Implementing Residual Radioactive Material Guidelines*, ANL/ES-160, DOE/CH/8901, prepared by Argonne National Laboratory for U.S. Department of Energy, June.

APPENDIX A:

SOURCE TERM CALCULATION

A.1 SCENARIOS A AND D

The source terms used for Scenarios A and D in the RESRAD computer code were calculated using the data provided by Oak Ridge National Laboratory (ORNL) (Cottrell 1990). Both radium-226 and uranium-238 concentrations in the hot spot have been estimated by ORNL to be less than 500 pCi/g, with the majority existing in the first foot of soil from the surface. The area of the hot spot has been conservatively estimated by ORNL to be 3 m^2. Background values for radium-226 and uranium-238 were obtained from Cottrell, Quillen, and Crutcher (1990).

To obtain the concentrations of uranium-234 and uranium-235, it was assumed that uranium-238, uranium-234, and uranium-235 were present in their natural activity concentration ratio of 1:1:0.046. The concentrations of associated daughters (actinium-227, protactinium-231, lead-210, thorium-230) were obtained by assuming that the uranium series was in secular equilibrium.

A.2 SCENARIOS B AND C

The volume-weighted average radionuclide concentration values for the entire site were used to calculate the source terms for Scenarios B and C. Data were obtained from Cottrell (1990) and Cottrell, Quillen, and Crutcher (1990).

The total area of the site -- 9,662 m^2 -- and a depth of 1 m were assumed in estimating the average concentrations of radium-226 and uranium-238 for Scenarios B and C. The calculated concentrations for radium-226 and uranium-238 are 2.5 pCi/g and 4.2 pCi/g, respectively. The same procedure as described for Scenarios A and D was used to calculate the concentrations of uranium-238, uranium-235, actinium-227, protactinium-231, lead-210, and thorium-230.

A.3 REFERENCES

Cottrell, W.D., 1990, "Source Term Information, Palmerton Ore Storage Site. Palmerton, Pennsylvania," letter from W.D. Cottrell (Oak Ridge National Laboratory) to C. Yu (Argonne National Laboratory), Sept. 6.

Cottrell, W.D., J.L. Quillen, and J.W. Crutcher, 1990, *Results of the Radiological Survey at the Former Ore Storage Site, Palmerton, Pennsylvania (PP001)*, Oak Ridge National Laboratory, ORNL/TM-11218, Dec.

APPENDIX B:

PARAMETERS USED IN THE PALMERTON ORE STORAGE SITE ANALYSIS

B.1 PARAMETRIC VALUES USED IN THE RESRAD ANALYSIS

The following parameters were used in Scenarios A through D. The parameters that differ from the RESRAD default values are indicated by providing the scenarios and the varying values.

Area of contaminated zone:
Scenarios A and D = 3.0 m^2 (area of hot spot).
Scenarios B and C = 9,662 m^2 (total area of site).

Length parallel to aquifer flow:
Is approximately equal to the square root of the area.
Scenario A and D = 1.73 m^2.
Scenario B and C = 98.3 m^2.

Cover depth:
Scenarios B and C = 0.15 m.
Six-inch-thick crust of concrete-like consistency.
Source: Williams 1990.

Density of cover:
Scenarios B and C = 2.25 g/cm^3.
Density of concrete.
Source: U.S. Department of Health, Education, and Welfare 1970.

Cover layer erosion rate:
= 0 m/yr.

Contaminated zone total porosity:
= 0.492.
Based on silty clay soil at POSS.
Source: Gilbert et al. 1989, p. 170.

Contaminated zone effective porosity:
= 0.13.
Average of silt and clay material, based on silty clay soil at POSS.
Source: Gilbert et al. 1989, p. 187.

Contaminated zone hydraulic conductivity:
= 32.6 m/yr.
Based on silty clay soil at POSS.
Source: Gilbert et al. 1989, p. 170.

Contaminated zone b parameter:
= 10.4.
Based on silty clay soil at POSS.
Source: Gilbert et al. 1989, p. 170.

Precipitation:
= 0.96 m/yr.
Source: Griffin 1990.

Distance from surface to water table:
Scenarios A and D = 1.52 m; no cover material.
Scenarios B and C = 1.67 m; cover material.
Source: Ecology and Environment, Inc. 1980.

Water table drop rate:
= 0 m/yr.

Unsaturated zone 1, thickness:
= .52 m.
Based on the distance from the surface to the water table.

Unsaturated zone 1, total porosity:
= 0.492.
Based on silty clay soil at POSS.
Source: Gilbert et al. 1989, p. 170.

Unsaturated zone 1, effective porosity:
= 0.13.
Average of silt and clay material, based on silty clay soil at POSS.
Source: Gilbert et al. 1989, p. 187.

