



June 10, 2016

Attention: Document Control Desk  
Director, Office of Nuclear Material Safety and Safeguards  
U.S. Nuclear Regulatory Commission  
11555 Rockville Pike  
Rockville, MD 20852

Re: 5A of one year Forbearance Agreement dated as of August 17, 2015  
Dear Sir/Madam:

By letter 30 March 2016, NRC indicated that FMRI did not acceptably address existing contaminated groundwater at the facility, and that values of certain parameters for derived concentration guidelines (DCGL) for soils should be evaluated to determine whether they are still appropriate. By teleconference of 04 April 2016, it was agreed that FMRI would revise the DCGLs pursuant to NRC correspondence of 30 March 2016 and subject teleconference. By letter of 11 April 2016, FMRI requested an extension of time to comply with Condition 5A of the Forbearance Agreement. Thus please find below 1) concentrations limits for radionuclides in groundwater and 2) revision of the soil DCGLs.

Table 1 provides concentration limits (CL) for radionuclides in groundwater that are equivalent to 25 mrem/y for each radionuclide. The CLs would be applied using the sum-of-fractions (unity or mixture) rule.

NM5520

Table 1  
Groundwater concentrations  
that each result in a projected dose of 25 mrem/y from the drinking water pathway

<b>Radionuclide</b>	<b>Dose Conversion Factor<sup>1</sup> mrem/pCi</b>	<b>Concentration Limit<sup>2</sup> pCi/L</b>
U-238 + D	$2.69 \times 10^{-4}$	372
U-234	$2.83 \times 10^{-4}$	353
U-235 + D	$2.67 \times 10^{-4}$	375
Pa-231	$1.06 \times 10^{-2}$	9.43
Ac-227 + D	$1.48 \times 10^{-2}$	6.76
Th-232	$2.73 \times 10^{-3}$	36.6
Th-230	$5.48 \times 10^{-4}$	182
Th-228 + D	$8.08 \times 10^{-4}$	124
Ra-226 + D	$1.33 \times 10^{-3}$	75.2
Ra-228 + D	$1.44 \times 10^{-3}$	69.4
Pb-210 + D	$5.37 \times 10^{-3}$	18.6

<sup>1</sup> Yu, C., et. al. "User's Manual for RESRAD Version 6" Argonne, IL: Argonne National Laboratory. ANL/EAD-4. July 2001.

<sup>2</sup> Concentration for 25 mrem/y at drinking water intake of two liters per day\* adjusted for 250 workdays per year and one-half of daily intake at work. \*40 CFR 141.66(d)(2).

Table 2 provides revised DCGLs for radionuclides in soil that are equivalent to 25 mrem/y for each radionuclide. The DCGLs of Table 2 reflect revision of values for several parameters of the RESRAD. The DCGLs would be applied using the sum-of-fractions (unity or mixture) rule.

Table 2  
Revised Derived Concentration Guideline Levels  
that each result in a projected dose of 25 mrem/y from the soil and sediment pathway

<b>Radionuclide</b>	<b>DCGL pCi/g</b>
U-238 + D	1058
U-234	2880
U-235 + D	285
Pa-231	34.2
Ac-227 + D	39.0
Th-232	13.8
Th-230	59.0
Th-228 + D	27.5
Ra-226 + D	21.2
Ra-228 + D	24.5
Pb-210 + D	780

Enclosure identifies each RESRAD parameter, provides the FMRI input (value), and includes a basis for the value. Enclosure also provides the results of a sensitivity analysis of the revised DCGLs.

FMRI recognizes that there is not a groundwater pathway for DCGLs of building surfaces and equipment. This is consistent with the absence of the pathway from the RESRAD-BUILD model. Thus no revision is made for the DCGLs of building surfaces and equipment.

FMRI shall remediate the site to residual radioactive levels to ensure that exposure to residual radiation in all media from applicable pathways will not result in a dose exceeding 25 mrem/y, as specified in 10 CFR 20.1402. The residual radioactivity concentrations for each media of groundwater, soils and sediment, and building and equipment surfaces will be remediated such that the sum of the sums-of-fractions does not exceed one.

