Westinghouse Non-Proprietary Class 3

Hematite Former Fuel Cycle Facility Decommissioning

TITLE: **Derivation of Site Specific Soil DCGLs for Westinghouse Electric Company Hematite Facility (Resident Gardener) License SNM-33, Docket No. 70-36**

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ACRONYMS & ABBREVIATIONS

ABB	Asea, Brown, and Boveri
ALARA	as low as reasonably achievable
Am-241	americium-241
AEC	Atomic Energy Commission
bgs	below ground surface
cm/sec	centimeters per second
cm^3/g	cubic centimeters per gram
CE	Combustion Engineering Inc.
CFR	Code of Federal Regulations
cm	centimeter
CSM	conceptual site model
CSSG	clayey, silty, sandy-gravel unit
d/yr	days per year
DCGL	derived concentration guideline level
DSCC	deeper, silty clay/clay unit
DSR	dose-to-source ratio
DOE	U.S. Department of Energy
$Dose_{GW}$	dose contribution from groundwater
EPA	U. S. Environmental Protection Agency
EU	enriched uranium
g/cm^3	grams per cubic centimeter
g/m^3	grams per cubic meter
g/yr	grams per year
Gulf	Gulf United Nuclear Fuels Corporation
HEU	highly enriched uranium
hr/d	hours per day
kg/d	kilogram per day
kg/m^2	kilogram per square meter
kg/yr	kilogram per year
K_d	distribution coefficient
LEU	low enriched uranium
L/hr	liters per hour
L/d	liters per day
LBG	Leggette, Brashears, and Graham, Inc.
m	meters
m^2	square meters
m/sec	meters per second
m/yr	meters per year
m^3/hr	cubic meters per hour
m^3/yr	cubic meters per year
MB	mass balance
MDNR	Missouri Department of Natural Resources
mg/d	milli-grams per day
mrem	millirem

mrem/yr	millirem per year
MTR	materials test reactor
NA	not applicable
N/A	not available
ND	non-dispersion
NRC	U. S. Nuclear Regulatory Commission
Np-237	neptunium-237
NSSSC	near surface silt, silty clay unit
pCi/g	picocuries per gram
pCi/L	picocuries per liter
Pu-239	plutonium-239
Ra-228	radium-228
RI	remedial investigation
RME	reasonable maximum exposure
SAIC	Science Applications International Corporation
SI	sensitivity index
site	The Westinghouse Electric Co. Hematite site
SNM	special nuclear material
TEDE	total effective dose equivalent
Tc-99	technetium-99
TcO_4	pertechnetate anion
Th-228	thorium-228
Th-232	thorium-232
U	uranium
UF_4	uranium tetrafluoride
UF_6	uranium hexafluoride
UO_2	uranium dioxide
UNC	United Nuclear Corporation
U-234	uranium-234
U-235	uranium-235
U-238	uranium-238
wt%	weight percent

EXECUTIVE SUMMARY

This report presents the derived concentration guidance levels ($DCGL_W$; hereafter referred to as DCGL) for radionuclides of concern that are potentially present in soil at the Westinghouse Electric Co. Hematite site (site). Soil DCGLs are derived radionuclide-specific activity concentrations that correspond to the site-wide soil release criteria (or remedial goal).

The site has been impacted by licensed activities and has been in operation since 1956. The plant was primarily used for the manufacturing of uranium metal and uranium compounds for nuclear fuel, using natural and enriched uranium. Numerous research and development activities were also conducted at the site. Because of these past activities, enriched uranium and technetium may have been released to the soils at the site. Other radionuclides that may be present at the site include americium-241 (Am-241), plutonium-239 (Pu-239), neptunium-237 (Np-237), and thorium-232 (Th-232) in equilibrium with its progeny (i.e. radium-228 (Ra-228), and thorium-228 (Th-228)).

The U.S. Nuclear Regulatory Commission (NRC) is the regulatory licensing authority for the site. The NRC has promulgated a primary limit of 25 mrem total effective dose equivalent (TEDE) in any one year, in excess of natural background, for releasing a radiologically contaminated site. This radiological criterion was used in the derivation of soil DCGLs. As noted in the Decommissioning Plan, Westinghouse has established these soil DCGLs in accordance with NRC guidance and protocol. Under the NCP process (Ref 4), the approved soil DCGLs will be included in the consideration of applicable or relevant and appropriate requirements (ARARs) and the establishment of cleanup levels.

The Hematite site has both soil and groundwater residual contamination. In addition, one or more buildings containing some residual contamination might also be left in place. Implementation of the soil DCGLs will involve administrative controls to apportion the 25 mrem/yr criteria among the remaining final dose components of residual soil, groundwater (if groundwater is impacted), and building contamination (if any buildings are left in place). For survey areas where all three dose components are present, the total dose, H_{Total}, can be expressed as:

$$H_{Total} = H_{Soil} + H_{GW} + H_{Building} \qquad \text{(Equation 5-1)}$$

Where:

H_{Total} = Total dose from all components, i.e., 25 mrem/yr
H_{Soil} = Dose component from soil
H_{GW} = Dose component from groundwater
$H_{Building}$ = Dose component from building(s)

Apportionment of the dose in this manner will have the effect of reducing the "base-case" soil DCGLs in Tables 1 through 4. "Base case" soil DCGLs were derived assuming that all dose (i.e., 25 mrem/yr) results from exposure to surface or volumetric soils (i.e., no contribution from residual contamination on buildings left in place or groundwater). The reduced or "operational" DCGLs for soil will be calculated based on the value of H_{Soil}, which will be determined after the

values of H_{GW} and $H_{Building}$ are derived from the analysis of site characterization data for groundwater and buildings.

The operational soil $DCGL_W$ for an individual radionuclide "*i*" is related to the base-case soil $DCGL_W$ as follows:

$$H_{Soil} = 25 \times \frac{DCGL^{i}_{OP}}{DCGL^{i}_{Base}} \qquad \text{(Equation 5-2)}$$

Where:

$DCGL^{i}_{OP}$ = Operational soil $DCGL_W$ for radionuclide "*i*"

$DCGL^{i}_{Base}$ = Base-case soil $DCGL_W$ for radionuclide "*i*" (from Tables 1 through 4)

Solving for $DCGL^{i}_{OP}$ gives the following relationship:

$$DCGL^{i}_{OP} = \frac{H_{Soil}}{25} \times DCGL^{i}_{Base} \qquad \text{(Equation 5-3)}$$

In other words, the "operational" DCGLs will be derived for soil after taking into account residual dose from other applicable components (i.e., buildings and groundwater).

Soil DCGLs were derived using dose modeling and the RESRAD code Version 6.22 (Ref 2, 22). In the modeling, a residential gardener was considered as the critical receptor for the site. The resident gardener is assumed to move onto the site after the site was released for unrestricted use. The resident gardener builds a home and raises some crops on the property for consumption. As a result, the resident gardener will be exposed to the residual radioactive contamination. Both surface (top 15 cm) and volumetric (0-2 meters) soil sources were considered during soil DCGL calculations; however, only the surface or volumetric soil DCGL will be implemented in any one survey unit to demonstrate compliance with the primary dose limit of 25 mrem/yr.

In the derivation of the soil DCGLs, surface and subsurface dose assessments were performed by using a unit concentration of 1 picocurie per gram (1 pCi/g) for each of the radionuclides of concern. The output of RESRAD "runs" could then be interpreted as an estimate of the dose per unit activity (millirem/year per pCi/g), also called a dose-to-source ratio (DSR). The primary limit was then divided by the DSR to yield a soil DCGL for that radionuclide, in units of pCi/g.

Sensitivity analyses were performed by examining the model input parameters related to intake assumptions for the receptor. The results of the sensitivity analyses showed that the fruit, vegetable, and grain consumption pathway is the most sensitive for most of the radionuclides of concern at the site.

Table ES-1 presents the proposed site-specific soil DCGLs for the radionuclides of concern at the Hematite site. Each soil DCGL represents a concentration (based on the presented model) that would produce 25 mrem/yr. Note that soil DCGLs are presented for individual uranium

isotopes. These concentrations do not represent realistic soil conditions given that the relative concentration of each uranium isotope is dependent on the degree of enrichment.

Table ES-2 presents an example calculation of the soil DCGLs for total uranium based upon a given degree of enrichment. These calculated values are based on soil DCGLs presented for NRC approval in ES-1. Given the site's history with enriched uranium, a range of soil DCGLs is presented to match the range of potential conditions that may be encountered at the site. These total uranium soil DCGLs may be more useful for planning characterization and/or remedial activities. The relative contributions of each uranium isotope to the total uranium soil DCGL are provided in table ES-2 as well.

TABLE ES-1. Site-Specific, Radionuclide-Specific, Soil DCGLs

Radionuclide	Units	Surface Source	Volumetric Source
Am-241	pCi/g	160	110
Np-237+D	pCi/g	1.6	0.12
Pu-239	pCi/g	184	121
Tc-99	pCi/g	873	145
Th-232+C	pCi/g	5.5	3.3
U-234	pCi/g	1922	924
U-235+D	pCi/g	87	50
U-238+D	pCi/g	388	305

"+D" = plus short-lived decay products
"+C" = plus entire decay chain (Th-232 assumed to be in equilibrium with Ra-228+D and Th-228+D)

TABLE ES-2. Example Calculation of Site-Specific Soil DCGLs for Uranium, by Enrichment

Isotope	Units	Percent Enrichment				
		0.72%	**3.5%**	**20%**	**75%**	**90%**
Surface Source DCGL						
Total U(1)	**pCi/g**	**597**	**741**	**889**	**1116**	**1181**
U-234(2)		*53.0%*	*78.0%*	*92.0%*	*96.5%*	*97.0%*
U-235(2)		*2.1%*	*4.2%*	*4.9%*	*3.4%*	*3.0%*
U-238(2)		*44.9%*	*17.8%*	*3.1%*	*0.2%*	*0.1%*
Volumetric Source DCGL						
Total U(1)	pCi/g	**434**	**514**	**587**	**682**	**706**
U-234(2)		*53.0%*	*78.0%*	*92.0%*	*96.5%*	*97.0%*
U-235(2)		*2.1%*	*4.2%*	*4.9%*	*3.4%*	*3.0%*
U-238(2)		*44.9%*	*17.8%*	*3.1%*	*0.2%*	*0.1%*

(1) Total uranium (Total U) = sum of individual isotopic concentrations. Each Total U concentration corresponds to 25 mrem/yr.

(2) Relative percent contribution of the isotope to the total U soil DCGL, taken to one decimal place.

1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this report is to calculate derived concentration guideline levels ($DCGL_W$; hereafter referred to as DCGL) for the radionuclides of concern that are potentially present in soil (including sediment) at the Westinghouse Electric Co. Hematite site (site). The soil DCGLs meet the "radiological criteria for unrestricted use" requirements set forth by the U.S. Nuclear Regulatory Commission (NRC). These criteria can be found in the Code of Federal Regulations (CFR) 10 CFR Part 20.1402 (Ref 16) and state:

> "A site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a TEDE to an average member of the critical group that does not exceed 25 mrem (0.25 mSv) per year, including that from groundwater sources of drinking water, and the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA). Determination of the levels which are ALARA must take into account consideration of any detriments, such as deaths from transportation accidents, expected to potentially result from decontamination and waste disposal."

The 25 mrem/yr value is a primary limit. The soil DCGLs represent remedial goals that, if met, will ensure that the primary limit is satisfied. These are known as secondary or derived limits. As a result, demonstrating compliance with the soil DCGLs presented in this report would allow release of the site without institutional controls. As noted in the Decommissioning Plan, Westinghouse has established these soil DCGLs in accordance with NRC guidance and protocol. Under the NCP process (Rev 4), the approved soil DCGLs will be included in the consideration of applicable or relevant and appropriate requirements (ARARs) and the establishment of cleanup levels.

1.2 SCOPE

The scope of this document is limited to soils (including sediment) that may have been impacted by licensed activities. This document addressed the following radionuclides of potential concern:

- uranium-234 (U-234),
- uranium-235 (U-235),
- uranium-238 (U-238),
- technetium-99 (Tc-99),
- thorium-232 (Th-232) and progeny,
- americium-241 (Am-241),
- neptunium-237 (Np-237), and
- plutonium-2239 (Pu-239).

This report does not address the impact of non-radiological contaminants present at the site nor does it address the derivation of DCGLs for any structures (i.e., non-environmental media) that are present at the site. To the extent possible, this report uses information from available site-specific documents to ensure consistency in the dose models.

RESRAD Version 6.22 (Ref 22) was used during the derivation of soil DCGLs for each radionuclide of potential concern. RESRAD is a computer code developed at Argonne National Laboratory for the U.S. Department of Energy (DOE) to determine site-specific residual radiation guidelines and dose to a future hypothetical on-site receptor at sites that are contaminated with residual radioactive materials.

2.0 REGULATORY FRAMEWORK FOR DEVELOPMENT OF THE DCGL

The NRC has the regulatory authority over the license issued for the site. The NRC's regulations that are applicable to licensing, license termination, and release of real property with residual radioactive material are contained in the CFR, Title 10, "Energy," Parts 20, 30, 40, 50, 51, and 70. These regulations are ARARs under the NCP process that is currently underway (Ref 4).

The NRC regulations present a performance-based standard that requires the responsible party (licensee) to demonstrate compliance with the primary limit (25 mrem in any one year), from all credible sources and pathways for exposure. In addition, the licensee must demonstrate that potential future doses arising from residual radioactivity at the site have been reduced to levels that are as low as reasonably achievable (ALARA).

3.0 SITE HISTORY AND DESCRIPTION

3.1 SITE HISTORY

In 1955, Mallinckrodt Chemical Works purchased the parcel of farmland on which the Hematite plant resides. The plant became operational in July of 1956, producing uranium for use in the navy nuclear fuel program. Mallinckrodt Chemical Works and its affiliate, Mallinckrodt Nuclear Corporation, operated the facility until May of 1961, at which time ownership was transferred to the United Nuclear Corporation (UNC). UNC provided uranium products to the federal government. Figure 1 illustrates the location of the plant.

In 1970, UNC and Gulf Nuclear Corporation entered into a joint venture, forming Gulf United Nuclear Fuels Corporation (Gulf). Gulf owned and operated the facility until the spring of 1973, when Gulf closed the plant and began decommissioning. The property was conveyed to the General Atomic Company in January 1974, and Combustion Engineering Inc. (CE) purchased the property in May of 1974. In 1989, Asea Brown Boveri (ABB) acquired the stock of CE, and CE began operating the facility as ABB Combustion Engineering. In April of 2000, Westinghouse Electric Co. purchased the nuclear operations of ABB, which include the Hematite facility, and shortly thereafter initiated the decommissioning process.

Throughout its history, the site's primary function was the manufacture uranium metal and uranium compounds from processed and enriched uranium (EU) for use as nuclear fuel. Specifically, operations included the conversion of uranium hexafluoride (UF_6) gas of various U-235 enrichments to uranium oxide, uranium carbide, uranium dioxide (UO_2) pellets, and uranium metal. From its inception in 1956 through 1974, the facility was used primarily in support of government contracts that required production of EU products. Much of the work on behalf of the government at the site was classified, and therefore specific details regarding the exact nature of the processes are not known.

Examples of known projects during this time include:

- production of uranium metal for nuclear submarines and a D1G destroyer reactor,
- the supply of specialized uranium oxides for the Army Package Power Reactor,
- the supply of high enriched oxides for a General Atomics gas-cooled reactor,
- the production of highly enriched metal for materials test reactors (MTR) utilized by the Navy,
- the supply of uranium-beryllium pellets for use in the "SL-1" reactor,
- the production of high enrichment uranium zirconia pellets for a naval reactor, and
- and the production of highly enriched oxides to General Atomics for use in nuclear rocket projects.

These products were manufactured for use by the federal government, government contractors, and by commercial and research reactors approved by the Atomic Energy Commission (AEC). Research and development was also conducted at the plant, as were uranium scrap recovery efforts. From 1974 through the plant closure in 2001, the focus changed from government contracts to commercial fuel production contracts. Although the physical design of the plant has

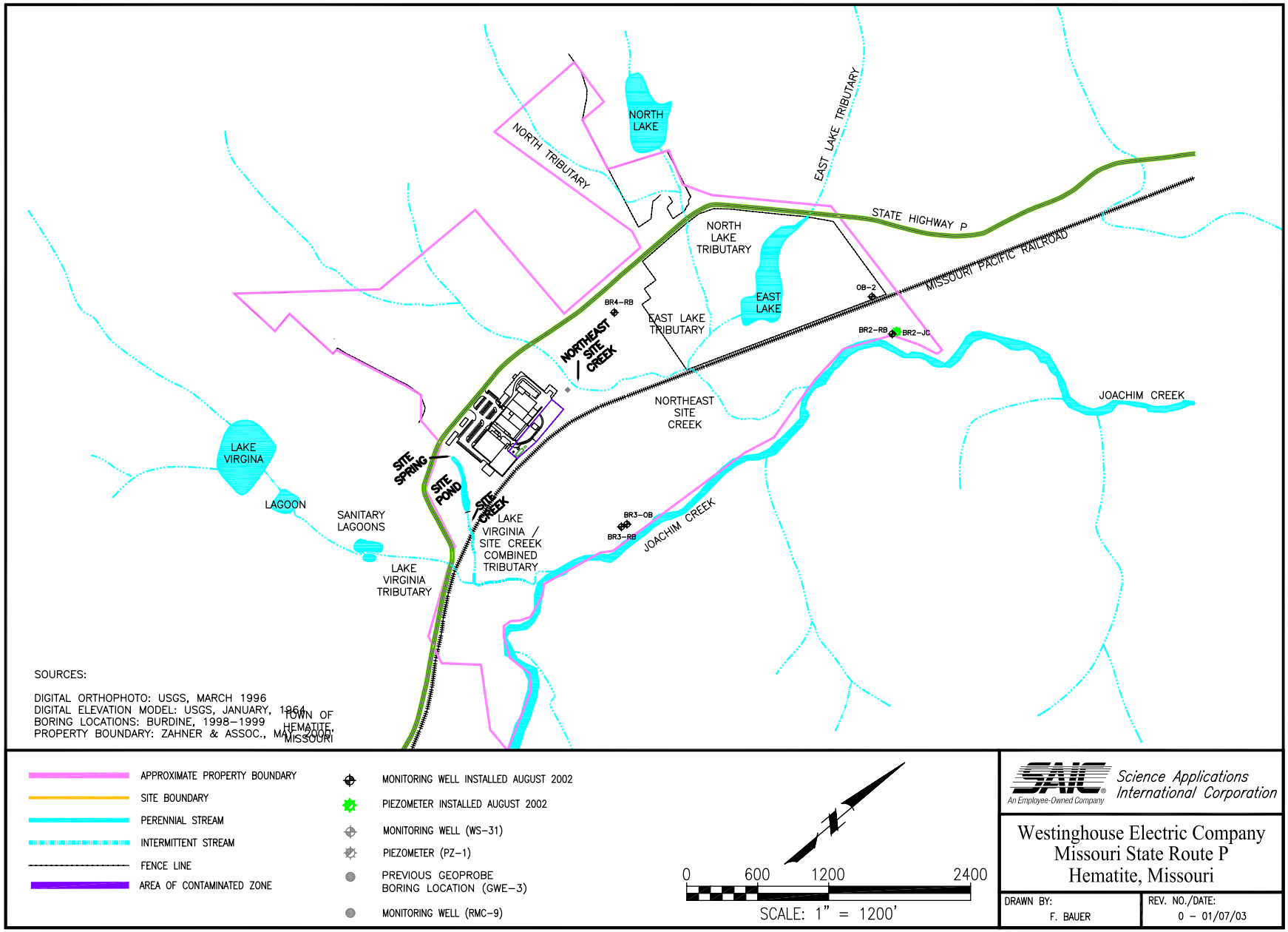

Figure 1. Site Location and Area of Contaminated Zone

changed over the years, certain areas of the plant were dedicated to particular production processes (i.e., low enrichment processes versus high enrichment processes). For example, Building 240 was historically dedicated to the chemical conversion of uranium into compounds, solutions, and metal.

Building 240 was further divided into areas for highly enriched uranium (HEU) and low enriched uranium (LEU) processes:

- the "Red Room" (Area 240-2) containing HEU conversion processes, and
- the "Green Room" (Area 240-3) containing LEU conversion processes and scrap processing.

The Red Room was specifically used for the reduction of UF_6 to uranium tetrafluoride (UF_4), the conversion of UF_4 to uranium metal, HEU scrap recovery, and other chemical conversion processes using HEU. Building 255 of the plant was used for the fabrication of uranium compounds into physical shapes. Other activities within the plant included the blending of UO_2 with other chemical compounds. Figure 2 presents the locations of the buildings within the plant.

Other areas of the plant were used for storage, and again were separated primarily by degree of enrichment or product stored. HEU storage areas included Buildings 235, 250, and 252. Also, HEU scrap was held in an (outdoor) fenced 75 ft by 120 ft area to the south of the plant.

3.2 PHYSICAL SITE CHARACTERISTICS

The physical site characteristics information provided in the following section are based on information available prior to conduct of the remedial investigation (RI) at the site. However, updated information following completion of the RI does not result in changes to relevant assumptions made during development of soil DCGLs or deviation from the actual site-specific soil DCGLs calculated in this report.

3.2.1 Site Specific Bedrock Stratigraphy

In 1956, Mallinckrodt Chemical Company installed an industrial water supply well for the plant. The *Missouri Geological Survey and Water Resources Log* (Ref 13) documents the bedrock stratigraphy encountered by the well. Unconsolidated sediments were present to 35 feet below ground surface (bgs). The Jefferson City-Cotter Dolomite extended from 35 to 125 feet bgs, the Roubidoux Formation from 125 to 255 feet bgs, the Gasconade Formation from 255 to 470 feet bgs, the Gunter Sandstone Member of the Gasconade Formation from 455 to 470 feet bgs and the Eminence Dolomite, from 470 to the total depth of the well, which was 600 feet bgs.

3.2.2 Unconsolidated Sediments (Pleistocene and Quaternary)

The site is positioned in the valley of the Joachim Creek, which has incised the surrounding Cotter and Jefferson City Formations. During late Pleistocene glacial regression, terrace units were deposited in the Joachim Creek valley. These units are chiefly derived from loess and colluvium. Later during the Holocene period, alluvium was deposited in the Joachim Creek valley.

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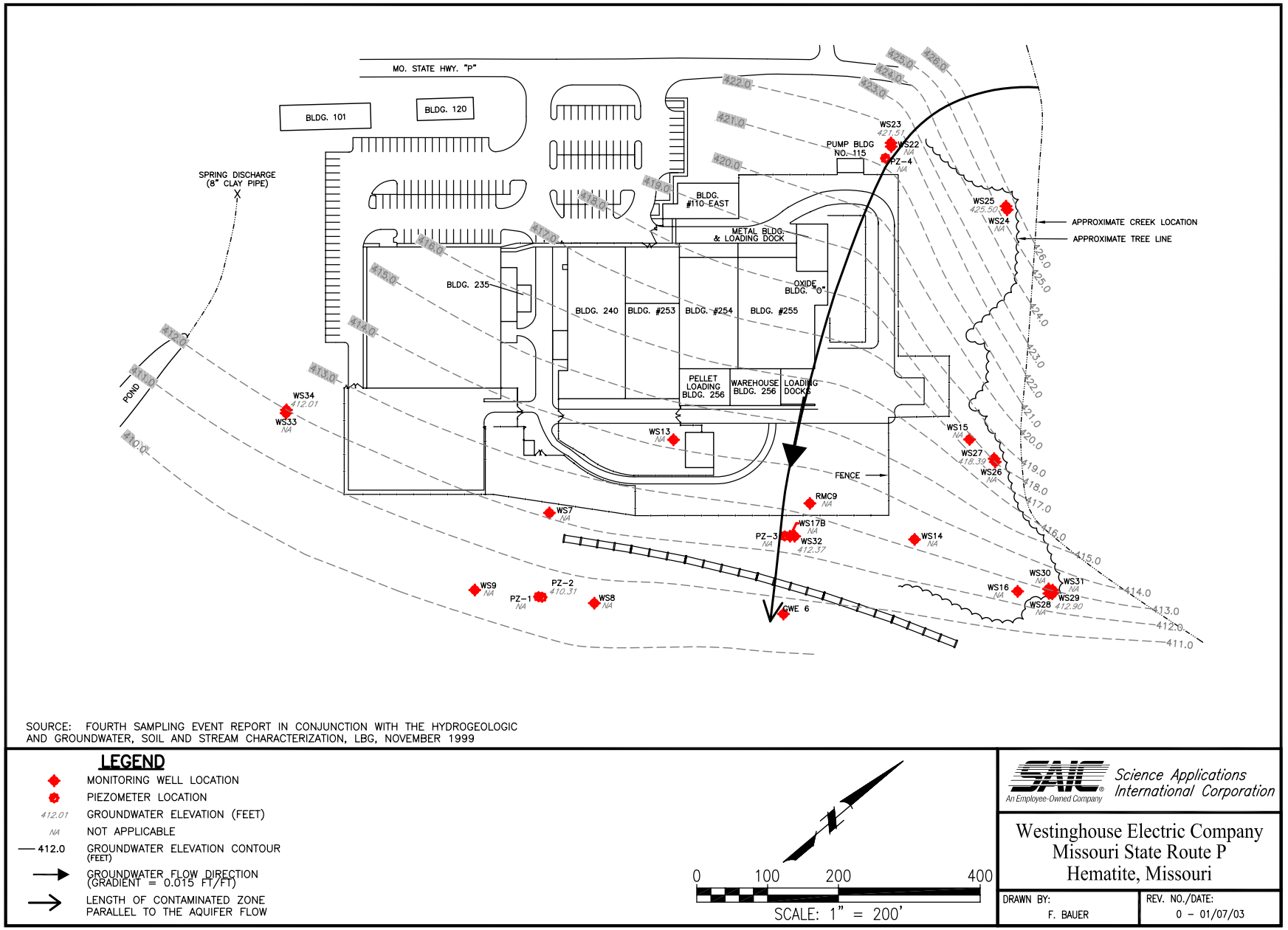

Figure 2. Location of the Buildings, Groundwater Flow and Gradient

A more comprehensive geologic investigation performed by Leggette, Brashears & Graham, Inc., (LBG) provides more site-specific information regarding the unconsolidated subsurface (Ref 7). The study supports the concept of a sand/gravel unit present in the subsurface above the uppermost bedrock unit. Soil collected during the investigation was analyzed for physical properties (i.e., permeability, distribution coefficient, etc.) and/or chemical laboratory parameters. Generally, the geologic information collected during this investigation corroborated geologic data obtained during previous studies.

Specifically, six unique hydrostratigraphic units are located beneath the plant portion of the site:

- a near surface silt, silty-clay (NSSSC),
- a fat clay,
- a deeper, silty clay/clay (DSCC),
- a clayey, silty, sandy-gravel (CSSG) sometimes later in this document is referred to as the sandy-gravel unit,
- The Jefferson City-Cotter Dolomite, and
- The Roubidoux formation.

3.2.3 Regional Bedrock and Geologic Structures

The site is on the north-northeast flank of the Precambrian-age St. Francis Mountains uplift, which created the Ozark Dome. Cambrian, Ordovician, Silurian, Devonian and Mississippian age sedimentary formations of various depositional environments are draped on the flanks of the Ozark Dome. The site is situated over these sedimentary formations. Based upon the *Missouri Geologic Map* (Ref 14) and the *Bedrock Geologic Map of the Festus 7.5 Minute Quadrangle* (Ref 23) the uppermost bedrock beneath the site is the lower Ordovician Canadian series, Jefferson City-Cotter Dolomite.

The Jefferson City-Cotter Dolomite is described as mostly light-brown to medium-brown, medium to finely crystalline dolomite and argillaceous dolomite (Ref 10). Chert, which is not abundant, is typically oolitic, banded, mottled or sandy. Lithologic succession within the formation is complex and varies among locations. The Jefferson City Dolomite typically is 125 to 325 feet thick, and is bounded by the overlying Cotter Formation (also mostly a dolomite), and beneath by the Roubidoux formation that is dominantly a sandy dolomite with lesser beds of dolomitic sandstone and dolomite.