Unsaturated zone 1, soil specific b parameter:
= 10.4.
Based on silty clay soil at POSS.
Source: Gilbert et al. 1989, p. 170.

Unsaturated zone 1, hydraulic conductivity:
= 32.6 m/yr.
Based on silty clay soil at POSS.
Source: Gilbert et al. 1989, p. 170.

Occupancy and shielding factor, external gamma:
Scenario A = 0.0015.
Scenario B = 0.21.
Scenario C = 0.6.
Scenario D = 0.56.
Based on the scenario description.

Occupancy factor, inhalation:
Scenario A = 0.0015.
Scenario B = 0.19.
Scenario C = 0.45.
Scenario D = 0.45.
Based on the scenario description.

Irrigation:
Scenarios A, B, and C = 0.
Based on the scenario description (no ingestion of plant foods).

The parametric values used in the RESRAD code for the POSS analysis are provided in the following pages. All parametric values are reported to two significant figures.

Summary : Scenario A File: SA.DAT

Site-Specific Parameter Summary

Menu	Parameter	Used	Default
R011	Area of contaminated zone (m**2)	3.000E+00	1.000E+04
R011	Thickness of contaminated zone (m)	3.000E-01	1.000E+00
R011	Length parallel to aquifer flow (m)	1.730E+00	1.000E+02
R011	Basic radiation dose limit (mrem/yr)	1.000E+02	1.000E+02
R011	Times for calculations (yr)	1.000E+00	1.000E+00
R011	Times for calculations (yr)	1.000E+01	3.000E+00
R011	Times for calculations (yr)	1.000E+02	1.000E+01
R011	Times for calculations (yr)	2.000E+02	3.000E+01
R011	Times for calculations (yr)	4.000E+02	1.000E+02
R011	Times for calculations (yr)	6.000E+02	3.000E+02
R011	Times for calculations (yr)	8.000E+02	1.000E+03
R011	Times for calculations (yr)	1.000E+03	3.000E+03
R011	Times for calculations (yr)	2.000E+03	1.000E+04
R012	Initial principal radionuclide (pCi/g): Ac-227	2.300E+01	0.000E+00
R012	Initial principal radionuclide (pCi/g): Pa-231	2.300E+01	0.000E+00
R012	Initial principal radionuclide (pCi/g): Pb-210	4.992E+02	0.000E+00
R012	Initial principal radionuclide (pCi/g): Ra-226	4.992E+02	0.000E+00
R012	Initial principal radionuclide (pCi/g): Th-230	4.994E+02	0.000E+00
R012	Initial principal radionuclide (pCi/g): U-234	4.994E+02	0.000E+00
R012	Initial principal radionuclide (pCi/g): U-235	2.300E+01	0.000E+00
R012	Initial principal radionuclide (pCi/g): U-238	4.994E+02	0.000E+00
R013	Cover depth (m)	0.000E+00	0.000E+00
R013	Density of contaminated zone (g/cm**3)	1.600E+00	1.600E+00
R013	Contaminated zone erosion rate (m/yr)	0.000E+00	1.000E-03
R013	Contaminated zone total porosity	4.920E-01	4.000E-01
R013	Contaminated zone effective porosity	1.300E-01	2.000E-01
R013	Contaminated zone hydraulic conductivity (m/yr)	3.260E+01	1.000E+01
R013	Contaminated zone b parameter	1.040E+01	5.300E+00
R013	Evapotranspiration coefficient	6.000E-01	6.000E-01
R013	Precipitation (m/yr)	9.600E-01	1.000E+00
R013	Irrigation (m/yr)	0.000E+00	2.000E-01
R013	Irrigation mode	overhead	overhead
R013	Runoff coefficient	2.000E-01	2.000E-01
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06
R014	Density of saturated zone (g/cm**3)	1.600E+00	1.600E+00
R014	Saturated zone total porosity	4.000E-01	4.000E-01
R014	Saturated zone effective porosity	2.000E-01	2.000E-01
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02
R014	Distance from surface to water table (m)	1.520E+00	5.000E+00
R014	Water table drop rate (m/yr)	0.000E+00	1.000E-03
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND
R015	Number of unsaturated zone strata	1	1

Summary : Scenario A File: SA.DAT

Site-Specific Parameter Summary (continued)

Menu	Parameter	Used	Default
R015	Unsat. zone 1, thickness (m)	1.220E+00	4.000E+00
R015	Unsat. zone 1, soil density (g/cm**3)	1.600E+00	1.600E+00
R015	Unsat. zone 1, total porosity	3.920E-01	4.000E-01
R015	Unsat. zone 1, effective porosity	1.300E-01	2.000E-01
R015	Unsat. zone 1, soil-specific b parameter	1.040E+01	5.300E+00
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	3.260E+01	1.000E+02
R016	Distribution coefficients for Ac-227		
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R016	Distribution coefficients for Pa-231		
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R016	Distribution coefficients for Pb-210		
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R016	Distribution coefficients for Ra-226		
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R016	Distribution coefficients for Th-230		
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R016	Distribution coefficients for U-234		
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R016	Distribution coefficients for U-235		
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Leach rate (/yr)	0.000E+00	0.000E+00

