Westinghouse

Derivation of Site-Specific DCGLs for Westinghouse Electric Company Hematite Facility (Groundwater)

Document # DO-05-004

NRC Licence SNM-33, Docket No. 70-36

HEMATITE, MISSOURI

September 2005

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ACRONYMS & ABBREVIATIONS

ABB	Asea, Brown, 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
f(p)min	minimum dose related to input parameter
f(p)max	maximum dose related to input parameter
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	milligrams 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/FS	remedial investigation/feasibility study

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

1.0 INTRODUCTION[1]

1.1 PURPOSE

The purpose of this report is to calculate derived concentration guideline levels (DCGL) for the radionuclides of concern that are potentially present in groundwater at the Westinghouse Electric Co. Hematite site (the site). The DCGLs are required to 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 (NRC 1987) 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 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 DCGLs presented in this report would allow release of the site without institutional controls. As noted in the Decommissioning Plan, Westinghouse has established these DCGLs in accordance with NRC guidance and protocol. Under the NCP process, the approved DCGLs will be included in the consideration of applicable or relevant and appropriate requirements (ARARs) and the establishment of cleanup levels.

1.2 SCOPE

As discussed in a companion document describing the Hematite Decommissioning Plan (Westinghouse 2005b), the only radiological contaminants of concern are the uranium isotopes (U-238, U-234 and U-235) and technetium (Tc-99). Site characterization data for other radionuclides are below the limits of quantitation or within the range of background variability. Thus, the scope of this document is limited to groundwater that may have been impacted by licensed activities. This document addresses the following radionuclides of potential concern:

[1] Much of the content of Sections 1 to 4 of this report have been taken from the "Derivation of Site Specific DCGLs for Westinghouse Electric Company Hematite Facility (Resident Gardener)" Document # DO-04-012 (Westinghouse 2005a), and modified as required.

- uranium-234 (U-234),
- uranium-235 (U-235),
- uranium-238 (U-238), and
- technetium-99 (Tc-99).

This report does not address the impact of the chemical effects of uranium or the effects of non-radiological contaminants present at the site nor does it address the derivation of DCGLs for any structures (i.e., non- environmental media) or contaminated soils that are present at the site (see the companion document Westinghouse 2005a). These issues may be addressed in greater detail in the RI/FS process that is currently ongoing. To the extent possible, this report uses site-specific information from available documents to ensure consistency in the dose models.

RESRAD Version 6.22 (Yu *et al.* 2002) was used during the derivation of groundwater 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) and is widely used to determine site-specific residual radiation guidelines and doses to future hypothetical on-site receptors at sites that are contaminated with residual radioactive materials.

2.0 REGULATORY FRAMEWORK FOR DEVELOPMENT OF THE GROUNDWATER DCGL

The NRC has the regulatory authority over the NRC 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 (40 CFR 300). In addition to being radioactive, uranium is also chemically toxic, an issue that may need to be considered in the future (e.g., by comparison to the EPA's maximum contaminant level (MCL) for uranium in drinking water (CFR 2000)).

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 3.1 illustrates the location of the plant.

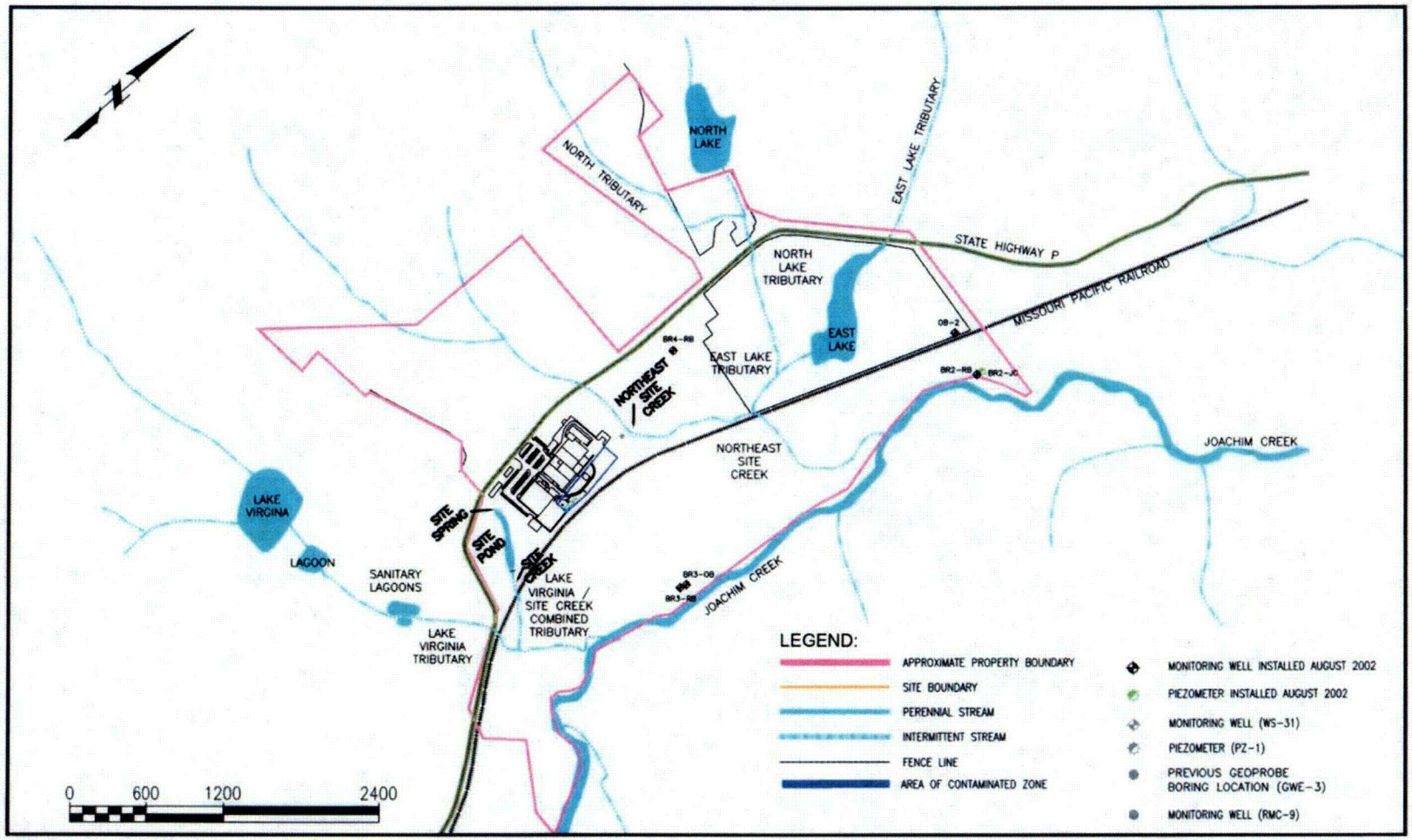
In 1970, UNC and Gulf Nuclear Corporation entered into a joint venture, forming Gulf United Nuclear Fuels Corporation (Gulf). Gulf owned and operated the facility until the spring of 1973, when Gulf closed the plant and began decommissioning. The property was conveyed to General Atomic Company in January 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 of 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 enriched uranium 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
- the production of highly enriched oxides to General Atomics for use in nuclear rocket projects.

FIGURE 3.1
SITE LOCATION AND AREA OF CONTAMINATED ZONE



SOURCE: Adapted from Westinghouse, 2005a

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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 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.

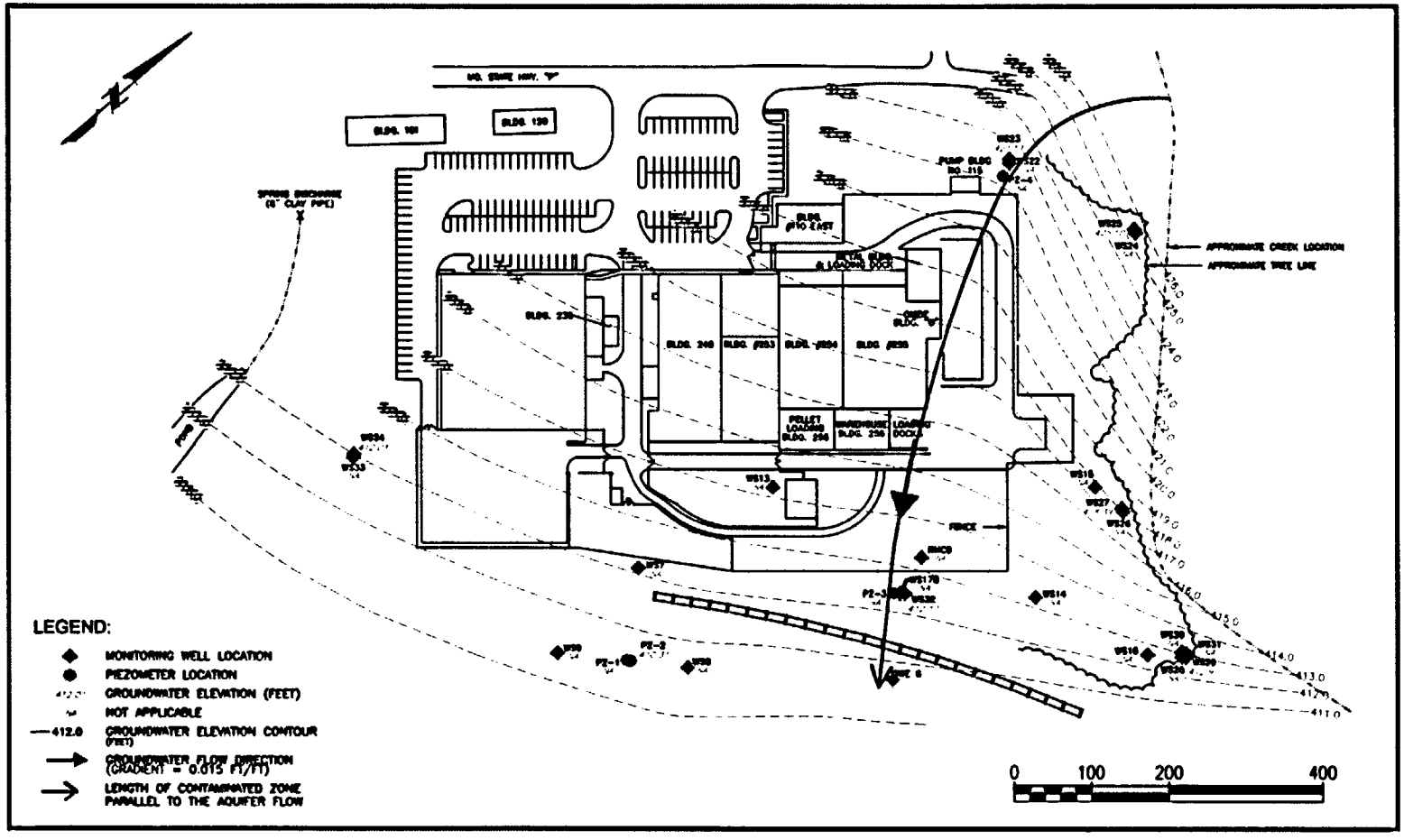
The Red Room was specifically used for the reduction of UF_6 to uranium tetrafluoride (UF_4), the conversion of UF_4 to uranium metal, HEU scrap recovery, and other chemical conversion processes using HEU. Building 255 was used for the fabrication of uranium compounds into physical shapes. Other activities within the plant included the blending of UO_2 with other chemical compounds. Figure 3.2 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

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 (Missouri 1956) 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.

FIGURE 3.2
LOCATION OF THE BUILDINGS, GROUNDWATER FLOW AND GRADIENT



SOURCE: Adapted from Westinghouse, 2005a

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. A more comprehensive geologic investigation performed by Leggette, Brashears & Graham, Inc., LBG provides more site-specific information regarding the unconsolidated subsurface (LBG 2002). 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* (Missouri Geological Survey 1979) and the *Bedrock Geologic Map of the Festus 7.5 Minute Quadrangle* (Whitfield and Middendorf) 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 (Missouri Geological Survey 1979). 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 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

3.3.1 Hydrogeology

LBG characterized the near-surface hydrostratigraphic units at the site (LBG 2002). In that investigation, two groundwater 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 (LBG 2002), shows that the Roubidoux unit also flows in the southeast direction.