The indurated sedimentary rocks in this area dip gently and uniformly to the north-northeast. There are no mapped or suspected faults within several miles of the site.

3.3 HYDROGEOLOGY, HYDROLOGY AND WATER SUPPLY

The hydrogeology, hydrology and water supply information provided in the following section are based on information available prior to conduct of the remedial investigation (RI) at the site. However, updated information following completion of the RI does not result in changes to relevant assumptions made during development of soil DCGLs or deviation from the actual site-specific soil DCGLs calculated in this report.

3.3.1 Hydrogeology

LBG characterized the near-surface hydrostratigraphic units at the site (Ref 7). In that investigation, two ground-water monitoring wells were installed to provide discrete geologic unit mapping, sampling, and vertical hydraulic gradient information.

As part of LBG's hydrogeologic studies, single-well hydraulic conductivity tests were performed to characterize the horizontal hydraulic conductivity of distinct geologic horizons. From these tests, the average hydraulic conductivities of the unconsolidated materials above bedrock were found to be 3×10^{-5} cm/sec and 8×10^{-4} cm/sec for the NSSSC and DSCC units, respectively. Single-well testing of the Jefferson City Dolomite showed a hydraulic conductivity of 8×10^{-4} cm/sec. Fracturing and other features causing secondary porosity and permeability in the rock affect the hydrogeologic characteristics of the Jefferson City Dolomite and other bedrock formations. The primary permeability of the bedrock (i.e., through the solid rock matrix) is measured to be low, thus, slow ground-water velocity would be predicted. However, ground water flowing discretely through fractures, partings, or other secondary permeability features may have a much higher velocity. The size, density, and orientation of these fractures and partings determine the effective hydraulic conductivity of the bedrock.

Potentiometric surface (ground-water elevation) maps were constructed for the NSSSC, DSCC, and Jefferson City units to determine groundwater flow direction and horizontal hydraulic gradient. In the NSSSC unit, ground water flows to the northeast and southeast. In the DSCC and Jefferson City units, ground water flows to the southeast. An interim hydrogeologic investigation, performed by LBG during 2002 (Ref 8), shows that the Roubidoux unit also flows in the southeast direction.

3.3.2 Hydrology, Precipitation and Stream Characteristics

The *Missouri Water Atlas* (Ref 15) was referenced to determine local precipitation and stream characteristics. The area receives an average of 38 inches of precipitation per year, with 12 inches of average annual runoff. The maximum 10-day event expected precipitation is 9 inches in a given 25-year event. The Atlas shows that Joachim Creek, located along the southeast site boundary, is a permanent flowing stream. There are several other surface water features present on the site, including a spring, intermittent perennial and ephemeral streams, a lake, and ponds.

3.3.3 Water Supply

Water for the Plant is supplied by a well located north of Building 253, within the fenced manufacturing area. During site operations, up to 36,000 gallons were withdrawn from this well daily. Well water is stored in an elevated 200,000-gallon tank and distributed as needed within the plant, primarily for process water.

According to the *Water Resources Report of the St. Louis Area* (Ref 12), domestic and industrial water wells in the vicinity produce water from the Powell - Gasconade aquifer group. This includes the Jefferson City Dolomite; the uppermost bedrock unit at the site. Wells in the area may penetrate the Jefferson City Dolomite if it is present, but presumably do not derive significant quantities of water from it due to its poor storativity.

There are no public water supply intakes on Joachim Creek. According to an U.S. Environmental Protection Agency (EPA) field investigation report *Preliminary Assessment, Hematite Radioactive site* (Ref 11), most of the residents of Hematite receive their drinking water from Rural Water District No. 5. The report also states that surface water is not used for drinking within at least a four-mile radius of the site.

4.0 RADIOLOGICAL CHARACTERISTICS OF FEED STOCK AND ENRICHED URANIUM

The mix of radionuclides found in EU is governed by the physical and chemical processes used to produce the EU and by the laws of physics describing radioactive decay. The same physical laws govern the relative concentrations of these radionuclides, making their proportions at a given U-235 mass enrichment known with a reasonable degree of certainty. The EU fuel stock used at the site is known to have come from gaseous diffusion enrichment processes. There is no indication that EU fuel stock derived from other enrichment processes (e.g., centrifuge, laser) was ever used at the site.

In the enrichment process, the smaller U-234 atoms are more readily separated than the heavier U-235 or U-238 atoms. Likewise, U-235 atoms are more readily separated than U-238 atoms. As a result, at a given uranium enrichment, the mass of U-234 will be roughly equal to the mass of U-235 and both should be less than the mass of U-238 that is present.

U-234 has a specific activity (activity per mass, or pCi/g) that is about four orders of magnitude greater that U-238 and U-235, therefore U-234 dominates the total uranium activity concentration for EU. The percent of uranium enrichment reflects the amount of U-235 that is present, and is calculated from the activity concentrations of the uranium isotopes in the fuel mixture.

Typical commercial grade LEU fuel stock was produced at about 3.5% enrichment. HEU with enrichments greater than 90% was used to manufacture special nuclear fuels for the federal government. Thus, a wide range of uranium isotopic ratios might occur on the site, and could vary from one location to another depending upon the deposition source.

Uranium that was recycled from spent nuclear fuel was fed back into the enrichment process at some gaseous diffusion facilities, resulting in the presence of transuranics and Tc-99 (in trace quantities) in the uranium stock used at the site. Quantities of Tc-99 have been detected in some of the environmental monitoring wells at the site.

A review of the characteristics of recycled uranium is provided in the DOE Project Overview and Field Site Reports entitled “A Preliminary Review of the Flow and Characteristics of Recycled Uranium Throughout the DOE Complex 1951-1999”. This publication notes that most of the fission products and transuranic isotopes were disposed of as high level waste during spent nuclear fuel reprocessing. It further notes that trace concentrations of Tc-99, Am-241, Pu-239, and Np-237 remained with the recovered uranium. The gaseous diffusion plants (enrichment plants) then blended the recycled uranium with natural uranium, the predominant feed to the gaseous diffusion enrichment process, further diluting any contaminants.

Since Tc-99 forms volatile and semi-volatile chemical compounds that tend to migrate toward the top of the gaseous diffusion cascade, it is reasonable to assume that technetium would tend to end up in the enriched product. Due to their higher atomic weight, Am-241, Pu-239, and Np-237 would generally migrate towards the bottom of the gaseous diffusion cascade along with much of the U-238. Since uranium at nearly any enrichment contains U-238, there is a potential for Am-241, Pu-239, and Np-237 to be present in the EU used at the Hematite site.

Enriched product, such as 3.5 wt% of U-235 that is likely to be encountered at the site, would tend to favor the lower mass isotopes (i.e. Tc-99). Tc-99 is a low energy beta emitter and is found in the environment primarily as the pertechnetate anion (TcO_4). This form is highly water soluble and mobile in soil and groundwater (Ref 9).

In addition, a limited amount of work was performed with thorium compounds as part of early research into the use of thorium in the fuel cycle. Any thorium present at the site is assumed to be derived from naturally occurring Th-232 in secular equilibrium with its progeny.

Am-241, Pu-239, Np-237, and Th-232 are all alpha and gamma radiation emitters and are heavy metals that would behave similar to EU in the environment. These radionuclides are expected to be at concentrations that are insignificant to the uranium concentrations found at the site.

5.0 DEVELOPMENT OF THE DERIVED CONCENTRATION GUIDELINE LEVELS

5.1 SELECTION OF THE ANNUAL PUBLIC DOSE LIMIT

The annual dose limit for the site corresponds to the radiological criteria for unrestricted use given in 10 CFR Part 20.1402 (Ref 16) as described in Sections 1.1 and 2.1 of this report.

5.2 CONCEPTUAL SITE MODEL

The conceptual site model (CSM) identifies the relationship between the sources of contamination, source areas, transport mechanisms, exposure routes, and the receptor. The CSM provides a description of how contaminants enter into the environment, how they are transported within the environment, and the routes of exposures to humans. Figure 3 illustrates the CSM for residual soil contamination at the site.

The residual radioactive material in this CSM is defined as contaminated soil subdivided into a surface source (top 15 cm) and a volumetric source (0-2 meters). The surface source conservatively represents the most likely contaminant geometry across the site assuming most contamination, if any, was distributed through stack emissions. The volume source represents potential smaller portions of the site where contamination extends beyond the first several centimeters of soil. Environmental pathways include external gamma radiation, inhalation of suspended dust, ingestion of impacted fruits and vegetables, ingestion of impacted fish, ingestion of impacted groundwater, and ingestion of contaminated soil. The critical receptor for the site is a resident gardener. This receptor incurs a radiological dose from all complete exposure pathways and is the subject of soil DCGL calculations. The following sections of the report provide additional details on the critical receptor and the exposure pathways modeled by the RESRAD code.

5.2.1 Selection of Critical Receptor Scenario

Resident gardener was recommended for use as a critical receptor scenario in case the current land use areas being assessed changes to residential. The receptor will be exposed to the residual contamination present in site-wide soils. This scenario was utilized for the soil DCGL derivations of surface and volumetric soils. Under the scenario, a resident is assumed to move onto the site after it has been released for use without radiological restrictions, and builds a home. The receptor living on the site may ingest radioactive material by consumption of plants grown in a family garden. As defined in EPA's *Soil Screening Guidance Document for Radionuclides*, the fruits and vegetables are primarily contaminated by root uptake of radionuclides contained in the pore water of the soil in which the plants are growing (Ref 6). The land-use zoned regulations regarding residential generally prohibit the keeping of livestock. Therefore, no pathways related to livestock such as meat and milk ingestion are considered for this scenario. Appendix A presents the scenario-specific RESRAD parameters used in the soil DCGL calculations.

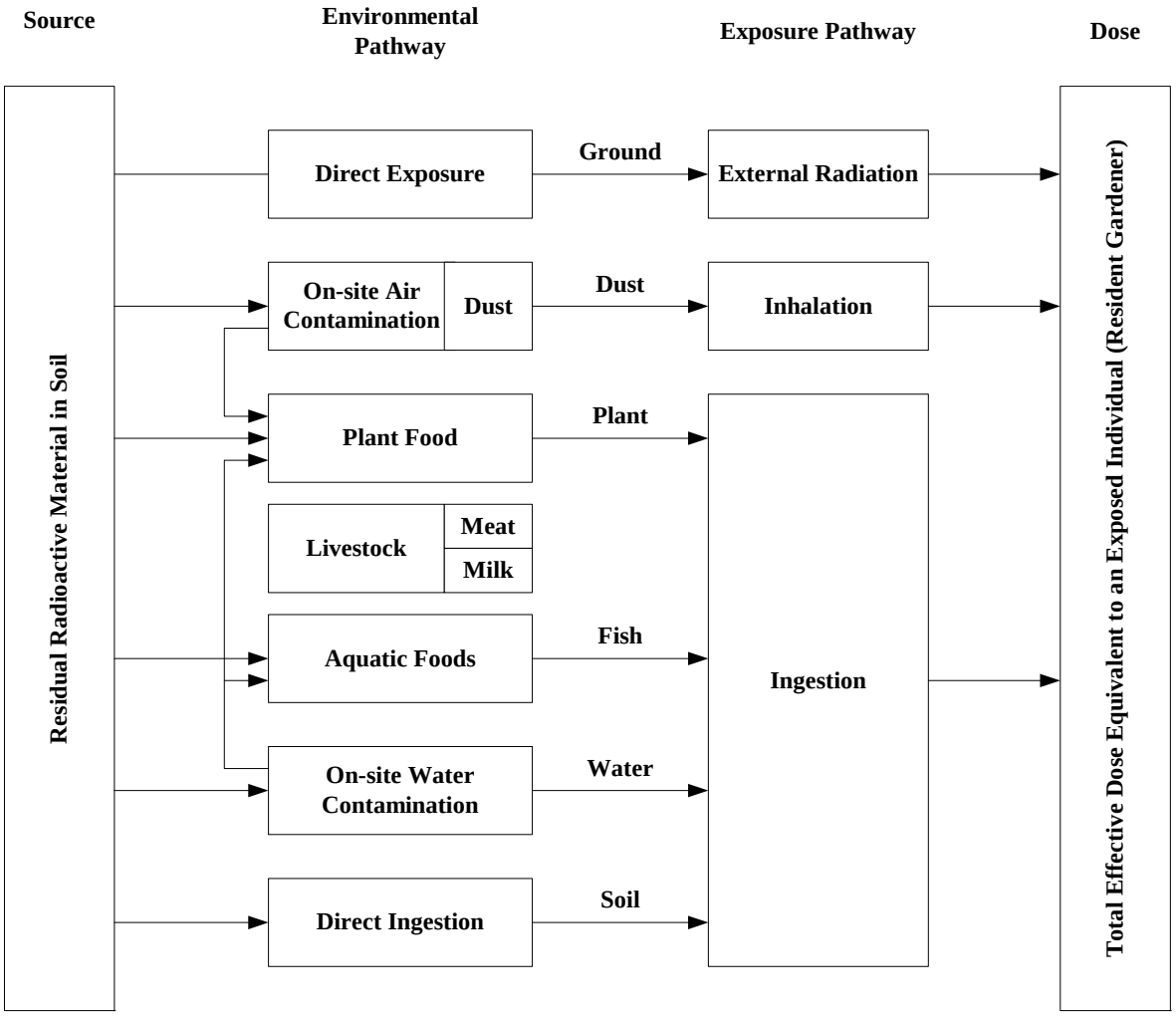

Figure 3. Conceptual Site Model for Hematite Facility Soils

5.2.2 Selection of Exposure Pathways

The resident gardener may be exposed to radioactive contamination through several exposure pathways relative to site soils. Members of the resident gardener critical group can incur a radiation dose via the following pathways:

(1) Direct radiation from radionuclides in the soil,
(2) Inhalation of resuspended dust (if the contaminated area is exposed at the ground surface),
(3) Ingestion of food from crops grown in contaminated soil,
(4) Ingestion of fish from a nearby pond contaminated by water percolated through the contaminated area,
(5) Ingestion of water from a well contaminated by water percolated through the contaminated zone, and
(6) Direct ingestion of contaminated soil.

Radium-226 (the parent of radon-222) is not a radionuclide of concern due to licensed activities at the site. The NRC's radiological criteria for unrestricted use specifies that radioactivity that is distinguishable from background is to be considered in the 25 mrem/yr primary limit. Since radon may be present at some concentration from natural background, but should not be present due to licensed activities, exposure due to radon was not considered for the site.

5.3 RECOMMENDED VALUES FOR RESRAD PARAMETERS

The following hierarchy was implemented in selecting the RESRAD input parameters presented in Appendix A. In general, the preference was to use site-specific information first, followed by NRC recommended values, EPA recommended values, and finally RESRAD defaults:

(1) First Preference – Site Specific Parameter: Site-specific information is the first preference for selection of values for RESRAD input parameters. The following two site-related documents were used during the selection process.

   a. *Site-Specific Soil Parameters Westinghouse Former Fuel Cycle Facility D & D Project.* (Ref 9)

   b. *Determination of Distribution Coefficients for Radionuclides of Concern at the Westinghouse Hematite Facility.* (Ref 21)

(2) Second Preference – NRC Documents: When site-specific data is not available, the values provided in NRC documents were reviewed to determine if they were applicable based on the receptor scenario. NRC documents do not provide assigned values for a resident gardener scenario. However, Volumes 3 and 4 of NUREG/CR-5512 (Ref 17, 18) do define a residential farmer scenario. EPA's guidance documents define a residential scenario where the receptor grows home-grown produce in a garden. Therefore, parameters from both NRC and EPA were considered during the selection of exposure parameters for the critical receptor. For example, the NRC resident farmer scenario provides assigned values for the time spent by the farmer for different activities (such as indoor, outdoors, and gardening), mass loading factor for inhalation and the inhalation rate associated with each activity. Even though the assigned values were conservative as compared to EPA's guidance document, NUREG/CR-5512 assigned values for that scenario were given first preference. The following NRC documents were used during the selection process.

   a. *Residual Radioactive Contamination From Decommissioning - Parameter Analysis, Draft Report for Comments*; NUREG/CR-5512 Volume 3 (Ref 18)

   b. *Comparison of the Models and Assumptions used in DandD 1.0, RESRAD 5.61, and RESRAD-Build 1.50 Computer Codes with Respect to the Residual Farmer and Industrial Occupant Scenarios*; NUREG/CR-5512 Volume 4 (Ref 17)

   c. *Development of Probabilistic RESRAD 6.0 and RESRAD-Build 3.0 Computer Codes* NUREG/CR-6697 (Ref 19).

(3) Third Preference – EPA's Guidance documents: The following EPA documents were mainly used for selection of values for intake parameters.

   a. *Soil Screening Guidance Document for Radionuclides: User's Guide* (Ref 6)

b. *Exposure Factors Handbook* (Ref 5).

(4) Fourth Preference – RESRAD Default: When no site-specific, NRC, and EPA values for the RESRAD parameters is available, the following document was used for selection of RESRAD default values:

Data Collection Handbook to Support Modeling Impacts of Radioactive Material in Soil, Environmental Assessment and Information Sciences Division, Argonne National Laboratory (Ref 1).

5.4 METHODOLOGY TO DETERMINE SOIL DCGLS

The RESRAD model was used to calculate soil DCGLs from exposure to direct and indirect pathways. Direct pathways include soil ingestion, dust inhalation and external gamma. Indirect pathways include plant ingestion and water dependent pathways (e.g., groundwater ingestion and use of groundwater for irrigation). The dose from all complete exposure pathways was included in soil DCGLs.

The Hematite site may have both soil and groundwater residual contamination. In addition, one or more buildings containing some residual contamination might also be left in place. Implementation of the soil DCGLs calculated in this report will involve administrative controls to apportion the 25 mrem/yr criteria among the remaining final dose components of residual soil, groundwater (if groundwater is impacted), and building contamination (if any buildings are left in place). For survey areas where all three dose components are present, the total dose, H_{Total}, can be expressed as:

$$H_{Total} = H_{Soil} + H_{GW} + H_{Building} \qquad \text{(Equation 5-1)}$$

Where:

H_{Total} = Total dose from all components, i.e., 25 mrem/yr
H_{Soil} = Dose component from soil
H_{GW} = Dose component from groundwater
$H_{Building}$ = Dose component from building(s)

Apportionment of the dose in this manner will have the effect of reducing the "base-case" soil DCGLs in Tables 1 through 4. The reduced or "operational" DCGLs for soil will be calculated based on the value of H_{Soil}, which will be determined after the values of H_{GW} and $H_{Building}$ are derived from the analysis of site characterization data for groundwater and buildings.

The operational soil $DCGL_W$ for an individual radionuclide "*i*" is related to the base-case soil $DCGL_W$ as follows:

$$H_{Soil} = 25 \times \frac{DCGL^{i}_{OP}}{DCGL^{i}_{Base}} \qquad \text{(Equation 5-2)}$$

Where:

$DCGL^{i}_{OP}$ = Operational soil $DCGL_W$ for radionuclide "*i*"

$DCGL^{i}_{Base}$ = Base-case soil $DCGL_W$ for radionuclide "*i*" (from Tables 1 through 4)

Solving for $DCGL^{i}_{OP}$ gives the following relationship:

$$DCGL^{i}_{OP} = \frac{H_{Soil}}{25} \times DCGL^{i}_{Base} \qquad \text{(Equation 5-3)}$$

5.4.1 Determination of Site-Specific Soil DCGLs

RESRAD 6.22 (Ref 22) was used to perform the dose assessments for both the surface and volumetric soil sources. The actual fractional concentrations of the radionuclides of concern for the site are not currently available. Therefore, a unit concentration of 1 pico-Curie per gram (pCi/g) for each radionuclide of concern and the recommended model input parameters provided in Appendix A were used during the dose assessments. The dose resulting from a unit concentration for a given radionuclide is defined as the dose-to-source ratio (DSR) The maximum DSR (in units mrem/yr per pCi/g) over the 1000-year evaluation period for each radionuclide of concern was then divided into the 25 mrem/yr primary limit to determine the soil DCGLs. Appendix B presents the results of the surface soil RESRAD "run" for Am-241, Np-237, Pu-239, Th-232 and its progeny, Tc-99 and uranium isotopes. Appendix C presents the RESRAD "run" for the volumetric source term.

Table 1 lists the surface soil DCGLs for individual radionuclides. All radionuclides except Np-237 and Th-232+C produce a maximum dose at year zero. Neptunium produces a maximum dose at year 103 due to the water dependent pathways (groundwater ingestion, fish ingestion, etc.) because the distribution coefficient of 2 cm^3/g allows for rapid migration of soil contaminants to groundwater. Without the water dependent pathways, the neptunium soil DCGL would be approximately 39 pCi/g with the maximum dose occurring at year zero. The soil DCGL for Th-232 at year 0 would be approximately 95 pCi/g. Note also that soil DCGLs are presented for individual uranium isotopes. These concentrations do not represent realistic soil conditions given that the relative concentration of each isotope is dependent on the enrichment.

Table 2 presents an example of calculated total uranium soil DCGLs, given a range of enrichments. These calculated values are based on isotopic uranium soil DCGLs presented for NRC approval in Table 1. Soils found to be contaminated at this total uranium concentration would produce a dose of 25 mrem/yr. These total uranium soil DCGLs may be more useful for planning future characterization and/or remedial activities, if necessary.

All uranium isotopes produced a maximum dose at year zero, thus all total uranium soil DCGLs listed in Table 2 are also for year zero. Total uranium results indicate that the soil DCGLs are smaller (more restrictive) for lower enrichments, noting that 0.72% represents natural uranium. Assuming a single total uranium enrichment is desirable, the 741 pCi/g value for 3.5% enrichment is conservative and reasonable given the site's operational history.

Table 1. Determination of Single-Nuclide Surface Soil DCGLs

Radionuclides of Concern	Dose-to-source Ratio (mrem/yr per pCi/g)	Year of Maximum dose	Surface Soil DCGLs (pCi/g)
Am-241	1.56E-01	0	160
Np-237+D	1.57E+01	103	1.6
Pu-239	1.36E-01	0	184
Tc-99	2.86E-02	0	873
Th-232+C	4.52E+00	32	5.5
U-234	1.30E-02	0	1922
U-235+D	2.89E-01	0	87
U-238+D	6.45E-02	0	388

Notes:
"+D" = plus short-lived decay products
"+C" = plus entire decay chain (Th-232 assumed to be in equilibrium with Ra-228+D and Th-228+D)
DCGL = 25 mrem/yr divided by the dose-to-source ratio

Table 2. Example Uranium Surface Soil DCGLs by Enrichment

Isotope	Units	Percent Enrichment				
		0.72%	**3.5%**	**20%**	**75%**	**90%**
U-234		*53.0%*	*78.0%*	*92.0%*	*96.5%*	*97.0%*
U-235		*2.1%*	*4.2%*	*4.9%*	*3.4%*	*3.0%*
U-238		*44.9%*	*17.8%*	*3.1%*	*0.2%*	*0.1%*
Total U	**pCi/g**	**597**	**741**	**889**	**1116**	**1181**

Table 3 lists the volumetric soil DCGLs for individual radionuclides. All radionuclides except Np-237, Th-232, and U-235 produce a maximum dose at year zero. Neptunium produces a maximum dose at year 115 due to the water dependent pathways (groundwater ingestion, fish ingestion, etc.) likely because the distribution coefficient of 2 cm^3/g allows for rapid migration of soil contaminants to groundwater. Without the water-dependent pathways the neptunium soil DCGL would be approximately 10 pCi/g with the maximum dose occurring at year zero. Uranium-235 would also produce a maximum dose at year zero without the water-dependent pathway. The corresponding year-zero soil DCGL for U-235 is approximately 81 pCi/g. The soil DCGL for Th-232 at year 0 would be approximately 63 pCi/g.

As with the surface soil DCGLs, Table 4 presents an example of calculated total uranium soil DCGLs given a range of enrichments such that the total uranium concentration would produce a dose of 25 mrem/yr.

Although U-235 produces a maximum dose at year 1000, the combination of all uranium isotopes produces a maximum dose at year zero, regardless of enrichment. Therefore, all total uranium soil DCGLs listed in Table 4 are also for year zero. As with surface soils, the total uranium results indicate that the soil DCGLs are more restrictive for lower enrichments. Assuming a single total uranium enrichment is desirable, the 514 pCi/g value for 3.5% enrichment is conservative and reasonable given the site's operational history.

Table 3. Determination of Single-Nuclide Volumetric Soil DCGLs

Radionuclides of Concern	Dose-to-source Ratio (mrem/yr per pCi/g)	Year of Maximum dose	Subsurface Soil DCGLs (pCi/g)
Am-241	2.28E-01	0	110
Np-237+D	2.05E+02	115	0.12
Pu-239	2.06E-01	0	121
Tc-99	1.73E-01	0	145
Th-232+C	7.51E+00	91	3.3
U-234	2.71E-02	0	924
U-235+D	5.01E-01	1000	50
U-238+D	8.20E-02	0	305

Notes:
"+D" = plus short-lived decay products
"+C" = plus entire decay chain (Th-232 assumed to be in equilibrium with Ra-228+D and Th-228+D)
DCGL = 25 mrem/yr divided by the dose-to-source ratio

Table 4. Example Uranium Volumetric Soil DCGLs by Enrichment

Isotope	Units	Percent Enrichment				
		0.72%	**3.5%**	**20%**	**75%**	**90%**
U-234		*53.0%*	*78.0%*	*92.0%*	*96.5%*	*97.0%*
U-235		*2.1%*	*4.2%*	*4.9%*	*3.4%*	*3.0%*
U-238		*44.9%*	*17.8%*	*3.1%*	*0.2%*	*0.1%*
Total U	**pCi/g**	**434**	**514**	**587**	**682**	**706**

The DCGLs for surface soil range from approximately one and one half to thirteen times the volumetric values. This is primarily due to the thickness of the modeled contamination zone in combination with two other factors. First, produce ingestion is a major pathway for almost all radionuclides, but the modeled root depth of 0.9 m extends well beyond the surface soil contamination zone of 0.15 m (see Appendices B and C). This limits the plant intake of contamination and the subsequent receptor dose. The volumetric source extends beyond the root depth thus plant uptake is maximized. Second, the erosion rate of 0.0006 m/yr assures that the 0.15 m surface soil contaminated zone is completely eroded in 250 years. There is still 1.4 m of the volumetric source left after 1000 years. In spite of these differences, the soil DCGLs were derived based on the CSM and still conservatively represent the defined source geometries.

One outstanding issue may prompt a revision to the "operational" soil DCGL values (see Section 5.4) at some point during the project. This issue is briefly summarized as follows:

The very low soil DCGL anticipated for Np-237 may necessitate the use of advanced laboratory analytical techniques to demonstrate compliance. Np-237 is only a potential trace contaminant and may not be present at all in site soils. NUREG-1757 Section 3.3 (Ref 20) may be used to evaluate the dose contribution from Np-237 and other radionuclides present in trace quantities. If relevant criteria are met, and following regulator concurrence, Np-237 and/or other trace contaminants may be eliminated from further survey, sampling, and evaluation efforts. The dose contribution from these trace contaminants will still need to be accounted for, therefore the soils DCGLs will need to account for the dose contribution from these trace radionuclides.

5.5 SENSITIVITY ANALYSIS

A sensitivity analysis was performed for each radionuclide of concern using the RESRAD sensitivity graphic utility for input parameters related to intake assumptions for the critical receptor. The following intake parameters were selected for the sensitivity analyses:

(1) Inhalation Rate,
(2) Fruit, Vegetable, and Grain Consumption,
(3) Leafy Vegetable Consumption,
(4) Fish Consumption,
(5) Soil Ingestion Rate, and
(6) Drinking Water Intake.

The RESRAD sensitivity utility operates by both reducing and increasing the selected input parameter by a common factor. During the sensitivity analyses, the common factor of 2 was selected. Table 5 shows the assigned, upper and lower values associated each intake parameter.