Summary : Scenario A File: SA.DAT

Site-Specific Parameter Summary (continued)

Menu	Parameter	Used	Default
R016	Distribution coefficients for U-238		
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03
R017	Mass loading for inhalation (g/m**3)	2.000E-04	2.000E-04
R017	Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00
R017	Occupancy factor, inhalation	1.500E-03	4.500E-01
R017	Occupancy and shielding factor, external gamma	1.500E-03	6.000E-01
R017	Shape factor, external gamma	1.000E+00	1.000E+00
R018	Fruits, vegetables and grain consumption (kg/yr)	0.000E+00	1.600E+02
R018	Leafy vegetable consumption (kg/yr)	0.000E+00	1.400E+01
R018	Milk consumption (L/yr)	0.000E+00	9.200E+01
R018	Meat and poultry consumption (kg/yr)	0.000E+00	6.300E+01
R018	Fish consumption (kg/yr)	0.000E+00	5.400E+00
R018	Other seafood consumption (kg/yr)	0.000E+00	9.000E-01
R018	Drinking water intake (L/yr)	0.000E+00	4.100E+02
R018	Fraction of drinking water from site	0.000E+00	1.000E+00
R018	Fraction of aquatic food from site	0.000E+00	5.000E-01
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01
R019	Depth of roots (m)	9.000E-01	9.000E-01
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00

Summary : Scenario B File: SB.DAT

Site-Specific Parameter Summary

Menu	Parameter	Used	Default
R011	Area of contaminated zone (m**2)	9.662E+03	1.000E+04
R011	Thickness of contaminated zone (m)	1.000E+00	1.000E+00
R011	Length parallel to aquifer flow (m)	9.830E+01	1.000E+02
R011	Basic radiation dose limit (mrem/yr)	1.000E+02	1.000E+02
R011	Times for calculations (yr)	1.000E+00	1.000E+00
R011	Times for calculations (yr)	1.000E+01	3.000E+00
R011	Times for calculations (yr)	1.000E+02	1.000E+01
R011	Times for calculations (yr)	2.000E+02	3.000E+01
R011	Times for calculations (yr)	4.000E+02	1.000E+02
R011	Times for calculations (yr)	6.000E+02	3.000E+02
R011	Times for calculations (yr)	8.000E+02	1.000E+03
R011	Times for calculations (yr)	1.000E+03	3.000E+03
R011	Times for calculations (yr)	2.000E+03	1.000E+04
R012	Initial principal radionuclide (pCi/g): Ac-227	1.900E-01	0.000E+00
R012	Initial principal radionuclide (pCi/g): Pa-231	1.900E-01	0.000E+00
R012	Initial principal radionuclide (pCi/g): Pb-210	2.530E+00	0.000E+00
R012	Initial principal radionuclide (pCi/g): Ra-226	2.530E+00	0.000E+00
R012	Initial principal radionuclide (pCi/g): Th-230	4.200E+00	0.000E+00
R012	Initial principal radionuclide (pCi/g): U-234	4.200E+00	0.000E+00
R012	Initial principal radionuclide (pCi/g): U-235	1.900E-01	0.000E+00
R012	Initial principal radionuclide (pCi/g): U-238	4.200E+00	0.000E+00
R013	Cover depth (m)	1.500E-01	0.000E+00
R013	Density of cover material (g/cm**3)	2.250E+00	1.600E+00
R013	Cover depth erosion rate (m/yr)	0.000E+00	1.000E-03
R013	Density of contaminated zone (g/cm**3)	1.600E+00	1.600E+00
R013	Contaminated zone erosion rate (m/yr)	0.000E+00	1.000E-03
R013	Contaminated zone total porosity	4.920E-01	4.000E-01
R013	Contaminated zone effective porosity	1.300E-01	2.000E-01
R013	Contaminated zone hydraulic conductivity (m/yr)	3.260E+01	1.000E+01
R013	Contaminated zone b parameter	1.040E+01	5.300E+00
R013	Evapotranspiration coefficient	6.000E-01	6.000E-01
R013	Precipitation (m/yr)	9.600E-01	1.000E+00
R013	Irrigation (m/yr)	0.000E+00	2.000E-01
R013	Irrigation mode	overhead	overhead
R013	Runoff coefficient	2.000E-01	2.000E-01
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06
R014	Density of saturated zone (g/cm**3)	1.600E+00	1.600E+00
R014	Saturated zone total porosity	4.000E-01	4.000E-01
R014	Saturated zone effective porosity	2.000E-01	2.000E-01
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02
R014	Distance from surface to water table (m)	1.670E+00	5.000E+00
R014	Water table drop rate (m/yr)	0.000E+00	1.000E-03
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND
R015	Number of unsaturated zone strata	1	1