3.3.2 Hydrology, Precipitation and Stream Characteristics

The *Missouri Water Atlas* (Missouri 1986) 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* (Miller *et al.* 1990), 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* (Mearns 1990), 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 enriched uranium is governed by the physical and chemical processes used to produce the enriched uranium 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 enriched uranium fuel stock used at the site is known to have come from gaseous diffusion enrichment processes. There is no indication that enriched uranium 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 enriched uranium. 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 low enriched uranium (LEU) fuel stock was produced at about 3.5% enrichment. High enriched uranium (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.

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 processed 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 enriched uranium 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 (LBG 2003).

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 enriched uranium in the environment. However, as noted previously, all radionuclides in groundwater at the Hematite site other than the uranium isotopes (U-238, U-234 and U-235) and technetium (Tc-99) are either below the limit of quantitation or in the range of background levels (Westinghouse 2005b).

5.0 REVIEW OF GROUNDWATER CONCENTRATIONS

This section provides a summary of measured concentrations of Tc-99, U-234, U-235 and U-238 in groundwater on, and near, the site in four formations. The concentrations of these radionuclides are measurably above background levels in the overburden formations at locations in the vicinity of the burial pits and the buildings. There is no apparent elevation in the two bedrock formations. Concentrations of other radionuclides of potential concern were below limits of quantitation or were below background levels and have not been considered further.

5.1 DATA CONSIDERED

Groundwater concentrations have been measured on the site in various programs and over a number of years. The most comprehensive program relative to spatial extent and the number of groundwater formations considered is the site-wide program conducted in 2004. Samples were collected from four formations: two overburden zones; shallow overburden (SOB) and deep overburden (OB) and two bedrock formations; Jefferson City/Cotter (JC) and Roubidoux (RB) were sampled.

Measurements from this program indicated measurable groundwater concentrations of Tc-99, U-234, U-235 and U-238; however, the measurements of all other radionuclides of potential interest were below limits of quantitation or within the range of background levels (Westinghouse 2005b). Measured concentrations of Tc-99, U-234, U-235 and U-238 considered in this analysis are documented in Westinghouse (2005b).

5.2 URANIUM

Table 5.1 summarizes the measurements for uranium activity and mass concentrations reported in the samples. The table shows that the overburden locations have the highest mean and highest maximum uranium concentrations. The maximum concentrations in the overburden formations are in the vicinity of the burial pits and buildings. For example, Figure 5.1 shows the spatial distribution of groundwater concentrations in the deep overburden formation: the uranium activity concentrations above 10 pCi/L are located within the vicinity of the buildings and burial pits.

TABLE 5.1
SUMMARY OF URANIUM IN GROUNDWATER MEASUREMENTS

	Formation	Num. of Obs.	Median	Mean	Maximum
Activity Concentration (pCi/L)					
Bedrock	JC	16	2.4	3.0	7.9
	RB	10	5.5	6.1	13.8
Overburden	OB	70	0.4	7.2	387.8
	SOB	12	1.4	21.8	206.2
Mass Concentration (µg U/L)					
Bedrock	JC	16	1.5	1.8	5.2
	RB	10	1.5	1.7	3.7
Overburden	OB	70	0.4	3.7	175.1
	SOB	12	1.1	10.8	82.6

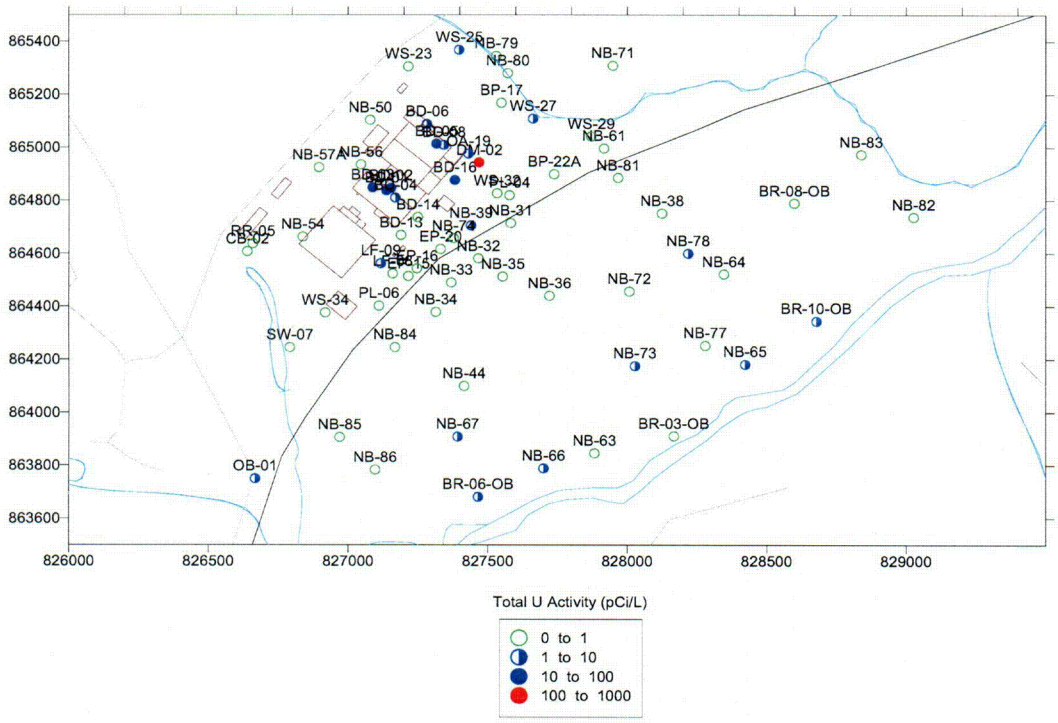
Notes:

Activity has been assumed to be sum of U-238, U-235 and U-234 activity.
A value of zero was assigned for below detection limit measurements.

The table indicates that the mean concentration in the shallow overburden is higher than the mean concentrations in the deep overburden samples. However, the SOB samples are generally nearer the buildings where contamination is expected to be higher while the OB samples represent a much larger area (much of which is expected to be unaffected).

There is no apparent evidence of contamination by uranium in the bedrock formations. The range of concentrations is lower than in the overburden samples and there was no readily apparent spatial pattern in the measured concentrations. However, it is interesting that the median, or typical, concentrations were higher in the bedrock formations than in the overburden formation.

FIGURE 5.1
SPATIAL DISTRIBUTION OF URANIUM ACTIVITY CONCENTRATIONS (pCi/L) IN THE DEEP OVERBURDEN FORMATION



Note:

From Total U in GW.xls provided by Westinghouse (in email of 29 July 2005)

Ratio between Uranium Activity and Uranium Mass Concentrations

The groundwater data exhibit disequilibrium among the uranium isotopes. Figure 5.2 shows a plot between uranium activity and uranium mass concentration in the groundwater samples. The line on the graph shows the relationship between uranium mass and total uranium activity (approximated as 1.5 μg equals 1 pCi) if all uranium radionuclides were at secular equilibrium.

The figure shows that there is more activity in the groundwater than if natural equilibrium were present: this implies that the activity of shorter-lived uranium radionuclides (U-234 and/or U-235) is higher than the activity of U-238. While enriched uranium has been processed at the site and is present in contaminated soil, the apparent disparity in groundwater samples are also due, in part, to natural processes. The ratios of U-234 to U-238 can range substantially higher than 1:1 in groundwater (Ivanovich and Harmon 1992). A national US survey for drinking water suggests 1.3 pCi equals 1 g for uranium (compared to 0.67 pCi equals 1 g if U-234/U-238 = 1), implying a ratio of about 3:1 for U-234 activity relative to U-238 activity (Longtin 1990).

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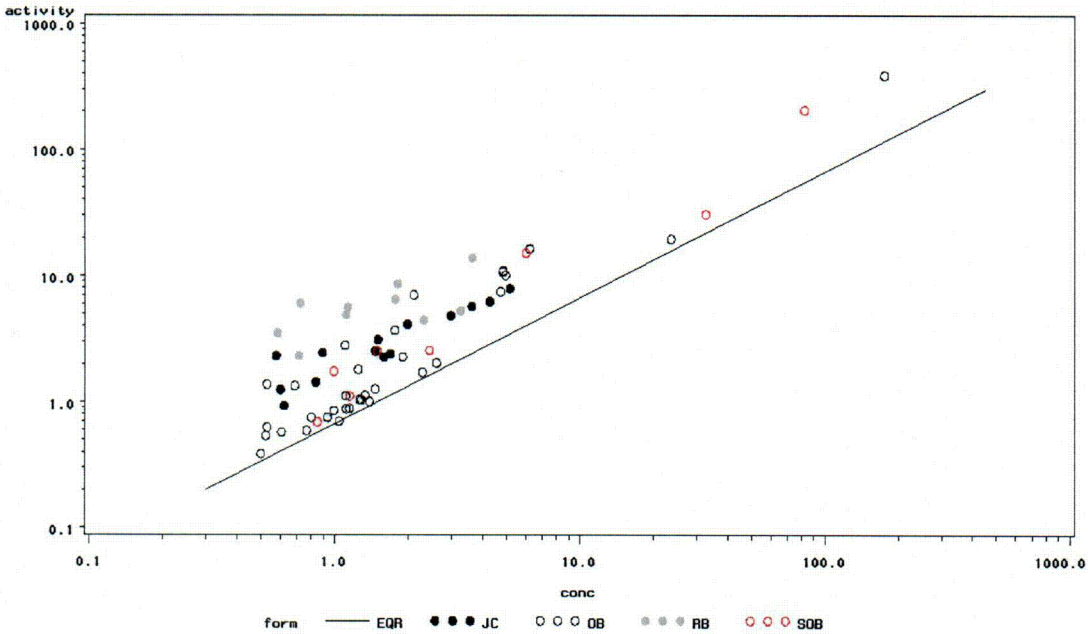
The largest disparities in activity appear in the bedrock formations with the disparity in Jefferson City/Cotter formation (about 3 times) being lower compared to the disparity in the Roubidoux formation (about 10 times). The groundwater from overburden zones has less disparity between activity and mass concentration; however, there does appear to be two groupings. For overburden samples, there is a group of measurements close to "the line" and another with more disparity between activity and mass concentration. There may be some effect of contamination by enriched uranium as the groundwater samples with higher mass concentrations tend to also have higher disparity between activity and mass concentrations. Separate groundwater derived concentration guideline levels are developed in the next section for each of U-238, U-234 and U-235.

FIGURE 5.2
DISPARITY BETWEEN URANIUM ACTIVITY CONCENTRATION (pCi/L) AND URANIUM MASS CONCENTRATION (µg/L)



Note: does not include data with uranium concentrations less than 0.5 µg/L

5.3 TECHNETIUM

Table 5.2 shows a summary of the technetium data collected in the December 2004 program. Most of the measurements were below the limit of quantitation, particularly for both of the bedrock formations where all measured concentrations were below the limit of quantitation. Measurable concentrations of Tc-99 in overburden samples were located in the vicinity of the buildings and burial pits. Figure 5.3 shows the spatial pattern for the deep overburden samples.