Table 5. Values used for Determining Sensitivity Indices

Intake Parameters	Unit	Assigned Value	Common Factor	Upper Value	Lower Value
Inhalation Rate	m^3/yr	8,600	2	17,200	4,300
Fruits, Vegetables, and Grains Consumption	kg/yr	42.7		85.4	21.35
Leafy Vegetables Consumption	kg/yr	4.66		9.32	2.33
Fish Consumption	kg/yr	7.34		14.68	3.67
Soil Ingestion	g/yr	43.8		87.6	21.8
Drinking Water Intake	L/yr	515		1030	257.5

The dose was then calculated for each perturbed parameter value. The output, including dose with the parameter unperturbed (Assigned value), dose with parameter reduced (Lower value), and dose with parameter increased (Upper value), was graphically displayed with time as the independent variable. A sensitivity index (SI) was calculated to determine which parameters have the greatest influence on the calculated soil DCGLs by using the following formula.

$$SI = 1 - \frac{Dose_{LowerValue}}{Dose_{UpperValue}}$$

Sensitivity analyses were performed for both surface soil and volumetric soil by using a unit concentration of 1 pCi/g for each radionuclide of concern. Table 6 presents the results of the sensitivity analysis for radionuclide specific intake parameters. The table presents the maximum, mean, and minimum SI, determined based on the dose results examined over a 1000-year period. The table also includes the year at which the maximum SI first occurred. A positive value of the sensitivity index indicates that the DCGL is directly proportional to the parameter of interest, whereas a negative value indicates the DCGL is inversely proportional to the parameter of interest. A value of < 0.01 indicates that the DCGL is independent of the parameter. The higher the value of SI, the more sensitive is the intake value. A mean SI value of greater than 10% was

used in the selection of the most sensitive parameters. Appendix D provides an example showing how the sensitivity indices were calculated.

The results of the sensitivity analysis summarized in Table 6 show that the fruit, vegetable, and grain consumption pathway is the most sensitive pathway for most of the radionuclides of concern. Soil ingestion pathway is sensitive to Am-241, Pu-239, U-234, and U-238 for both surface and volumetric soil sources, whereas drinking water pathway is sensitive to Np-237 for both soil sources. Leafy vegetable pathway is only sensitive to Tc-99. However, inhalation, and fish consumption are the least sensitive intake parameters for all radionuclides. Conservative values were assigned for the intake parameters that are most sensitive to the radionuclides of concern under current site conditions.

In addition to intake parameters, sensitivity analyses were performed for site-specific contaminated zone distribution coefficient (K_d) of Tc-99 and uranium isotopes. Common factors of 1.64 and 2.7 were selected for Tc-99 and uranium isotopes respectively, so that the upper value selected for the sensitivity analysis corresponded to the maximum site-specific K_d values associated with those two analytes. The results in Table 7 showed that the K_d values for both radionuclides are relatively sensitive for both surface and volumetric soil sources.

Table 6. Sensitivity Indices For Receptor Intake Parameters

Intake/ Analytes	Statistics	Am-241		Np-237+D		Pu-239		Tc-99		Th-232+C		U-234		U-235+D		U-238+D	
		Surf.	**Vol.**	**Surf.**	**Vol.**	**Surf.**	**Vol.**	**Surf.**	**Vol.**	**Surf.**	**Vol.**	**Surf.**	**Vol.**	**Surf.**	**Vol.**	**Surf.**	**Vol.**
Inhalation	Maximum	0.02	0.01	0.01	0.00	0.02	0.01	0.00	0.00	0.02	0.01	0.06	0.03	0.00	0.00	0.01	0.01
	Year @Max	0	0	0	ND	0	0	ND	ND	0	0	0	0	ND	ND	0	0
	Average	0.01	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.06	0.03	0.00	0.00	0.01	0.01
	Minimum	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.01
Fruit, Vegetable, and Grain Consumption	Maximum	0.12	0.38	0.39	0.62	0.13	0.40	0.71	0.71	0.10	0.33	0.24	0.54	0.02	0.14	0.05	0.22
	Year @Max	0	0	0	0	0	0	0	0	0	0	0	0	265	588	0	0
	Average	0.09	**0.38**	**0.18**	**0.31**	0.10	**0.40**	**0.71**	**0.71**	0.06	**0.24**	**0.23**	**0.53**	0.01	0.08	0.05	**0.22**
	Minimum	0.02	0.37	0.00	0.02	0.02	0.40	0.71	0.71	0.03	0.22	0.02	0.50	0.01	0.07	0.01	0.22
Leafy Vegetable Consumption	Maximum	0.01	0.05	0.05	0.11	0.02	0.06	0.13	0.13	0.01	0.05	0.03	0.09	0.01	0.02	0.01	0.03
	Year @Max	0	0	0	0	0	0	0	0	0	0	0	0	0	451	0	0
	Average	0.01	0.05	0.03	0.06	0.01	0.06	**0.13**	**0.13**	0.01	0.03	0.03	0.09	0.00	0.01	0.01	0.03
	Minimum	0.01	0.05	0.01	0.01	0.01	0.06	0.13	0.13	0.00	0.03	0.00	0.08	0.00	0.01	0.00	0.03
Fish Consumption	Maximum	0.02	0.00	0.02	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.01	0.01	0.06	0.00
	Year @Max	265	ND	30	30	265	ND	ND	ND	ND	ND	1000	ND	265	1000	1000	ND
	Average	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Soil Ingestion	Maximum	0.66	0.53	0.29	0.08	0.70	0.55	0.00	0.00	0.21	0.15	0.63	0.39	0.05	0.06	0.18	0.15
	Year @Max	0	0	19	0	0	0	ND	ND	0	0	0	0	0	24	0	0
	Average	**0.51**	**0.52**	0.10	0.04	**0.55**	**0.55**	0.00	0.00	0.07	0.05	**0.61**	**0.39**	0.03	0.05	**0.16**	**0.15**
	Minimum	0.00	0.52	0.00	0.00	0.00	0.55	0.00	0.00	0.02	0.03	0.00	0.31	0.00	0.02	0.00	0.15
Drinking Water Ingestion	Maximum	0.73	0.04	0.74	0.73	0.72	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.72	0.57	0.43	0.00
	Year @Max	265	156	24	41	265	ND	ND	ND	ND	ND	1000	ND	265	1000	1000	ND
	Average	**0.16**	0.01	**0.41**	**0.38**	**0.16**	0.00	0.00	0.00	0.00	0.00	0.02	0.00	**0.16**	0.03	0.02	0.00
	Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Surf. = Surface Soil Source; Vol. = Volumetric Soil Source
ND = Not determined due to insignificant (<0.01) SI.

Table 7. Determination of SI for Tc-99 and Uranium Isotopes K_d values

Parameter/ Analytes	Statistics	Tc-99		U-234		U-235+D		U-238+D	
		Surf.	**Vol.**	**Surf.**	**Vol.**	**Surf.**	**Vol.**	**Surf.**	**Vol.**
Contaminated Zone Kd	Maximum	0.97	0.71	0.98	0.72	0.99	0.60	0.99	0.82
	Year @Max	203	1000	203	1000	203	588	203	1000
	Average	**0.35**	**0.14**	**0.35**	**0.16**	**0.19**	**0.14**	**0.27**	**0.17**
	Minimum	0.02	0.00	-1.14	0.00	-0.93	0.00	-3.26	0.00

Surf. = Surface Soil Source; Vol. = Volumetric Soil Source

6.0 UNCERTAINTY ANALYSIS

6.1 TYPES OF UNCERTAINTY

Uncertainty is inherent in all dose and risk assessment calculations and should be considered in determining whether a selected DCGL concentration will satisfy the regulatory decision-making criteria. In general, there are three primary sources of uncertainty in a dose/risk assessment (Ref 3). The following sections explain each of the source of uncertainty, and summarize how the project handled the associated uncertainties.

6.1.1 Uncertainty in the models

A number of computer software models are available to characterize the site-specific fate and transport mechanisms of contaminants in the environment, and to assess the residual dose presented by contamination from licensed activities at the site. Models are simplifications of reality, and in general, are not able to fully characterize the physical condition of the site. During this project, the RESRAD code was used for estimating the dose to human receptors from exposure to soil contaminated with residual radioactivity. The DOE and NRC have approved the use of RESRAD for dose evaluation and waste disposal at licensed nuclear facilities. The EPA also used the code in rule making for sites contaminated with radioactivity. Therefore, the uncertainty associated with the RESRAD model is considered to be acceptable.

6.1.2 Uncertainty in the scenario

Uncertainty due to the selected scenario results from lack of absolute knowledge about the future uses of the site. During this evaluation, a residential gardener scenario was chosen for determining the soil DCGLs at the site. It is important to recognize that the model evaluation time period (next 1000 years) is not intended to predict the future scenarios in these 1000 years. It is intended to evaluate the continued protectiveness of a given soil DCGL for 1000 years into the future given the reasonable and plausible future uses of the site in today's social and economic conditions. Since conservative values were assigned for the exposure parameters under this receptor scenario, the uncertainty associated with this scenario is considered to be acceptable.

6.1.3 Uncertainty in the parameters

Uncertainty in parameters was limited by using, whenever possible, site-specific values. However, there are no site-specific values for many of the parameters, thus conservative NRC/EPA reference values were used to assure that doses would be over estimated rather than underestimated. The selection of prudently conservative parameters was conducted based on the hierarchy presented in Section 5.3 and was designed to utilize broadly accepted values while adhering to the CSM and particular nuances of the RESRAD code. Because of the established hierarchy and tendency toward prudently conservative parameters values that tend to overestimate doses, the uncertainties associated with parameter selection is considered to be acceptable.

RESRAD allows users to consider parameters as point estimates (deterministic) or as distributions (probabilistic). A sensitivity analysis on point estimate values may be used to determine which parameters have the largest impact on dose results. This analysis was performed as described in Section 5. Sensitivity analysis results help modelers limit uncertainty by focusing

on the most sensitive parameters. When the probabilistic module is used, modelers can represent parameters as distributions (e.g., with a mean and standard deviation) to limit the conservatism in using NRC/EPA reference values. In some cases there is sufficient site-specific data to utilize the probabilistic module, or NRC default definitions can be used. In either case, the selection of probabilistic inputs can limit uncertainty assuming those inputs are representative of site conditions. If a probabilistic module is populated with default distributions the uncertainty may or may not be reduced depending on the overlap of modeled versus actual conditions.

Soil DCGLs for the Hematite site were calculated using the deterministic and not the probabilistic approach. However, Appendix E presents (for reference) probabilistic parameters along with the selected deterministic values. Potential probabilistic parameter values were selected from available site-specific and literature values as follows:

(1) First Preference: Site-Specific Information. If site-specific sampling information is available, the minimum and maximum sampling results for that parameter were defined as the uncertainty range.
(2) Second Preference: NRC Documents. NUREG/CR-6697 (Ref 19) assigned values for uncertainty ranges for most of the RESRAD parameters under a residential scenario. When site-specific values were not available, values defined in NUREG/CR-6697 were used.

Should soil DCGLs be calculated based on these probabilistic or similar parameters, it is likely that similar but different results would be produced. However, the uncertainty associated with these revisions may not necessarily be reduced.

7.0 SUMMARY AND CONCLUSIONS

Surface and volumetric soil DCGLs were derived for the radionuclides of concern potentially present at the site, using a residential gardener scenario. The NRC's primary dose limit of 25 mrem in any year in excess of natural background radiation dose was used as the basis for each derivation. Surface and volumetric soil DCGLs will be used separately when demonstrating compliance with the primary dose limit (i.e., only one or the other will be used in a single survey unit).

The site may have both soil and groundwater residual contamination. In addition, one or more buildings containing some residual contamination might also be left in place. Implementation of the soil DCGLs derived in this report will involve administrative controls to apportion the 25 mrem/yr criteria among the remaining final dose components of residual soil, groundwater (if groundwater is impacted), and building contamination (if any buildings are left in place). RESRAD 6.22 was used during the dose assessments for soil contamination. The modeling used site-specific values and values presented in NRC or EPA dose assessment guidance documents for a residential farmer or gardener scenario. Sensitivity analyses were performed to determine the impact of the receptor intake parameters on the total dose. Conservative values were assigned to the parameters that are most sensitive to the total dose to account for the uncertainty associated with those parameters.

Tables 1 and 3 present (for NRC approval) the proposed site-specific soil DCGLs for the potential radionuclides of concern at the Hematite Site. Tables 2 and 4 are calculated values of total uranium soil DCGLs using the values in Tables 1 and 3. Each soil DCGL represents the concentration (based on the presented model) that would produce 25 mrem/yr.

NUREG-1757 Section 3.3 (Ref 23) may be used to evaluate the dose contribution from Np-237 and other radionuclides present in trace quantities. If relevant criteria are met, and following regulator concurrence, Np-237 and/or other trace contaminants may be eliminated from further survey, sampling, and evaluation efforts. The dose contribution from these trace contaminants will still need to be accounted for, therefore the "operational" soils DCGLs will need to account for the dose contribution from these trace radionuclides.

Although the soil DCGLs provided in this report translate to the full 25 mrem/yr dose criterion, the ALARA criterion can also be demonstrated. Experience with other sites has shown that soils are rarely contaminated to levels equal to the DCGLs. Soils are generally found to be near background levels or (prior to remediation) well in excess of remedial goals. When soil remediation is conducted through soil removal actions, the remaining excavation surfaces are also generally found to be near background levels. As a result, using soil DCGLs as provided in this report will generally result in a residual site dose that is well below the 25 mrem/yr dose criterion.

8.0 REFERENCES

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APPENDIX A

DEFAULT AND RECOMMENDED VALUES FOR RESRAD INPUT PARAMETERS

DEFAULT AND RECOMMENDED VALUES FOR RESRAD INPUT PARAMETERS

RESRAD			Recommendations			
Parameter	**Code**	**Default Value**	**Value**	**Units**	**Justification**	**Reference**
Area of contaminated zone	AREA	10,000	77458	m^2	Site-specific value was determined for this parameter	LBG 2003
Thickness of contaminated zone	THICK0	2	0.15	m	Conservative site-specific value based on conceptual site model for surface soil.	NA
			2.0		RESRAD default used for volumetric source.	ANL 1993
Length parallel to aquifer flow	LCZPAQ	100	291	m	Site-specific value was used. No NRC and EPA value could be located for this parameter.	LBG 2003
Time since placement of material	TI	0	1,3,10,30, 100, 300, 1000	yr	This is RESRAD model-related parameter. No NRC and EPA value could be located for this parameter.	ANL 1993
Cover depth	COVER0	0	0	m	The project assumed no cover as a conservative approach.	NA
Density of cover material	DENSCV	1.5	NA	g/cm^3	No value is assigned for this parameter due to no soil cover.	NA
Cover depth erosion rate	VCV	0.001	NA	m/yr	No value is assigned for this parameter due to no soil cover.	NA
Density of contaminated zone	DENSCZ	1.5	1.69	g/cm^3	Site-specific value was determined based on silty clay soil.	LBG 2003
Contaminated zone erosion rate	VCZ	0.001	0.0006	m/yr	No site-specific data is available. No NRC and EPA value for this parameter could be located. Assuming 2% slope and significant farming and gardening activities at the site, 0.0006 m/yr was assigned for this parameter.	ANL 1993
Contaminated zone total porosity	TPCZ	0.4	0.45	unitless	Site-specific value was determined based on silty clay soil.	LBG 2003
Contaminated zone field capacity	FCCZ	0.2	0.17	unitless	The value was calculated per ANL, 1993 by using site-specific total and effective porosity for the site.	LBG 2003
Contaminated zone hydraulic conductivity	HCCZ	10	14.56	m/yr	Site-specific value was determined based on silty clay soil.	LBG 2003
Contaminated zone b parameter	BCZ	5.3	10.4	unitless	Site-specific value was determined based on silty clay soil.	ANL 1993
Average annual wind speed	WIND	2	2	m/sec	Site-specific data, NRC and EPA value could not be located. Hence, RESRAD default value was assigned.	ANL 1993

DEFAULT AND RECOMMENDED VALUES FOR RESRAD INPUT PARAMETERS (CONT'D)

RESRAD			Recommendations			
Parameter	**Code**	**Default Value**	**Value**	**Units**	**Justification**	**Reference**
Humidity in air	HUMID	8	NA	g/m^3	No value was assigned, as Tritium is not a radionuclide of interest for this site. Humidity input only required if Tritium is present.	NA
Evapotranspiration coefficient	EVAPTR	0.5	0.5	unitless	No site-specific data is available. NRC and EPA value could not be located. Hence, RESRAD default value was assigned for this parameter.	ANL 1993
Precipitation	PRECIP	1	0.965	m/yr	The value was calculated based on 38" annual average rainfall for the site.	LBG 2003
Irrigation	RI	0.2	0.2	m/yr	No site-specific data is available. NRC and EPA value could not be located. Hence, RESRAD default value was assigned for this parameter.	ANL 1993
Irrigation mode	IDITCH	Overhead	Overhead	unitless	Site-specific. No NRC and EPA value could be located.	LBG 2003
Runoff coefficient	RUNOFF	0.2	0.305	unitless	The value for this parameter was calculated based on 12" annual average runoff	LBG 2003
Watershed area for nearby stream or pond	WAREA	1.00E+06	998939	m^2	Site-specific.	LBG 2003
Accuracy for water/soil computations	EPS	0.001	0.001	unitless	This is RESRAD model-related parameter. No NRC and EPA value could be located for this parameter.	ANL 1993
Saturated zone density	DENSAQ	1.5	1.69	g/cm^3	Site-specific value was determined based on silty clay soil.	LBG 2003
Saturated zone total porosity	TPSZ	0.4	0.45	unitless	Site-specific value was determined based on silty clay soil.	LBG 2003
Saturated zone effective porosity	EPSZ	0.2	0.29	unitless	Site-specific value was determined based on silty clay soil.	LBG 2003
Saturated zone field capacity	FCSZ	0.2	0.17	unitless	Site-specific value was determined based on silty clay soil.	LBG 2003
Saturated zone hydraulic conductivity	HCSZ	100	169.58	m/yr	Site-specific value was determined based on silty clay soil.	LBG 2003
Saturated zone hydraulic gradient	HGWT	0.02	0.015	unitless	Site-specific value was determined for this parameter	LBG 2003
Saturated zone b parameter	BSZ	5.3	10.4	unitless	Site-specific value was determined based on silty clay soil.	ANL 1993
Water table drop rate	VWT	0.001	0.001	m/yr	No site-specific data is available. NRC and EPA value could not be located. Hence, RESRAD default value was assumed.	ANL 1993

DEFAULT AND RECOMMENDED VALUES FOR RESRAD INPUT PARAMETERS (CONT'D)

RESRAD			Recommendations			
Parameter	**Code**	**Default Value**	**Value**	**Units**	**Justification**	**Reference**
Well pump intake depth (m below water table)	DWIBWT	10	16	m	Site-specific; Calculated using the available extrapolated data from the private wells (3, 14, 15, and 18).	LBG 2003
Model: Nondispersion (ND) or Mass-Balance (MB)	MODEL	ND	ND	unitless	Area of contamination is greater than 1000 m^2, hence non-dispersion model was assumed.	LBG 2003
Well pumping rate	UW	250	913	m^3/yr	Site-specific value was determined for this parameter.	LBG 2003
Number of unsaturated zone strata #	NS	1	1	unitless	No site-specific data is available for this parameter. Both NRC & RESRAD default used the same value.	NUREG/CR-5512 (Vol. 4)
Unsaturated zone thickness	H(1)	4	4.5	m	Site-specific value was assigned for this parameter.	LBG 2003
Unsaturated zone density	DENSUZ(1)	1.5	1.69	g/cm^3	Site-specific value was determined based on silty clay soil.	LBG 2003
Unsaturated zone total porosity	TPUZ(1)	0.4	0.45	unitless	Site-specific value was determined based on silty clay soil.	LBG 2003
Unsaturated zone effective porosity	EPUZ(1)	0.2	0.29	unitless	Site-specific value was determined based on silty clay soil.	LBG 2003
Unsaturated zone field capacity	FCUZ(1)	0.2	0.17	unitless	The value was calculated per ANL, 1993 by using site-specific total and effective porosity for the site.	LBG 2003
Unsaturated zone hydraulic conductivity	HCUZ(1)	10	14.56	m/yr	Site-specific value was determined based on silty clay soil.	LBG 2003
Unsaturated zone b parameter	BUZ(1)	5.3	10.4	unitless	Site-specific value was determined based on silty clay soil.	ANL 1993
Distribution coefficients						
Uranium	D-1	50	175	cm^3/g	Site-specific derived value. The kd value for each radionuclide of interests were justified in "Determination of Distribution Coefficients for Radionuclides of Concern at the Westinghouse Hematite Facility. The default value was used radium, plutonium, and thorium.	ANL 1993 SAIC 2003
Plutonium	D-1	2,000	2,000	cm^3/g		
Radium	D-1	70	70	cm^3/g		
Technetium	D-1	0	106	cm^3/g		
Thorium	D-1	60,000	60,000	cm^3/g		
Neptunium	D-1	-1	2	cm^3/g		
Americium	D-1	20	1,000	cm^3/g		
Inhalation rate	INHALR	8,400	8,600 (Note 1)	m^3/yr	Site-specific value for this parameter is not available. Hence, time-weighted inhalation rate was calculated based on NRC defined inhalation rates for different activities, and the time, receptor will spend for each activity.	NUREG/CR-5512 (Vol. 3)

DEFAULT AND RECOMMENDED VALUES FOR RESRAD INPUT PARAMETERS (CONT'D)

RESRAD			Recommendations			
Parameter	**Code**	**Default Value**	**Value**	**Units**	**Justification**	**Reference**
Mass loading for inhalation	MLINH	0.0001	5.9E-6 (Note 2)	g/m^3	Site-specific value for this parameter is not available. Hence, time-weighted mass loading for inhalation rate was calculated based on NRC defined mass loading factor for different activities, and the time, receptor will spend for each activity. Indoor = 1.4E-6; Outdoor=3.14E-6; Gardening = 4E-4; (g/m^3)	NUREG/CR-5512 (Vol. 3)
Exposure duration	ED	30	30	yr	RESRAD default. EPA assigned the same default value. Exposure duration not relevant to DCGL calculations.	ANL 1993 EPA 2000
Indoor Dust Filtration Factor	SHF3	0.4	0.4	unitless	No site-specific, NRC and EPA value for this parameter could be located; hence, RESRAD default was assigned.	ANL 1993
External gamma shielding factor	SHF1	0.7	0.4	unitless	No site-specific value is available. EPA's *Soil Screening Guidance document for Radionuclides* value was chosen.	EPA 2000
Fraction of time spent indoors	FIND	0.5	0.6571	unitless	No site-specific value is available. (15.77 hr/day for 350 days/yr)	NUREG/CR-5512 (Vol. 4)
Fraction of time spent outdoors (on site)	FOTD	0.25	0.1181	unitless	No site-specific value is available. (2.756 + 0.2 hr/day for 350 days/yr). The 0.2 hrs/day is time spent gardening.	NUREG/CR-5512 (Vol. 4)
Shape of the contaminated zone: Circular; Non-Circular	FS	Circular	Circular	unitless	No site-specific, NRC and EPA value for this parameter could be located; hence, RESRAD default was assigned.	ANL 1993
Fruits, vegetables and grain consumption	DIET(1)	160	42.7	kg/yr	No site-specific value is available. EPA's *Soil Screening Guidance document for Radionuclides* value was chosen.	EPA 2000
Leafy vegetable consumption	DIET(2)	14	4.66	kg/yr	No site-specific value is available. EPA's *Soil Screening Guidance document for Radionuclides* value was chosen.	EPA 2000
Milk consumption	DIET(3)	92	NA	L/yr	Not applicable as milk ingestion pathway is not selected.	NA

DEFAULT AND RECOMMENDED VALUES FOR RESRAD INPUT PARAMETERS (CONT'D)

RESRAD			Recommendations			
Parameter	**Code**	**Default Value**	**Value**	**Units**	**Justification**	**Reference**
Meat and poultry consumption	DIET(4)	63	NA	kg/yr	Not applicable as meat ingestion pathway is not selected.	NA
Fish consumption	DIET(5)	5.4	7.34	kg/yr	No site-specific value is available. Hence, the assigned value (20.1 g/day) was chosen from EPA's Exposure Factor Handbook.	EPA 1997
Other seafood consumption	DIET(6)	0.9	0.9	kg/yr	No site-specific value is available. No NRC and EPA value could be located. Hence, RESRAD default value was assigned.	ANL 1993
Soil ingestion rate	SOIL	36.5	43.8	g/yr	No site-specific value is available. EPA's *Soil Screening Guidance document for Radionuclides* value (120 mg/day) was chosen.	EPA 2000
Drinking water intake	DWI	510	515	L/yr	No site-specific value is available. Hence, the assigned value (1.41 L/day) was chosen from EPA's *Exposure Factor Handbook.*	EPA 1997
Contamination fraction of drinking water	FDW	1	1	unitless	No site-specific value is available. Hence, the maximum NRC value was used for this parameter.	NUREG/CR-6697
Contamination fraction of household water	FHHW	1	NA	unitless	Radon pathway is not selected; hence this parameter is not applicable	NA
Contamination fraction of livestock water	FLW	1	NA	unitless	Not applicable as meat ingestion pathway is not selected.	NA
Contamination fraction of irrigation water	FIRW	1	1	unitless	No site-specific value is available. Hence, the maximum NRC value was used for this parameter.	NUREG/CR-6697
Contamination fraction of aquatic food	FR9	0.5	0.5	unitless	No site-specific value is available. Hence, the maximum NRC value was used for this parameter.	ANL 1993
Contamination fraction of plant food	FPLANT	-1 **	0.5	unitless	No site-specific value is available. EPA's *Soil Screening Guidance document for Radionuclides* value was chosen.	EPA 2000
Contamination fraction of meat	FMEAT	-1 **	NA	unitless	Not applicable as meat ingestion pathway is not selected.	NA

DEFAULT AND RECOMMENDED VALUES FOR RESRAD INPUT PARAMETERS (CONT'D)

RESRAD			Recommendations			
Parameter	**Code**	**Default Value**	**Value**	**Units**	**Justification**	**Reference**
Contamination fraction of milk	FMILK	-1**	NA	unitless	Not applicable as milk ingestion pathway is not selected.	NA
Livestock fodder intake for meat	LFI5	68	NA	kg/day	Not applicable as meat ingestion pathway is not selected.	NA
Livestock fodder intake for milk	LFI6	55	NA	kg/day	Not applicable as milk ingestion pathway is not selected.	NA
Livestock water intake for meat	LWI5	50	NA	L/day	Not applicable as meat ingestion pathway is not selected.	NA
Livestock water intake for milk	LWI6	160	NA	L/day	Not applicable as milk ingestion pathway is not selected.	NA
Livestock soil intake	LSI	0.5	NA	kg/day	Not applicable as meat ingestion pathway is not selected.	NA
Mass loading for foliar deposition	MLFD	0.0001	0.0001	g/m^3	Site-specific value is not available. No NRC and EPA value could be located. Hence RESRAD Default value is assigned.	ANL 1993
Depth of soil mixing layer	DM	0.15	0.15	m	Site-specific value is not available. No NRC and EPA value could be located. Hence RESRAD default value is assigned for this parameter.	ANL 1993
Depth of roots	DROOT	0.9	0.9	m	Site-specific value is not available. No EPA value could be located. Hence RESRAD default value is assigned for this parameter.	ANL 1993
Drinking water fraction from ground water	FGWDW	1	1	unitless	Both NRC and RESRAD values for this parameter are the same; hence that value was assigned. No EPA value could be located.	NUREG/CR-5512 (Vol. 4)
Household water fraction from ground water	FGWHH	1	NA	unitless	Radon pathway is not selected; hence this parameter is not applicable	NA
Livestock fraction from ground water	FGWLW	1	NA	unitless	Not applicable as meat ingestion pathway is not selected.	NA