Summary : Scenario B File: SB.DAT

Site-Specific Parameter Summary (continued)

Menu	Parameter	Used	Default
R015	Unsat. zone 1, thickness (m)	5.200E-01	4.000E+00
R015	Unsat. zone 1, soil density (g/cm**3)	1.600E+00	1.600E+00
R015	Unsat. zone 1, total porosity	4.920E-01	4.000E-01
R015	Unsat. zone 1, effective porosity	1.300E-01	2.000E-01
R015	Unsat. zone 1, soil-specific b parameter	1.040E+01	5.300E+00
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	3.260E+01	1.000E+02
R016	Distribution coefficients for Ac-227		
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R016	Distribution coefficients for Pa-231		
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R016	Distribution coefficients for Pb-210		
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R016	Distribution coefficients for Ra-226		
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R016	Distribution coefficients for Th-230		
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R016	Distribution coefficients for U-234		
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R016	Distribution coefficients for U-235		
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Leach rate (/yr)	0.000E+00	0.000E+00

Summary : Scenario B File: SB.DAT

Site-Specific Parameter Summary (continued)

Menu	Parameter	Used	Default
R016	Distribution coefficients for U-238		
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03
R017	Mass loading for inhalation (g/m**3)	2.000E-04	2.000E-04
R017	Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00
R017	Occupancy factor, inhalation	1.900E-01	4.500E-01
R017	Occupancy and shielding factor, external gamma	2.100E-01	6.000E-01
R017	Shape factor, external gamma	1.000E+00	1.000E+00
R018	Fruits, vegetables and grain consumption (kg/yr)	0.000E+00	1.600E+02
R018	Leafy vegetable consumption (kg/yr)	0.000E+00	1.400E+01
R018	Milk consumption (L/yr)	0.000E+00	9.200E+01
R018	Meat and poultry consumption (kg/yr)	0.000E+00	6.300E+01
R018	Fish consumption (kg/yr)	0.000E+00	5.400E+00
R018	Other seafood consumption (kg/yr)	0.000E+00	9.000E-01
R018	Drinking water intake (L/yr)	0.000E+00	4.100E+02
R018	Fraction of drinking water from site	0.000E+00	1.000E+00
R018	Fraction of aquatic food from site	0.000E+00	5.000E-01
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01
R019	Depth of roots (m)	9.000E-01	9.000E-01
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00

Summary : Scenario C File: SC.DAT

Site-Specific Parameter Summary

Menu	Parameter	Used	Default
R011	Area of contaminated zone (m**2)	9.662E+03	1.000E+04
R011	Thickness of contaminated zone (m)	1.000E+00	1.000E+00
R011	Length parallel to aquifer flow (m)	9.830E+01	1.000E+02
R011	Basic radiation dose limit (mrem/yr)	1.000E+02	1.000E+02
R011	Times for calculations (yr)	1.000E+00	1.000E+00
R011	Times for calculations (yr)	1.000E+01	3.000E+00
R011	Times for calculations (yr)	1.000E+02	1.000E+01
R011	Times for calculations (yr)	2.000E+02	3.000E+01
R011	Times for calculations (yr)	4.000E+02	1.000E+02
R011	Times for calculations (yr)	6.000E+02	3.000E+02
R011	Times for calculations (yr)	8.000E+02	1.000E+03
R011	Times for calculations (yr)	1.000E+03	3.000E+03
R011	Times for calculations (yr)	2.000E+03	1.000E+04
R012	Initial principal radionuclide (pCi/g): Ac-227	1.900E-01	0.000E+00
R012	Initial principal radionuclide (pCi/g): Pa-231	1.900E-01	0.000E+00
R012	Initial principal radionuclide (pCi/g): Pb-210	2.530E+00	0.000E+00
R012	Initial principal radionuclide (pCi/g): Ra-226	2.530E+00	0.000E+00
R012	Initial principal radionuclide (pCi/g): Th-230	4.200E+00	0.000E+00
R012	Initial principal radionuclide (pCi/g): U-234	4.200E+00	0.000E+00
R012	Initial principal radionuclide (pCi/g): U-235	1.900E-01	0.000E+00
R012	Initial principal radionuclide (pCi/g): U-238	4.200E+00	0.000E+00
R013	Cover depth (m)	1.500E-01	0.000E+00
R013	Density of cover material (g/cm**3)	2.250E+00	1.600E+00
R013	Cover depth erosion rate (m/yr)	0.000E+00	1.000E-03
R013	Density of contaminated zone (g/cm**3)	1.600E+00	1.600E+00
R013	Contaminated zone erosion rate (m/yr)	0.000E+00	1.000E-03
R013	Contaminated zone total porosity	4.920E-01	4.000E-01
R013	Contaminated zone effective porosity	1.300E-01	2.000E-01
R013	Contaminated zone hydraulic conductivity (m/yr)	3.260E+01	1.000E+01
R013	Contaminated zone b parameter	1.040E+01	5.300E+00
R013	Evapotranspiration coefficient	6.000E-01	6.000E-01
R013	Precipitation (m/yr)	9.600E-01	1.000E+00
R013	Irrigation (m/yr)	0.000E+00	2.000E-01
R013	Irrigation mode	overhead	overhead
R013	Runoff coefficient	2.000E-01	2.000E-01
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06
R014	Density of saturated zone (g/cm**3)	1.600E+00	1.600E+00
R014	Saturated zone total porosity	4.000E-01	4.000E-01
R014	Saturated zone effective porosity	2.000E-01	2.000E-01
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02
R014	Distance from surface to water table (m)	1.670E+00	5.000E+00
R014	Water table drop rate (m/yr)	0.000E+00	1.000E-03
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND
R015	Number of unsaturated zone strata	1	1