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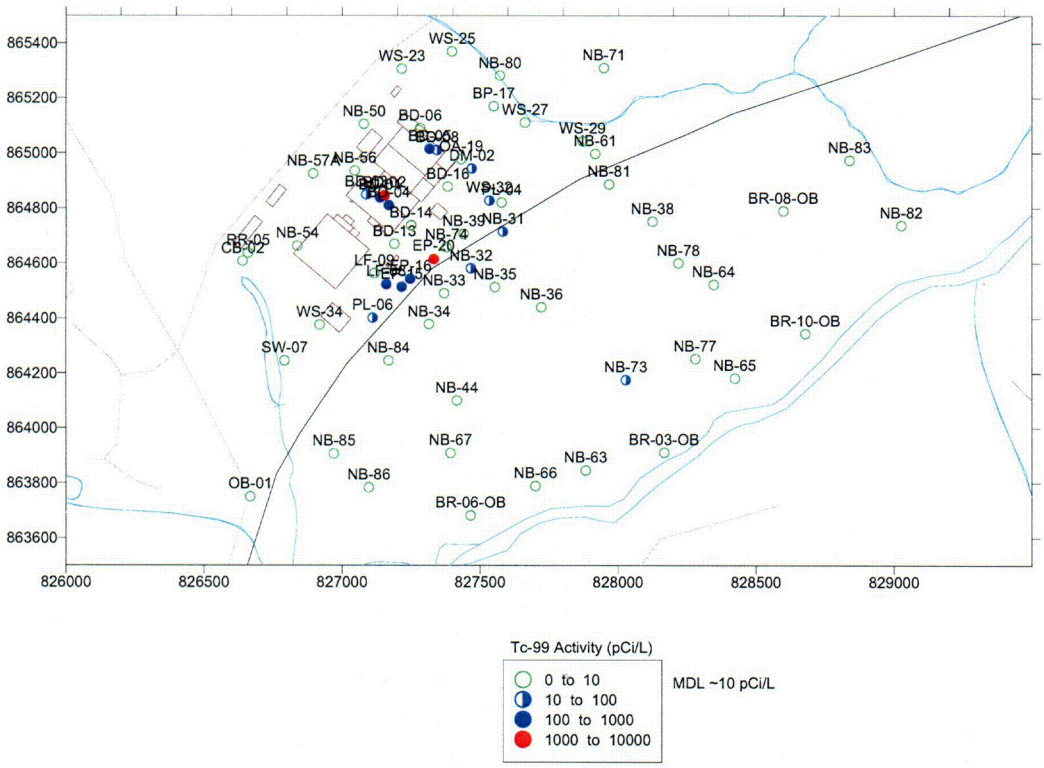
TABLE 5.2
SUMMARY OF TECHNETIUM-99 IN GROUNDWATER MEASUREMENTS

	Formation	Num. of Obs.	Median	Mean	Maximum
Activity Concentration (pCi/L)					
Bedrock	JC	19	4.6	4.6	9.3
	RB	10	3.2	3.1	6.4
Overburden	OB	70	5.0	134.0	5100.0
	SOB	12	22.4	367.7	3610.0

Note:

All measured concentrations in the bedrock formations were below the limit of quantitation.
The instrument reading was used rather than substitution with a value of zero.

FIGURE 5.3
SPATIAL DISTRIBUTION OF TECHNETIUM-99 ACTIVITY CONCENTRATIONS (pCi/L) IN THE DEEP OVERBURDEN FORMATION



Note:

From Tc in GW.xls provided by Westinghouse (in email of 29 July 2005).

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5.4 DISCUSSION

The groundwater data for uranium and Tc-99 indicate that groundwater contamination is present in overburden formations at locations near the buildings and burial pits. There is little evidence of contamination of bedrock formations or in overburden at locations further from the buildings and burial pits. The presence of elevated Tc-99 and uranium concentrations in some samples supports the assessment of these radionuclides as radionuclides of concern. The groundwater concentrations of other radionuclides such as neptunium, plutonium and americium were all below detection limits or limits of quantitation suggesting that these radionuclides may not be of concern regarding the groundwater source.

There is variation in relative activity of uranium isotopes in groundwater. Background characterization of uranium concentrations should recognize the variation in both relative activity and in mass concentrations that are present in the formations.

6.0 DEVELOPMENT OF THE DERIVED CONCENTRATION GUIDELINE LEVELS (GROUNDWATER)

6.1 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 as described in Sections 1.1 and 2.0 of this report.

6.2 CONCEPTUAL SITE MODEL

The conceptual site model (CSM) identifies the relationship between the sources of contamination (groundwater), 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.

The residual radioactive material in this CSM is defined as a contaminated groundwater plume which is intercepted by a well used as a source of drinking and irrigation water by a resident with a backyard garden (resident gardener)[2]. For the development of groundwater DCGLs, there is no radioactive contamination attached to the surficial soils or soils surrounding the aquifer. Environmental pathways include ingestion of well water, ingestion of produce irrigated with well water, and, ingestion of fish from a pond that captures runoff from irrigation.

Note that RESRAD models migration of contaminants into groundwater and subsequent dispersal though water-dependent pathways. This modeling component is included in soil DCGL calculations. Specific exposure pathways included in the development of the soil DCGLs are external gamma, inhalation, and ingestion although, as noted, the ingestion pathway includes multiple routes. For the purposes of developing groundwater DCGLs, the critical receptor for the site is a resident gardener. This critical receptor scenario has the same characteristics as the resident gardener scenario used in developing the soil DCGLs (Westinghouse 2005a). This receptor incurs a radiological dose from all complete[3] exposure pathways and is the subject of DCGL calculations. The following sections of the report provide additional details on the critical receptor and the exposure pathways modeled by the RESRAD code.

[2] Westinghouse believes that the realistic future use of the site is that the small (approximately 8-acre portion where the existing soil and groundwater contamination is present) central portion of the site would continue as an industrial site while the major portion of the remaining site would be a residential gardener use. These projected land uses are consistent with the current use and are anticipated to continue into the future.

[3] A complete exposure pathway is where all the linkages necessary for a source to result in a dose are present.

6.2.1 Selection of Critical Receptor Scenario

Under the resident gardener scenario, a resident is assumed to move onto the site after it has been released for use without radiological restrictions, builds a home, sinks a well into the aquifer for drinking and for irrigating a backyard garden. It should be understood that this scenario is likely to lead to results that greatly overestimate the potential dose from groundwater pathways and hence results in an unduly restrictive groundwater DCGL. This is so since it is anticipated that non-contaminated municipal water would be provided to residential developments in the area, thus cutting off, as a minimum, the drinking water pathway. Appendix A presents the scenario-specific RESRAD parameters used in the DCGL calculations described in this report.

6.2.2 Selection of Exposure Pathways

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

(1) ingestion of well water;
(2) ingestion of irrigated produce (fruits and vegetables); and
(3) ingestion of fish from a pond that captures runoff from irrigation.

Note that the inhalation of radon is not required by the NRC to be included in the calculation of DCGLs, and is not considered a pathway since radium-226 (the parent of radon-222) is not a radionuclide of concern due to licensed activities at the site.

6.3 METHODOLOGY TO DETERMINE GROUNDWATER DCGLS

Site characterization at the Hematite Facility has shown measurable, above background concentrations of Tc-99 and the three uranium isotopes, U-238, U-235 and U-234 in groundwater. At the time that the site is released for unrestricted use, there are expected to be residual concentrations of these radionuclides in groundwater representing a potential dose contribution to future users of the site. Potential exposure pathways that are expected to result in the highest doses involve the sinking of a well into the impacted groundwater, and use of the well water for drinking and irrigating crops. This dose contribution would be in addition to that resulting from the leaching of radionuclides from soils as was considered in the development of the soil DCGLs (see Westinghouse 2005a). It was necessary therefore to develop DCGLs for groundwater as described in this report.

The groundwater DCGLs were calculated using the RESRAD 6.22 model generally following the guidance provided by Charles Yu (2005) and the paper on "Developing Site-Specific Derived Concentrations Guideline Levels for Multiple Media at the Connecticut Yankee Haddam Neck Plant" by Taylor et al (2003). In the following paragraphs, the critical group is identified and the exposure pathways are described. The parameter inputs used to apply the RESRAD 6.22 model to the groundwater scenario, for which it was not specifically adapted, are highlighted, and the calculations to determine DCGLs for each of the radionuclides are presented. Spreadsheet calculations used determine radionuclide concentrations in water corresponding to annual doses of 25 mrem from all water dependent pathways are shown, and Quality Assurance checks are described.

The critical group was identified as a suburban resident with a backyard garden "resident gardener" who lives on the site and sinks a well into the impacted groundwater. The water is used for human consumption and irrigating gardens.

The following exposure pathways to members of the critical group from well water were considered:

- ingestion of drinking water;
- ingestion of irrigated fruits and vegetables; and
- ingestion of fish from a pond that captures irrigation runoff.

The conceptual model for this backyard gardener scenario places residual radioactive materials in the water phase in a soil horizon within the saturated zone, and all sources in the solid phase that had contributed to this contamination have been removed. Groundwater is withdrawn from the saturated zone via a well, and used for irrigation and drinking water. This groundwater serves as the source from which the critical group is exposed via the pathways described above.

The RESRAD code was originally designed to estimate radiation doses from residual radioactive material contained in a solid phase source above the water table rather than a liquid phase source in the groundwater itself. To model the scenario described above, it was necessary to modify the input to RESRAD to reflect the conceptual model which considers doses from water-dependent pathways only. To eliminate the water-independent pathways, a cover layer 3 m thick was placed above the contaminated layer to shut down external gamma, resuspension and inhalation of dust, soil intake by humans and livestock, and soil-to-plant uptake by vegetables and livestock feed. Finally, the RESRAD model was set to the mass balance option for water transport, and the number of unsaturated zones strata was set to zero.

To calculate isotope-specific DCGLs using RESRAD 6.22, the solid phase concentration of each radionuclide in the contaminated layer was set at the value that resulted in an annual dose of 25 mrem/y (an iterative process) from all water-dependent pathways. The corresponding liquid phase radionuclide concentration is not provided by RESRAD, but was calculated separately using the spreadsheet shown in Table 6.1. The solid phase radionuclide concentration for each radionuclide was used to calculate the liquid phase concentration (Table 6.1) using the following relationship provided by Taylor (2003):

$$C = 1000\, S\, \rho \,/\, \{[1+(K_d\, \rho\, /n)]n\}$$

Where

C	=	equilibrium groundwater concentration, pCi/L;
S	=	initial radionuclide concentration in the solid phase, pCi/g;
ρ	=	bulk density in contaminated zone, g/cm^3;
K_d	=	distribution coefficient in the contaminated zone, cm^3/g;
n	=	total porosity of the contaminated zone, cm^3/cm^3; and
1000	=	units conversion factor, cm^3/L.

The liquid phase concentration of U-238 was calculated at 175.0 pCi/L where the solid phase concentration was 30.67 pCi/g (Table 6.1) using the parameter values from the RESRAD code. As indicated above, the solid phase concentration of 30.67 pCi/g U-238 in the contaminated zone resulted in a maximum annual dose of 25 mrem/y from all water-dependent pathways at 0.5 years into the simulation. The corresponding annual dose from drinking water alone was predicted by RESRAD at 24.24 mrem (see the last line in Table 6.1). As a Quality Assurance check, the annual dose from drinking water was calculated in the spreadsheet shown in Table 6.1 using parameter values taken from the RESRAD code, and was found to be in exact agreement with the corresponding value predicted by RESRAD. Therefore, there is confidence that a U-238 concentration of 175.0 pCi/L in groundwater would result in an annual dose of 25 mrem/y from all water-dependent pathways. Similar calculations of drinking water dose from the other radionuclides were made and the results are shown in Table 6.1 to be in excellent agreement with the RESRAD results.

The results of the RESRAD calculations are summarized in Table 6.2, and the radionuclide concentrations in water resulting in an annual dose of 25 mrem/y from water dependent pathways are shown in the second column from the left. The limiting radioactivity concentrations of uranium isotopes are similar because the ingestion dose factors are similar where expressed on a radioactivity basis. The percentages of annual dose from each water-dependent pathway are shown in the five columns on the right. In all cases, drinking water is the major contributor to dose.