DEFAULT AND RECOMMENDED VALUES FOR RESRAD INPUT PARAMETERS (CONT'D)

RESRAD			Recommendations			
Parameter	**Code**	**Default Value**	**Value**	**Units**	**Justification**	**Reference**
Irrigation fraction from ground water	FGWIR	1	1	unitless	Both NRC and RESRAD values for this parameter are the same; hence that value was assigned. No EPA value could be located.	NUREG/CR-5512 (Vol. 4)
Wet weight crop yield for non-leafy vegetables	YV(1)	0.7	0.7	kg/m^2	Site-specific value is not available. No NRC and EPA value could be located. Hence RESRAD default value was assigned.	ANL 1993
Wet weight crop yield for leafy	YV(2)	1.5	1.5	kg/m^2	Site-specific value is not available. No NRC and EPA value could be located. Hence RESRAD default value was assigned.	ANL 1993
Wet weight crop yield for fodder	YV(3)	1.1	NA	kg/m^2	Not applicable as meat ingestion pathway is not selected.	NA
Growing season for non-leafy	TE(1)	0.17	0.17	years	Site-specific value is not available. No NRC and EPA value could be located. Hence RESRAD default value was assigned.	ANL 1993
Growing season for leafy	TE(2)	0.25	0.25	years	Site-specific value is not available. No NRC and EPA value could be located. Hence RESRAD default value was assigned.	ANL 1993
Growing season for fodder	TE(3)	0.08	NA	years	Not applicable as meat ingestion pathway is not selected.	NA
Translocation factor for non-leafy	TIV(1)	0.1	0.1	unitless	Both NRC and RESRAD values for this parameter are the same; hence that value was assigned. No EPA value could be located.	NUREG/CR-5512 (Vol. 3)
Translocation factor for leafy	TIV(2)	1	1	unitless	Both NRC and RESRAD values for this parameter are the same; hence that value was assigned. No EPA value could be located.	NUREG/CR-5512 (Vol. 3)
Translocation factor for fodder	TIV(3)	1	NA	unitless	Not applicable as meat ingestion pathway is not selected.	NA
Dry foliar interception fraction for non-leafy vegetables	RDRY(1)	0.25	0.25	unitless	Site-specific value is not available. No NRC and EPA value could be located. Hence RESRAD default value was assigned.	ANL 1993

DEFAULT AND RECOMMENDED VALUES FOR RESRAD INPUT PARAMETERS (CONT'D)

RESRAD			Recommendations			
Parameter	**Code**	**Default Value**	**Value**	**Units**	**Justification**	**Reference**
Dry foliar interception fraction for leafy vegetables	RDRY(2)	0.25	0.25	unitless	Site-specific value is not available. No NRC and EPA value could be located. Hence RESRAD default value was assigned.	ANL 1993
Dry foliar interception fraction for fodder	RDRY(3)	0.25	NA	unitless	Not applicable as meat ingestion pathway is not selected.	NA
Wet foliar interception fraction for non-leafy vegetables	RWET(1)	0.25	0.25	unitless	Site-specific value is not available. No NRC and EPA value could be located. Hence RESRAD default value was assigned.	ANL 1993
Wet foliar interception fraction for leafy	RWET(2)	0.25	0.25	unitless	Site-specific value is not available. Most likely value defined in NUREG/CR was assigned. No EPA value could be located.	ANL 1993
Wet foliar interception fraction for fodder	RWET(3)	0.25	NA	unitless	Not applicable as meat ingestion pathway is not selected.	NA
Weathering removal constant for vegetation	WLAM	20	20	unitless	Site-specific value is not available. No NRC and EPA value could be located. Hence RESRAD default value was assigned.	ANL 1993
Storage time: fruits, non-leafy vegetables, and grain	STOR_T(1)	14	14	days	Both NRC and RESRAD values for this parameter are the same; hence that value was assigned. No EPA value could be located.	NUREG/CR-5512 (Vol. 4)
Storage time: leafy vegetables	STOR_T(2)	1	1	days	Both NRC and RESRAD values for this parameter are the same; hence that value was assigned. No EPA value could be located.	NUREG/CR-5512 (Vol. 4)
Storage time: milk	STOR_T(3)	1	NA	days	Not applicable as meat ingestion pathway is not selected.	NA
Storage time: meat and poultry	STOR_T(4)	20	NA	days	Not applicable as meat ingestion pathway is not selected.	NA
Storage time: fish	STOR_T(5)	7	7	days	Both NRC and RESRAD values for this parameter are the same; hence that value was assigned. No EPA value could be located.	NUREG/CR-5512 (Vol. 4)
Storage time: crustacea and mollusks	STOR_T(6)	7	7	days	Both NRC and RESRAD values for this parameter are the same; hence that value was assigned. No EPA value could be located.	NUREG/CR-5512 (Vol. 4)

DEFAULT AND RECOMMENDED VALUES FOR RESRAD INPUT PARAMETERS (CONT'D)

RESRAD			Recommendations			
Parameter	**Code**	**Default Value**	**Value**	**Units**	**Justification**	**Reference**
Storage time: well water	STOR_T(7)	1	1	days	Both NRC and RESRAD values for this parameter are the same; hence that value was assigned. No EPA value could be located.	NUREG/CR-5512 (Vol. 4)
Storage time: surface water	STOR_T(8)	1	1	days	Both NRC and RESRAD values for this parameter are the same; hence that value was assigned. No EPA value could be located.	NUREG/CR-5512 (Vol. 4)
Storage time: livestock fodder	STOR_T(9)	45	NA	days	Not applicable as meat ingestion pathway is not selected.	NA
Thickness of building foundation	FLOOR1	0.15	NA	m	No Radon pathway, hence this parameter is not applicable.	NA
Bulk density of building foundation	DENSFL	2.4	NA	g/cm^3	No Radon pathway, hence this parameter is not applicable.	NA
Total porosity of the cover material	TPCV	0.4	NA	unitless	No Radon pathway, hence this parameter is not applicable.	NA
Total porosity of the building foundation	TPFL	0.1	NA	unitless	No Radon pathway, hence this parameter is not applicable.	NA
Volumetric water constant of the cover material	PH2OCV	0.05	NA	unitless	No Radon pathway, hence this parameter is not applicable.	NA
Volumetric water constant of the foundation	PH2OFL	0.03	NA	unitless	No Radon pathway, hence this parameter is not applicable.	NA
Diffusion coefficient for radon gas in cover material	DIFCV	2.00E+06	NA	m/sec	No Radon pathway, hence this parameter is not applicable.	NA
Diffusion coefficient for radon gas in foundation material	DIFFL	3.00E-07	NA	m/sec	No Radon pathway, hence this parameter is not applicable.	NA
Diffusion coefficient for radon gas in contaminated zone soil	DIFCZ	2.00E-06	NA	m/sec	No Radon pathway, hence this parameter is not applicable.	NA
Radon vertical dimension of mixing	HMIX	2	NA	m	No Radon pathway, hence this parameter is not applicable.	NA
Average building air exchange rate	REXG	0.5	NA	1/hour	No Radon pathway, hence this parameter is not applicable.	NA
Height of the building (room)	HRM	2.5	NA	m	No Radon pathway, hence this parameter is not applicable.	NA
Building interior area factor	FAI	0	NA	unitless	No Radon pathway, hence this parameter is not applicable.	NA

DEFAULT AND RECOMMENDED VALUES FOR RESRAD INPUT PARAMETERS (CONT'D)

RESRAD			Recommendations			
Parameter	**Code**	**Default Value**	**Value**	**Units**	**Justification**	**Reference**
Building depth below ground surface	DMFL	-1	NA	m	No Radon pathway, hence this parameter is not applicable.	NA
Emanating power of Rn-222 gas	EMANA(1)	0.25	NA	unitless	No Radon pathway, hence this parameter is not applicable.	NA
Emanating power of Rn-220 gas	EMANA(2)	0.15	NA	unitless	No Radon pathway, hence this parameter is not applicable.	NA
Pathway – external gamma	NA	active	active	unitless	NA	NA
Pathway – inhalation (w/o radon)	NA	active	active	unitless	NA	NA
Pathway – plant ingestion	NA	active	active	unitless	NA	NA
Pathway – meat ingestion	NA	active	inactive	unitless	NA	NA
Pathway – milk ingestion	NA	active	inactive	unitless	NA	NA
Pathway – aquatic foods	NA	active	active	unitless	NA	NA
Pathway – drinking water	NA	active	active	unitless	NA	NA
Pathway – soil ingestion	NA	active	active	unitless	NA	NA
Pathway – radon	NA	active	inactive	unitless	NA	NA

ANL, 1993. *Data Collection Handbook to Support Modeling Impacts of Radioactive Material in Soil*, Environmental Assessment and Information Sciences Division, Argonne National Laboratory NUREG/CR-5512

Comparison of the Models and Assumptions used in DandD 1.0, RESRAD 5.61, and RESRAD-Build 1.50 Computer Codes with Respect to the Residual Farmer and Industrial Occupant Scenarios Provided in NUREG/CR-5512 (NUREG/CR-5512, Vol. 4)

Residual Radioactive Contamination From Decommissioning - Parameter Analysis, Draft Report for Comments (NUREG/CR-5512, Vol. 3)

Residual Radioactive Contamination From Decommissioning: Technical Basis for Translating Contamination Levels to Annual Total Effective Dose Equivalent, Volume 1, IV) PNL-7994

EPA, 1997. Exposure Factors Handbook, Volumes I, II, and III, EPA/600/P-95/002Fa-c, Office of Research and Development, Washington, DC, August.

EPA, 2000. *Soil Screening Guidance for Radionuclides: User's Guide*, EPA/540-R-00-007, Office of Radiation and Indoor Air/Office of Solid Waste and Emergency Response, Washington, DC, October.

LBG, 2003. *Site-Specific Soil Parameters Westinghouse Former Fuel Cycle Facility D & D Project.*

NUREG/CR-6697, 2000. *Development of Probabilistic RESRAD 6.0 and RESRAD-Build 3.0 Computer Codes.*

SAIC, 2003. *Determination of Distribution Coefficients for Radionuclides of Concern at the Westinghouse Hematite Facility (Draft).*

NA = Not Applicable

N/A = Not Available

** specifies that the contaminated fraction will be calculated from the appropriate area factor in RESRAD.

Note 1:

Inhalation Rate =((0.9 m^3/hr x 15.77 hrs/day) + (1.4 m^3/hr x 2.756 hrs/day) + (1.7 m^3/hr x 0.20 hrs/day)) x 8760 hrs/yr / (24 hrs/day) = 6710 m^3/yr, where 15.77, 2.756, and 0.2 hrs/day are indoor, outdoor, and gardening activities for the receptor. Rate must also account for time off-site because of way the RESRAD the occupancy factor is applied. Therefore, using weighted average approach based on given hourly fractions: =((0.9 m^3/hr x 4.441 hrs/day) + (1.4 m^3/hr x 0.776 hrs/day) + (1.7 m^3/hr x 0.056 hrs/day)) x 8760 hrs/yr / (24 hrs/day) = 1890 m^3/yr. Total rate = 6710 + 1890 = 8600 m^3/yr.

Note 2:

Mass loading for inhalation =[(1.4 E-6 g/m^3 x {15.77 + 4.441} hrs/day) + (3.14E-06 g/m^3 x {2.756 + 0.776} hrs/day) + (4E-04 g/m^3 x {0.20 + 0.056} hrs/day)] /24 hrs/day = 5.9E-06 g/m^3. As with inhalation rate, the mass loading estimate must also account for time off-site because of way the RESRAD the occupancy factor is applied.

APPENDIX B

SURFACE SOIL DOSE ASSESSMENT SUMMARY REPORT

Summary : Surface Soil Dose Assessment for NRC Resident Gardener
File : WH NRC RESIDENT.RAD

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Dose Conversion Factor (and Related) Parameter Summary
File: FGR 13 Morbidity

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Am-241	4.440E-01	4.440E-01	DCF2(2)
B-1	Np-237+D	5.400E-01	5.400E-01	DCF2(3)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(4)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(5)
B-1	Pu-239	4.290E-01	4.290E-01	DCF2(6)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(7)
B-1	Ra-228+D	5.080E-03	5.080E-03	DCF2(8)
B-1	Tc-99	8.330E-06	8.330E-06	DCF2(9)
B-1	Th-228+D	3.450E-01	3.450E-01	DCF2(10)
B-1	Th-229+D	2.160E+00	2.160E+00	DCF2(11)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(12)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(13)
B-1	U-233	1.350E-01	1.350E-01	DCF2(14)
B-1	U-234	1.320E-01	1.320E-01	DCF2(15)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(16)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(17)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Am-241	3.640E-03	3.640E-03	DCF3(2)
D-1	Np-237+D	4.440E-03	4.440E-03	DCF3(3)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(4)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(5)
D-1	Pu-239	3.540E-03	3.540E-03	DCF3(6)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(7)
D-1	Ra-228+D	1.440E-03	1.440E-03	DCF3(8)
D-1	Tc-99	1.460E-06	1.460E-06	DCF3(9)
D-1	Th-228+D	8.080E-04	8.080E-04	DCF3(10)
D-1	Th-229+D	4.030E-03	4.030E-03	DCF3(11)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(12)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(13)
D-1	U-233	2.890E-04	2.890E-04	DCF3(14)
D-1	U-234	2.830E-04	2.830E-04	DCF3(15)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(16)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(17)
D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34				

```
D-34 ³ Am-241   , plant/soil concentration ratio, dimensionless    ³ 1.000E-03 ³ 1.000E-03 ³ RTF( 2,1)
D-34 ³ Am-241   , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)    ³ 5.000E-05 ³ 5.000E-05 ³ RTF( 2,2)
D-34 ³ Am-241   , milk/livestock-intake ratio, (pCi/L)/(pCi/d)     ³ 2.000E-06 ³ 2.000E-06 ³ RTF( 2,3)
D-34 ³                                                            ³           ³           ³
D-34 ³ Np-237+D , plant/soil concentration ratio, dimensionless   ³ 2.000E-02 ³ 2.000E-02 ³ RTF( 3,1)
D-34 ³ Np-237+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 1.000E-03 ³ 1.000E-03 ³ RTF( 3,2)
D-34 ³ Np-237+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 5.000E-06 ³ 5.000E-06 ³ RTF( 3,3)
```

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: FGR 13 Morbidity

Menu	Parameter	Current Value	Default	Parameter Name
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(4,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(4,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(4,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(5,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(5,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(5,3)
D-34				
D-34	Pu-239 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(6,1)
D-34	Pu-239 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(6,2)
D-34	Pu-239 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(6,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(7,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(7,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(7,3)
D-34				
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(8,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(8,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(8,3)
D-34				
D-34	Tc-99 , plant/soil concentration ratio, dimensionless	5.000E+00	5.000E+00	RTF(9,1)
D-34	Tc-99 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(9,2)
D-34	Tc-99 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(9,3)
D-34				
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(10,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(10,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(10,3)
D-34				
D-34	Th-229+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(11,1)
D-34	Th-229+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(11,2)
D-34	Th-229+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(11,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(12,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(12,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(12,3)
D-34				
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(13,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(13,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(13,3)
D-34				
D-34	U-233 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(14,1)
D-34	U-233 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(14,2)
D-34	U-233 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(14,3)

D-34 ³ ³ ³ ³
D-34 ³ U-234 , plant/soil concentration ratio, dimensionless ³ 2.500E-03 ³ 2.500E-03 ³ RTF(15,1)
D-34 ³ U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d) ³ 3.400E-04 ³ 3.400E-04 ³ RTF(15,2)
D-34 ³ U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d) ³ 6.000E-04 ³ 6.000E-04 ³ RTF(15,3)
D-34 ³ ³ ³ ³

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: FGR 13 Morbidity

Menu	Parameter	Current Value	Default	Parameter Name
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(16,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(16,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(16,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(17,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(17,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(17,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5				
D-5	Am-241 , fish	3.000E+01	3.000E+01	BIOFAC(2,1)
D-5	Am-241 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(2,2)
D-5				
D-5	Np-237+D , fish	3.000E+01	3.000E+01	BIOFAC(3,1)
D-5	Np-237+D , crustacea and mollusks	4.000E+02	4.000E+02	BIOFAC(3,2)
D-5				
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(4,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(4,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(5,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(5,2)
D-5				
D-5	Pu-239 , fish	3.000E+01	3.000E+01	BIOFAC(6,1)
D-5	Pu-239 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(6,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(7,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(7,2)
D-5				
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(8,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(8,2)
D-5				
D-5	Tc-99 , fish	2.000E+01	2.000E+01	BIOFAC(9,1)
D-5	Tc-99 , crustacea and mollusks	5.000E+00	5.000E+00	BIOFAC(9,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(10,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(10,2)
D-5				
D-5	Th-229+D , fish	1.000E+02	1.000E+02	BIOFAC(11,1)
D-5	Th-229+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(11,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(12,1)

```
D-5  ³ Th-230   , crustacea and mollusks                ³ 5.000E+02 ³ 5.000E+02 ³ BIOFAC(12,2)
D-5  ³                                                 ³           ³           ³
D-5  ³ Th-232   , fish                                 ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC(13,1)
D-5  ³ Th-232   , crustacea and mollusks               ³ 5.000E+02 ³ 5.000E+02 ³ BIOFAC(13,2)
D-5  ³                                                 ³           ³           ³
D-5  ³ U-233    , fish                                 ³ 1.000E+01 ³ 1.000E+01 ³ BIOFAC(14,1)
D-5  ³ U-233    , crustacea and mollusks               ³ 6.000E+01 ³ 6.000E+01 ³ BIOFAC(14,2)
```

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: FGR 13 Morbidity

Menu	Parameter	Current Value	Default	Parameter Name
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(15,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(15,2)
D-5				
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(16,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(16,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(17,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(17,2)

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	7.746E+04	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	1.500E-01	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	2.910E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	2.500E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Am-241	1.000E+00	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Np-237	1.000E+00	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): Pu-239	1.000E+00	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Tc-99	1.000E+00	0.000E+00	---	S1(9)
R012	Initial principal radionuclide (pCi/g): Th-232	1.000E+00	0.000E+00	---	S1(13)
R012	Initial principal radionuclide (pCi/g): U-234	1.000E+00	0.000E+00	---	S1(15)
R012	Initial principal radionuclide (pCi/g): U-235	1.000E+00	0.000E+00	---	S1(16)
R012	Initial principal radionuclide (pCi/g): U-238	1.000E+00	0.000E+00	---	S1(17)
R012	Concentration in groundwater (pCi/L): Am-241	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Np-237	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): Pu-239	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Tc-99	not used	0.000E+00	---	W1(9)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	W1(13)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(15)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(16)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(17)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.690E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	6.000E-04	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.500E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	1.700E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.456E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	1.040E+01	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR

R013	Precipitation (m/yr)	9.650E-01	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	3.050E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	9.989E+05	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R014	Density of saturated zone (g/cm**3)	1.690E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.500E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.900E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	1.700E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.696E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	1.500E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	1.040E+01	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.600E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	9.130E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	4.500E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.690E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.500E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.900E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	1.700E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	1.040E+01	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.456E+01	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Am-241				
R016	Contaminated zone (cm**3/g)	1.000E+03	2.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+03	2.000E+01	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	1.000E+03	2.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.717E-03	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Np-237				
R016	Contaminated zone (cm**3/g)	2.000E+00	-1.000E+00	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+00	-1.000E+00	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	2.000E+00	-1.000E+00	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.702E-01	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for Pu-239				
R016	Contaminated zone (cm**3/g)	2.000E+03	2.000E+03	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+03	2.000E+03	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	2.000E+03	2.000E+03	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.586E-04	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for Tc-99				
R016	Contaminated zone (cm**3/g)	1.060E+02	0.000E+00	---	DCNUCC(9)

R016 [3]	Unsaturated zone 1 (cm**3/g)	[3] 1.060E+02	[3] 0.000E+00	[3] ---	[3] DCNUCU(9,1)
R016 [3]	Saturated zone (cm**3/g)	[3] 1.060E+02	[3] 0.000E+00	[3] ---	[3] DCNUCS(9)
R016 [3]	Leach rate (/yr)	[3] 0.000E+00	[3] 0.000E+00	[3] 1.617E-02	[3] ALEACH(9)
R016 [3]	Solubility constant	[3] 0.000E+00	[3] 0.000E+00	[3] not used	[3] SOLUBK(9)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(13)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(13,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(13)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.862E-05	ALEACH(13)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(13)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCC(15)
R016	Unsaturated zone 1 (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCU(15,1)
R016	Saturated zone (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCS(15)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.800E-03	ALEACH(15)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(15)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCC(16)
R016	Unsaturated zone 1 (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCU(16,1)
R016	Saturated zone (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCS(16)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.800E-03	ALEACH(16)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(16)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCC(17)
R016	Unsaturated zone 1 (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCU(17,1)
R016	Saturated zone (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCS(17)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.800E-03	ALEACH(17)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(17)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.489E-02	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.419E-02	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(5)

R016 [3]	Unsaturated zone 1 (cm**3/g)	[3] 1.000E+02	[3] 1.000E+02	---	[3] DCNUCU(5,1)
R016 [3]	Saturated zone (cm**3/g)	[3] 1.000E+02	[3] 1.000E+02	---	[3] DCNUCS(5)
R016 [3]	Leach rate (/yr)	[3] 0.000E+00	[3] 0.000E+00	1.713E-02	[3] ALEACH(5)
R016 [3]	Solubility constant	[3] 0.000E+00	[3] 0.000E+00	not used	[3] SOLUBK(5)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.445E-02	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.445E-02	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for daughter Th-228				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(10)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(10,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.862E-05	ALEACH(10)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10)
R016	Distribution coefficients for daughter Th-229				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(11,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.862E-05	ALEACH(11)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(12)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(12,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.862E-05	ALEACH(12)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(12)
R016	Distribution coefficients for daughter U-233				
R016	Contaminated zone (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCC(14)
R016	Unsaturated zone 1 (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCU(14,1)
R016	Saturated zone (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCS(14)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.800E-03	ALEACH(14)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(14)
R017	Inhalation rate (m**3/yr)	8.600E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	5.900E-06	1.000E-04	---	MLINH

R017	Exposure duration	3.000E+01	3.000E+01	---		ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---		SHF3
R017	Shielding factor, external gamma	4.000E-01	7.000E-01	---		SHF1
R017	Fraction of time spent indoors	6.571E-01	5.000E-01	---		FIND
R017	Fraction of time spent outdoors (on site)	1.181E-01	2.500E-01	---		FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.		FS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	4.270E+01	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	4.660E+00	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	7.340E+00	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	4.380E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	5.150E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	5.000E-01	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK

R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	2.000E+01	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
C14	DCF correction factor for gaseous forms of C14	not used	8.894E+01	---	CO2F
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)

STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	active
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	active
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	active

Summary : Surface Soil Dose Assessment for NRC Resident Gardener
File : WH NRC RESIDENT.RAD

Contaminated Zone Dimensions

Area:	77458.00 square meters
Thickness:	0.15 meters
Cover Depth:	0.00 meters

Initial Soil Concentrations, pCi/g

Am-241	1.000E+00
Np-237	1.000E+00
Pu-239	1.000E+00
Tc-99	1.000E+00
Th-232	1.000E+00
U-234	1.000E+00
U-235	1.000E+00
U-238	1.000E+00

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 2.500E+01 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	1.583E+00	1.586E+00	2.107E+00	3.994E+00	2.032E+01	1.999E+01	8.991E-05	4.923E-02
M(t):	6.333E-02	6.343E-02	8.429E-02	1.598E-01	8.126E-01	7.994E-01	3.597E-06	1.969E-03

Maximum TDOSE(t): 2.057E+01 mrem/yr at t = 34.45 ñ 0.07 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.445E+01 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	1.473E-02	0.0007	1.369E-03	0.0001	0.000E+00	0.0000	1.111E-02	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	9.466E-02	0.0046
Np-237	1.062E-08	0.0000	2.023E-09	0.0000	0.000E+00	0.0000	1.027E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.627E-08	0.0000
Pu-239	1.037E-04	0.0000	1.440E-03	0.0001	0.000E+00	0.0000	1.176E-02	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	1.002E-01	0.0049
Tc-99	2.687E-05	0.0000	1.639E-08	0.0000	0.000E+00	0.0000	1.409E-02	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	2.423E-05	0.0000
Th-232	4.199E+00	0.2042	6.669E-03	0.0003	0.000E+00	0.0000	1.735E-01	0.0084	0.000E+00	0.0000	0.000E+00	0.0000	1.338E-01	0.0065
U-234	1.128E-04	0.0000	3.248E-04	0.0000	0.000E+00	0.0000	1.713E-03	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	5.872E-03	0.0003
U-235	1.939E-01	0.0094	3.059E-04	0.0000	0.000E+00	0.0000	1.754E-03	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	5.682E-03	0.0003
U-238	3.604E-02	0.0018	2.901E-04	0.0000	0.000E+00	0.0000	1.628E-03	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	5.578E-03	0.0003
Total	4.444E+00	0.2161	1.040E-02	0.0005	0.000E+00	0.0000	2.156E-01	0.0105	0.000E+00	0.0000	0.000E+00	0.0000	3.458E-01	0.0168

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.445E+01 years

	Water Dependent Pathways													
	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	3.870E-05	0.0000	1.687E-06	0.0000	0.000E+00	0.0000	8.452E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.219E-01	0.0059
Np-237	1.459E+01	0.7096	6.374E-01	0.0310	0.000E+00	0.0000	3.196E-01	0.0155	0.000E+00	0.0000	0.000E+00	0.0000	1.555E+01	0.7561
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.135E-01	0.0055
Tc-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.414E-02	0.0007
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.513E+00	0.2194
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.023E-03	0.0004
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.017E-01	0.0098
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.353E-02	0.0021
Total	1.459E+01	0.7096	6.374E-01	0.0310	0.000E+00	0.0000	3.196E-01	0.0155	0.000E+00	0.0000	0.000E+00	0.0000	2.057E+01	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	1.652E-02	0.0104	1.781E-03	0.0011	0.000E+00	0.0000	1.445E-02	0.0091	0.000E+00	0.0000	0.000E+00	0.0000	1.231E-01	0.0778
Np-237	2.777E-01	0.1754	1.513E-03	0.0010	0.000E+00	0.0000	2.494E-01	0.1575	0.000E+00	0.0000	0.000E+00	0.0000	1.049E-01	0.0663
Pu-239	1.086E-04	0.0001	1.723E-03	0.0011	0.000E+00	0.0000	1.407E-02	0.0089	0.000E+00	0.0000	0.000E+00	0.0000	1.199E-01	0.0757
Tc-99	4.706E-05	0.0000	3.319E-08	0.0000	0.000E+00	0.0000	2.854E-02	0.0180	0.000E+00	0.0000	0.000E+00	0.0000	4.908E-05	0.0000
Th-232	1.380E-01	0.0872	6.598E-03	0.0042	0.000E+00	0.0000	2.321E-02	0.0147	0.000E+00	0.0000	0.000E+00	0.0000	9.548E-02	0.0603
U-234	1.506E-04	0.0001	5.277E-04	0.0003	0.000E+00	0.0000	2.785E-03	0.0018	0.000E+00	0.0000	0.000E+00	0.0000	9.543E-03	0.0060
U-235	2.765E-01	0.1746	4.918E-04	0.0003	0.000E+00	0.0000	2.631E-03	0.0017	0.000E+00	0.0000	0.000E+00	0.0000	9.007E-03	0.0057
U-238	5.229E-02	0.0330	4.717E-04	0.0003	0.000E+00	0.0000	2.647E-03	0.0017	0.000E+00	0.0000	0.000E+00	0.0000	9.071E-03	0.0057
Total	7.613E-01	0.4808	1.311E-02	0.0083	0.000E+00	0.0000	3.378E-01	0.2133	0.000E+00	0.0000	0.000E+00	0.0000	4.711E-01	0.2976