Summary : Scenario C File: SC.DAT

Site-Specific Parameter Summary (continued)

Menu	Parameter	Used	Default
R015	Unsat. zone 1, thickness (m)	5.200E-01	4.000E+00
R015	Unsat. zone 1, soil density (g/cm**3)	1.600E+00	1.600E+00
R015	Unsat. zone 1, total porosity	4.920E-01	4.000E-01
R015	Unsat. zone 1, effective porosity	1.300E-01	2.000E-01
R015	Unsat. zone 1, soil-specific b parameter	1.040E+01	5.300E+00
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	3.260E+01	1.000E+02
R016	Distribution coefficients for Ac-227		
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R016	Distribution coefficients for Pa-231		
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R016	Distribution coefficients for Pb-210		
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R016	Distribution coefficients for Ra-226		
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R016	Distribution coefficients for Th-230		
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R016	Distribution coefficients for U-234		
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R016	Distribution coefficients for U-235		
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Leach rate (/yr)	0.000E+00	0.000E+00

Summary : Scenario C File: SC.DAT

Site-Specific Parameter Summary (continued)

Menu	Parameter	Used	Default
R016	Distribution coefficients for U-238		
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03
R017	Mass loading for inhalation (g/m**3)	2.000E-04	2.000E-04
R017	Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00
R017	Occupancy factor, inhalation	4.500E-01	4.500E-01
R017	Occupancy and shielding factor, external gamma	6.000E-01	6.000E-01
R017	Shape factor, external gamma	1.000E+00	1.000E+00
R018	Fruits, vegetables and grain consumption (kg/yr)	0.000E+00	1.600E+02
R018	Leafy vegetable consumption (kg/yr)	0.000E+00	1.400E+01
R018	Milk consumption (L/yr)	0.000E+00	9.200E+01
R018	Meat and poultry consumption (kg/yr)	0.000E+00	6.300E+01
R018	Fish consumption (kg/yr)	0.000E+00	5.400E+00
R018	Other seafood consumption (kg/yr)	0.000E+00	9.000E-01
R018	Drinking water intake (L/yr)	0.000E+00	4.100E+02
R018	Fraction of drinking water from site	0.000E+00	1.000E+00
R018	Fraction of aquatic food from site	0.000E+00	5.000E-01
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01
R019	Depth of roots (m)	9.000E-01	9.000E-01
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00