TABLE 6.1
CALCULATION OF RADIONUCLIDE CONCENTRATIONS IN WATER (DCGLs), AND DRINKING WATER DOSE

	Unit	Name	U-238	U-235	U-234	Tc-99	Equation / Reference
Solid-Liquid Phase Concentrations							
radionuclide conc in solid phase	pCi/g	consol	30.67	30.81	29.150	3330.0	
bulk density	g/cm^3	denblk	1.69	1.69	1.69	1.69	R013[a]
distribution coefficient	cm^3/g	kd	175	175	175	106	R016[a]
total porosity	cm^3/cm^3	poros	0.45	0.45	0.45	0.45	R013[a]
Radionuclide concentration in water	pCi/L	conwat	175.0	175.8	166.3	31336.4	=1000*consol*denblk/((1+(kd*denblk/poros))*poros)
Drinking Water-Human							
annual intake water	L/y	manwat	515	515	515	515	R018[a]
fraction of intake from site	-	watfrac	1.0	1.0	1.0	1.0	
ingestion dose factor	mrem/pCi	dcf	2.69E-04	2.67E-04	2.83E-04	1.46E-06	D-1[a]
annual drinking water dose	mrem/y	doswat	24.24	24.17	24.24	23.56	=conwat*manwat*watfrac*dcf
RESRAD output at 0.5 y	**mrem/y**		**24.24**	**24.24**	**24.24**	**23.57**	

[a] Menu value used in RESRAD (see Appendices A and B).

TABLE 6.2[4]
LIMITING RADIOACTIVITY CONCENTRATIONS AND PERCENTAGE OF DOSE FROM EACH PATHWAY

Radionuclide	Radiological Limit* (pCi/L)	Time to Peak Dose (years)	Water %	Fish %	Plant %	Meat %	Milk %
Tc-99	31336	0.2146	94.28	1.08	4.64	0	0
U-234	166	0.4996	96.95	0.93	2.12	0	0
U-235	176	0.5	96.95	0.93	2.11	0	0
U-238	175	0.4783	96.96	0.93	2.12	0	0

* Concentration in water resulting in 25 mrem/y from water-dependent pathways

[4] In addition to being radioactive, uranium is chemically toxic. (e.g. see CFR 2000). The potential role of the chemical toxicity of uranium may need to be considered at a later date.

7.0 UNCERTAINTY ANALYSIS

It is acknowledged that even the best models are imperfect reflections of the real world. However, the RESRAD family of models is well-established and widely recognized by the NRC, EPA and the DOE as acceptable models for calculation of DCGLs. Thus, while there is, and would always be, some uncertainty in model results, the uncertainties with the use of the RESRAD model are considered to be within generally accepted norms.

In the development of groundwater DCGLs described previously, the reference scenario has been that of a resident gardener. Where there is some uncertainty concerning the amount of backyard produce a critical receptor might consume, the larger proportion of the dose via groundwater pathways is from drinking water and the uncertainty in the consumption rate of irrigated produce is unlikely to have much impact on dose.

In addition, it is understood that, non-contaminated, municipal water would be supplied to any residential development. In this situation, the drinking water pathway and some or all of the irrigation pathways would be eliminated.

Overall, while it is understood that there is uncertainty associated with calculations such as those described in this report, the use of a widely accepted and well-documented model (RESRAD) helps to ensure that the uncertainty is within generally accepted levels. In addition, as described earlier, the analysis was performed with intentionally conservative assumptions that are more likely than not to result in an overestimate of the dose.

8.0 SUMMARY AND CONCLUSIONS

This derivation of groundwater DCGLs for the Hematite site has utilized the RESRAD model for the purposes of establishing a relationship between the concentration of a radionuclide in groundwater and radiological dose to a resident gardener. Once this relationship was established, it was used to estimate the groundwater concentrations that correspond to an annual dose of 25 mrem – the groundwater DCGL with the results as summarized in Table 8.1.

TABLE 8.1
DCGLs (EACH ISOTOPE ALONE)

Radionuclide	DCGL* (pCi/L)
Tc-99	31,336
U-234	166
U-235	176
U-238	175

* Concentration in water resulting in 25 mrem/y from water-dependent pathways.

9.0 REFERENCES

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APPENDIX A

PARAMETER VALUES USED IN THE RESRAD CALCULATIONS

APPENDIX A: Parameter Values Used in RESRAD

(Note: current values were used in RESRAD model calculations)

Menu	Parameter	Current Value	RESRAD Default	Reference for Current Value
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Tc-99	1.460E-06	1.460E-06	RESRAD Default
D-1	Pb-210+D	7.270E-03	7.270E-03	RESRAD Default
D-1	Ra-226+D	1.330E-03	1.330E-03	RESRAD Default
D-1	Th-230	5.480E-04	5.480E-04	RESRAD Default
D-1	U-234	2.830E-04	2.830E-04	RESRAD Default
D-1	Ac-227+D	1.480E-02	1.480E-02	RESRAD Default
D-1	Pa-231	1.060E-02	1.060E-02	RESRAD Default
D-1	U-235+D	2.670E-04	2.670E-04	RESRAD Default
D-1	Pb-210+D	7.270E-03	7.270E-03	RESRAD Default
D-1	Ra-226+D	1.330E-03	1.330E-03	RESRAD Default
D-1	Th-230	5.480E-04	5.480E-04	RESRAD Default
D-1	U-234	2.830E-04	2.830E-04	RESRAD Default
D-1	U-238+D	2.690E-04	2.690E-04	RESRAD Default
D-34	Food transfer factors:			
D-34	Tc-99, plant/soil concentration ratio, dimensionless	5.000E+00	5.000E+00	RESRAD Default
D-34	Tc-99, beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RESRAD Default
D-34	Tc-99, milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RESRAD Default
D-34	Pb-210+D, plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RESRAD Default
D-34	Pb-210+D, beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RESRAD Default
D-34	Pb-210+D, milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RESRAD Default
D-34	Ra-226+D, plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RESRAD Default
D-34	Ra-226+D, beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RESRAD Default
D-34	Ra-226+D, milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RESRAD Default
D-34	Th-230+D, plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RESRAD Default
D-34	Th-230+D, beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RESRAD Default
D-34	Th-230+D, milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RESRAD Default
D-34	U-234, plant/soil concentration ratio,	2.500E-03	2.500E-03	RESRAD Default

Menu	Parameter	Current Value	RESRAD Default	Reference for Current Value
	dimensionless			
D-34	U-234, beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RESRAD Default
D-34	U-234, milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RESRAD Default
D-34	Ac-227+D, plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RESRAD Default
D-34	Ac-227+D, beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RESRAD Default
D-34	Ac-227+D, milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RESRAD Default
D-34	Pa-231+D, plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RESRAD Default
D-34	Pa-231+D, beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RESRAD Default
D-34	Pa-231+D, milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RESRAD Default
D-34	U-235+D, plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RESRAD Default
D-34	U-235+D, beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RESRAD Default
D-34	U-235+D, milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RESRAD Default
D-34	Pb-210+D, plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RESRAD Default
D-34	Pb-210+D, beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RESRAD Default
D-34	Pb-210+D, milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RESRAD Default
D-34	Ra-226+D, plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RESRAD Default
D-34	Ra-226+D, beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RESRAD Default
D-34	Ra-226+D, milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RESRAD Default
D-34	Th-230+D, plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RESRAD Default
D-34	Th-230+D, beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RESRAD Default
D-34	Th-230+D, milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RESRAD Default
D-34	U-234, plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RESRAD Default
D-34	U-234, beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RESRAD Default
D-34	U-234, milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RESRAD Default

Menu	Parameter	Current Value	RESRAD Default	Reference for Current Value
D-34	U-238+D, plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RESRAD Default
D-34	U-238+D, beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RESRAD Default
D-34	U-238+D, milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RESRAD Default
D-5	Bioaccumulation factors, fresh water, L/kg			
D-5	Tc-99, fish	2.000E+01	2.000E+01	RESRAD Default
D-5	Pb-210+D, fish	3.000E+02	3.000E+02	RESRAD Default
D-5	Ra-226+D, fish	5.000E+01	5.000E+01	RESRAD Default
D-5	Th-230, fish	1.000E+02	1.000E+02	RESRAD Default
D-5	U-234, fish	1.000E+01	1.000E+01	RESRAD Default
D-5	Ac-227+D, fish	3.000E+02	3.000E+02	RESRAD Default
D-5	Pa-231, fish	5.000E+01	5.000E+01	RESRAD Default
D-5	U-235+D, fish	1.000E+02	1.000E+02	RESRAD Default
D-5	Pb-210+D, fish	3.000E+02	3.000E+02	RESRAD Default
D-5	Ra-226+D, fish	5.000E+01	5.000E+01	RESRAD Default
D-5	Th-230, fish	1.000E+02	1.000E+02	RESRAD Default
D-5	U-234, fish	1.000E+01	1.000E+01	RESRAD Default
D-5	U-238+D, fish	1.000E+01	1.000E+01	RESRAD Default

Site-Specific Parameter Summary

(Note: User input values were used in RESRAD model calculations)

Menu	Parameter	User Input	RESRAD Default	Reference for User Input
R011	Area of contaminated zone (m^2)	7.746E+04	1.000E+04	Provided by Westinghouse
R011	Thickness of contaminated zone (m)	2.000E+00	2.000E+00	Provided by Westinghouse
R011	Length parallel to aquifer flow (m)	2.910E+02	1.000E+02	Provided by Westinghouse
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	2.500E+01	Provided by Westinghouse
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	Provided by Westinghouse
R011	Times for calculations (yr)	3.827E-01	1.000E+00	Used for assessment
R011	Times for calculations (yr)	5.000E-01	3.000E+00	Used for assessment
R011	Times for calculations (yr)	1.000E+00	1.000E+01	Provided by Westinghouse
R011	Times for calculations (yr)	3.000E+00	3.000E+01	Provided by Westinghouse
R011	Times for calculations (yr)	1.000E+01	1.000E+02	Provided by Westinghouse
R011	Times for calculations (yr)	3.000E+01	3.000E+02	Provided by Westinghouse
R011	Times for calculations (yr)	1.000E+02	1.000E+03	Provided by Westinghouse
R011	Times for calculations (yr)	3.000E+02		Provided by Westinghouse
R011	Times for calculations (yr)	1.000E+03		Provided by Westinghouse
R012	Initial principal radionuclide (pCi/g): Tc-99	2.558E+03	0.000E+00	Value used for assessment
R012	Initial principal radionuclide (pCi/g): U-234	2.583E+01	0.000E+00	Value used for assessment
R012	Initial principal radionuclide (pCi/g): U-235	2.726E+01	0.000E+00	Value used for assessment
R012	Initial principal radionuclide (pCi/g): U-238	2.718E+01	0.000E+00	Value used for assessment
R013	Cover depth (m)	3.000E+00	0.000E+00	Used for assessment
R013	Density of cover material (g/cm^3)	1.500E+00	1.500E+00	Provided by Westinghouse
R013	Cover depth erosion rate (m/yr)	0.000E+00	1.000E-03	Provided by Westinghouse
R013	Density of contaminated zone (g/cm^3)	1.690E+00	1.500E+00	Value used for assessment
R013	Contaminated zone total porosity	4.500E-01	4.000E-01	Provided by Westinghouse
R013	Contaminated zone field capacity	1.700E-01	2.000E-01	Provided by Westinghouse
R013	Contaminated zone hydraulic conductivity (m/yr)	1.456E+01	1.000E+01	Provided by Westinghouse
R013	Contaminated zone b parameter	1.040E+01	5.300E+00	Provided by Westinghouse
R013	Precipitation (m/yr)	9.650E-01	1.000E+00	Provided by Westinghouse
R013	Irrigation (m/yr)	2.000E-01	2.000E-01	Provided by Westinghouse