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.559E-01	0.0985
Np-237	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.336E-01	0.4002
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.358E-01	0.0858
Tc-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.864E-02	0.0181
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.633E-01	0.1663
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.301E-02	0.0082
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.886E-01	0.1823
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.448E-02	0.0407
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.583E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	1.646E-02	0.0104	1.768E-03	0.0011	0.000E+00	0.0000	1.434E-02	0.0090	0.000E+00	0.0000	0.000E+00	0.0000	1.222E-01	0.0771
Np-237	1.285E-01	0.0810	6.977E-04	0.0004	0.000E+00	0.0000	1.156E-01	0.0729	0.000E+00	0.0000	0.000E+00	0.0000	4.839E-02	0.0305
Pu-239	1.085E-04	0.0001	1.714E-03	0.0011	0.000E+00	0.0000	1.400E-02	0.0088	0.000E+00	0.0000	0.000E+00	0.0000	1.193E-01	0.0752
Tc-99	4.630E-05	0.0000	3.253E-08	0.0000	0.000E+00	0.0000	2.797E-02	0.0176	0.000E+00	0.0000	0.000E+00	0.0000	4.810E-05	0.0000
Th-232	4.577E-01	0.2886	6.619E-03	0.0042	0.000E+00	0.0000	4.688E-02	0.0296	0.000E+00	0.0000	0.000E+00	0.0000	1.011E-01	0.0637
U-234	1.491E-04	0.0001	5.205E-04	0.0003	0.000E+00	0.0000	2.747E-03	0.0017	0.000E+00	0.0000	0.000E+00	0.0000	9.412E-03	0.0059
U-235	2.737E-01	0.1726	4.851E-04	0.0003	0.000E+00	0.0000	2.604E-03	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	8.891E-03	0.0056
U-238	5.174E-02	0.0326	4.652E-04	0.0003	0.000E+00	0.0000	2.611E-03	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	8.946E-03	0.0056
Total	9.284E-01	0.5855	1.227E-02	0.0077	0.000E+00	0.0000	2.268E-01	0.1430	0.000E+00	0.0000	0.000E+00	0.0000	4.183E-01	0.2638

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.548E-01	0.0976
Np-237	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.932E-01	0.1849
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.351E-01	0.0852
Tc-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.807E-02	0.0177
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.123E-01	0.3861
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.283E-02	0.0081
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.857E-01	0.1801
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.376E-02	0.0402
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.586E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	1.635E-02	0.0078	1.742E-03	0.0008	0.000E+00	0.0000	1.414E-02	0.0067	0.000E+00	0.0000	0.000E+00	0.0000	1.205E-01	0.0572
Np-237	2.751E-02	0.0131	1.483E-04	0.0001	0.000E+00	0.0000	2.458E-02	0.0117	0.000E+00	0.0000	0.000E+00	0.0000	1.029E-02	0.0049
Pu-239	1.082E-04	0.0001	1.697E-03	0.0008	0.000E+00	0.0000	1.386E-02	0.0066	0.000E+00	0.0000	0.000E+00	0.0000	1.181E-01	0.0561
Tc-99	4.482E-05	0.0000	3.124E-08	0.0000	0.000E+00	0.0000	2.686E-02	0.0127	0.000E+00	0.0000	0.000E+00	0.0000	4.619E-05	0.0000
Th-232	1.173E+00	0.5569	6.725E-03	0.0032	0.000E+00	0.0000	8.494E-02	0.0403	0.000E+00	0.0000	0.000E+00	0.0000	1.115E-01	0.0529
U-234	1.463E-04	0.0001	5.063E-04	0.0002	0.000E+00	0.0000	2.672E-03	0.0013	0.000E+00	0.0000	0.000E+00	0.0000	9.155E-03	0.0043
U-235	2.682E-01	0.1273	4.722E-04	0.0002	0.000E+00	0.0000	2.549E-03	0.0012	0.000E+00	0.0000	0.000E+00	0.0000	8.663E-03	0.0041
U-238	5.065E-02	0.0240	4.525E-04	0.0002	0.000E+00	0.0000	2.539E-03	0.0012	0.000E+00	0.0000	0.000E+00	0.0000	8.702E-03	0.0041
Total	1.536E+00	0.7291	1.174E-02	0.0056	0.000E+00	0.0000	1.721E-01	0.0817	0.000E+00	0.0000	0.000E+00	0.0000	3.869E-01	0.1836

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.527E-01	0.0725
Np-237	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.253E-02	0.0297
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.338E-01	0.0635
Tc-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.695E-02	0.0128
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.376E+00	0.6533
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.248E-02	0.0059
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.798E-01	0.1328
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.234E-02	0.0296
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.107E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	1.598E-02	0.0040	1.653E-03	0.0004	0.000E+00	0.0000	1.342E-02	0.0034	0.000E+00	0.0000	0.000E+00	0.0000	1.143E-01	0.0286
Np-237	1.249E-04	0.0000	6.593E-07	0.0000	0.000E+00	0.0000	1.088E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.559E-05	0.0000
Pu-239	1.072E-04	0.0000	1.639E-03	0.0004	0.000E+00	0.0000	1.339E-02	0.0034	0.000E+00	0.0000	0.000E+00	0.0000	1.141E-01	0.0286
Tc-99	4.001E-05	0.0000	2.711E-08	0.0000	0.000E+00	0.0000	2.331E-02	0.0058	0.000E+00	0.0000	0.000E+00	0.0000	4.008E-05	0.0000
Th-232	3.072E+00	0.7692	7.055E-03	0.0018	0.000E+00	0.0000	1.538E-01	0.0385	0.000E+00	0.0000	0.000E+00	0.0000	1.334E-01	0.0334
U-234	1.371E-04	0.0000	4.593E-04	0.0001	0.000E+00	0.0000	2.424E-03	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	8.307E-03	0.0021
U-235	2.497E-01	0.0625	4.294E-04	0.0001	0.000E+00	0.0000	2.361E-03	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	7.907E-03	0.0020
U-238	4.699E-02	0.0118	4.106E-04	0.0001	0.000E+00	0.0000	2.304E-03	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	7.895E-03	0.0020
Total	3.385E+00	0.8476	1.165E-02	0.0029	0.000E+00	0.0000	2.111E-01	0.0529	0.000E+00	0.0000	0.000E+00	0.0000	3.860E-01	0.0967

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.454E-01	0.0364
Np-237	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.799E-04	0.0001
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.292E-01	0.0323
Tc-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.339E-02	0.0059
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.367E+00	0.8429
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.133E-02	0.0028
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.603E-01	0.0652
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.760E-02	0.0144
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.994E+00	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	1.495E-02	0.0007	1.418E-03	0.0001	0.000E+00	0.0000	1.151E-02	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	9.806E-02	0.0048
Np-237	9.796E-09	0.0000	2.139E-09	0.0000	0.000E+00	0.0000	1.093E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.838E-08	0.0000
Pu-239	1.044E-04	0.0000	1.476E-03	0.0001	0.000E+00	0.0000	1.205E-02	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	1.027E-01	0.0051
Tc-99	2.889E-05	0.0000	1.798E-08	0.0000	0.000E+00	0.0000	1.546E-02	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	2.658E-05	0.0000
Th-232	4.193E+00	0.2064	6.798E-03	0.0003	0.000E+00	0.0000	1.762E-01	0.0087	0.000E+00	0.0000	0.000E+00	0.0000	1.362E-01	0.0067
U-234	1.166E-04	0.0000	3.462E-04	0.0000	0.000E+00	0.0000	1.827E-03	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	6.260E-03	0.0003
U-235	2.031E-01	0.0100	3.257E-04	0.0000	0.000E+00	0.0000	1.857E-03	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	6.043E-03	0.0003
U-238	3.784E-02	0.0019	3.093E-04	0.0000	0.000E+00	0.0000	1.736E-03	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	5.948E-03	0.0003
Total	4.449E+00	0.2190	1.067E-02	0.0005	0.000E+00	0.0000	2.206E-01	0.0109	0.000E+00	0.0000	0.000E+00	0.0000	3.552E-01	0.0175

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	1.853E-05	0.0000	8.062E-07	0.0000	0.000E+00	0.0000	4.033E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.260E-01	0.0062
Np-237	1.434E+01	0.7058	6.262E-01	0.0308	0.000E+00	0.0000	3.140E-01	0.0155	0.000E+00	0.0000	0.000E+00	0.0000	1.528E+01	0.7521
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.163E-01	0.0057
Tc-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.551E-02	0.0008
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.512E+00	0.2221
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.550E-03	0.0004
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.114E-01	0.0104
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.583E-02	0.0023
Total	1.434E+01	0.7058	6.262E-01	0.0308	0.000E+00	0.0000	3.140E-01	0.0155	0.000E+00	0.0000	0.000E+00	0.0000	2.032E+01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	1.179E-02	0.0006	7.655E-04	0.0000	0.000E+00	0.0000	6.213E-03	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	5.294E-02	0.0026
Np-237	1.809E-08	0.0000	8.733E-10	0.0000	0.000E+00	0.0000	4.001E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.536E-08	0.0000
Pu-239	9.171E-05	0.0000	9.445E-04	0.0000	0.000E+00	0.0000	7.716E-03	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	6.574E-02	0.0033
Tc-99	9.098E-06	0.0000	3.948E-09	0.0000	0.000E+00	0.0000	3.395E-03	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	5.837E-06	0.0000
Th-232	3.659E+00	0.1831	4.635E-03	0.0002	0.000E+00	0.0000	1.212E-01	0.0061	0.000E+00	0.0000	0.000E+00	0.0000	9.312E-02	0.0047
U-234	7.676E-05	0.0000	1.191E-04	0.0000	0.000E+00	0.0000	6.283E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.152E-03	0.0001
U-235	9.481E-02	0.0047	1.129E-04	0.0000	0.000E+00	0.0000	6.727E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.114E-03	0.0001
U-238	1.689E-02	0.0008	1.061E-04	0.0000	0.000E+00	0.0000	5.955E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.040E-03	0.0001
Total	3.782E+00	0.1892	6.683E-03	0.0003	0.000E+00	0.0000	1.404E-01	0.0070	0.000E+00	0.0000	0.000E+00	0.0000	2.181E-01	0.0109

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	2.816E-04	0.0000	1.230E-05	0.0000	0.000E+00	0.0000	6.167E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.201E-02	0.0036
Np-237	1.486E+01	0.7437	6.492E-01	0.0325	0.000E+00	0.0000	3.255E-01	0.0163	0.000E+00	0.0000	0.000E+00	0.0000	1.584E+01	0.7925
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.450E-02	0.0037
Tc-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.410E-03	0.0002
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.877E+00	0.1940
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.977E-03	0.0001
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.771E-02	0.0049
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.963E-02	0.0010
Total	1.486E+01	0.7437	6.492E-01	0.0325	0.000E+00	0.0000	3.255E-01	0.0163	0.000E+00	0.0000	0.000E+00	0.0000	1.999E+01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Np-237	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Tc-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	7.690E-05	0.8553	3.359E-06	0.0374	0.000E+00	0.0000	1.685E-06	0.0187	0.000E+00	0.0000	0.000E+00	0.0000	8.195E-05	0.9114
Np-237	4.956E-06	0.0551	4.787E-08	0.0005	0.000E+00	0.0000	1.081E-07	0.0012	0.000E+00	0.0000	0.000E+00	0.0000	5.112E-06	0.0569
Pu-239	4.155E-14	0.0000	3.155E-15	0.0000	0.000E+00	0.0000	9.042E-16	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.561E-14	0.0000
Tc-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	2.601E-06	0.0289	1.976E-07	0.0022	0.000E+00	0.0000	5.663E-08	0.0006	0.000E+00	0.0000	0.000E+00	0.0000	2.855E-06	0.0318
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	8.446E-05	0.9393	3.605E-06	0.0401	0.000E+00	0.0000	1.850E-06	0.0206	0.000E+00	0.0000	0.000E+00	0.0000	8.991E-05	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Np-237	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Tc-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	1.830E-05	0.0004	7.995E-07	0.0000	0.000E+00	0.0000	4.009E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.951E-05	0.0004
Np-237	4.950E-06	0.0001	4.881E-08	0.0000	0.000E+00	0.0000	1.080E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.106E-06	0.0001
Pu-239	4.166E-09	0.0000	2.668E-10	0.0000	0.000E+00	0.0000	9.085E-11	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.523E-09	0.0000
Tc-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	2.243E-07	0.0000	2.906E-08	0.0000	0.000E+00	0.0000	4.908E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.583E-07	0.0000
U-235	4.535E-02	0.9210	2.873E-03	0.0584	0.000E+00	0.0000	9.891E-04	0.0201	0.000E+00	0.0000	0.000E+00	0.0000	4.921E-02	0.9995
U-238	4.191E-11	0.0000	6.158E-12	0.0000	0.000E+00	0.0000	9.518E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.901E-11	0.0000
Total	4.537E-02	0.9215	2.874E-03	0.0584	0.000E+00	0.0000	9.896E-04	0.0201	0.000E+00	0.0000	0.000E+00	0.0000	4.923E-02	1.0000

*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

0Parent (i)	Product (j)	Branch Fraction*	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
			DSR(j,t) (mrem/yr)/(pCi/g)							
Am-241	Am-241	1.000E+00		1.559E-01	1.548E-01	1.527E-01	1.454E-01	1.259E-01	7.171E-02	0.000E+00	0.000E+00
Am-241	Np-237	1.000E+00		1.124E-07	2.540E-07	3.471E-07	3.584E-07	2.006E-05	3.003E-04	8.195E-05	1.950E-05
Am-241	U-233	1.000E+00		3.040E-15	1.631E-14	5.722E-14	2.109E-13	7.155E-13	4.353E-11	1.877E-10	2.784E-10
Am-241	Th-229	1.000E+00		3.544E-18	4.572E-17	4.000E-16	5.208E-15	4.583E-14	3.434E-13	1.105E-13	7.808E-13
Am-241	äDSR(j)			1.559E-01	1.548E-01	1.527E-01	1.454E-01	1.260E-01	7.201E-02	8.195E-05	1.951E-05
0Np-237	Np-237	1.000E+00		6.336E-01	2.932E-01	6.253E-02	2.799E-04	1.528E+01	1.584E+01	0.000E+00	0.000E+00
Np-237	U-233	1.000E+00		2.521E-08	5.304E-08	7.012E-08	6.835E-08	2.902E-07	4.230E-06	5.107E-06	5.088E-06
Np-237	Th-229	1.000E+00		4.214E-11	2.427E-10	8.856E-10	3.408E-09	9.539E-09	2.100E-08	4.780E-09	1.870E-08
Np-237	äDSR(j)			6.336E-01	2.932E-01	6.253E-02	2.799E-04	1.528E+01	1.584E+01	5.112E-06	5.106E-06
0Pu-239	Pu-239	1.000E+00		1.358E-01	1.351E-01	1.338E-01	1.292E-01	1.163E-01	7.450E-02	0.000E+00	0.000E+00
Pu-239	U-235	1.000E+00		1.422E-10	4.246E-10	9.794E-10	2.820E-09	7.283E-09	1.561E-08	0.000E+00	0.000E+00
Pu-239	Pa-231	1.000E+00		2.814E-15	1.979E-14	1.018E-13	8.049E-13	4.741E-12	1.548E-11	0.000E+00	8.179E-10
Pu-239	Ac-227	1.000E+00		3.888E-17	5.520E-16	5.886E-15	1.176E-13	1.411E-12	7.650E-12	4.561E-14	3.705E-09
Pu-239	äDSR(j)			1.358E-01	1.351E-01	1.338E-01	1.292E-01	1.163E-01	7.450E-02	4.561E-14	4.523E-09
0Tc-99	Tc-99	1.000E+00		2.864E-02	2.807E-02	2.695E-02	2.339E-02	1.551E-02	3.410E-03	0.000E+00	0.000E+00
0Th-232	Th-232	1.000E+00		1.101E-01	1.097E-01	1.088E-01	1.057E-01	9.684E-02	6.588E-02	0.000E+00	0.000E+00
Th-232	Ra-228	1.000E+00		1.316E-01	3.717E-01	7.576E-01	1.476E+00	1.808E+00	1.552E+00	0.000E+00	0.000E+00
Th-232	Th-228	1.000E+00		2.154E-02	1.308E-01	5.101E-01	1.785E+00	2.608E+00	2.259E+00	0.000E+00	0.000E+00
Th-232	äDSR(j)			2.633E-01	6.123E-01	1.376E+00	3.367E+00	4.512E+00	3.877E+00	0.000E+00	0.000E+00
0U-234	U-234	1.000E+00		1.301E-02	1.283E-02	1.248E-02	1.132E-02	8.540E-03	2.945E-03	0.000E+00	0.000E+00
U-234	Th-230	1.000E+00		1.018E-07	3.014E-07	6.898E-07	1.943E-06	4.710E-06	7.839E-06	0.000E+00	0.000E+00
U-234	Ra-226	1.000E+00		2.561E-09	1.778E-08	9.182E-08	7.523E-07	4.940E-06	2.281E-05	0.000E+00	7.993E-08
U-234	Pb-210	1.000E+00		3.182E-12	4.294E-11	4.551E-10	9.893E-09	1.490E-07	1.112E-06	0.000E+00	1.784E-07
U-234	äDSR(j)			1.301E-02	1.283E-02	1.248E-02	1.133E-02	8.550E-03	2.977E-03	0.000E+00	2.583E-07
0U-235	U-235	1.000E+00		2.886E-01	2.856E-01	2.798E-01	2.602E-01	2.110E-01	9.747E-02	0.000E+00	0.000E+00
U-235	Pa-231	1.000E+00		8.674E-06	2.578E-05	5.748E-05	1.447E-04	2.549E-04	1.567E-04	0.000E+00	9.412E-03
U-235	Ac-227	1.000E+00		1.553E-07	1.021E-06	4.818E-06	2.980E-05	9.876E-05	8.968E-05	2.855E-06	3.980E-02
U-235	äDSR(j)			2.886E-01	2.857E-01	2.798E-01	2.603E-01	2.114E-01	9.771E-02	2.855E-06	4.921E-02
0U-238	U-238	1.000E+00		6.448E-02	6.376E-02	6.234E-02	5.760E-02	4.583E-02	1.963E-02	0.000E+00	0.000E+00
U-238	U-234	1.000E+00		1.839E-08	5.451E-08	1.238E-07	3.371E-07	7.384E-07	8.391E-07	0.000E+00	0.000E+00
U-238	Th-230	1.000E+00		9.655E-14	6.646E-13	3.430E-12	2.846E-11	1.936E-10	9.370E-10	0.000E+00	0.000E+00
U-238	Ra-226	1.000E+00		1.812E-15	2.699E-14	3.080E-13	7.505E-12	1.437E-10	2.155E-09	0.000E+00	1.024E-11
U-238	Pb-210	1.000E+00		1.865E-18	5.166E-17	1.176E-15	7.581E-14	3.420E-12	9.024E-11	0.000E+00	3.878E-11
U-238	äDSR(j)			6.448E-02	6.376E-02	6.234E-02	5.760E-02	4.583E-02	1.963E-02	0.000E+00	4.901E-11

*Branch Fraction is the cumulative factor for the j't principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
The DSR includes contributions from associated (half-life ó 0.5 yr) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 2.500E+01 mrem/yr

0Nuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Am-241	1.604E+02	1.615E+02	1.637E+02	1.719E+02	1.985E+02	3.472E+02	3.051E+05	1.282E+06
Np-237	3.945E+01	8.526E+01	3.998E+02	8.930E+04	1.636E+00	1.579E+00	4.891E+06	4.896E+06
Pu-239	1.841E+02	1.850E+02	1.868E+02	1.935E+02	2.149E+02	3.356E+02	*6.212E+10	5.527E+09
Tc-99	8.730E+02	8.908E+02	9.275E+02	1.069E+03	1.611E+03	7.331E+03	*1.696E+10	*1.696E+10
Th-232	9.495E+01	4.083E+01	1.816E+01	7.426E+00	5.540E+00	6.448E+00	*1.096E+05	*1.096E+05
U-234	1.922E+03	1.949E+03	2.003E+03	2.207E+03	2.924E+03	8.399E+03	*6.245E+09	9.678E+07
U-235	8.662E+01	8.752E+01	8.934E+01	9.603E+01	1.183E+02	2.558E+02	*2.160E+06	5.080E+02
U-238	3.877E+02	3.921E+02	4.010E+02	4.340E+02	5.454E+02	1.273E+03	*3.360E+05	*3.360E+05

 *At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 34.45 ñ 0.07 years

0Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Am-241	1.000E+00	0.000E+00	1.559E-01	1.604E+02	1.219E-01	2.051E+02
Np-237	1.000E+00	102.8 ñ 0.2	1.589E+01	1.573E+00	1.555E+01	1.608E+00
Pu-239	1.000E+00	0.000E+00	1.358E-01	1.841E+02	1.135E-01	2.202E+02
Tc-99	1.000E+00	0.000E+00	2.864E-02	8.730E+02	1.414E-02	1.767E+03
Th-232	1.000E+00	32.16 ñ 0.06	4.516E+00	5.536E+00	4.513E+00	5.540E+00
U-234	1.000E+00	0.000E+00	1.301E-02	1.922E+03	8.023E-03	3.116E+03
U-235	1.000E+00	0.000E+00	2.886E-01	8.662E+01	2.017E-01	1.240E+02
U-238	1.000E+00	0.000E+00	6.448E-02	3.877E+02	4.353E-02	5.743E+02

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

0Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Am-241	Am-241	1.000E+00	1.559E-01	1.548E-01	1.527E-01	1.454E-01	1.259E-01	7.171E-02	0.000E+00	0.000E+00
0Np-237	Am-241	1.000E+00	1.124E-07	2.540E-07	3.471E-07	3.584E-07	2.006E-05	3.003E-04	8.195E-05	1.950E-05
Np-237	Np-237	1.000E+00	6.336E-01	2.932E-01	6.253E-02	2.799E-04	1.528E+01	1.584E+01	0.000E+00	0.000E+00
Np-237	äDOSE(j)		6.336E-01	2.932E-01	6.253E-02	2.802E-04	1.528E+01	1.584E+01	8.195E-05	1.950E-05
0U-233	Am-241	1.000E+00	3.040E-15	1.631E-14	5.722E-14	2.109E-13	7.155E-13	4.353E-11	1.877E-10	2.784E-10
U-233	Np-237	1.000E+00	2.521E-08	5.304E-08	7.012E-08	6.835E-08	2.902E-07	4.230E-06	5.107E-06	5.088E-06
U-233	äDOSE(j)		2.521E-08	5.304E-08	7.012E-08	6.835E-08	2.902E-07	4.230E-06	5.107E-06	5.088E-06
0Th-229	Am-241	1.000E+00	3.544E-18	4.572E-17	4.000E-16	5.208E-15	4.583E-14	3.434E-13	1.105E-13	7.808E-13
Th-229	Np-237	1.000E+00	4.214E-11	2.427E-10	8.856E-10	3.408E-09	9.539E-09	2.100E-08	4.780E-09	1.870E-08
Th-229	äDOSE(j)		4.214E-11	2.427E-10	8.856E-10	3.408E-09	9.539E-09	2.100E-08	4.780E-09	1.870E-08
0Pu-239	Pu-239	1.000E+00	1.358E-01	1.351E-01	1.338E-01	1.292E-01	1.163E-01	7.450E-02	0.000E+00	0.000E+00
0U-235	Pu-239	1.000E+00	1.422E-10	4.246E-10	9.794E-10	2.820E-09	7.283E-09	1.561E-08	0.000E+00	0.000E+00
U-235	U-235	1.000E+00	2.886E-01	2.856E-01	2.798E-01	2.602E-01	2.110E-01	9.747E-02	0.000E+00	0.000E+00
U-235	äDOSE(j)		2.886E-01	2.856E-01	2.798E-01	2.602E-01	2.110E-01	9.747E-02	0.000E+00	0.000E+00
0Pa-231	Pu-239	1.000E+00	2.814E-15	1.979E-14	1.018E-13	8.049E-13	4.741E-12	1.548E-11	0.000E+00	8.179E-10
Pa-231	U-235	1.000E+00	8.674E-06	2.578E-05	5.748E-05	1.447E-04	2.549E-04	1.567E-04	0.000E+00	9.412E-03
Pa-231	äDOSE(j)		8.674E-06	2.578E-05	5.748E-05	1.447E-04	2.549E-04	1.567E-04	0.000E+00	9.412E-03
0Ac-227	Pu-239	1.000E+00	3.888E-17	5.520E-16	5.886E-15	1.176E-13	1.411E-12	7.650E-12	4.561E-14	3.705E-09
Ac-227	U-235	1.000E+00	1.553E-07	1.021E-06	4.818E-06	2.980E-05	9.876E-05	8.968E-05	2.855E-06	3.980E-02
Ac-227	äDOSE(j)		1.553E-07	1.021E-06	4.818E-06	2.980E-05	9.876E-05	8.968E-05	2.855E-06	3.980E-02
0Tc-99	Tc-99	1.000E+00	2.864E-02	2.807E-02	2.695E-02	2.339E-02	1.551E-02	3.410E-03	0.000E+00	0.000E+00
0Th-232	Th-232	1.000E+00	1.101E-01	1.097E-01	1.088E-01	1.057E-01	9.684E-02	6.588E-02	0.000E+00	0.000E+00
0Ra-228	Th-232	1.000E+00	1.316E-01	3.717E-01	7.576E-01	1.476E+00	1.808E+00	1.552E+00	0.000E+00	0.000E+00
0Th-228	Th-232	1.000E+00	2.154E-02	1.308E-01	5.101E-01	1.785E+00	2.608E+00	2.259E+00	0.000E+00	0.000E+00
0U-234	U-234	1.000E+00	1.301E-02	1.283E-02	1.248E-02	1.132E-02	8.540E-03	2.945E-03	0.000E+00	0.000E+00
U-234	U-238	1.000E+00	1.839E-08	5.451E-08	1.238E-07	3.371E-07	7.384E-07	8.391E-07	0.000E+00	0.000E+00
U-234	äDOSE(j)		1.301E-02	1.283E-02	1.248E-02	1.132E-02	8.541E-03	2.946E-03	0.000E+00	0.000E+00
0Th-230	U-234	1.000E+00	1.018E-07	3.014E-07	6.898E-07	1.943E-06	4.710E-06	7.839E-06	0.000E+00	0.000E+00
Th-230	U-238	1.000E+00	9.655E-14	6.646E-13	3.430E-12	2.846E-11	1.936E-10	9.370E-10	0.000E+00	0.000E+00
Th-230	äDOSE(j)		1.018E-07	3.014E-07	6.898E-07	1.943E-06	4.710E-06	7.840E-06	0.000E+00	0.000E+00
0Ra-226	U-234	1.000E+00	2.561E-09	1.778E-08	9.182E-08	7.523E-07	4.940E-06	2.281E-05	0.000E+00	7.993E-08
Ra-226	U-238	1.000E+00	1.812E-15	2.699E-14	3.080E-13	7.505E-12	1.437E-10	2.155E-09	0.000E+00	1.024E-11
Ra-226	äDOSE(j)		2.561E-09	1.778E-08	9.182E-08	7.523E-07	4.940E-06	2.281E-05	0.000E+00	7.994E-08

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr							
		t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pb-210	U-234	1.000E+00	3.182E-12	4.294E-11	4.551E-10	9.893E-09	1.490E-07	1.112E-06	0.000E+00	1.784E-07
Pb-210	U-238	1.000E+00	1.865E-18	5.166E-17	1.176E-15	7.581E-14	3.420E-12	9.024E-11	0.000E+00	3.878E-11
Pb-210	äDOSE(j)		3.182E-12	4.294E-11	4.551E-10	9.893E-09	1.490E-07	1.112E-06	0.000E+00	1.784E-07
U-238	U-238	1.000E+00	6.448E-02	6.376E-02	6.234E-02	5.760E-02	4.583E-02	1.963E-02	0.000E+00	0.000E+00