Summary : Scenario D File: SD.DAT

Site-Specific Parameter Summary

Menu	Parameter	Used	Default
R011	Area of contaminated zone (m**2)	3.000E+00	1.000E+04
R011	Thickness of contaminated zone (m)	3.000E-01	1.000E+00
R011	Length parallel to aquifer flow (m)	1.730E+00	1.000E+02
R011	Basic radiation dose limit (mrem/yr)	1.000E+02	1.000E+02
R011	Times for calculations (yr)	1.000E+00	1.000E+00
R011	Times for calculations (yr)	1.000E+01	3.000E+00
R011	Times for calculations (yr)	1.000E+02	1.000E+01
R011	Times for calculations (yr)	2.000E+02	3.000E+01
R011	Times for calculations (yr)	4.000E+02	1.000E+02
R011	Times for calculations (yr)	6.000E+02	3.000E+02
R011	Times for calculations (yr)	8.000E+02	1.000E+03
R011	Times for calculations (yr)	1.000E+03	3.000E+03
R011	Times for calculations (yr)	2.000E+03	1.000E+04
R012	Initial principal radionuclide (pCi/g): Ac-227	2.300E+01	0.000E+00
R012	Initial principal radionuclide (pCi/g): Pa-231	2.300E+01	0.000E+00
R012	Initial principal radionuclide (pCi/g): Pb-210	4.992E+02	0.000E+00
R012	Initial principal radionuclide (pCi/g): Ra-226	4.992E+02	0.000E+00
R012	Initial principal radionuclide (pCi/g): Th-230	4.994E+02	0.000E+00
R012	Initial principal radionuclide (pCi/g): U-234	4.994E+02	0.000E+00
R012	Initial principal radionuclide (pCi/g): U-235	2.300E+01	0.000E+00
R012	Initial principal radionuclide (pCi/g): U-238	4.994E+02	0.000E+00
R013	Cover depth (m)	0.000E+00	0.000E+00
R013	Density of contaminated zone (g/cm**3)	1.600E+00	1.600E+00
R013	Contaminated zone erosion rate (m/yr)	0.000E+00	1.000E-03
R013	Contaminated zone total porosity	4.920E-01	4.000E-01
R013	Contaminated zone effective porosity	1.300E-01	2.000E-01
R013	Contaminated zone hydraulic conductivity (m/yr)	3.260E+01	1.000E+01
R013	Contaminated zone b parameter	1.040E+01	5.300E+00
R013	Evapotranspiration coefficient	6.000E-01	6.000E-01
R013	Precipitation (m/yr)	9.600E-01	1.000E+00
R013	Irrigation (m/yr)	2.000E-01	2.000E-01
R013	Irrigation mode	overhead	overhead
R013	Runoff coefficient	2.000E-01	2.000E-01
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06
R014	Density of saturated zone (g/cm**3)	1.600E+00	1.600E+00
R014	Saturated zone total porosity	4.000E-01	4.000E-01
R014	Saturated zone effective porosity	2.000E-01	2.000E-01
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02
R014	Distance from surface to water table (m)	1.520E+00	5.000E+00
R014	Water table drop rate (m/yr)	0.000E+00	1.000E-03
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND
R015	Number of unsaturated zone strata	1	1

Summary : Scenario D File: SD.DAT

Site-Specific Parameter Summary (continued)

Menu	Parameter	Used	Default
R015	Unsat. zone 1, thickness (m)	1.220E+00	4.000E+00
R015	Unsat. zone 1, soil density (g/cm**3)	1.600E+00	1.600E+00
R015	Unsat. zone 1, total porosity	4.920E-01	4.000E-01
R015	Unsat. zone 1, effective porosity	1.300E-01	2.000E-01
R015	Unsat. zone 1, soil-specific b parameter	1.040E+01	5.300E+00
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	3.260E+01	1.000E+02
R016	Distribution coefficients for Ac-227		
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R016	Distribution coefficients for Pa-231		
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R016	Distribution coefficients for Pb-210		
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R016	Distribution coefficients for Ra-226		
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R016	Distribution coefficients for Th-230		
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R016	Distribution coefficients for U-234		
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R016	Distribution coefficients for U-235		
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Leach rate (/yr)	0.000E+00	0.000E+00

Summary : Scenario D File: SD.DAT

Site-Specific Parameter Summary (continued)

Menu	Parameter	Used	Default
R016	Distribution coefficients for U-238		
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01
R016	Leach rate (/yr)	0.000E+00	0.000E+00
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03
R017	Mass loading for inhalation (g/m**3)	2.000E-04	2.000E-04
R017	Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00
R017	Occupancy factor, inhalation	4.500E-01	4.500E-01
R017	Occupancy and shielding factor, external gamma	5.600E-01	6.000E-01
R017	Shape factor, external gamma	1.000E+00	1.000E+00
R018	Fruits, vegetables and grain consumption (kg/yr)	1.600E+02	1.600E+02
R018	Leafy vegetable consumption (kg/yr)	1.400E+01	1.400E+01
R018	Milk consumption (L/yr)	0.000E+00	9.200E+01
R018	Meat and poultry consumption (kg/yr)	0.000E+00	6.300E+01
R018	Fish consumption (kg/yr)	0.000E+00	5.400E+00
R018	Other seafood consumption (kg/yr)	0.000E+00	9.000E-01
R018	Drinking water intake (L/yr)	0.000E+00	4.100E+02
R018	Fraction of drinking water from site	0.000E+00	1.000E+00
R018	Fraction of aquatic food from site	0.000E+00	5.000E-01
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01
R019	Depth of roots (m)	9.000E-01	9.000E-01
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00

B.2 REFERENCES

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U.S. Department of Health, Education, and Welfare, 1970, *Radiological Health Handbook,* Bureau of Radiological Health, Rockville, Md.

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APPENDIX C:

RESRAD RESULTS

The RESRAD summary results for Scenarios A, B, C, and D are presented on the following pages.