Menu	Parameter	User Input	RESRAD Default	Reference for User Input
R013	Runoff coefficient	3.050E-01	2.000E-01	Provided by Westinghouse
R013	Watershed area for nearby stream or pond (m^2)	9.989E+05	1.000E+06	Provided by Westinghouse
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	Provided by Westinghouse
R014	Density of saturated zone (g/cm^3)	1.690E+00	1.500E+00	Provided by Westinghouse
R014	Saturated zone total porosity	4.500E-01	4.000E-01	Provided by Westinghouse
R014	Saturated zone effective porosity	2.900E-01	2.000E-01	Provided by Westinghouse
R014	Saturated zone field capacity	1.700E-01	2.000E-01	Provided by Westinghouse
R014	Saturated zone hydraulic conductivity (m/yr)	1.696E+02	1.000E+02	Provided by Westinghouse
R014	Saturated zone hydraulic gradient	1.500E-02	2.000E-02	Provided by Westinghouse
R014	Saturated zone b parameter	1.040E+01	5.300E+00	Provided by Westinghouse
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	Provided by Westinghouse
R014	Well pump intake depth (m below water table)	5.000E-01	1.000E+01	Value used for assessment
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	MB	ND	Model used for assessment
R014	Well pumping rate (m3/yr)	9.130E+02	2.500E+02	Provided by Westinghouse
R015	Number of unsaturated zone strata	0	1	Value used for assessment
R016	Distribution Coefficients for Tc-99			
R016	Contaminated zone (cm^3/g)	1.060E+02	0.000E+00	Provided by Westinghouse
R016	Saturated zone (cm^3/g)	1.060E+02	0.000E+00	Provided by Westinghouse
R016	Leach rate (/yr)	0.000E+00	0.000E+00	Provided by Westinghouse
R016	Solubility constant	0.000E+00	0.000E+00	Provided by Westinghouse
R016	Distribution Coefficients for U-234			
R016	Contaminated zone (cm^3/g)	1.750E+02	5.000E+01	Provided by Westinghouse
R016	Saturated zone (cm^3/g)	1.750E+02	5.000E+01	Provided by Westinghouse
R016	Leach rate (/yr)	0.000E+00	0.000E+00	Provided by Westinghouse
R016	Solubility constant	0.000E+00	0.000E+00	Provided by Westinghouse
R016	Distribution Coefficients for Pb-210			
R016	Contaminated zone (cm^3/g)	1.000E+02	1.000E+02	Provided by Westinghouse
R016	Saturated zone (cm^3/g)	1.000E+02	1.000E+02	Provided by Westinghouse
R016	Leach rate (/yr)	0.000E+00	0.000E+00	Provided by Westinghouse
R016	Solubility constant	0.000E+00	0.000E+00	Provided by Westinghouse
R016	Distribution Coefficients for Ra-226			

Menu	Parameter	User Input	RESRAD Default	Reference for User Input
R016	Contaminated zone (cm^3/g)	7.000E+01	7.000E+01	Provided by Westinghouse
R016	Saturated zone (cm^3/g)	7.000E+01	7.000E+01	Provided by Westinghouse
R016	Leach rate (/yr)	0.000E+00	0.000E+00	Provided by Westinghouse
R016	Solubility constant	0.000E+00	0.000E+00	Provided by Westinghouse
R016	Distribution Coefficients for Th-230			
R016	Contaminated zone (cm^3/g)	6.000E+04	6.000E+04	Provided by Westinghouse
R016	Saturated zone (cm^3/g)	6.000E+04	6.000E+04	Provided by Westinghouse
R016	Leach rate (/yr)	0.000E+00	0.000E+00	Provided by Westinghouse
R016	Solubility constant	0.000E+00	0.000E+00	Provided by Westinghouse
R016	Distribution Coefficients for U-235			
R016	Contaminated zone (cm^3/g)	1.750E+02	5.000E+01	Provided by Westinghouse
R016	Saturated zone (cm^3/g)	1.750E+02	5.000E+01	Provided by Westinghouse
R016	Leach rate (/yr)	0.000E+00	0.000E+00	Provided by Westinghouse
R016	Solubility constant	0.000E+00	0.000E+00	Provided by Westinghouse
R016	Distribution Coefficients for Ac-227			
R016	Contaminated zone (cm^3/g)	2.000E+01	2.000E+01	Provided by Westinghouse
R016	Saturated zone (cm^3/g)	2.000E+01	2.000E+01	Provided by Westinghouse
R016	Leach rate (/yr)	0.000E+00	0.000E+00	Provided by Westinghouse
R016	Solubility constant	0.000E+00	0.000E+00	Provided by Westinghouse
R016	Distribution Coefficients for Pa-231			
R016	Contaminated zone (cm^3/g)	5.000E+01	5.000E+01	Provided by Westinghouse
R016	Saturated zone (cm^3/g)	5.000E+01	5.000E+01	Provided by Westinghouse
R016	Leach rate (/yr)	0.000E+00	0.000E+00	Provided by Westinghouse
R016	Solubility constant	0.000E+00	0.000E+00	Provided by Westinghouse
R016	Distribution Coefficients for U-238			
R016	Contaminated zone (cm^3/g)	1.750E+02	5.000E+01	Provided by Westinghouse
R016	Saturated zone (cm^3/g)	1.750E+02	5.000E+01	Provided by Westinghouse
R016	Leach rate (/yr)	0.000E+00	0.000E+00	Provided by Westinghouse
R016	Solubility constant	0.000E+00	0.000E+00	Provided by Westinghouse
R016	Distribution Coefficients for Pb-210			
R016	Contaminated zone (cm^3/g)	1.000E+02	1.000E+02	Provided by Westinghouse

Menu	Parameter	User Input	RESRAD Default	Reference for User Input
R016	Saturated zone (cm^3/g)	1.000E+02	1.000E+02	Provided by Westinghouse
R016	Leach rate (/yr)	0.000E+00	0.000E+00	Provided by Westinghouse
R016	Solubility constant	0.000E+00	0.000E+00	Provided by Westinghouse
R016	Distribution Coefficients for Ra-226			
R016	Contaminated zone (cm^3/g)	7.000E+01	7.000E+01	Provided by Westinghouse
R016	Saturated zone (cm^3/g)	7.000E+01	7.000E+01	Provided by Westinghouse
R016	Leach rate (/yr)	0.000E+00	0.000E+00	Provided by Westinghouse
R016	Solubility constant	0.000E+00	0.000E+00	Provided by Westinghouse
R016	Distribution Coefficients for Th-230			
R016	Contaminated zone (cm^3/g)	6.000E+04	6.000E+04	Provided by Westinghouse
R016	Saturated zone (cm^3/g)	6.000E+04	6.000E+04	Provided by Westinghouse
R016	Leach rate (/yr)	0.000E+00	0.000E+00	Provided by Westinghouse
R016	Solubility constant	0.000E+00	0.000E+00	Provided by Westinghouse
R016	Distribution Coefficients for U-234			
R016	Contaminated zone (cm^3/g)	1.750E+02	5.000E+01	Provided by Westinghouse
R016	Saturated zone (cm^3/g)	1.750E+02	5.000E+01	Provided by Westinghouse
R016	Leach rate (/yr)	0.000E+00	0.000E+00	Provided by Westinghouse
R016	Solubility constant	0.000E+00	0.000E+00	Provided by Westinghouse
R018	Fruits, vegetables and grain consumption (kg/yr)	4.270E+01	1.600E+02	Provided by Westinghouse
R018	Leafy vegetable consumption (kg/yr)	4.660E+00	1.400E+01	Provided by Westinghouse
R018	Milk consumption (L/yr)	NA	9.200E+01	Provided by Westinghouse
R018	Meat and poultry consumption (kg/yr)	NA	6.300E+01	Provided by Westinghouse
R018	Fish consumption (kg/yr)	7.340E+00	5.400E+00	Provided by Westinghouse
R018	Drinking water intake (L/yr)	5.150E+02	5.100E+02	Provided by Westinghouse
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	Provided by Westinghouse
R018	Contamination fraction of livestock water	NA	1.000E+00	Provided by Westinghouse
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	Provided by Westinghouse
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	Provided by Westinghouse
R018	Contamination fraction of plant food	5.000E-01	-1	Provided by Westinghouse
R018	Contamination fraction of meat	NA	-1	Provided by Westinghouse
R018	Contamination fraction of milk	NA	-1	Provided by Westinghouse
R019	Livestock fodder intake for meat (kg/day)	NA	6.800E+01	Provided by Westinghouse

Menu	Parameter	User Input	RESRAD Default	Reference for User Input
R019	Livestock fodder intake for milk (kg/day)	NA	5.500E+01	Provided by Westinghouse
R019	Livestock water intake for meat (L/day)	NA	5.000E+01	Provided by Westinghouse
R019	Livestock water intake for milk (L/day)	NA	1.600E+02	Provided by Westinghouse
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	Provided by Westinghouse
R019	Livestock water fraction from ground water	NA	1.000E+00	Provided by Westinghouse
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	Provided by Westinghouse
R19B	Wet weight crop yield for Non-Leafy (kg/m^2)	7.000E-01	7.000E-01	Provided by Westinghouse
R19B	Wet weight crop yield for Leafy (kg/m^2)	1.500E+00	1.500E+00	Provided by Westinghouse
R19B	Wet weight crop yield for Fodder (kg/m^2)	NA	1.100E+00	Provided by Westinghouse
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	Provided by Westinghouse
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	Provided by Westinghouse
R19B	Growing Season for Fodder (years)	NA	8.000E-02	Provided by Westinghouse
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	Provided by Westinghouse
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	Provided by Westinghouse
R19B	Translocation Factor for Fodder	NA	1.000E+00	Provided by Westinghouse
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	Provided by Westinghouse
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	Provided by Westinghouse
R19B	Wet Foliar Interception Fraction for Fodder	NA	2.500E-01	Provided by Westinghouse
	External gamma pathway	Active	Active	
	Inhalation pathway (w/o radon)	Active	Active	
	Plant ingestion pathway	Active	Active	
	Meat ingestion pathway	Suppressed	Active	Suppressed for this assessment
	Milk ingestion pathway	Suppressed	Active	Suppressed for this assessment
	Aquatic foods pathway	Active	Active	
	Drinking water pathway	Active	Active	
	Soil ingestion pathway	Active	Active	
	Radon pathway	Suppressed	Active	

APPENDIX B:

RESRAD OUTPUT

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	Tc-99	8.330E-06	8.330E-06	DCF2(1)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Tc-99	1.460E-06	1.460E-06	DCF3(1)
D-34	Food transfer factors:			
D-34	Tc-99 , plant/soil concentration ratio, dimensionless	5.000E+00	5.000E+00	RTF(1,1)
D-34	Tc-99 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(1,2)
D-34	Tc-99 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(1,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Tc-99 , fish	2.000E+01	2.000E+01	BIOFAC(1,1)
D-5	Tc-99 , crustacea and mollusks	5.000E+00	5.000E+00	BIOFAC(1,2)

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)	2.146E-01	1.000E+00	---	T(2)
R011	Times for calculations (yr)	1.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	3.000E+00	1.000E+01	---	T(4)
R011	Times for calculations (yr)	1.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	3.000E+01	1.000E+02	---	T(6)
R011	Times for calculations (yr)	1.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	3.000E+02	1.000E+03	---	T(8)
R011	Times for calculations (yr)	1.000E+03	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Tc-99	3.330E+03	0.000E+00	---	S1(1)
R012	Concentration in groundwater (pCi/L): Tc-99	not used	0.000E+00	---	W1(1)
R013	Cover depth (m)	3.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	1.500E+00	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	0.000E+00	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)	0.000E+00	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
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)	5.000E-01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	MB	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	9.130E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	0	1	---	NS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Tc-99				
R016	Contaminated zone (cm**3/g)	1.060E+02	0.000E+00	---	DCNUCC(1)
R016	Saturated zone (cm**3/g)	1.060E+02	0.000E+00	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.212E-03	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
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
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

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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
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

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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
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

Contaminated Zone Dimensions	
Area:	77458.00 square meters
Thickness:	2.00 meters
Cover Depth:	3.00 meters

Initial Soil Concentrations, pCi/g	
Tc-99	3.330E+03

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	2.146E-01	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	2.324E+01	2.500E+01	2.496E+01	2.492E+01	2.476E+01	2.432E+01	2.285E+01	1.911E+01	1.022E+01
M(t):	9.295E-01	1.000E+00	9.985E-01	9.967E-01	9.905E-01	9.730E-01	9.140E-01	7.644E-01	4.090E-01