BRF(i) is the branch fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

0Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Am-241	Am-241	1.000E+00	1.000E+00	9.967E-01	9.901E-01	9.673E-01	9.052E-01	7.174E-01	3.693E-01	3.613E-02
0Np-237	Am-241	1.000E+00	0.000E+00	2.254E-07	3.763E-07	4.084E-07	3.823E-07	3.030E-07	1.560E-07	1.526E-08
Np-237	Np-237	1.000E+00	1.000E+00	4.629E-01	9.921E-02	4.520E-04	9.237E-11	3.562E-34	0.000E+00	0.000E+00
Np-237	äS(j):		1.000E+00	4.629E-01	9.921E-02	4.524E-04	3.824E-07	3.030E-07	1.560E-07	1.526E-08
0U-233	Am-241	1.000E+00	0.000E+00	5.541E-13	3.316E-12	1.510E-11	4.377E-11	9.660E-11	9.003E-11	1.028E-11
U-233	Np-237	1.000E+00	0.000E+00	3.033E-06	5.014E-06	5.212E-06	4.286E-06	2.158E-06	3.036E-07	3.174E-10
U-233	äS(j):		0.000E+00	3.033E-06	5.014E-06	5.212E-06	4.286E-06	2.158E-06	3.037E-07	3.277E-10
0Th-229	Am-241	1.000E+00	0.000E+00	1.852E-17	3.648E-16	6.460E-15	6.323E-14	5.578E-13	2.449E-12	4.658E-12
Th-229	Np-237	1.000E+00	0.000E+00	1.617E-10	9.703E-10	4.466E-09	1.339E-08	3.367E-08	5.042E-08	4.898E-08
Th-229	äS(j):		0.000E+00	1.617E-10	9.703E-10	4.466E-09	1.339E-08	3.367E-08	5.043E-08	4.898E-08
0Pu-239	Pu-239	1.000E+00	1.000E+00	9.991E-01	9.973E-01	9.912E-01	9.737E-01	9.151E-01	7.663E-01	4.117E-01
0U-235	Pu-239	1.000E+00	0.000E+00	9.796E-10	2.908E-09	9.339E-09	2.524E-08	5.965E-08	7.883E-08	4.549E-08
U-235	U-235	1.000E+00	1.000E+00	9.902E-01	9.710E-01	9.066E-01	7.453E-01	3.753E-01	5.286E-02	5.543E-05
U-235	äS(j):		1.000E+00	9.902E-01	9.710E-01	9.066E-01	7.453E-01	3.753E-01	5.286E-02	5.548E-05
0Pa-231	Pu-239	1.000E+00	0.000E+00	1.026E-14	8.967E-14	8.993E-13	6.116E-12	2.909E-11	4.870E-11	2.888E-11
Pa-231	U-235	1.000E+00	0.000E+00	2.070E-05	5.943E-05	1.702E-04	3.354E-04	2.970E-04	4.579E-05	4.805E-08
Pa-231	äS(j):		0.000E+00	2.070E-05	5.943E-05	1.702E-04	3.354E-04	2.970E-04	4.579E-05	4.808E-08
0Ac-227	Pu-239	1.000E+00	0.000E+00	1.062E-16	2.649E-15	7.530E-14	1.045E-12	7.265E-12	1.327E-11	7.938E-12
Ac-227	U-235	1.000E+00	0.000E+00	3.193E-07	2.587E-06	2.021E-05	7.480E-05	8.593E-05	1.363E-05	1.431E-08
Ac-227	äS(j):		0.000E+00	3.193E-07	2.587E-06	2.021E-05	7.480E-05	8.593E-05	1.363E-05	1.431E-08
0Tc-99	Tc-99	1.000E+00	1.000E+00	9.840E-01	9.527E-01	8.507E-01	6.156E-01	1.985E-01	7.822E-03	9.502E-08
0Th-232	Th-232	1.000E+00	1.000E+00	1.000E+00	9.999E-01	9.997E-01	9.991E-01	9.971E-01	9.915E-01	9.718E-01
0Ra-228	Th-232	1.000E+00	0.000E+00	1.122E-01	2.932E-01	6.362E-01	8.201E-01	8.291E-01	8.244E-01	8.081E-01
0Th-228	Th-232	1.000E+00	0.000E+00	1.849E-02	1.213E-01	5.209E-01	8.129E-01	8.291E-01	8.244E-01	8.081E-01
0U-234	U-234	1.000E+00	1.000E+00	9.902E-01	9.710E-01	9.066E-01	7.452E-01	3.752E-01	5.282E-02	5.528E-05
U-234	U-238	1.000E+00	0.000E+00	2.807E-06	8.258E-06	2.570E-05	6.338E-05	1.064E-04	4.494E-05	1.569E-07
U-234	äS(j):		1.000E+00	9.902E-01	9.710E-01	9.066E-01	7.453E-01	3.753E-01	5.286E-02	5.543E-05
0Th-230	U-234	1.000E+00	0.000E+00	8.958E-06	2.661E-05	8.573E-05	2.338E-04	5.725E-04	8.628E-04	8.877E-04
Th-230	U-238	1.000E+00	0.000E+00	1.268E-11	1.126E-10	1.195E-09	9.459E-09	6.815E-08	2.091E-07	2.576E-07
Th-230	äS(j):		0.000E+00	8.958E-06	2.661E-05	8.573E-05	2.338E-04	5.726E-04	8.630E-04	8.880E-04
0Ra-226	U-234	1.000E+00	0.000E+00	1.927E-09	1.695E-08	1.739E-07	1.255E-06	6.941E-06	1.450E-05	1.548E-05
Ra-226	U-238	1.000E+00	0.000E+00	1.822E-15	4.812E-14	1.650E-12	3.588E-11	6.528E-10	3.280E-09	4.490E-09
Ra-226	äS(j):		0.000E+00	1.927E-09	1.695E-08	1.739E-07	1.255E-06	6.942E-06	1.450E-05	1.548E-05

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g							
		t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pb-210	U-234	1.000E+00	0.000E+00	1.979E-11	5.127E-10	1.647E-08	3.014E-07	3.420E-06	9.128E-06	9.984E-06
Pb-210	U-238	1.000E+00	0.000E+00	1.406E-17	1.097E-15	1.192E-13	6.786E-12	2.758E-10	1.980E-09	2.896E-09
Pb-210	äS(j):		0.000E+00	1.979E-11	5.127E-10	1.647E-08	3.014E-07	3.420E-06	9.130E-06	9.987E-06
U-238	U-238	1.000E+00	1.000E+00	9.902E-01	9.710E-01	9.066E-01	7.453E-01	3.753E-01	5.286E-02	5.543E-05

 BRF(i) is the branch fraction of the parent nuclide.
RESCALC.EXE execution time =   60.57 seconds

APPENDIX C

VOLUMETRIC SOIL DOSE ASSESSMENT SUMMARY REPORT

Summary : Volumetric Dose Assessment for Resident NRC Gardener
File : WH NRC Volume Resident.RAD

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Dose Conversion Factor (and Related) Parameter Summary
File: FGR 13 Morbidity

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Am-241	4.440E-01	4.440E-01	DCF2(2)
B-1	Np-237+D	5.400E-01	5.400E-01	DCF2(3)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(4)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(5)
B-1	Pu-239	4.290E-01	4.290E-01	DCF2(6)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(7)
B-1	Ra-228+D	5.080E-03	5.080E-03	DCF2(8)
B-1	Tc-99	8.330E-06	8.330E-06	DCF2(9)
B-1	Th-228+D	3.450E-01	3.450E-01	DCF2(10)
B-1	Th-229+D	2.160E+00	2.160E+00	DCF2(11)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(12)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(13)
B-1	U-233	1.350E-01	1.350E-01	DCF2(14)
B-1	U-234	1.320E-01	1.320E-01	DCF2(15)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(16)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(17)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Am-241	3.640E-03	3.640E-03	DCF3(2)
D-1	Np-237+D	4.440E-03	4.440E-03	DCF3(3)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(4)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(5)
D-1	Pu-239	3.540E-03	3.540E-03	DCF3(6)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(7)
D-1	Ra-228+D	1.440E-03	1.440E-03	DCF3(8)
D-1	Tc-99	1.460E-06	1.460E-06	DCF3(9)
D-1	Th-228+D	8.080E-04	8.080E-04	DCF3(10)
D-1	Th-229+D	4.030E-03	4.030E-03	DCF3(11)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(12)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(13)
D-1	U-233	2.890E-04	2.890E-04	DCF3(14)
D-1	U-234	2.830E-04	2.830E-04	DCF3(15)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(16)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(17)
D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34				

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D-34 ³ Am-241   , plant/soil concentration ratio, dimensionless    ³ 1.000E-03 ³ 1.000E-03 ³ RTF( 2,1)
D-34 ³ Am-241   , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)    ³ 5.000E-05 ³ 5.000E-05 ³ RTF( 2,2)
D-34 ³ Am-241   , milk/livestock-intake ratio, (pCi/L)/(pCi/d)     ³ 2.000E-06 ³ 2.000E-06 ³ RTF( 2,3)
D-34 ³                                                            ³           ³           ³
D-34 ³ Np-237+D , plant/soil concentration ratio, dimensionless   ³ 2.000E-02 ³ 2.000E-02 ³ RTF( 3,1)
D-34 ³ Np-237+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)   ³ 1.000E-03 ³ 1.000E-03 ³ RTF( 3,2)
D-34 ³ Np-237+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)    ³ 5.000E-06 ³ 5.000E-06 ³ RTF( 3,3)
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Dose Conversion Factor (and Related) Parameter Summary (continued)
File: FGR 13 Morbidity

Menu	Parameter	Current Value	Default	Parameter Name
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(4,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(4,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(4,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(5,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(5,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(5,3)
D-34				
D-34	Pu-239 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(6,1)
D-34	Pu-239 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(6,2)
D-34	Pu-239 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(6,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(7,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(7,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(7,3)
D-34				
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(8,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(8,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(8,3)
D-34				
D-34	Tc-99 , plant/soil concentration ratio, dimensionless	5.000E+00	5.000E+00	RTF(9,1)
D-34	Tc-99 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(9,2)
D-34	Tc-99 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(9,3)
D-34				
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(10,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(10,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(10,3)
D-34				
D-34	Th-229+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(11,1)
D-34	Th-229+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(11,2)
D-34	Th-229+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(11,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(12,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(12,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(12,3)
D-34				
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(13,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(13,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(13,3)
D-34				
D-34	U-233 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(14,1)
D-34	U-233 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(14,2)
D-34	U-233 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(14,3)

D-34 ³ ³ ³ ³
D-34 ³ U-234 , plant/soil concentration ratio, dimensionless ³ 2.500E-03 ³ 2.500E-03 ³ RTF(15,1)
D-34 ³ U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d) ³ 3.400E-04 ³ 3.400E-04 ³ RTF(15,2)
D-34 ³ U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d) ³ 6.000E-04 ³ 6.000E-04 ³ RTF(15,3)
D-34 ³ ³ ³ ³

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: FGR 13 Morbidity

Menu	Parameter	Current Value	Default	Parameter Name
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(16,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(16,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(16,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(17,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(17,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(17,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5				
D-5	Am-241 , fish	3.000E+01	3.000E+01	BIOFAC(2,1)
D-5	Am-241 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(2,2)
D-5				
D-5	Np-237+D , fish	3.000E+01	3.000E+01	BIOFAC(3,1)
D-5	Np-237+D , crustacea and mollusks	4.000E+02	4.000E+02	BIOFAC(3,2)
D-5				
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(4,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(4,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(5,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(5,2)
D-5				
D-5	Pu-239 , fish	3.000E+01	3.000E+01	BIOFAC(6,1)
D-5	Pu-239 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(6,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(7,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(7,2)
D-5				
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(8,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(8,2)
D-5				
D-5	Tc-99 , fish	2.000E+01	2.000E+01	BIOFAC(9,1)
D-5	Tc-99 , crustacea and mollusks	5.000E+00	5.000E+00	BIOFAC(9,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(10,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(10,2)
D-5				
D-5	Th-229+D , fish	1.000E+02	1.000E+02	BIOFAC(11,1)
D-5	Th-229+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(11,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(12,1)

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D-5  ³ Th-230   , crustacea and mollusks                ³ 5.000E+02 ³ 5.000E+02 ³ BIOFAC(12,2)
D-5  ³                                                 ³           ³           ³
D-5  ³ Th-232   , fish                                 ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC(13,1)
D-5  ³ Th-232   , crustacea and mollusks               ³ 5.000E+02 ³ 5.000E+02 ³ BIOFAC(13,2)
D-5  ³                                                 ³           ³           ³
D-5  ³ U-233    , fish                                 ³ 1.000E+01 ³ 1.000E+01 ³ BIOFAC(14,1)
D-5  ³ U-233    , crustacea and mollusks               ³ 6.000E+01 ³ 6.000E+01 ³ BIOFAC(14,2)
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Dose Conversion Factor (and Related) Parameter Summary (continued)
File: FGR 13 Morbidity

Menu	Parameter	Current Value	Default	Parameter Name
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(15,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(15,2)
D-5				
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(16,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(16,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(17,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(17,2)

Site-Specific Parameter Summary

Menu	Parameter		User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)		7.746E+04	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)		2.000E+00	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)		2.910E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)		2.500E+01	2.500E+01	---	BRDL
R011	Time since placement of material (yr)		0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)		1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)		3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)		1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)		3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)		1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)		3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)		1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)		not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)		not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g):	Am-241	1.000E+00	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g):	Np-237	1.000E+00	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g):	Pu-239	1.000E+00	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g):	Tc-99	1.000E+00	0.000E+00	---	S1(9)
R012	Initial principal radionuclide (pCi/g):	Th-232	1.000E+00	0.000E+00	---	S1(13)
R012	Initial principal radionuclide (pCi/g):	U-234	1.000E+00	0.000E+00	---	S1(15)
R012	Initial principal radionuclide (pCi/g):	U-235	1.000E+00	0.000E+00	---	S1(16)
R012	Initial principal radionuclide (pCi/g):	U-238	1.000E+00	0.000E+00	---	S1(17)
R012	Concentration in groundwater (pCi/L):	Am-241	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L):	Np-237	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L):	Pu-239	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L):	Tc-99	not used	0.000E+00	---	W1(9)
R012	Concentration in groundwater (pCi/L):	Th-232	not used	0.000E+00	---	W1(13)
R012	Concentration in groundwater (pCi/L):	U-234	not used	0.000E+00	---	W1(15)
R012	Concentration in groundwater (pCi/L):	U-235	not used	0.000E+00	---	W1(16)
R012	Concentration in groundwater (pCi/L):	U-238	not used	0.000E+00	---	W1(17)
R013	Cover depth (m)		0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)		not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)		not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)		1.690E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)		6.000E-04	1.000E-03	---	VCZ
R013	Contaminated zone total porosity		4.500E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity		1.700E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)		1.456E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter		1.040E+01	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)		2.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)		not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient		5.000E-01	5.000E-01	---	EVAPTR

R013	Precipitation (m/yr)	9.650E-01	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	3.050E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	9.989E+05	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R014	Density of saturated zone (g/cm**3)	1.690E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.500E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.900E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	1.700E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.696E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	1.500E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	1.040E+01	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.600E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	9.130E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	4.500E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.690E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.500E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.900E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	1.700E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	1.040E+01	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.456E+01	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Am-241				
R016	Contaminated zone (cm**3/g)	1.000E+03	2.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+03	2.000E+01	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	1.000E+03	2.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.288E-04	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Np-237				
R016	Contaminated zone (cm**3/g)	2.000E+00	-1.000E+00	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+00	-1.000E+00	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	2.000E+00	-1.000E+00	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.776E-02	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for Pu-239				
R016	Contaminated zone (cm**3/g)	2.000E+03	2.000E+03	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+03	2.000E+03	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	2.000E+03	2.000E+03	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.439E-05	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for Tc-99				
R016	Contaminated zone (cm**3/g)	1.060E+02	0.000E+00	---	DCNUCC(9)

R016 [3]	Unsaturated zone 1 (cm**3/g)	[3] 1.060E+02	[3] 0.000E+00	[3] ---	[3] DCNUCU(9,1)
R016 [3]	Saturated zone (cm**3/g)	[3] 1.060E+02	[3] 0.000E+00	[3] ---	[3] DCNUCS(9)
R016 [3]	Leach rate (/yr)	[3] 0.000E+00	[3] 0.000E+00	[3] 1.212E-03	[3] ALEACH(9)
R016 [3]	Solubility constant	[3] 0.000E+00	[3] 0.000E+00	[3] not used	[3] SOLUBK(9)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(13)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(13,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(13)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.147E-06	ALEACH(13)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(13)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCC(15)
R016	Unsaturated zone 1 (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCU(15,1)
R016	Saturated zone (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCS(15)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.350E-04	ALEACH(15)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(15)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCC(16)
R016	Unsaturated zone 1 (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCU(16,1)
R016	Saturated zone (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCS(16)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.350E-04	ALEACH(16)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(16)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCC(17)
R016	Unsaturated zone 1 (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCU(17,1)
R016	Saturated zone (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCS(17)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.350E-04	ALEACH(17)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(17)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.367E-03	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.564E-03	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(5)

R016 [3]	Unsaturated zone 1 (cm**3/g)	[3] 1.000E+02	[3] 1.000E+02	---	[3] DCNUCU(5,1)
R016 [3]	Saturated zone (cm**3/g)	[3] 1.000E+02	[3] 1.000E+02	---	[3] DCNUCS(5)
R016 [3]	Leach rate (/yr)	[3] 0.000E+00	[3] 0.000E+00	1.285E-03	[3] ALEACH(5)
R016 [3]	Solubility constant	[3] 0.000E+00	[3] 0.000E+00	not used	[3] SOLUBK(5)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.834E-03	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.834E-03	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for daughter Th-228				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(10)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(10,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.147E-06	ALEACH(10)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10)
R016	Distribution coefficients for daughter Th-229				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(11,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.147E-06	ALEACH(11)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(12)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(12,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.147E-06	ALEACH(12)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(12)
R016	Distribution coefficients for daughter U-233				
R016	Contaminated zone (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCC(14)
R016	Unsaturated zone 1 (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCU(14,1)
R016	Saturated zone (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCS(14)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.350E-04	ALEACH(14)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(14)
R017	Inhalation rate (m**3/yr)	8.600E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	5.900E-06	1.000E-04	---	MLINH

R017	Exposure duration	3.000E+01	3.000E+01	---		ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---		SHF3
R017	Shielding factor, external gamma	4.000E-01	7.000E-01	---		SHF1
R017	Fraction of time spent indoors	6.571E-01	5.000E-01	---		FIND
R017	Fraction of time spent outdoors (on site)	1.181E-01	2.500E-01	---		FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.		FS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	4.270E+01	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	4.660E+00	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	7.340E+00	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	4.380E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	5.150E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	5.000E-01	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK

R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	2.000E+01	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
C14	DCF correction factor for gaseous forms of C14	not used	8.894E+01	---	CO2F
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)

STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	active
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	active
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	active

Summary : Volumetric Dose Assessment for Resident NRC Gardener
File : WH NRC Volume Resident.RAD

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	77458.00 square meters	Am-241	1.000E+00
Thickness:	2.00 meters	Np-237	1.000E+00
Cover Depth:	0.00 meters	Pu-239	1.000E+00
		Tc-99	1.000E+00
		Th-232	1.000E+00
		U-234	1.000E+00
		U-235	1.000E+00
		U-238	1.000E+00

0

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 2.500E+01 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	4.014E+00	4.383E+00	5.213E+00	7.461E+00	6.302E+01	2.132E+02	8.329E+00	8.340E+00
M(t):	1.606E-01	1.753E-01	2.085E-01	2.985E-01	2.521E+00	8.529E+00	3.332E-01	3.336E-01

0Maximum TDOSE(t): 2.148E+02 mrem/yr at t = 115.5 ñ 0.2 years
0

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.155E+02 years
0 Water Independent Pathways (Inhalation excludes radon)

0	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	1.354E-02	0.0001	1.462E-03	0.0000	0.000E+00	0.0000	7.063E-02	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	1.011E-01	0.0005
Np-237	5.068E-04	0.0000	2.723E-06	0.0000	0.000E+00	0.0000	2.598E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.866E-04	0.0000
Pu-239	1.097E-04	0.0000	1.708E-03	0.0000	0.000E+00	0.0000	8.306E-02	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	1.189E-01	0.0006
Tc-99	4.117E-05	0.0000	2.912E-08	0.0000	0.000E+00	0.0000	1.501E-01	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	4.305E-05	0.0000
Th-232	5.906E+00	0.0275	7.988E-03	0.0000	0.000E+00	0.0000	1.431E+00	0.0067	0.000E+00	0.0000	0.000E+00	0.0000	1.678E-01	0.0008
U-234	2.372E-04	0.0000	4.891E-04	0.0000	0.000E+00	0.0000	1.546E-02	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	8.844E-03	0.0000
U-235	2.616E-01	0.0012	5.018E-04	0.0000	0.000E+00	0.0000	2.081E-02	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	9.736E-03	0.0000
U-238	5.190E-02	0.0002	4.363E-04	0.0000	0.000E+00	0.0000	1.464E-02	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	8.390E-03	0.0000
Total	6.234E+00	0.0290	1.259E-02	0.0001	0.000E+00	0.0000	1.788E+00	0.0083	0.000E+00	0.0000	0.000E+00	0.0000	4.150E-01	0.0019

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.155E+02 years

	Water Dependent Pathways													
	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Am-241	4.297E-03	0.0000	1.876E-04	0.0000	0.000E+00	0.0000	9.411E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.913E-01	0.0009
Np-237	1.936E+02	0.9015	8.458E+00	0.0394	0.000E+00	0.0000	4.243E+00	0.0198	0.000E+00	0.0000	0.000E+00	0.0000	2.063E+02	0.9607
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.038E-01	0.0009
Tc-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.502E-01	0.0007
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.512E+00	0.0350
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.503E-02	0.0001
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.926E-01	0.0014
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.536E-02	0.0004
Total	1.936E+02	0.9015	8.458E+00	0.0394	0.000E+00	0.0000	4.243E+00	0.0198	0.000E+00	0.0000	0.000E+00	0.0000	2.148E+02	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	1.653E-02	0.0041	1.786E-03	0.0004	0.000E+00	0.0000	8.626E-02	0.0215	0.000E+00	0.0000	0.000E+00	0.0000	1.235E-01	0.0308
Np-237	3.992E-01	0.0995	2.112E-03	0.0005	0.000E+00	0.0000	2.047E+00	0.5099	0.000E+00	0.0000	0.000E+00	0.0000	1.465E-01	0.0365
Pu-239	1.108E-04	0.0000	1.727E-03	0.0004	0.000E+00	0.0000	8.395E-02	0.0209	0.000E+00	0.0000	0.000E+00	0.0000	1.202E-01	0.0299
Tc-99	4.737E-05	0.0000	3.351E-08	0.0000	0.000E+00	0.0000	1.728E-01	0.0430	0.000E+00	0.0000	0.000E+00	0.0000	4.954E-05	0.0000
Th-232	1.530E-01	0.0381	6.612E-03	0.0016	0.000E+00	0.0000	1.396E-01	0.0348	0.000E+00	0.0000	0.000E+00	0.0000	9.570E-02	0.0238
U-234	1.520E-04	0.0000	5.311E-04	0.0001	0.000E+00	0.0000	1.676E-02	0.0042	0.000E+00	0.0000	0.000E+00	0.0000	9.605E-03	0.0024
U-235	2.835E-01	0.0706	4.950E-04	0.0001	0.000E+00	0.0000	1.584E-02	0.0039	0.000E+00	0.0000	0.000E+00	0.0000	9.066E-03	0.0023
U-238	5.650E-02	0.0141	4.748E-04	0.0001	0.000E+00	0.0000	1.593E-02	0.0040	0.000E+00	0.0000	0.000E+00	0.0000	9.130E-03	0.0023
Total	9.090E-01	0.2264	1.374E-02	0.0034	0.000E+00	0.0000	2.578E+00	0.6422	0.000E+00	0.0000	0.000E+00	0.0000	5.137E-01	0.1280

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years

Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.281E-01	0.0568
Np-237	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.595E+00	0.6463
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.060E-01	0.0513
Tc-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.729E-01	0.0431
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.949E-01	0.0984
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.705E-02	0.0067
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.089E-01	0.0769
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.203E-02	0.0204
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.014E+00	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	1.650E-02	0.0038	1.783E-03	0.0004	0.000E+00	0.0000	8.611E-02	0.0196	0.000E+00	0.0000	0.000E+00	0.0000	1.233E-01	0.0281
Np-237	3.768E-01	0.0860	1.994E-03	0.0005	0.000E+00	0.0000	1.933E+00	0.4409	0.000E+00	0.0000	0.000E+00	0.0000	1.383E-01	0.0315
Pu-239	1.108E-04	0.0000	1.727E-03	0.0004	0.000E+00	0.0000	8.395E-02	0.0192	0.000E+00	0.0000	0.000E+00	0.0000	1.202E-01	0.0274
Tc-99	4.731E-05	0.0000	3.347E-08	0.0000	0.000E+00	0.0000	1.726E-01	0.0394	0.000E+00	0.0000	0.000E+00	0.0000	4.948E-05	0.0000
Th-232	5.151E-01	0.1175	6.660E-03	0.0015	0.000E+00	0.0000	2.861E-01	0.0653	0.000E+00	0.0000	0.000E+00	0.0000	1.018E-01	0.0232
U-234	1.519E-04	0.0000	5.308E-04	0.0001	0.000E+00	0.0000	1.675E-02	0.0038	0.000E+00	0.0000	0.000E+00	0.0000	9.599E-03	0.0022
U-235	2.833E-01	0.0646	4.947E-04	0.0001	0.000E+00	0.0000	1.588E-02	0.0036	0.000E+00	0.0000	0.000E+00	0.0000	9.067E-03	0.0021
U-238	5.646E-02	0.0129	4.745E-04	0.0001	0.000E+00	0.0000	1.592E-02	0.0036	0.000E+00	0.0000	0.000E+00	0.0000	9.124E-03	0.0021
Total	1.248E+00	0.2848	1.366E-02	0.0031	0.000E+00	0.0000	2.610E+00	0.5954	0.000E+00	0.0000	0.000E+00	0.0000	5.114E-01	0.1167

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years

Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.277E-01	0.0519
Np-237	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.450E+00	0.5589
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.060E-01	0.0470
Tc-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.727E-01	0.0394
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.097E-01	0.2075
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.703E-02	0.0062
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.087E-01	0.0704
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.197E-02	0.0187
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.383E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	1.645E-02	0.0032	1.776E-03	0.0003	0.000E+00	0.0000	8.581E-02	0.0165	0.000E+00	0.0000	0.000E+00	0.0000	1.228E-01	0.0236
Np-237	3.357E-01	0.0644	1.776E-03	0.0003	0.000E+00	0.0000	1.722E+00	0.3303	0.000E+00	0.0000	0.000E+00	0.0000	1.232E-01	0.0236
Pu-239	1.108E-04	0.0000	1.726E-03	0.0003	0.000E+00	0.0000	8.393E-02	0.0161	0.000E+00	0.0000	0.000E+00	0.0000	1.202E-01	0.0230
Tc-99	4.720E-05	0.0000	3.339E-08	0.0000	0.000E+00	0.0000	1.721E-01	0.0330	0.000E+00	0.0000	0.000E+00	0.0000	4.936E-05	0.0000
Th-232	1.355E+00	0.2599	6.827E-03	0.0013	0.000E+00	0.0000	5.330E-01	0.1022	0.000E+00	0.0000	0.000E+00	0.0000	1.138E-01	0.0218
U-234	1.518E-04	0.0000	5.300E-04	0.0001	0.000E+00	0.0000	1.672E-02	0.0032	0.000E+00	0.0000	0.000E+00	0.0000	9.585E-03	0.0018
U-235	2.829E-01	0.0543	4.943E-04	0.0001	0.000E+00	0.0000	1.596E-02	0.0031	0.000E+00	0.0000	0.000E+00	0.0000	9.071E-03	0.0017
U-238	5.637E-02	0.0108	4.738E-04	0.0001	0.000E+00	0.0000	1.589E-02	0.0030	0.000E+00	0.0000	0.000E+00	0.0000	9.110E-03	0.0017
Total	2.047E+00	0.3926	1.360E-02	0.0026	0.000E+00	0.0000	2.645E+00	0.5074	0.000E+00	0.0000	0.000E+00	0.0000	5.078E-01	0.0974