Summary : Scenario A File: SA.DAT

Contaminated Zone Dimensions	
Area:	3.00 square meters
Thickness:	0.30 meters
Cover Depth:	0.00 meters

Initial Soil Concentrations, pCi/g	
Ac-227	2.300E+01
Pa-231	2.300E+01
Pb-210	4.992E+02
Ra-226	4.992E+02
Th-230	4.994E+02
U-234	4.994E+02
U-235	2.300E+01
U-238	4.994E+02

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 100 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0	1	10	100	200	400	600	800	1000	2000
TDOSE(t):	1.006E+00	9.950E-01	9.032E-01	4.474E-01	2.709E-01	1.850E-01	1.729E-01	1.706E-01	1.697E-01	1.664E-01
M(t):	1.006E-02	9.950E-03	9.032E-03	4.474E-03	2.709E-03	1.850E-03	1.729E-03	1.706E-03	1.697E-03	1.664E-03

Maximum TDOSE(t): 1.006E+00 mrem/yr at t = 0 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p), mrem/yr

At t = 0 years

Radio-	Water Independent Pathways					Water Dependent Pathways					
Nuclide	Ground	Dust	Plant	Meat	Milk	Water	Fish	Plant	Meat	Milk	Total
Ac-227	4.608E-03	1.421E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.467E-01
Pa-231	3.680E-04	2.758E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.795E-02
Pb-210	1.596E-04	9.670E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.829E-03
Ra-226	5.470E-01	3.638E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.507E-01
Th-230	7.087E-05	1.474E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.475E-01
U-234	4.917E-05	5.988E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.993E-02
U-235	1.507E-03	2.546E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.053E-03
U-238	4.561E-03	5.528E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.984E-02
Total	5.584E-01	4.481E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.006E+00

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p), percent

At t = 0 years

Radio-	Water Independent Pathways					Water Dependent Pathways					
Nuclide	Ground	Dust	Plant	Meat	Milk	Water	Fish	Plant	Meat	Milk	Total
Ac-227	4.578E-01	1.412E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.458E+01
Pa-231	3.656E-02	2.740E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.777E+00
Pb-210	1.586E-02	9.607E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.766E-01
Ra-226	5.435E+01	3.614E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.471E+01
Th-230	7.041E-03	1.465E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.465E+01
U-234	4.885E-03	5.950E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.955E+00
U-235	1.498E-01	2.529E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.027E-01
U-238	4.531E-01	5.492E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.945E+00
Total	5.548E+01	4.452E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.000E+02

Summary : Scenario B File: SB.DAT

Contaminated Zone Dimensions

Area:	9662.00 square meters
Thickness:	1.00 meters
Cover Depth:	0.15 meters

Initial Soil Concentrations, pCi/g

Ac-227	1.900E-01
Pa-231	1.900E-01
Pb-210	2.530E+00
Ra-226	2.530E+00
Th-230	4.200E+00
U-234	4.200E+00
U-235	1.900E-01
U-238	4.200E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 100 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0	1	10	100	200	400	600	800	1000	2000
TDOSE(t):	2.317E-01	2.311E-01	2.258E-01	1.817E-01	1.458E-01	1.006E-01	7.681E-02	6.418E-02	5.745E-02	4.974E-02
M(t):	2.317E-03	2.311E-03	2.258E-03	1.817E-03	1.458E-03	1.006E-03	7.681E-04	6.418E-04	5.745E-04	4.974E-04

Maximum TDOSE(t): 2.317E-01 mrem/yr at t = 0 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p), mrem/yr

At t = 0 years

Radio-	Water Independent Pathways					Water Dependent Pathways					
Nuclide	Ground	Dust	Plant	Meat	Milk	Water	Fish	Plant	Meat	Milk	Total
Ac-227	2.534E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.534E-03
Pa-231	6.174E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.174E-05
Pb-210	1.183E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.183E-05
Ra-226	2.216E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.216E-01
Th-230	8.695E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.695E-06
U-234	6.035E-06	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.035E-06
U-235	1.818E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.818E-04
U-238	7.285E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.285E-03
Total	2.317E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.317E-01

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p), percent

At t = 0 years

Radio-	Water Independent Pathways					Water Dependent Pathways					
Nuclide	Ground	Dust	Plant	Meat	Milk	Water	Fish	Plant	Meat	Milk	Total
Ac-227	1.094E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.094E+00
Pa-231	2.665E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.665E-02
Pb-210	5.107E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.107E-03
Ra-226	9.564E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.564E+01
Th-230	3.753E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.753E-03
U-234	2.605E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.605E-03
U-235	7.847E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.847E-02
U-238	3.145E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.145E+00
Total	1.000E+02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.000E+02