Maximum TDOSE(t): 2.500E+01 mrem/yr at t = 2.146E-01 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 = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
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
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 = 0.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Tc-99	2.192E+01	0.9433	2.491E-01	0.0107	0.000E+00	0.0000	1.068E+00	0.0460	0.000E+00	0.0000	0.000E+00	0.0000	2.324E+01	1.0000
Total	2.192E+01	0.9433	2.491E-01	0.0107	0.000E+00	0.0000	1.068E+00	0.0460	0.000E+00	0.0000	0.000E+00	0.0000	2.324E+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 = 2.146E-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.
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
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 = 2.146E-01 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Tc-99	2.357E+01	0.9428	2.694E-01	0.0108	0.000E+00	0.0000	1.160E+00	0.0464	0.000E+00	0.0000	0.000E+00	0.0000	2.500E+01	1.0000
Total	2.357E+01	0.9428	2.694E-01	0.0108	0.000E+00	0.0000	1.160E+00	0.0464	0.000E+00	0.0000	0.000E+00	0.0000	2.500E+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+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
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
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+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Tc-99	2.354E+01	0.9430	2.681E-01	0.0107	0.000E+00	0.0000	1.155E+00	0.0463	0.000E+00	0.0000	0.000E+00	0.0000	2.496E+01	1.0000
Total	2.354E+01	0.9430	2.681E-01	0.0107	0.000E+00	0.0000	1.155E+00	0.0463	0.000E+00	0.0000	0.000E+00	0.0000	2.496E+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+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
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
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+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Tc-99	2.350E+01	0.9430	2.676E-01	0.0107	0.000E+00	0.0000	1.153E+00	0.0463	0.000E+00	0.0000	0.000E+00	0.0000	2.492E+01	1.0000
Total	2.350E+01	0.9430	2.676E-01	0.0107	0.000E+00	0.0000	1.153E+00	0.0463	0.000E+00	0.0000	0.000E+00	0.0000	2.492E+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+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
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
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+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Tc-99	2.335E+01	0.9430	2.660E-01	0.0107	0.000E+00	0.0000	1.146E+00	0.0463	0.000E+00	0.0000	0.000E+00	0.0000	2.476E+01	1.0000
Total	2.335E+01	0.9430	2.660E-01	0.0107	0.000E+00	0.0000	1.146E+00	0.0463	0.000E+00	0.0000	0.000E+00	0.0000	2.476E+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+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
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
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+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Tc-99	2.294E+01	0.9430	2.613E-01	0.0107	0.000E+00	0.0000	1.125E+00	0.0463	0.000E+00	0.0000	0.000E+00	0.0000	2.432E+01	1.0000
Total	2.294E+01	0.9430	2.613E-01	0.0107	0.000E+00	0.0000	1.125E+00	0.0463	0.000E+00	0.0000	0.000E+00	0.0000	2.432E+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-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
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
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+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Tc-99	2.155E+01	0.9430	2.454E-01	0.0107	0.000E+00	0.0000	1.057E+00	0.0463	0.000E+00	0.0000	0.000E+00	0.0000	2.285E+01	1.0000
Total	2.155E+01	0.9430	2.454E-01	0.0107	0.000E+00	0.0000	1.057E+00	0.0463	0.000E+00	0.0000	0.000E+00	0.0000	2.285E+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-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
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
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-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Tc-99	1.802E+01	0.9430	2.052E-01	0.0107	0.000E+00	0.0000	8.841E-01	0.0463	0.000E+00	0.0000	0.000E+00	0.0000	1.911E+01	1.0000
Total	1.802E+01	0.9430	2.052E-01	0.0107	0.000E+00	0.0000	8.841E-01	0.0463	0.000E+00	0.0000	0.000E+00	0.0000	1.911E+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+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
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
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-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Tc-99	9.642E+00	0.9430	1.098E-01	0.0107	0.000E+00	0.0000	4.731E-01	0.0463	0.000E+00	0.0000	0.000E+00	0.0000	1.022E+01	1.0000
Total	9.642E+00	0.9430	1.098E-01	0.0107	0.000E+00	0.0000	4.731E-01	0.0463	0.000E+00	0.0000	0.000E+00	0.0000	1.022E+01	1.0000

*Sum of all water independent and dependent pathways.

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

Parent (i)	Product (j)	Branch Fraction*	t= 0.000E+00	2.146E-01	1.000E+00	DSR(j,t) (mrem/yr)/(pCi/g) 3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Tc-99	Tc-99	1.000E+00	6.978E-03	7.508E-03	7.496E-03	7.483E-03	7.436E-03	7.305E-03	6.862E-03	5.738E-03	3.070E-03

*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 ≤ 0.5 yr) daughters.

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

Nuclide (i)	t= 0.000E+00	2.146E-01	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Tc-99	3.583E+03	3.330E+03	3.335E+03	3.341E+03	3.362E+03	3.422E+03	3.643E+03	4.357E+03	8.142E+03

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 = 2.146E-01 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Tc-99	3.330E+03	2.146E-01	7.508E-03	3.330E+03	7.508E-03	3.330E+03

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	2.146E-01	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Tc-99	Tc-99	1.000E+00	2.324E+01	2.500E+01	2.496E+01	2.492E+01	2.476E+01	2.432E+01	2.285E+01	1.911E+01	1.022E+01

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

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	2.146E-01	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Tc-99	Tc-99	1.000E+00	3.330E+03	3.329E+03	3.326E+03	3.318E+03	3.290E+03	3.211E+03	2.949E+03	2.312E+03	9.874E+02

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

RESCALC.EXE execution time = 2.69 seconds

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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	Pb-210+D	2.320E-02	2.320E-02	DCF2(1)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(2)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(3)
B-1	U-234	1.320E-01	1.320E-01	DCF2(4)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(1)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(2)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(3)
D-1	U-234	2.830E-04	2.830E-04	DCF3(4)
D-34	Food transfer factors:			
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(1,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(1,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(1,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(2,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(2,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(2,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(3,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(3,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(3,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(4,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(4,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(4,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(1,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(1,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(2,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(2,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(3,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(3,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(4,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(4,2)

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)	4.996E-01	1.000E+00	---	T(2)
R011	Times for calculations (yr)	1.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	3.000E+00	1.000E+01	---	T(4)
R011	Times for calculations (yr)	1.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	3.000E+01	1.000E+02	---	T(6)
R011	Times for calculations (yr)	1.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	3.000E+02	1.000E+03	---	T(8)
R011	Times for calculations (yr)	1.000E+03	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): U-234	2.915E+01	0.000E+00	---	S1(4)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(4)
R013	Cover depth (m)	3.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	1.500E+00	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	0.000E+00	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)	0.000E+00	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
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)	5.000E-01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	MB	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	9.130E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	0	1	---	NS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCC(4)
R016	Saturated zone (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.350E-04	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(1)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E-03	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(2)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.834E-03	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(3)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.147E-06	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
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
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)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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
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)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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
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)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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

Contaminated Zone Dimensions	
Area:	77458.00 square meters
Thickness:	2.00 meters
Cover Depth:	3.00 meters

Initial Soil Concentrations, pCi/g	
U-234	2.915E+01

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	4.996E-01	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	2.276E+01	2.500E+01	2.499E+01	2.497E+01	2.490E+01	2.470E+01	2.401E+01	2.226E+01	1.786E+01
M(t):	9.103E-01	9.999E-01	9.997E-01	9.989E-01	9.959E-01	9.879E-01	9.603E-01	8.904E-01	7.143E-01

Maximum TDOSE(t): 2.501E+01 mrem/yr at t = 0.2241 ± 0.0004 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 = 2.241E-01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide 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.
U-234	8.206E-24	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	8.206E-24	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 = 2.241E-01 years

Water Dependent Pathways

Radio-Nuclide Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	2.425E+01	0.9695	2.328E-01	0.0093	0.000E+00	0.0000	5.288E-01	0.0211	0.000E+00	0.0000	0.000E+00	0.0000	2.501E+01	1.0000
Total	2.425E+01	0.9695	2.328E-01	0.0093	0.000E+00	0.0000	5.288E-01	0.0211	0.000E+00	0.0000	0.000E+00	0.0000	2.501E+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 = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	4.503E-24	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	4.503E-24	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 = 0.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	2.208E+01	0.9701	2.090E-01	0.0092	0.000E+00	0.0000	4.708E-01	0.0207	0.000E+00	0.0000	0.000E+00	0.0000	2.276E+01	1.0000
Total	2.208E+01	0.9701	2.090E-01	0.0092	0.000E+00	0.0000	4.708E-01	0.0207	0.000E+00	0.0000	0.000E+00	0.0000	2.276E+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 = 4.996E-01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	1.462E-23	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	1.462E-23	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 = 4.996E-01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	2.424E+01	0.9695	2.325E-01	0.0093	0.000E+00	0.0000	5.287E-01	0.0212	0.000E+00	0.0000	0.000E+00	0.0000	2.500E+01	1.0000
Total	2.424E+01	0.9695	2.325E-01	0.0093	0.000E+00	0.0000	5.287E-01	0.0212	0.000E+00	0.0000	0.000E+00	0.0000	2.500E+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+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	3.149E-23	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	3.149E-23	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+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	2.423E+01	0.9695	2.324E-01	0.0093	0.000E+00	0.0000	5.286E-01	0.0212	0.000E+00	0.0000	0.000E+00	0.0000	2.499E+01	1.0000
Total	2.423E+01	0.9695	2.324E-01	0.0093	0.000E+00	0.0000	5.286E-01	0.0212	0.000E+00	0.0000	0.000E+00	0.0000	2.499E+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+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	1.661E-22	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	1.661E-22	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+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	2.421E+01	0.9695	2.322E-01	0.0093	0.000E+00	0.0000	5.282E-01	0.0212	0.000E+00	0.0000	0.000E+00	0.0000	2.497E+01	1.0000
Total	2.421E+01	0.9695	2.322E-01	0.0093	0.000E+00	0.0000	5.282E-01	0.0212	0.000E+00	0.0000	0.000E+00	0.0000	2.497E+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+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.
U-234	1.476E-21	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	1.476E-21	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+01 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	2.414E+01	0.9695	2.315E-01	0.0093	0.000E+00	0.0000	5.266E-01	0.0212	0.000E+00	0.0000	0.000E+00	0.0000	2.490E+01	1.0000
Total	2.414E+01	0.9695	2.315E-01	0.0093	0.000E+00	0.0000	5.266E-01	0.0212	0.000E+00	0.0000	0.000E+00	0.0000	2.490E+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+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.
U-234	1.220E-20	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	1.220E-20	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+01 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	2.394E+01	0.9695	2.301E-01	0.0093	0.000E+00	0.0000	5.224E-01	0.0212	0.000E+00	0.0000	0.000E+00	0.0000	2.470E+01	1.0000
Total	2.394E+01	0.9695	2.301E-01	0.0093	0.000E+00	0.0000	5.224E-01	0.0212	0.000E+00	0.0000	0.000E+00	0.0000	2.470E+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		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.
U-234	1.235E-19	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	1.235E-19	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+02 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	2.327E+01	0.9695	2.257E-01	0.0094	0.000E+00	0.0000	5.077E-01	0.0211	0.000E+00	0.0000	0.000E+00	0.0000	2.401E+01	1.0000
Total	2.327E+01	0.9695	2.257E-01	0.0094	0.000E+00	0.0000	5.077E-01	0.0211	0.000E+00	0.0000	0.000E+00	0.0000	2.401E+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-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	9.113E-19	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	9.113E-19	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-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	2.156E+01	0.9686	2.279E-01	0.0102	0.000E+00	0.0000	4.704E-01	0.0211	0.000E+00	0.0000	0.000E+00	0.0000	2.226E+01	1.0000
Total	2.156E+01	0.9686	2.279E-01	0.0102	0.000E+00	0.0000	4.704E-01	0.0211	0.000E+00	0.0000	0.000E+00	0.0000	2.226E+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+03 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.
U-234	5.491E-18	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	5.491E-18	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		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-234	1.716E+01	0.9611	3.197E-01	0.0179	0.000E+00	0.0000	3.745E-01	0.0210	0.000E+00	0.0000	0.000E+00	0.0000	1.786E+01	1.0000
Total	1.716E+01	0.9611	3.197E-01	0.0179	0.000E+00	0.0000	3.745E-01	0.0210	0.000E+00	0.0000	0.000E+00	0.0000	1.786E+01	1.0000

*Sum of all water independent and dependent pathways.