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+00 years

Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.269E-01	0.0435
Np-237	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.182E+00	0.4186
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.059E-01	0.0395
Tc-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.722E-01	0.0330
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.008E+00	0.3853
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.699E-02	0.0052
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.084E-01	0.0592
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.185E-02	0.0157
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.213E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	1.625E-02	0.0022	1.755E-03	0.0002	0.000E+00	0.0000	8.478E-02	0.0114	0.000E+00	0.0000	0.000E+00	0.0000	1.214E-01	0.0163
Np-237	2.241E-01	0.0300	1.185E-03	0.0002	0.000E+00	0.0000	1.149E+00	0.1540	0.000E+00	0.0000	0.000E+00	0.0000	8.221E-02	0.0110
Pu-239	1.107E-04	0.0000	1.725E-03	0.0002	0.000E+00	0.0000	8.388E-02	0.0112	0.000E+00	0.0000	0.000E+00	0.0000	1.201E-01	0.0161
Tc-99	4.680E-05	0.0000	3.311E-08	0.0000	0.000E+00	0.0000	1.707E-01	0.0229	0.000E+00	0.0000	0.000E+00	0.0000	4.894E-05	0.0000
Th-232	3.789E+00	0.5078	7.428E-03	0.0010	0.000E+00	0.0000	1.049E+00	0.1406	0.000E+00	0.0000	0.000E+00	0.0000	1.436E-01	0.0192
U-234	1.518E-04	0.0000	5.274E-04	0.0001	0.000E+00	0.0000	1.664E-02	0.0022	0.000E+00	0.0000	0.000E+00	0.0000	9.537E-03	0.0013
U-235	2.814E-01	0.0377	4.933E-04	0.0001	0.000E+00	0.0000	1.627E-02	0.0022	0.000E+00	0.0000	0.000E+00	0.0000	9.091E-03	0.0012
U-238	5.608E-02	0.0075	4.713E-04	0.0001	0.000E+00	0.0000	1.581E-02	0.0021	0.000E+00	0.0000	0.000E+00	0.0000	9.064E-03	0.0012
Total	4.367E+00	0.5853	1.359E-02	0.0018	0.000E+00	0.0000	2.586E+00	0.3466	0.000E+00	0.0000	0.000E+00	0.0000	4.949E-01	0.0663

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+01 years

Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.241E-01	0.0300
Np-237	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.457E+00	0.1952
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.058E-01	0.0276
Tc-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.708E-01	0.0229
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.989E+00	0.6686
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.685E-02	0.0036
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.073E-01	0.0412
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.143E-02	0.0109
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.461E+00	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	1.570E-02	0.0002	1.695E-03	0.0000	0.000E+00	0.0000	8.190E-02	0.0013	0.000E+00	0.0000	0.000E+00	0.0000	1.172E-01	0.0019
Np-237	7.057E-02	0.0011	3.734E-04	0.0000	0.000E+00	0.0000	3.619E-01	0.0057	0.000E+00	0.0000	0.000E+00	0.0000	2.589E-02	0.0004
Pu-239	1.105E-04	0.0000	1.722E-03	0.0000	0.000E+00	0.0000	8.372E-02	0.0013	0.000E+00	0.0000	0.000E+00	0.0000	1.199E-01	0.0019
Tc-99	4.567E-05	0.0000	3.231E-08	0.0000	0.000E+00	0.0000	1.666E-01	0.0026	0.000E+00	0.0000	0.000E+00	0.0000	4.777E-05	0.0000
Th-232	5.720E+00	0.0908	7.939E-03	0.0001	0.000E+00	0.0000	1.398E+00	0.0222	0.000E+00	0.0000	0.000E+00	0.0000	1.657E-01	0.0026
U-234	1.561E-04	0.0000	5.199E-04	0.0000	0.000E+00	0.0000	1.640E-02	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	9.400E-03	0.0001
U-235	2.775E-01	0.0044	4.930E-04	0.0000	0.000E+00	0.0000	1.719E-02	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	9.192E-03	0.0001
U-238	5.526E-02	0.0009	4.645E-04	0.0000	0.000E+00	0.0000	1.558E-02	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	8.932E-03	0.0001
Total	6.139E+00	0.0974	1.321E-02	0.0002	0.000E+00	0.0000	2.141E+00	0.0340	0.000E+00	0.0000	0.000E+00	0.0000	4.563E-01	0.0072

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	4.537E-05	0.0000	1.970E-06	0.0000	0.000E+00	0.0000	9.846E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.166E-01	0.0034
Np-237	5.094E+01	0.8083	2.219E+00	0.0352	0.000E+00	0.0000	1.111E+00	0.0176	0.000E+00	0.0000	0.000E+00	0.0000	5.473E+01	0.8684
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.054E-01	0.0033
Tc-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.667E-01	0.0026
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.292E+00	0.1157
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.647E-02	0.0004
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.044E-01	0.0048
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.024E-02	0.0013
Total	5.094E+01	0.8083	2.219E+00	0.0352	0.000E+00	0.0000	1.111E+00	0.0176	0.000E+00	0.0000	0.000E+00	0.0000	6.302E+01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	1.390E-02	0.0001	1.502E-03	0.0000	0.000E+00	0.0000	7.254E-02	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	1.038E-01	0.0005
Np-237	1.238E-03	0.0000	6.591E-06	0.0000	0.000E+00	0.0000	6.348E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.549E-04	0.0000
Pu-239	1.098E-04	0.0000	1.711E-03	0.0000	0.000E+00	0.0000	8.318E-02	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	1.191E-01	0.0006
Tc-99	4.195E-05	0.0000	2.967E-08	0.0000	0.000E+00	0.0000	1.530E-01	0.0007	0.000E+00	0.0000	0.000E+00	0.0000	4.387E-05	0.0000
Th-232	5.906E+00	0.0277	7.988E-03	0.0000	0.000E+00	0.0000	1.431E+00	0.0067	0.000E+00	0.0000	0.000E+00	0.0000	1.678E-01	0.0008
U-234	2.157E-04	0.0000	4.945E-04	0.0000	0.000E+00	0.0000	1.562E-02	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	8.942E-03	0.0000
U-235	2.644E-01	0.0012	5.003E-04	0.0000	0.000E+00	0.0000	2.023E-02	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	9.648E-03	0.0000
U-238	5.249E-02	0.0002	4.413E-04	0.0000	0.000E+00	0.0000	1.480E-02	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	8.486E-03	0.0000
Total	6.238E+00	0.0293	1.264E-02	0.0001	0.000E+00	0.0000	1.796E+00	0.0084	0.000E+00	0.0000	0.000E+00	0.0000	4.183E-01	0.0020

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years

Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	3.447E-03	0.0000	1.505E-04	0.0000	0.000E+00	0.0000	7.548E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.955E-01	0.0009
Np-237	1.922E+02	0.9012	8.393E+00	0.0394	0.000E+00	0.0000	4.210E+00	0.0197	0.000E+00	0.0000	0.000E+00	0.0000	2.048E+02	0.9603
Pu-239	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.041E-01	0.0010
Tc-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.531E-01	0.0007
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.513E+00	0.0352
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.527E-02	0.0001
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.948E-01	0.0014
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.623E-02	0.0004
Total	1.922E+02	0.9012	8.393E+00	0.0394	0.000E+00	0.0000	4.210E+00	0.0197	0.000E+00	0.0000	0.000E+00	0.0000	2.132E+02	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	9.833E-03	0.0012	1.062E-03	0.0001	0.000E+00	0.0000	5.130E-02	0.0062	0.000E+00	0.0000	0.000E+00	0.0000	7.343E-02	0.0088
Np-237	1.118E-06	0.0000	4.909E-08	0.0000	0.000E+00	0.0000	1.284E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.533E-07	0.0000
Pu-239	1.079E-04	0.0000	1.679E-03	0.0002	0.000E+00	0.0000	8.164E-02	0.0098	0.000E+00	0.0000	0.000E+00	0.0000	1.169E-01	0.0140
Tc-99	3.289E-05	0.0000	2.327E-08	0.0000	0.000E+00	0.0000	1.200E-01	0.0144	0.000E+00	0.0000	0.000E+00	0.0000	3.440E-05	0.0000
Th-232	5.904E+00	0.7088	7.984E-03	0.0010	0.000E+00	0.0000	1.430E+00	0.1717	0.000E+00	0.0000	0.000E+00	0.0000	1.678E-01	0.0201
U-234	6.692E-04	0.0001	4.289E-04	0.0001	0.000E+00	0.0000	1.381E-02	0.0017	0.000E+00	0.0000	0.000E+00	0.0000	7.775E-03	0.0009
U-235	2.300E-01	0.0276	5.007E-04	0.0001	0.000E+00	0.0000	2.522E-02	0.0030	0.000E+00	0.0000	0.000E+00	0.0000	1.023E-02	0.0012
U-238	4.532E-02	0.0054	3.812E-04	0.0000	0.000E+00	0.0000	1.279E-02	0.0015	0.000E+00	0.0000	0.000E+00	0.0000	7.330E-03	0.0009
Total	6.189E+00	0.7431	1.204E-02	0.0014	0.000E+00	0.0000	1.735E+00	0.2083	0.000E+00	0.0000	0.000E+00	0.0000	3.835E-01	0.0460

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years

Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	3.834E-03	0.0005	1.675E-04	0.0000	0.000E+00	0.0000	8.401E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.397E-01	0.0168
Np-237	4.756E-03	0.0006	2.057E-04	0.0000	0.000E+00	0.0000	1.043E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.069E-03	0.0006
Pu-239	8.060E-14	0.0000	6.119E-15	0.0000	0.000E+00	0.0000	1.754E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.003E-01	0.0240
Tc-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.200E-01	0.0144
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.509E+00	0.9016
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.268E-02	0.0027
U-235	5.282E-06	0.0000	4.011E-07	0.0000	0.000E+00	0.0000	1.150E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.659E-01	0.0319
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.582E-02	0.0079
Total	8.595E-03	0.0010	3.735E-04	0.0000	0.000E+00	0.0000	1.885E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.329E+00	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
Am-241	2.924E-03	0.0004	3.158E-04	0.0000	0.000E+00	0.0000	1.526E-02	0.0018	0.000E+00	0.0000	0.000E+00	0.0000	2.184E-02	0.0026
Np-237	2.847E-06	0.0000	6.108E-08	0.0000	0.000E+00	0.0000	1.079E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.007E-06	0.0000
Pu-239	1.012E-04	0.0000	1.573E-03	0.0002	0.000E+00	0.0000	7.648E-02	0.0092	0.000E+00	0.0000	0.000E+00	0.0000	1.095E-01	0.0131
Tc-99	1.405E-05	0.0000	9.936E-09	0.0000	0.000E+00	0.0000	5.123E-02	0.0061	0.000E+00	0.0000	0.000E+00	0.0000	1.469E-05	0.0000
Th-232	5.895E+00	0.7068	7.972E-03	0.0010	0.000E+00	0.0000	1.428E+00	0.1712	0.000E+00	0.0000	0.000E+00	0.0000	1.675E-01	0.0201
U-234	3.367E-03	0.0004	2.624E-04	0.0000	0.000E+00	0.0000	1.036E-02	0.0012	0.000E+00	0.0000	0.000E+00	0.0000	4.927E-03	0.0006
U-235	1.392E-01	0.0167	3.663E-04	0.0000	0.000E+00	0.0000	2.260E-02	0.0027	0.000E+00	0.0000	0.000E+00	0.0000	7.962E-03	0.0010
U-238	2.709E-02	0.0032	2.284E-04	0.0000	0.000E+00	0.0000	7.663E-03	0.0009	0.000E+00	0.0000	0.000E+00	0.0000	4.391E-03	0.0005
Total	6.067E+00	0.7275	1.072E-02	0.0013	0.000E+00	0.0000	1.611E+00	0.1932	0.000E+00	0.0000	0.000E+00	0.0000	3.161E-01	0.0379

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+03 years

Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
Am-241	9.910E-04	0.0001	4.329E-05	0.0000	0.000E+00	0.0000	2.171E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.139E-02	0.0050
Np-237	6.654E-05	0.0000	6.559E-07	0.0000	0.000E+00	0.0000	1.452E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.364E-05	0.0000
Pu-239	3.900E-08	0.0000	2.579E-09	0.0000	0.000E+00	0.0000	8.504E-10	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.877E-01	0.0225
Tc-99	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.125E-02	0.0061
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.498E+00	0.8991
U-234	2.813E-07	0.0000	3.620E-08	0.0000	0.000E+00	0.0000	6.155E-09	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.892E-02	0.0023
U-235	3.064E-01	0.0367	1.976E-02	0.0024	0.000E+00	0.0000	6.681E-03	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	5.029E-01	0.0603
U-238	6.432E-11	0.0000	9.456E-12	0.0000	0.000E+00	0.0000	1.482E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.938E-02	0.0047
Total	3.074E-01	0.0369	1.980E-02	0.0024	0.000E+00	0.0000	6.705E-03	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	8.340E+00	1.0000

*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways
Parent and Progeny Principal Radionuclide Contributions Indicated

0Parent (i)	Product (j)	Branch Fraction*	DSR(j,t) (mrem/yr)/(pCi/g) t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Am-241	Am-241	1.000E+00	2.281E-01	2.277E-01	2.269E-01	2.241E-01	2.165E-01	1.918E-01	1.356E-01	4.033E-02
Am-241	Np-237	1.000E+00	4.048E-07	1.217E-06	2.709E-06	6.720E-06	6.029E-05	3.685E-03	4.095E-03	1.059E-03
Am-241	U-233	1.000E+00	9.156E-15	5.307E-14	2.465E-13	1.835E-12	1.124E-11	4.752E-10	3.942E-09	9.503E-09
Am-241	Th-229	1.000E+00	4.784E-18	6.928E-17	7.792E-16	1.864E-14	3.524E-13	6.535E-12	6.328E-11	4.478E-10
Am-241	äDSR(j)		2.281E-01	2.277E-01	2.269E-01	2.241E-01	2.166E-01	1.955E-01	1.397E-01	4.139E-02
0Np-237	Np-237	1.000E+00	2.595E+00	2.450E+00	2.182E+00	1.457E+00	5.473E+01	2.048E+02	4.998E-03	1.337E-20
Np-237	U-233	1.000E+00	7.516E-08	1.923E-07	4.022E-07	9.697E-07	2.332E-06	4.536E-05	6.936E-05	6.942E-05
Np-237	Th-229	1.000E+00	5.817E-11	3.946E-10	2.000E-09	1.571E-08	9.594E-08	4.867E-07	1.567E-06	4.217E-06
Np-237	äDSR(j)		2.595E+00	2.450E+00	2.182E+00	1.457E+00	5.473E+01	2.048E+02	5.069E-03	7.364E-05
0Pu-239	Pu-239	1.000E+00	2.060E-01	2.060E-01	2.059E-01	2.058E-01	2.054E-01	2.041E-01	2.003E-01	1.877E-01
Pu-239	U-235	1.000E+00	1.518E-10	4.558E-10	1.063E-09	3.181E-09	9.164E-09	2.934E-08	8.086E-08	2.046E-07
Pu-239	Pa-231	1.000E+00	9.581E-15	6.950E-14	3.724E-13	3.334E-12	2.756E-11	2.769E-10	1.994E-09	1.751E-08
Pu-239	Ac-227	1.000E+00	6.815E-17	9.465E-16	1.042E-14	2.520E-13	5.067E-12	1.054E-10	1.049E-09	4.275E-08
Pu-239	äDSR(j)		2.060E-01	2.060E-01	2.059E-01	2.058E-01	2.054E-01	2.041E-01	2.003E-01	1.877E-01
0Tc-99	Tc-99	1.000E+00	1.729E-01	1.727E-01	1.722E-01	1.708E-01	1.667E-01	1.531E-01	1.200E-01	5.125E-02
0Th-232	Th-232	1.000E+00	1.642E-01	1.642E-01	1.642E-01	1.642E-01	1.642E-01	1.642E-01	1.641E-01	1.639E-01
Th-232	Ra-228	1.000E+00	2.054E-01	5.923E-01	1.239E+00	2.580E+00	3.484E+00	3.570E+00	3.568E+00	3.563E+00
Th-232	Th-228	1.000E+00	2.523E-02	1.532E-01	6.054E-01	2.244E+00	3.643E+00	3.779E+00	3.777E+00	3.772E+00
Th-232	äDSR(j)		3.949E-01	9.097E-01	2.008E+00	4.989E+00	7.292E+00	7.513E+00	7.509E+00	7.498E+00
0U-234	U-234	1.000E+00	2.705E-02	2.703E-02	2.699E-02	2.685E-02	2.645E-02	2.512E-02	2.168E-02	1.293E-02
U-234	Th-230	1.000E+00	1.554E-07	4.565E-07	1.056E-06	3.148E-06	9.065E-06	2.909E-05	8.083E-05	2.112E-04
U-234	Ra-226	1.000E+00	3.467E-09	2.455E-08	1.302E-07	1.160E-06	9.599E-06	9.726E-05	7.175E-04	4.324E-03
U-234	Pb-210	1.000E+00	1.307E-11	1.712E-10	1.819E-09	4.336E-08	8.869E-07	1.953E-05	2.085E-04	1.448E-03
U-234	äDSR(j)		2.705E-02	2.703E-02	2.699E-02	2.685E-02	2.647E-02	2.527E-02	2.268E-02	1.892E-02
0U-235	U-235	1.000E+00	3.088E-01	3.086E-01	3.082E-01	3.066E-01	3.021E-01	2.869E-01	2.477E-01	1.481E-01
U-235	Pa-231	1.000E+00	2.996E-05	9.191E-05	2.156E-04	6.421E-04	1.807E-03	5.310E-03	1.152E-02	7.145E-02
U-235	Ac-227	1.000E+00	2.679E-07	1.748E-06	8.747E-06	7.021E-05	4.596E-04	2.492E-03	6.684E-03	2.834E-01
U-235	äDSR(j)		3.089E-01	3.087E-01	3.084E-01	3.073E-01	3.044E-01	2.948E-01	2.659E-01	5.029E-01
0U-238	U-238	1.000E+00	8.203E-02	8.197E-02	8.185E-02	8.143E-02	8.024E-02	7.622E-02	6.580E-02	3.933E-02
U-238	U-234	1.000E+00	3.833E-08	1.149E-07	2.678E-07	7.992E-07	2.288E-06	7.159E-06	1.847E-05	3.673E-05
U-238	Th-230	1.000E+00	1.501E-13	1.018E-12	5.303E-12	4.692E-11	3.907E-10	4.095E-09	3.319E-08	2.638E-07
U-238	Ra-226	1.000E+00	2.439E-15	3.712E-14	4.357E-13	1.153E-11	2.772E-10	9.296E-09	2.071E-07	4.200E-06
U-238	Pb-210	1.000E+00	7.775E-18	2.085E-16	4.729E-15	3.315E-13	2.012E-11	1.568E-09	5.509E-08	1.365E-06
U-238	äDSR(j)		8.203E-02	8.197E-02	8.185E-02	8.143E-02	8.024E-02	7.623E-02	6.582E-02	3.938E-02

*Branch Fraction is the cumulative factor for the j't principal radionuclide daughter: CUMBRF(j) = BRF(1)*BRF(2)* ... BRF(j).
The DSR includes contributions from associated (half-life ó 0.5 yr) daughters.

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 2.500E+01 mrem/yr

0Nuclide (i)	t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Am-241	1.096E+02	1.098E+02	1.102E+02	1.115E+02	1.154E+02	1.279E+02	1.789E+02	6.040E+02
Np-237	9.635E+00	1.021E+01	1.146E+01	1.716E+01	4.568E-01	1.221E-01	4.932E+03	3.395E+05
Pu-239	1.214E+02	1.214E+02	1.214E+02	1.215E+02	1.217E+02	1.225E+02	1.248E+02	1.332E+02
Tc-99	1.446E+02	1.448E+02	1.452E+02	1.464E+02	1.500E+02	1.633E+02	2.083E+02	4.878E+02
Th-232	6.331E+01	2.748E+01	1.245E+01	5.011E+00	3.429E+00	3.328E+00	3.329E+00	3.334E+00
U-234	9.243E+02	9.250E+02	9.263E+02	9.310E+02	9.443E+02	9.894E+02	1.102E+03	1.322E+03
U-235	8.094E+01	8.098E+01	8.107E+01	8.136E+01	8.214E+01	8.482E+01	9.401E+01	4.971E+01
U-238	3.048E+02	3.050E+02	3.054E+02	3.070E+02	3.115E+02	3.280E+02	3.798E+02	6.349E+02

0

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 115.5 ñ 0.2 years

0Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Am-241	1.000E+00	0.000E+00	2.281E-01	1.096E+02	1.913E-01	1.307E+02
Np-237	1.000E+00	115.4 ñ 0.2	2.063E+02	1.212E-01	2.063E+02	1.212E-01
Pu-239	1.000E+00	0.000E+00	2.060E-01	1.214E+02	2.038E-01	1.227E+02
Tc-99	1.000E+00	0.000E+00	1.729E-01	1.446E+02	1.502E-01	1.664E+02
Th-232	1.000E+00	91.1 ñ 0.2	7.513E+00	3.328E+00	7.512E+00	3.328E+00
U-234	1.000E+00	0.000E+00	2.705E-02	9.243E+02	2.503E-02	9.990E+02
U-235	1.000E+00	1.000E+03	5.029E-01	4.971E+01	2.926E-01	8.544E+01
U-238	1.000E+00	0.000E+00	8.203E-02	3.048E+02	7.536E-02	3.317E+02

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

0Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Am-241	Am-241	1.000E+00	2.281E-01	2.277E-01	2.269E-01	2.241E-01	2.165E-01	1.918E-01	1.356E-01	4.033E-02
0Np-237	Am-241	1.000E+00	4.048E-07	1.217E-06	2.709E-06	6.720E-06	6.029E-05	3.685E-03	4.095E-03	1.059E-03
Np-237	Np-237	1.000E+00	2.595E+00	2.450E+00	2.182E+00	1.457E+00	5.473E+01	2.048E+02	4.998E-03	1.337E-20
Np-237	äDOSE(j)		2.595E+00	2.450E+00	2.182E+00	1.457E+00	5.473E+01	2.048E+02	9.093E-03	1.059E-03
0U-233	Am-241	1.000E+00	9.156E-15	5.307E-14	2.465E-13	1.835E-12	1.124E-11	4.752E-10	3.942E-09	9.503E-09
U-233	Np-237	1.000E+00	7.516E-08	1.923E-07	4.022E-07	9.697E-07	2.332E-06	4.536E-05	6.936E-05	6.942E-05
U-233	äDOSE(j)		7.516E-08	1.923E-07	4.022E-07	9.697E-07	2.332E-06	4.536E-05	6.937E-05	6.943E-05
0Th-229	Am-241	1.000E+00	4.784E-18	6.928E-17	7.792E-16	1.864E-14	3.524E-13	6.535E-12	6.328E-11	4.478E-10
Th-229	Np-237	1.000E+00	5.817E-11	3.946E-10	2.000E-09	1.571E-08	9.594E-08	4.867E-07	1.567E-06	4.217E-06
Th-229	äDOSE(j)		5.817E-11	3.947E-10	2.000E-09	1.571E-08	9.594E-08	4.867E-07	1.567E-06	4.218E-06
0Pu-239	Pu-239	1.000E+00	2.060E-01	2.060E-01	2.059E-01	2.058E-01	2.054E-01	2.041E-01	2.003E-01	1.877E-01
0U-235	Pu-239	1.000E+00	1.518E-10	4.558E-10	1.063E-09	3.181E-09	9.164E-09	2.934E-08	8.086E-08	2.046E-07
U-235	U-235	1.000E+00	3.088E-01	3.086E-01	3.082E-01	3.066E-01	3.021E-01	2.869E-01	2.477E-01	1.481E-01
U-235	äDOSE(j)		3.088E-01	3.086E-01	3.082E-01	3.066E-01	3.021E-01	2.869E-01	2.477E-01	1.481E-01
0Pa-231	Pu-239	1.000E+00	9.581E-15	6.950E-14	3.724E-13	3.334E-12	2.756E-11	2.769E-10	1.994E-09	1.751E-08
Pa-231	U-235	1.000E+00	2.996E-05	9.191E-05	2.156E-04	6.421E-04	1.807E-03	5.310E-03	1.152E-02	7.145E-02
Pa-231	äDOSE(j)		2.996E-05	9.191E-05	2.156E-04	6.421E-04	1.807E-03	5.310E-03	1.152E-02	7.145E-02
0Ac-227	Pu-239	1.000E+00	6.815E-17	9.465E-16	1.042E-14	2.520E-13	5.067E-12	1.054E-10	1.049E-09	4.275E-08
Ac-227	U-235	1.000E+00	2.679E-07	1.748E-06	8.747E-06	7.021E-05	4.596E-04	2.492E-03	6.684E-03	2.834E-01
Ac-227	äDOSE(j)		2.679E-07	1.748E-06	8.747E-06	7.021E-05	4.596E-04	2.492E-03	6.684E-03	2.834E-01
0Tc-99	Tc-99	1.000E+00	1.729E-01	1.727E-01	1.722E-01	1.708E-01	1.667E-01	1.531E-01	1.200E-01	5.125E-02
0Th-232	Th-232	1.000E+00	1.642E-01	1.642E-01	1.642E-01	1.642E-01	1.642E-01	1.642E-01	1.641E-01	1.639E-01
0Ra-228	Th-232	1.000E+00	2.054E-01	5.923E-01	1.239E+00	2.580E+00	3.484E+00	3.570E+00	3.568E+00	3.563E+00
0Th-228	Th-232	1.000E+00	2.523E-02	1.532E-01	6.054E-01	2.244E+00	3.643E+00	3.779E+00	3.777E+00	3.772E+00
0U-234	U-234	1.000E+00	2.705E-02	2.703E-02	2.699E-02	2.685E-02	2.645E-02	2.512E-02	2.168E-02	1.293E-02
U-234	U-238	1.000E+00	3.833E-08	1.149E-07	2.678E-07	7.992E-07	2.288E-06	7.159E-06	1.847E-05	3.673E-05
U-234	äDOSE(j)		2.705E-02	2.703E-02	2.699E-02	2.685E-02	2.646E-02	2.513E-02	2.169E-02	1.297E-02
0Th-230	U-234	1.000E+00	1.554E-07	4.565E-07	1.056E-06	3.148E-06	9.065E-06	2.909E-05	8.083E-05	2.112E-04
Th-230	U-238	1.000E+00	1.501E-13	1.018E-12	5.303E-12	4.692E-11	3.907E-10	4.095E-09	3.319E-08	2.638E-07
Th-230	äDOSE(j)		1.554E-07	4.565E-07	1.056E-06	3.148E-06	9.065E-06	2.909E-05	8.086E-05	2.115E-04
0Ra-226	U-234	1.000E+00	3.467E-09	2.455E-08	1.302E-07	1.160E-06	9.599E-06	9.726E-05	7.175E-04	4.324E-03
Ra-226	U-238	1.000E+00	2.439E-15	3.712E-14	4.357E-13	1.153E-11	2.772E-10	9.296E-09	2.071E-07	4.200E-06
Ra-226	äDOSE(j)		3.467E-09	2.455E-08	1.302E-07	1.160E-06	9.599E-06	9.727E-05	7.177E-04	4.328E-03

Summary : Volumetric Dose Assessment for Resident NRC Gardener
File : WH NRC Volume Resident.RAD

Individual Nuclide Dose Summed Over All Pathways
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr							
		t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pb-210	U-234	1.000E+00	1.307E-11	1.712E-10	1.819E-09	4.336E-08	8.869E-07	1.953E-05	2.085E-04	1.448E-03
Pb-210	U-238	1.000E+00	7.775E-18	2.085E-16	4.729E-15	3.315E-13	2.012E-11	1.568E-09	5.509E-08	1.365E-06
Pb-210	äDOSE(j)		1.307E-11	1.712E-10	1.819E-09	4.336E-08	8.869E-07	1.953E-05	2.086E-04	1.450E-03
U-238	U-238	1.000E+00	8.203E-02	8.197E-02	8.185E-02	8.143E-02	8.024E-02	7.622E-02	6.580E-02	3.933E-02

BRF(i) is the branch fraction of the parent nuclide.