Summary : Scenario C

File: SC.DAT

Contaminated Zone Dimensions

Area:	9662.00 square meters
Thickness:	1.00 meters
Cover Depth:	0.15 meters

Initial Soil Concentrations, pCi/g

Ac-227	1.900E-01
Pa-231	1.900E-01
Pb-210	2.530E+00
Ra-226	2.530E+00
Th-230	4.200E+00
U-234	4.200E+00
U-235	1.900E-01
U-238	4.200E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 100 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0	1	10	100	200	400	600	800	1000	2000
TDOSE(t):	6.619E-01	6.602E-01	6.452E-01	5.192E-01	4.164E-01	2.876E-01	2.195E-01	1.834E-01	1.641E-01	1.421E-01
M(t):	6.619E-03	6.602E-03	6.452E-03	5.192E-03	4.164E-03	2.876E-03	2.195E-03	1.834E-03	1.641E-03	1.421E-03

Maximum TDOSE(t): 6.619E-01 mrem/yr at t = 0 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p), mrem/yr

At t = 0 years

Radio-	Water Independent Pathways					Water Dependent Pathways					
Nuclide	Ground	Dust	Plant	Meat	Milk	Water	Fish	Plant	Meat	Milk	Total
Ac-227	7.241E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.241E-03
Pa-231	1.764E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.764E-04
Pb-210	3.380E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.380E-05
Ra-226	6.331E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.331E-01
Th-230	2.484E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.484E-05
U-234	1.724E-05	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.724E-05
U-235	5.194E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.194E-04
U-238	2.081E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.081E-02
Total	6.619E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.619E-01

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p), percent

At t = 0 years

Radio-	Water Independent Pathways					Water Dependent Pathways					
Nuclide	Ground	Dust	Plant	Meat	Milk	Water	Fish	Plant	Meat	Milk	Total
Ac-227	1.094E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.094E+00
Pa-231	2.665E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.665E-02
Pb-210	5.107E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.107E-03
Ra-226	9.564E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	9.564E+01
Th-230	3.753E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.753E-03
U-234	2.605E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.605E-03
U-235	7.847E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	7.847E-02
U-238	3.145E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.145E+00
Total	1.000E+02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.000E+02

Summary : Scenario D

File: SD.DAT

Contaminated Zone Dimensions

Area:	3.00 square meters
Thickness:	0.30 meters
Cover Depth:	0.00 meters

Initial Soil Concentrations, pCi/g

Ac-227	2.300E+01
Pa-231	2.300E+01
Pb-210	4.992E+02
Ra-226	4.992E+02
Th-230	4.994E+02
U-234	4.994E+02
U-235	2.300E+01
U-238	4.994E+02

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 100 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0	1	10	100	200	400	600	800	1000	2000
TDOSE(t):	3.630E+02	3.581E+02	3.186E+02	1.345E+02	7.655E+01	5.423E+01	5.203E+01	5.161E+01	5.135E+01	5.021E+01
M(t):	3.630E+00	3.581E+00	3.186E+00	1.345E+00	7.655E-01	5.423E-01	5.203E-01	5.161E-01	5.135E-01	5.021E-01

Maximum TDOSE(t): 3.630E+02 mrem/yr at t = 0 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p), mrem/yr

At t = 0 years

Radio-Nuclide	Water Independent Pathways					Water Dependent Pathways					Total
	Ground	Dust	Plant	Meat	Milk	Water	Fish	Plant	Meat	Milk	
Ac-227	1.720E+00	4.264E+01	7.527E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.444E+01
Pa-231	1.374E-01	8.274E+00	5.520E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	8.466E+00
Pb-210	5.960E-02	2.901E+00	1.979E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.275E+01
Ra-226	2.042E+02	1.091E+00	6.726E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.054E+02
Th-230	2.646E-02	4.422E+01	9.689E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.434E+01
U-234	1.836E-02	1.796E+01	2.833E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.801E+01
U-235	5.627E-01	7.637E-01	1.255E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.328E+00
U-238	1.703E+00	1.658E+01	2.724E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.831E+01
Total	2.085E+02	1.344E+02	2.014E+01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.630E+02

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p), percent

At t = 0 years

Radio-Nuclide	Water Independent Pathways					Water Dependent Pathways					Total
	Ground	Dust	Plant	Meat	Milk	Water	Fish	Plant	Meat	Milk	
Ac-227	4.738E-01	1.175E+01	2.073E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.224E+01
Pa-231	3.784E-02	2.279E+00	1.520E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	2.332E+00
Pb-210	1.642E-02	7.991E-01	5.451E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	6.266E+00
Ra-226	5.626E+01	3.006E-01	1.853E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.657E+01
Th-230	7.288E-03	1.218E+01	2.669E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.221E+01
U-234	5.057E-03	4.949E+00	7.803E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	4.961E+00
U-235	1.550E-01	2.104E-01	3.456E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	3.657E-01
U-238	4.690E-01	4.568E+00	7.503E-03	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	5.044E+00
Total	5.742E+01	3.703E+01	5.548E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	1.000E+02