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

Parent (i)	Product (j)	Branch Fraction*	DSR(j,t) (mrem/yr)/(pCi/g) t= 0.000E+00	4.996E-01	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00	7.807E-01	8.575E-01	8.574E-01	8.566E-01	8.542E-01	8.471E-01	8.228E-01	7.572E-01	5.661E-01
U-234	Th-230	1.000E+00	5.823E-08	7.977E-08	9.268E-08	1.445E-07	3.191E-07	8.154E-07	2.520E-06	7.127E-06	2.055E-05
U-234	Ra-226	1.000E+00	1.805E-07	3.599E-07	3.874E-07	1.838E-06	1.525E-06	3.788E-05	2.074E-04	1.423E-03	9.847E-03
U-234	Pb-210	1.000E+00	8.867E-07	1.652E-06	1.657E-06	7.322E-06	9.253E-07	1.108E-04	5.692E-04	4.972E-03	3.665E-02
U-234	∑DSR(j)		7.807E-01	8.575E-01	8.574E-01	8.567E-01	8.542E-01	8.472E-01	8.236E-01	7.636E-01	6.126E-01

*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 ≤ 0.5 yr) daughters.

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

Nuclide (i)	t= 0.000E+00	4.996E-01	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	3.202E+01	2.915E+01	2.916E+01	2.918E+01	2.927E+01	2.951E+01	3.036E+01	3.274E+01	4.081E+01

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 = 0.2241 ± 0.0004 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
U-234	2.915E+01	0.2241 ± 0.0004	8.579E-01	2.914E+01	8.579E-01	2.914E+01

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	4.996E-01	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00	2.276E+01	2.500E+01	2.499E+01	2.497E+01	2.490E+01	2.469E+01	2.398E+01	2.207E+01	1.650E+01
Th-230	U-234	1.000E+00	1.697E-06	2.325E-06	2.702E-06	4.212E-06	9.303E-06	2.377E-05	7.346E-05	2.078E-04	5.989E-04
Ra-226	U-234	1.000E+00	5.261E-06	1.049E-05	1.129E-05	5.359E-05	4.446E-05	1.104E-03	6.047E-03	4.149E-02	2.870E-01
Pb-210	U-234	1.000E+00	2.585E-05	4.816E-05	4.831E-05	2.134E-04	2.697E-05	3.230E-03	1.659E-02	1.449E-01	1.068E+00

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

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	4.996E-01	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00	2.915E+01	2.914E+01	2.913E+01	2.909E+01	2.894E+01	2.851E+01	2.708E+01	2.336E+01	1.394E+01
Th-230	U-234	1.000E+00	0.000E+00	1.311E-04	2.623E-04	7.863E-04	2.614E-03	7.784E-03	2.528E-02	7.050E-02	1.844E-01
Ra-226	U-234	1.000E+00	0.000E+00	1.418E-08	5.678E-08	5.100E-07	5.627E-06	4.964E-05	5.146E-04	3.821E-03	2.308E-02
Pb-210	U-234	1.000E+00	0.000E+00	7.311E-11	5.837E-10	1.549E-08	5.400E-07	1.239E-05	2.839E-04	3.063E-03	2.133E-02

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

RESCALC.EXE execution time = 96.56 seconds

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	Pa-231	1.280E+00	1.280E+00	DCF2(2)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(3)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(2)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(3)
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	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(2,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(2,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(3,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(3,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(3,3)
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	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(2,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(2,2)
D-5				
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(3,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(3,2)

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)	5.000E-01	1.000E+00	---	T(2)
R011	Times for calculations (yr)	1.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	3.000E+00	1.000E+01	---	T(4)
R011	Times for calculations (yr)	1.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	3.000E+01	1.000E+02	---	T(6)
R011	Times for calculations (yr)	1.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	3.000E+02	1.000E+03	---	T(8)
R011	Times for calculations (yr)	1.000E+03	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): U-235	7.285E+00	0.000E+00	---	S1(3)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(3)
R013	Cover depth (m)	3.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	1.500E+00	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	0.000E+00	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)	0.000E+00	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
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)	5.000E-01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	MB	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	9.130E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	0	1	---	NS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCC(3)
R016	Saturated zone (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.350E-04	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(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(2)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.564E-03	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
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
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)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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
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)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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
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)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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

Contaminated Zone Dimensions	
Area:	77458.00 square meters
Thickness:	2.00 meters
Cover Depth:	3.00 meters

Initial Soil Concentrations, pCi/g	
U-235	7.285E+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	5.000E-01	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	5.374E+00	5.911E+00	5.920E+00	5.959E+00	6.145E+00	6.971E+00	1.074E+01	1.883E+01	2.479E+01
M(t):	2.150E-01	2.365E-01	2.368E-01	2.383E-01	2.458E-01	2.788E-01	4.296E-01	7.534E-01	9.917E-01

Maximum TDOSE(t): 2.500E+01 mrem/yr at t = 862 ± 2 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 = 8.624E+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide 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.
U-235	3.365E-25	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	3.365E-25	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 = 8.624E+02 years

Water Dependent Pathways

Radio-Nuclide Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	2.330E+01	0.9321	1.189E+00	0.0476	0.000E+00	0.0000	5.084E-01	0.0203	0.000E+00	0.0000	0.000E+00	0.0000	2.500E+01	1.0000
Total	2.330E+01	0.9321	1.189E+00	0.0476	0.000E+00	0.0000	5.084E-01	0.0203	0.000E+00	0.0000	0.000E+00	0.0000	2.500E+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 = 0.000E+00 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.
U-235	2.211E-27	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	2.211E-27	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 = 0.000E+00 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	5.214E+00	0.9701	4.941E-02	0.0092	0.000E+00	0.0000	1.112E-01	0.0207	0.000E+00	0.0000	0.000E+00	0.0000	5.374E+00	1.0000
Total	5.214E+00	0.9701	4.941E-02	0.0092	0.000E+00	0.0000	1.112E-01	0.0207	0.000E+00	0.0000	0.000E+00	0.0000	5.374E+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 = 5.000E-01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	2.339E-27	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	2.339E-27	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 = 5.000E-01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	5.731E+00	0.9695	5.508E-02	0.0093	0.000E+00	0.0000	1.250E-01	0.0211	0.000E+00	0.0000	0.000E+00	0.0000	5.911E+00	1.0000
Total	5.731E+00	0.9695	5.508E-02	0.0093	0.000E+00	0.0000	1.250E-01	0.0211	0.000E+00	0.0000	0.000E+00	0.0000	5.911E+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		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.
U-235	2.478E-27	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	2.478E-27	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+00 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	5.739E+00	0.9695	5.525E-02	0.0093	0.000E+00	0.0000	1.252E-01	0.0211	0.000E+00	0.0000	0.000E+00	0.0000	5.920E+00	1.0000
Total	5.739E+00	0.9695	5.525E-02	0.0093	0.000E+00	0.0000	1.252E-01	0.0211	0.000E+00	0.0000	0.000E+00	0.0000	5.920E+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-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	3.141E-27	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	3.141E-27	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+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	5.776E+00	0.9694	5.629E-02	0.0094	0.000E+00	0.0000	1.260E-01	0.0211	0.000E+00	0.0000	0.000E+00	0.0000	5.959E+00	1.0000
Total	5.776E+00	0.9694	5.629E-02	0.0094	0.000E+00	0.0000	1.260E-01	0.0211	0.000E+00	0.0000	0.000E+00	0.0000	5.959E+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-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	6.640E-27	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	6.640E-27	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+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	5.952E+00	0.9685	6.348E-02	0.0103	0.000E+00	0.0000	1.298E-01	0.0211	0.000E+00	0.0000	0.000E+00	0.0000	6.145E+00	1.0000
Total	5.952E+00	0.9685	6.348E-02	0.0103	0.000E+00	0.0000	1.298E-01	0.0211	0.000E+00	0.0000	0.000E+00	0.0000	6.145E+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-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	2.340E-26	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	2.340E-26	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+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	6.719E+00	0.9639	1.049E-01	0.0151	0.000E+00	0.0000	1.466E-01	0.0210	0.000E+00	0.0000	0.000E+00	0.0000	6.971E+00	1.0000
Total	6.719E+00	0.9639	1.049E-01	0.0151	0.000E+00	0.0000	1.466E-01	0.0210	0.000E+00	0.0000	0.000E+00	0.0000	6.971E+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+02 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	1.018E-25	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	1.018E-25	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+02 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	1.020E+01	0.9496	3.185E-01	0.0297	0.000E+00	0.0000	2.225E-01	0.0207	0.000E+00	0.0000	0.000E+00	0.0000	1.074E+01	1.0000
Total	1.020E+01	0.9496	3.185E-01	0.0297	0.000E+00	0.0000	2.225E-01	0.0207	0.000E+00	0.0000	0.000E+00	0.0000	1.074E+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-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	2.597E-25	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	2.597E-25	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-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	1.766E+01	0.9375	7.926E-01	0.0421	0.000E+00	0.0000	3.852E-01	0.0205	0.000E+00	0.0000	0.000E+00	0.0000	1.883E+01	1.0000
Total	1.766E+01	0.9375	7.926E-01	0.0421	0.000E+00	0.0000	3.852E-01	0.0205	0.000E+00	0.0000	0.000E+00	0.0000	1.883E+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+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	3.224E-25	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	3.224E-25	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-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-235	2.310E+01	0.9317	1.189E+00	0.0480	0.000E+00	0.0000	5.040E-01	0.0203	0.000E+00	0.0000	0.000E+00	0.0000	2.479E+01	1.0000
Total	2.310E+01	0.9317	1.189E+00	0.0480	0.000E+00	0.0000	5.040E-01	0.0203	0.000E+00	0.0000	0.000E+00	0.0000	2.479E+01	1.0000

*Sum of all water independent and dependent pathways.

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

Parent (i)	Product (j)	Branch Fraction*	DSR(j,t) (mrem/yr)/(pCi/g) t= 0.000E+00	5.000E-01	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-235	U-235	1.000E+00	7.366E-01	8.091E-01	8.089E-01	8.082E-01	8.059E-01	7.993E-01	7.765E-01	7.150E-01	5.356E-01
U-235	Pa-231	1.000E+00	1.070E-03	2.240E-03	3.415E-03	8.131E-03	2.446E-02	6.936E-02	2.084E-01	4.820E-01	7.114E-01
U-235	Ac-227	1.000E+00	5.039E-05	1.393E-04	3.009E-04	1.589E-03	1.323E-02	8.821E-02	4.895E-01	1.388E+00	2.156E+00
U-235	ΣDSR(j)		7.377E-01	8.114E-01	8.126E-01	8.179E-01	8.436E-01	9.568E-01	1.474E+00	2.585E+00	3.403E+00

*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 ≤ 0.5 yr) daughters.