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

0Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Am-241	Am-241	1.000E+00	1.000E+00	9.983E-01	9.948E-01	9.828E-01	9.494E-01	8.409E-01	5.947E-01	1.768E-01
0Np-237	Am-241	1.000E+00	0.000E+00	3.144E-07	8.898E-07	2.437E-06	4.466E-06	4.843E-06	3.438E-06	1.022E-06
Np-237	Np-237	1.000E+00	1.000E+00	9.439E-01	8.409E-01	5.612E-01	1.768E-01	3.100E-03	2.979E-08	8.197E-26
Np-237	äS(j):		1.000E+00	9.439E-01	8.409E-01	5.612E-01	1.768E-01	3.105E-03	3.467E-06	1.022E-06
0U-233	Am-241	1.000E+00	0.000E+00	6.942E-13	6.006E-12	5.844E-11	3.756E-10	1.825E-09	4.899E-09	7.439E-09
U-233	Np-237	1.000E+00	0.000E+00	4.248E-06	1.203E-05	3.308E-05	6.145E-05	7.099E-05	6.143E-05	3.661E-05
U-233	äS(j):		0.000E+00	4.248E-06	1.203E-05	3.308E-05	6.145E-05	7.099E-05	6.144E-05	3.662E-05
0Th-229	Am-241	1.000E+00	0.000E+00	2.196E-17	5.756E-16	1.929E-14	4.023E-13	7.664E-12	7.312E-11	5.084E-10
Th-229	Np-237	1.000E+00	0.000E+00	2.025E-10	1.754E-09	1.714E-08	1.115E-07	5.707E-07	1.798E-06	4.737E-06
Th-229	äS(j):		0.000E+00	2.025E-10	1.754E-09	1.714E-08	1.115E-07	5.707E-07	1.798E-06	4.737E-06
0Pu-239	Pu-239	1.000E+00	1.000E+00	9.999E-01	9.997E-01	9.991E-01	9.972E-01	9.907E-01	9.724E-01	9.110E-01
0U-235	Pu-239	1.000E+00	0.000E+00	9.845E-10	2.951E-09	9.808E-09	2.918E-08	9.451E-08	2.613E-07	6.622E-07
U-235	U-235	1.000E+00	1.000E+00	9.993E-01	9.978E-01	9.927E-01	9.782E-01	9.291E-01	8.021E-01	4.795E-01
U-235	äS(j):		1.000E+00	9.993E-01	9.978E-01	9.927E-01	9.782E-01	9.291E-01	8.021E-01	4.795E-01
0Pa-231	Pu-239	1.000E+00	0.000E+00	1.041E-14	9.345E-14	1.030E-12	9.064E-12	9.311E-11	6.748E-10	3.795E-09
Pa-231	U-235	1.000E+00	0.000E+00	2.112E-05	6.316E-05	2.081E-04	6.040E-04	1.795E-03	3.907E-03	4.621E-03
Pa-231	äS(j):		0.000E+00	2.112E-05	6.316E-05	2.081E-04	6.040E-04	1.795E-03	3.907E-03	4.621E-03
0Ac-227	Pu-239	1.000E+00	0.000E+00	1.094E-16	2.894E-15	9.989E-14	2.233E-12	4.816E-11	4.839E-10	3.070E-09
Ac-227	U-235	1.000E+00	0.000E+00	3.322E-07	2.909E-06	2.943E-05	2.066E-04	1.146E-03	3.087E-03	3.888E-03
Ac-227	äS(j):		0.000E+00	3.322E-07	2.909E-06	2.943E-05	2.066E-04	1.146E-03	3.087E-03	3.888E-03
0Tc-99	Tc-99	1.000E+00	1.000E+00	9.988E-01	9.964E-01	9.879E-01	9.642E-01	8.855E-01	6.944E-01	2.965E-01
0Th-232	Th-232	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00	9.999E-01	9.998E-01	9.994E-01	9.979E-01
0Ra-228	Th-232	1.000E+00	0.000E+00	1.135E-01	3.027E-01	6.953E-01	9.599E-01	9.848E-01	9.844E-01	9.829E-01
0Th-228	Th-232	1.000E+00	0.000E+00	1.863E-02	1.241E-01	5.610E-01	9.471E-01	9.848E-01	9.844E-01	9.829E-01
0U-234	U-234	1.000E+00	1.000E+00	9.993E-01	9.978E-01	9.926E-01	9.781E-01	9.289E-01	8.014E-01	4.781E-01
U-234	U-238	1.000E+00	0.000E+00	2.833E-06	8.486E-06	2.814E-05	8.319E-05	2.634E-04	6.819E-04	1.357E-03
U-234	äS(j):		1.000E+00	9.993E-01	9.978E-01	9.927E-01	9.782E-01	9.291E-01	8.021E-01	4.795E-01
0Th-230	U-234	1.000E+00	0.000E+00	8.999E-06	2.698E-05	8.968E-05	2.670E-04	8.673E-04	2.418E-03	6.327E-03
Th-230	U-238	1.000E+00	0.000E+00	1.275E-11	1.147E-10	1.270E-09	1.131E-08	1.215E-07	9.913E-07	7.899E-06
Th-230	äS(j):		0.000E+00	8.999E-06	2.698E-05	8.968E-05	2.671E-04	8.674E-04	2.419E-03	6.335E-03
0Ra-226	U-234	1.000E+00	0.000E+00	1.948E-09	1.750E-08	1.930E-07	1.703E-06	1.765E-05	1.311E-04	7.916E-04
Ra-226	U-238	1.000E+00	0.000E+00	1.841E-15	4.961E-14	1.825E-12	4.837E-11	1.679E-09	3.778E-08	7.686E-07
Ra-226	äS(j):		0.000E+00	1.948E-09	1.750E-08	1.930E-07	1.703E-06	1.765E-05	1.311E-04	7.924E-04

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g							
		t=	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pb-210	U-234	1.000E+00	0.000E+00	2.003E-11	5.313E-10	1.853E-08	4.250E-07	9.739E-06	1.051E-04	7.319E-04
Pb-210	U-238	1.000E+00	0.000E+00	1.422E-17	1.135E-15	1.334E-13	9.444E-12	7.768E-10	2.770E-08	6.896E-07
Pb-210	äS(j):		0.000E+00	2.003E-11	5.313E-10	1.853E-08	4.250E-07	9.739E-06	1.051E-04	7.326E-04
U-238	U-238	1.000E+00	1.000E+00	9.993E-01	9.978E-01	9.927E-01	9.782E-01	9.291E-01	8.021E-01	4.795E-01

 BRF(i) is the branch fraction of the parent nuclide.
0RESCALC.EXE execution time = 46.34 seconds

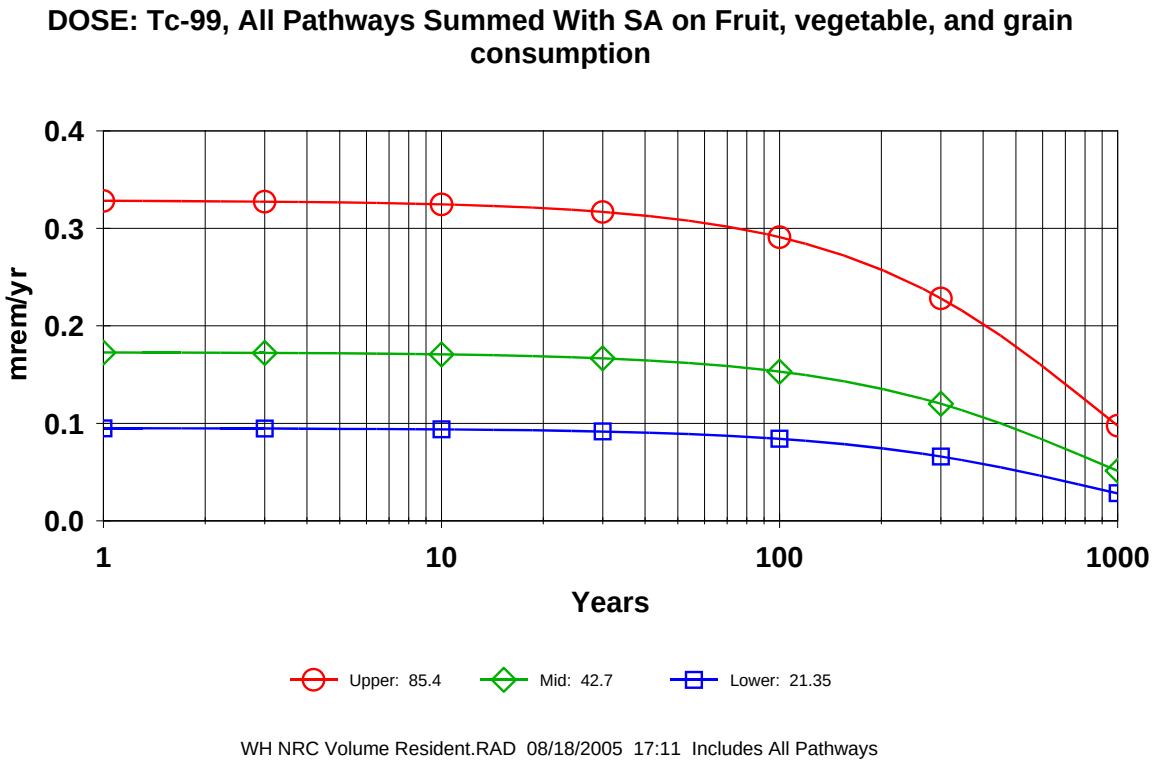
APPENDIX D

EXAMPLE OF SENSITIVITY INDEX CALCULATION

Determination of Sensitivity Index

Intake Parameter:	Fruit, Vegetable, and Grain Consumption
Soil Source:	Volumetric
Assigned Value:	42.7 kg/yr
Common Factor:	2
Upper Value	85.4 kg/yr (Assigned Value x Common factor)
Lower Value	21.35 kg/yr (Assigned Value / Common Factor)
Analyte:	Tc-99

By using RESRAD Standard Graphic Tool, the following graph was obtained.



The figure shows three different dose curves for three intake rates of fruits, vegetables and grain consumption from year 0 to 1000. By exporting the chart into an Excel worksheet, the sensitivity index (SI) was calculated by using the following formula:

$$S.I. = 1 - \frac{Dose_{Lower\ \ Intake}}{Dose_{Upper\ \ Intake}}$$

The results of SI calculation for year 1 to 1000 are presented in the following table:

DOSE: Tc-99, All Pathways Summed With SA on Fruit, Vegetable, and Grain Consumption

Years	Dose Upper: 85.4	Years	Dose Mid: 42.7	Years	Dose Lower: 21.35	$Dose_{Lower}/Dose_{upper}$	Sensitivity Index
1	0.328232	1	0.172653	1	0.0948641	0.29	0.71
1.30432	0.32811	1.30432	0.172589	1.30432	0.094829	0.29	0.71
1.70125	0.327952	1.70125	0.172506	1.70125	0.0947832	0.29	0.71
2.21898	0.327746	2.21898	0.172398	2.21898	0.0947236	0.29	0.71
2.89427	0.327477	2.89427	0.172256	2.89427	0.0946459	0.29	0.71
3	0.327435	3	0.172234	3	0.0946337	0.29	0.71
3.77505	0.327126	3.77505	0.172072	3.77505	0.0945446	0.29	0.71
4.92388	0.32667	4.92388	0.171832	4.92388	0.0944126	0.29	0.71
6.42232	0.326075	6.42232	0.171519	6.42232	0.0942408	0.29	0.71
8.37678	0.325301	8.37678	0.171112	8.37678	0.0940171	0.29	0.71
10	0.32466	10	0.170775	10	0.0938318	0.29	0.71
10.926	0.324295	10.926	0.170582	10.926	0.0937262	0.29	0.71
14.251	0.322986	14.251	0.169894	14.251	0.0933481	0.29	0.71
18.5879	0.321288	18.5879	0.169001	18.5879	0.0928573	0.29	0.71
24.2446	0.319086	24.2446	0.167843	24.2446	0.0922209	0.29	0.71
30	0.316861	30	0.166672	30	0.0915779	0.29	0.71
31.6228	0.316237	31.6228	0.166344	31.6228	0.0913974	0.29	0.71
41.2463	0.312559	41.2463	0.164409	41.2463	0.0903343	0.29	0.71
53.7984	0.307825	53.7984	0.161919	53.7984	0.0889663	0.29	0.71
70.1704	0.301759	70.1704	0.158728	70.1704	0.0872131	0.29	0.71
91.5247	0.294026	91.5247	0.154661	91.5247	0.0849781	0.29	0.71
100	0.291012	100	0.153075	100	0.0841071	0.29	0.71
119.378	0.284237	119.378	0.149511	119.378	0.0821489	0.29	0.71
155.707	0.271956	155.707	0.143052	155.707	0.0785997	0.29	0.71
203.092	0.256733	203.092	0.135044	203.092	0.0741998	0.29	0.71
264.897	0.23815	264.897	0.125269	264.897	0.068829	0.29	0.71
300	0.228201	300	0.120036	300	0.0659535	0.29	0.71
345.511	0.215918	345.511	0.113575	345.511	0.0624036	0.29	0.71
450.657	0.190009	450.657	0.0999466	450.657	0.0549155	0.29	0.71
587.802	0.160829	587.802	0.0845979	587.802	0.0464822	0.29	0.71
766.682	0.129396	766.682	0.0680637	766.682	0.0373975	0.29	0.71
1000	0.0974396	1000	0.0512543	1000	0.0281616	0.29	0.71

Maximum	0.71
Year at Maximum	0
Average	0.71
Minimum	0.71

APPENDIX E

RECOMMENDED VALUES AND UNCERTAINTY RANGES ASSOCIATED WITH RESRAD INPUT PARAMETERS

RESRAD Parameter	Recommended Value	Units	Uncertainty Range			
			Value	Statistics	Distribution	Reference: NUREG/CR-6697
Area of contaminated zone	77458	m^2	NA	NA	NA	NA
Thickness of contaminated zone	0.15	m	NA	NA	NA	NA
	2					
Length parallel to aquifer flow	291	m	NA	NA	NA	NA
Time since placement of material	1,3,10,30, 100, 300, 1000	yr	NA	NA	NA	NA
Cover depth	0	m	NA	NA	NA	NA
Density of cover material	NA	g/cm^3	NA	NA	NA	NA
Cover depth erosion rate	NA	m/yr	NA	NA	NA	NA
Density of contaminated zone	1.69	g/cm^3	1.39	Lower value	Truncated Normal	LBG, 2003
			2.11	Upper value		
Contaminated zone erosion rate	0.0006	m/yr	4.00E-04	Minimum	Bounded Normal	LBG, 2003
			8.00E-04	Maximum		
Contaminated zone total porosity	0.45	unitless	0.408	Lower value	Truncated Normal	LBG, 2003
			0.483	Upper value		
Contaminated zone field capacity	0.17	unitless	NA	NA	NA	NA
Contaminated zone hydraulic conductivity	14.56	m/yr	1.38E-03	Lower value	Bounded lognormal-n	LBG, 2003
			1.45E+02	Upper value		
Contaminated zone b parameter	10.4	unitless	2.29	Mean	Bounded lognormal-n	Table 3.5-1 (Silty Clay)
			0.259	Std. Dev		
			4.43	Lower value		
			22	Upper value		
Average annual wind speed	2	m/sec	1.445	Mean	Bounded lognormal-n	Section 4.5
			0.2419	Std. Dev		
			1.4	Lower value		
			13	Upper value		
Humidity in air	NA	g/m^3	NA	NA	NA	NA
Evapotranspiration coefficient	0.5	unitless	0.5	Minimum	Uniform	Section 4.3
			0.75	Maximum		
Precipitation	0.965	m/yr	NA	NA	NA	NA
Irrigation	0.2	m/yr	NA	NA	NA	NA
Irrigation mode	Overhead	unitless	NA	NA	NA	NA
Runoff coefficient	0.305	unitless	0.1	Minimum	Uniform	Section 4.2
			0.8	Maximum		
Watershed area for nearby stream or pond	998939	m^2	NA	NA	NA	NA

RESRAD Parameter	Recommended Value	Units	Uncertainty Range			
			Value	Statistics	Distribution	Reference: NUREG/CR-6697
Accuracy for water/soil computations	0.001	unitless	NA	NA	NA	NA
Saturated zone density	1.69	g/cm^3	1.39	Lower value	Truncated Normal	LBG, 2003
			2.11	Upper value		
Saturated zone total porosity	0.45	unitless	0.408	Lower value	Truncated Normal	LBG, 2003
			0.483	Upper value		
Saturated zone effective porosity	0.29	unitless	0.281	Lower value	Truncated Normal	LBG, 2003
			0.425	Upper value		
Saturated zone field capacity	0.17	unitless	NA	NA	NA	NA
Saturated zone hydraulic conductivity	169.58	m/yr	1.56E+01	Lower value	Bounded lognormal-n	LBG, 2003
			8.51E+02	Upper value		
Saturated zone hydraulic gradient	0.015	unitless	0.021	Mean	Bounded lognormal-n	Table 3.6-1 (National Average)
			0.006	Median		
			0.046	Std Dev		
			0.006	Geo Mean		
Saturated zone b parameter	10.4	unitless	2.29	Mean	Bounded lognormal-n	Table 3.5-1 (Silty Clay)
			0.259	Std. Dev		
			4.43	Lower value		
			22	Upper value		
Water table drop rate	0.001	m/yr	NA	NA	NA	NA
Well pump intake depth (m below water table)	16	m	6	Minimum	Triangular	Section 3.11
			30	Maximum		
			10	Most Likely		
Model: Nondispersion (ND) or Mass-Balance (MB)	Nondispersion	unitless	NA	NA	NA	NA
Well pumping rate	913	m^3/yr	NA	NA	NA	NA
Number of unsaturated zone strata #	1	unitless	N/A	N/A	N/A	N/A
Unsaturated zone thickness	4.5	m	2.296	Mean	Bounded lognormal-n	Section 3.7
			1.276	Std Dev		
Unsaturated zone density	1.69	g/cm^3	1.39	Lower value	Truncated Normal	LBG, 2003
			2.11	Upper value		
Unsaturated zone total porosity	0.45	unitless	0.408	Lower value	Truncated Normal	LBG, 2003
			0.483	Upper value		
Unsaturated zone effective porosity	0.29	unitless	0.289	Mean	Truncated Normal	Table 3.3-1 (Silty Clay)
			0.0735	Std. Dev		
			0.0623	Lower value		
			0.517	Upper value		
Unsaturated zone field capacity	0.17	unitless	NA	NA	NA	NA

RESRAD Parameter	Recommended Value	Units	Uncertainty Range			
			Value	Statistics	Distribution	Reference: NUREG/CR-6697
Unsaturated zone hydraulic conductivity	14.56	m/yr	-1.238	Mean	Bounded lognormal-n	Table 3.4-1 (Silty Clay)
			1.31	Std. Dev		
			0.00506	Lower value		
			16.6	Upper value		
Unsaturated zone b parameter	10.4	unitless	2.29	Mean	Bounded lognormal-n	Table 3.5-1 (Silty Clay)
			0.259	Std. Dev		
			4.43	Lower value		
			22	Upper value		
Distribution coefficients						
Uranium	175	cm^3/g	6.6	Min	Lognormal-n (Clay)	SAIC, 2003
			471.4	Max		
Plutonium	2,000	cm^3/g	316	Min	Truncated lognormal-n (Clay)	SAIC, 2003
			190,000	Max		
Technetium	106	cm^3/g	15.1	Min	Uniform	SAIC, 2003
			172.9	-Max		
Thorium	60,000	cm^3/g	244	Min	Truncated lognormal-n (Clay)	SAIC, 2003
			160000	Max		
			5800	Geo mean		
Neptunium	2	cm^3/g	0.4	Min	Truncated lognormal-n (Clay)	SAIC, 2003
			2575	Max		
			55	Geo mean		
Americium	1,000	cm^3/g	25	Min	Truncated lognormal-n (Clay)	SAIC, 2003
			400000	Max		
			8400	Geo mean		
Inhalation rate	8,600	m^3/yr	4,380	Minimum	Triangular	Section 5
			13,100	Maximum		
			8,400	Most likely		
Mass loading for inhalation	5.9E-06	g/m^3	2.00E-04	Indoor and outdoor time fraction	Empirical	RESRAD
Exposure duration	30	yr	NA	NA	NA	NA
Indoor Dust Filtration Factor	0.4	unitless	0.15	Minimum	Uniform	Section 7.1
			0.95	Maximum		
External gamma shielding factor	0.4	unitless	-1.3	Mean	Bounded lognormal-n	EPA, 2000
			0.59	Std. Dev		
			0.044	Lower value		
			1	Upper value		
Fraction of time spent indoors	0.6571	unitless	NA	NA	NA	NA

RESRAD Parameter	Recommended Value	Units	Uncertainty Range			
			Value	Statistics	Distribution	Reference: NUREG/CR-6697
Fraction of time spent outdoors (on site)	0.1181	unitless	NA	NA	NA	NA
Shape of the contaminated zone: Circular; Non-Circular	Circular	unitless	NA	NA	NA	NA
Fruits, vegetables and grain consumption	42.7	kg/yr	NA	NA	NA	NA
Leafy vegetable consumption	4.66	kg/yr	NA	NA	NA	NA
Milk consumption	NA	L/yr	N/A	N/A	N/A	N/A
Meat and poultry consumption	NA	kg/yr	N/A	N/A	N/A	N/A
Fish consumption	7.34	kg/yr	NA	NA	NA	EPA, 1997
Other seafood consumption	0.9	kg/yr	NA	NA	NA	NA
Soil ingestion rate	43.8	g/yr	0	Minimum	Triangular	EPA, 2000
			36.5	Maximum		
			18.3	Most likely		
Drinking water intake	515	L/yr	510	Mean	Truncated lognormal-n	Table 5.2-2 (Adult) (EPA, 1997)
			478.5	50th Percentile		
			840	90th Percentile		
Contamination fraction of drinking water	1	unitless	NA	NA	NA	NA
Contamination fraction of household water	NA	unitless	N/A	N/A	N/A	N/A
Contamination fraction of livestock water	NA	unitless	N/A	N/A	N/A	N/A
Contamination fraction of irrigation water	1	unitless	NA	NA	NA	NA
Contamination fraction of aquatic food	0.5	unitless	0	Minimum	Triangular	Section 5.5
			1	Maximum		
			0.39	Most Likely		
Contamination fraction of plant food	.5	unitless	NA	NA	NA	EPA, 2000
Contamination fraction of meat	NA	unitless	N/A	N/A	N/A	N/A
Contamination fraction of milk	NA	unitless	N/A	N/A	N/A	N/A
Livestock fodder intake for meat	NA	kg/day	N/A	N/A	N/A	N/A
Livestock fodder intake for milk	NA	kg/day	N/A	N/A	N/A	N/A

RESRAD Parameter	Recommended Value	Units	Uncertainty Range			
			Value	Statistics	Distribution	Reference: NUREG/CR-6697
Livestock water intake for meat	NA	L/day	N/A	N/A	N/A	N/A
Livestock water intake for milk	NA	L/day	N/A	N/A	N/A	N/A
Livestock soil intake	NA	kg/day	N/A	N/A	N/A	N/A
Mass loading for foliar deposition	NA	g/m^3	N/A	N/A	N/A	N/A
Depth of soil mixing layer	0.15	m	0.00	Minimum	Triangular	Section 3.12
			0.60	Maximum		
			0.15	Most Likely		
Depth of roots	0.9	m	NA	NA	NA	NA
Drinking water fraction from ground water	1	unitless	N/A	N/A	N/A	N/A
Household water fraction from ground water	NA	unitless	NA	NA	NA	NA
Livestock fraction from ground water	NA	unitless	N/A	N/A	N/A	N/A
Irrigation fraction from ground water	1	unitless	NA	NA	NA	NA
Wet weight crop yield for non-leafy vegetables	0.7	kg/m^2	0.56	Mean	Truncated lognormal-n	Section 6.5
			0.48	Std Dev		
Wet weight crop yield for leafy	1.5	kg/m^2	NA	NA	NA	NA
Wet weight crop yield for fodder	1.1	kg/m^2	NA	NA	NA	NA
Growing season for non-leafy	0.17	years	NA	NA	NA	NA
Growing season for leafy	0.25	years	NA	NA	NA	NA
Growing season for fodder	0.08	years	NA	NA	NA	NA
Translocation factor for non-leafy	0.1	unitless	NA	NA	NA	NA
Translocation factor for leafy	1	unitless	NA	NA	NA	NA
Translocation factor for fodder	1	unitless	NA	NA	NA	NA
Dry foliar interception fraction for non-leafy vegetables	0.25	unitless	NA	NA	NA	NA
Dry foliar interception fraction for leafy vegetables	0.25	unitless	NA	NA	NA	NA
Dry foliar interception fraction for fodder	0.25	unitless	NA	NA	NA	NA
Wet foliar interception fraction for non-leafy vegetables	0.25	unitless	NA	NA	NA	NA
Wet foliar interception fraction for leafy	0.25	unitless	0.06	Minimum	Triangular	Section 6.7
			0.95	Maximum		
			0.67	Most Likely		

RESRAD Parameter	Recommended Value	Units	Uncertainty Range			
			Value	Statistics	Distribution	Reference: NUREG/CR-6697
Wet foliar interception fraction for fodder	0.25	unitless	NA	NA	NA	NA
Weathering removal constant for vegetation	20	unitless	5.1	Minimum	Triangular	Section 6.6
			84	Maximum		
			18	Most Likely		
Storage time: fruits, non-leafy vegetables, and grain	14	days	NA	NA	NA	NA
Storage time: leafy vegetables	1	days	NA	NA	NA	NA
Storage time: milk	NA	days	N/A	N/A	N/A	N/A
Storage time: meat and poultry	NA	days	N/A	N/A	N/A	N/A
Storage time: fish	NA	days	NA	NA	NA	NA
Storage time: crustaceans and mollusks	7	days	NA	NA	NA	NA
Storage time: well water	1	days	N/A	N/A	N/A	N/A
Storage time: surface water	1	days	NA	NA	NA	NA
Storage time: livestock fodder	NA	days	N/A	N/A	N/A	N/A
Thickness of building foundation	NA	m	N/A	N/A	N/A	N/A
Bulk density of building foundation	NA	g/cm^3	N/A	N/A	N/A	N/A
Total porosity of the cover material	NA	unitless	N/A	N/A	N/A	N/A
Total porosity of the building foundation	NA	unitless	N/A	N/A	N/A	N/A
Volumetric water constant of the cover material	NA	unitless	N/A	N/A	N/A	N/A
Volumetric water constant of the foundation	NA	unitless	N/A	N/A	N/A	N/A
Diffusion coefficient for radon gas in cover material	NA	m/sec	N/A	N/A	N/A	N/A
Diffusion coefficient for radon gas in foundation material	NA	m/sec	N/A	N/A	N/A	N/A
Diffusion coefficient for radon gas in contaminated zone soil	NA	m/sec	N/A	N/A	N/A	N/A
Radon vertical dimension of mixing	NA	m	N/A	N/A	N/A	N/A
Average building air exchange rate	NA	1/hour	N/A	N/A	N/A	N/A
Height of the building (room)	NA	m	N/A	N/A	N/A	N/A
Building interior area factor	NA	unitless	N/A	N/A	N/A	N/A
Building depth below ground surface	NA	m	N/A	N/A	N/A	N/A
Emanating power of Rn-222 gas	NA	unitless	N/A	N/A	N/A	N/A
Emanating power of Rn-220 gas	NA	unitless	N/A	N/A	N/A	N/A

NA = Not Available
N/A = Not Applicable