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

Nuclide (i)	t= 0.000E+00	5.000E-01	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-235	3.389E+01	3.081E+01	3.077E+01	3.056E+01	2.964E+01	2.613E+01	1.696E+01	9.670E+00	7.346E+00

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 = 862 ± 2 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
U-235	7.285E+00	862 ± 2	3.432E+00	7.285E+00	3.432E+00	7.285E+00

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	5.000E-01	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-235	U-235	1.000E+00	5.366E+00	5.894E+00	5.893E+00	5.888E+00	5.871E+00	5.823E+00	5.657E+00	5.209E+00	3.902E+00
Pa-231	U-235	1.000E+00	7.794E-03	1.632E-02	2.488E-02	5.924E-02	1.782E-01	5.053E-01	1.518E+00	3.512E+00	5.182E+00
Ac-227	U-235	1.000E+00	3.671E-04	1.015E-03	2.192E-03	1.157E-02	9.638E-02	6.426E-01	3.566E+00	1.011E+01	1.571E+01

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

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	5.000E-01	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-235	U-235	1.000E+00	7.285E+00	7.282E+00	7.280E+00	7.269E+00	7.232E+00	7.126E+00	6.769E+00	5.843E+00	3.493E+00
Pa-231	U-235	1.000E+00	0.000E+00	7.701E-05	1.539E-04	4.601E-04	1.516E-03	4.400E-03	1.307E-02	2.846E-02	3.367E-02
Ac-227	U-235	1.000E+00	0.000E+00	6.092E-07	2.420E-06	2.119E-05	2.144E-04	1.505E-03	8.351E-03	2.249E-02	2.833E-02

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

RESCALC.EXE execution time = 5.27 seconds

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	Pb-210+D	2.320E-02	2.320E-02	DCF2(1)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(2)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(3)
B-1	U-234	1.320E-01	1.320E-01	DCF2(4)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(5)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(1)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(2)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(3)
D-1	U-234	2.830E-04	2.830E-04	DCF3(4)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(5)
D-34	Food transfer factors:			
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(1,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(1,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(1,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(2,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(2,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(2,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(3,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(3,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(3,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(4,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(4,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(4,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(5,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(5,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(5,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(1,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(1,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(2,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(2,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(3,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(3,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(4,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(4,2)
D-5				

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

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

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)	4.783E-01	1.000E+00	---	T(2)
R011	Times for calculations (yr)	1.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	3.000E+00	1.000E+01	---	T(4)
R011	Times for calculations (yr)	1.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	3.000E+01	1.000E+02	---	T(6)
R011	Times for calculations (yr)	1.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	3.000E+02	1.000E+03	---	T(8)
R011	Times for calculations (yr)	1.000E+03	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): U-238	3.067E+01	0.000E+00	---	S1(5)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(5)
R013	Cover depth (m)	3.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	1.500E+00	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	0.000E+00	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)	0.000E+00	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	Romberg failures occurred	EPS
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)	5.000E-01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	MB	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	9.130E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	0	1	---	NS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCC(5)
R016	Saturated zone (cm**3/g)	1.750E+02	5.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.350E-04	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(1)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.285E-03	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(2)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.834E-03	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(3)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.147E-06	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for daughter U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(4)
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)
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

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	77458.00 square meters	U-238	3.067E+01
Thickness:	2.00 meters		
Cover Depth:	3.00 meters		

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	4.783E-01	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	2.276E+01	2.500E+01	2.499E+01	2.497E+01	2.491E+01	2.471E+01	2.402E+01	2.217E+01	1.669E+01
M(t):	9.104E-01	1.000E+00	9.998E-01	9.990E-01	9.962E-01	9.883E-01	9.610E-01	8.867E-01	6.674E-01

Maximum TDOSE(t): 2.501E+01 mrem/yr at t = 0.2243 ± 0.0004 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 = 2.243E-01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide 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.
U-238	1.671E-18	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	1.671E-18	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 = 2.243E-01 years

Water Dependent Pathways

Radio-Nuclide Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-238	2.425E+01	0.9695	2.329E-01	0.0093	0.000E+00	0.0000	5.288E-01	0.0211	0.000E+00	0.0000	0.000E+00	0.0000	2.501E+01	1.0000
Total	2.425E+01	0.9695	2.329E-01	0.0093	0.000E+00	0.0000	5.288E-01	0.0211	0.000E+00	0.0000	0.000E+00	0.0000	2.501E+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 = 0.000E+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-238	1.671E-18	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	1.671E-18	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 = 0.000E+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-238	2.208E+01	0.9701	2.091E-01	0.0092	0.000E+00	0.0000	4.708E-01	0.0207	0.000E+00	0.0000	0.000E+00	0.0000	2.276E+01	1.0000
Total	2.208E+01	0.9701	2.091E-01	0.0092	0.000E+00	0.0000	4.708E-01	0.0207	0.000E+00	0.0000	0.000E+00	0.0000	2.276E+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 = 4.783E-01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-238	1.671E-18	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	1.671E-18	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 = 4.783E-01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-238	2.424E+01	0.9696	2.325E-01	0.0093	0.000E+00	0.0000	5.288E-01	0.0212	0.000E+00	0.0000	0.000E+00	0.0000	2.500E+01	1.0000
Total	2.424E+01	0.9696	2.325E-01	0.0093	0.000E+00	0.0000	5.288E-01	0.0212	0.000E+00	0.0000	0.000E+00	0.0000	2.500E+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+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-238	1.670E-18	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	1.670E-18	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+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-238	2.423E+01	0.9695	2.324E-01	0.0093	0.000E+00	0.0000	5.287E-01	0.0212	0.000E+00	0.0000	0.000E+00	0.0000	2.499E+01	1.0000
Total	2.423E+01	0.9695	2.324E-01	0.0093	0.000E+00	0.0000	5.287E-01	0.0212	0.000E+00	0.0000	0.000E+00	0.0000	2.499E+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+00 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-238	1.667E-18	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	1.667E-18	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+00 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-238	2.421E+01	0.9695	2.323E-01	0.0093	0.000E+00	0.0000	5.282E-01	0.0212	0.000E+00	0.0000	0.000E+00	0.0000	2.497E+01	1.0000
Total	2.421E+01	0.9695	2.323E-01	0.0093	0.000E+00	0.0000	5.282E-01	0.0212	0.000E+00	0.0000	0.000E+00	0.0000	2.497E+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+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-238	1.659E-18	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	1.659E-18	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+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-238	2.415E+01	0.9695	2.317E-01	0.0093	0.000E+00	0.0000	5.268E-01	0.0212	0.000E+00	0.0000	0.000E+00	0.0000	2.491E+01	1.0000
Total	2.415E+01	0.9695	2.317E-01	0.0093	0.000E+00	0.0000	5.268E-01	0.0212	0.000E+00	0.0000	0.000E+00	0.0000	2.491E+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+01 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-238	1.635E-18	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	1.635E-18	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+01 years

Water Dependent Pathways

Radio-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-238	2.395E+01	0.9695	2.300E-01	0.0093	0.000E+00	0.0000	5.226E-01	0.0212	0.000E+00	0.0000	0.000E+00	0.0000	2.471E+01	1.0000
Total	2.395E+01	0.9695	2.300E-01	0.0093	0.000E+00	0.0000	5.226E-01	0.0212	0.000E+00	0.0000	0.000E+00	0.0000	2.471E+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		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.
U-238	1.553E-18	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	1.553E-18	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+02 years

Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-238	2.329E+01	0.9695	2.243E-01	0.0093	0.000E+00	0.0000	5.081E-01	0.0212	0.000E+00	0.0000	0.000E+00	0.0000	2.402E+01	1.0000
Total	2.329E+01	0.9695	2.243E-01	0.0093	0.000E+00	0.0000	5.081E-01	0.0212	0.000E+00	0.0000	0.000E+00	0.0000	2.402E+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-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-238	1.341E-18	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	1.341E-18	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-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-238	2.149E+01	0.9694	2.086E-01	0.0094	0.000E+00	0.0000	4.688E-01	0.0211	0.000E+00	0.0000	0.000E+00	0.0000	2.217E+01	1.0000
Total	2.149E+01	0.9694	2.086E-01	0.0094	0.000E+00	0.0000	4.688E-01	0.0211	0.000E+00	0.0000	0.000E+00	0.0000	2.217E+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+03 years

Water Independent Pathways (Inhalation excludes radon)

Radio-	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-238	8.050E-19	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	8.050E-19	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-	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
U-238	1.617E+01	0.9692	1.616E-01	0.0097	0.000E+00	0.0000	3.528E-01	0.0211	0.000E+00	0.0000	0.000E+00	0.0000	1.669E+01	1.0000
Total	1.617E+01	0.9692	1.616E-01	0.0097	0.000E+00	0.0000	3.528E-01	0.0211	0.000E+00	0.0000	0.000E+00	0.0000	1.669E+01	1.0000

*Sum of all water independent and dependent pathways.

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

Parent (i)	Product (j)	Branch Fraction*	t= 0.000E+00	4.783E-01	1.000E+00	DSR(j,t) (mrem/yr)/(pCi/g) 3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-238	U-238	1.000E+00	7.421E-01	8.151E-01	8.149E-01	8.143E-01	8.119E-01	8.053E-01	7.823E-01	7.204E-01	5.396E-01
U-238	U-234	1.000E+00	3.811E-06	7.815E-06	1.220E-05	2.897E-05	8.742E-05	2.488E-04	7.482E-04	1.735E-03	2.580E-03
U-238	Th-230	1.000E+00	2.317E-10	3.204E-10	4.410E-10	6.413E-10	2.147E-09	7.149E-09	2.555E-08	7.082E-08	1.993E-07
U-238	Ra-226	1.000E+00	2.183E-07	4.039E-07	6.387E-07	1.107E-06	4.079E-06	1.394E-05	4.964E-05	1.332E-04	3.454E-04
U-238	Pb-210	1.000E+00	1.094E-06	1.926E-06	2.974E-06	4.953E-06	1.777E-05	6.013E-05	2.132E-04	5.714E-04	1.477E-03
U-238	∑DSR(j)		7.421E-01	8.151E-01	8.150E-01	8.143E-01	8.120E-01	8.056E-01	7.833E-01	7.228E-01	5.440E-01

*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 ≤ 0.5 yr) daughters.

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

Nuclide (i)	t= 0.000E+00	4.783E-01	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-238	3.369E+01	3.067E+01	3.068E+01	3.070E+01	3.079E+01	3.103E+01	3.192E+01	3.459E+01	4.595E+01

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 = 0.2243 ± 0.0004 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
U-238	3.067E+01	0.2243 ± 0.0004	8.155E-01	3.066E+01	8.155E-01	3.066E+01

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	4.783E-01	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-238	U-238	1.000E+00	2.276E+01	2.500E+01	2.499E+01	2.497E+01	2.490E+01	2.470E+01	2.399E+01	2.209E+01	1.655E+01
U-234	U-238	1.000E+00	1.169E-04	2.397E-04	3.741E-04	8.885E-04	2.681E-03	7.630E-03	2.295E-02	5.321E-02	7.914E-02
Th-230	U-238	1.000E+00	7.105E-09	9.828E-09	1.353E-08	1.967E-08	6.586E-08	2.192E-07	7.836E-07	2.172E-06	6.112E-06
Ra-226	U-238	1.000E+00	6.696E-06	1.239E-05	1.959E-05	3.396E-05	1.251E-04	4.276E-04	1.522E-03	4.085E-03	1.059E-02
Pb-210	U-238	1.000E+00	3.355E-05	5.907E-05	9.120E-05	1.519E-04	5.449E-04	1.844E-03	6.540E-03	1.752E-02	4.530E-02

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

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	4.783E-01	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-238	U-238	1.000E+00	3.067E+01	3.066E+01	3.065E+01	3.060E+01	3.045E+01	3.000E+01	2.850E+01	2.460E+01	1.471E+01
U-234	U-238	1.000E+00	0.000E+00	4.155E-05	8.680E-05	2.596E-04	8.553E-04	2.483E-03	7.382E-03	1.610E-02	1.911E-02
Th-230	U-238	1.000E+00	0.000E+00	8.948E-11	3.909E-10	3.511E-09	3.871E-08	3.408E-07	3.509E-06	2.561E-05	1.482E-04
Ra-226	U-238	1.000E+00	0.000E+00	6.180E-15	5.643E-14	1.519E-12	5.573E-11	1.463E-09	4.921E-08	1.014E-06	1.567E-05
Pb-210	U-238	1.000E+00	0.000E+00	2.290E-17	4.358E-16	3.477E-14	4.076E-12	2.864E-10	2.291E-08	7.513E-07	1.421E-05

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

RESCALC.EXE execution time = 504.16 seconds
Total water/soil iteration failures = 92.