Sincerely,

*Bob Compennolle by [Signature]*

Robert Compennolle  
FMRI, Inc.  
#10 Tantalum Place  
Muskogee, Ok. 74403

Enclosures:

**FMRI, Inc.**

**Docket No. 40-7580**

**June 2016**

**REVISION OF DERIVED CONCENTRATION GUIDELINE LEVELS  
Industrial Worker Scenario**

**ATTACHMENTS**

**Attachment 1**

**RESRAD SUMMARY REPORT  
Industrial Worker Scenario**

**Attachment 2**

**SENSITIVITY ANALYSIS  
Industrial Worker Scenario**

## REVISION OF DERIVED CONCENTRATION GUIDELINE LEVELS

### Introduction

Fansteel submitted a decommissioning plan (DP) to NRC in 2003.<sup>1</sup> The DP at Section 5.0 Dose Modeling Evaluations developed radiological criteria for license termination as concentrations of radionuclides in soil and on building and component surfaces; i.e., derived concentration guideline levels (DCGL). Development of the DCGLs for soil presumed that exposure of the critical group via drinking water from on site groundwater was not an applicable exposure pathway.

Subsequently, FMRI did not provide an adequate defense for excluding the exposure pathway of drinking water from on site groundwater.<sup>2</sup> Additionally, a technical concern was identified that some parameter values were established to be conservative (i.e., expected to result in a higher projected dose than if using the true value of the parameter) for a scenario in which the drinking water pathway was excluded but do not appear to be appropriate for a scenario in which a drinking water pathway is included.<sup>2</sup>

### Scope of Revision

This revision of DCGLs for soils is FMRI response to the aforementioned technical concern. FMRI reviewed the values of inputs to the dose model as described in the DP with intent to revise any values that were not appropriate. During the review, FMRI recognized that the original value for some parameters were not readily reproducible or were not internally consistent; thus model values were also revised in this context. The following sections identify which dose model inputs were revised and the revised value, and which model inputs were not changed.

### Source Term

#### Configuration

The configuration and principal radionuclides described in the DP were not changed for this revision of the DCGLs.

#### Chemical Form

The RESRAD address chemical form by means of the parameter Transport Distribution coefficient (labeled partition coefficient in the DP and applicable guidance). The values assigned in the Table 5-5 of the DP for the transport distribution coefficients could not be reproduced from the reference provided therein as "NUREG/CR-5512, Vol. 3". Therefore FMRI identified a transport distribution coefficient value for each radionuclide from applicable guidance<sup>3</sup>; the values are provided in Table 2.

---

<sup>1</sup> Fansteel. Decommissioning Plan, Fansteel, Muskogee, Oklahoma Site. Rev. 0. January 14, 2003. [ML030240051]

<sup>2</sup> Michael A. Norato, U.S. Nuclear Regulatory Commission, to Robert Compennolle, FMRI, March 30, 2016, [ML16069A084]

<sup>3</sup> U.S. Nuclear Regulatory Commission. Development of Probabilistic RESRAD 6.0 and RESRAD-BUILD 3.0 Computer Codes. Washington, D.C.: U.S. Nuclear Regulatory Commission. NUREG/CR-6697. December 2000. [Table 3.9-1]

### Residual Radioactivity Spatial Distribution

The residual radioactivity spatial distribution described in the DP was not changed for this revision of the DCGLs.

### **Critical Group, Scenario, and Pathways Identification and Selection**

#### Scenario Identification

The scenario identification described in the DP was not changed for this revision of the DCGLs.

#### Critical Group Determination

The critical group described in the DP was not changed for this revision of the DCGLs.

#### Exposure Pathways

The exposure pathways described in the DP were not changed for this revision of the DCGLs except that the drinking water pathway was activated. The exposure pathway selections are identified in Table 1. The drinking water pathway was modeled by assuming all on site drinking water is from a groundwater well on site for which the water has become contaminated by the residual radioactivity in soil, represented by the DCGLs; the associated model parameters and a brief basis for respective value are provided in Table 2.

The DP at Table 5-3 identified key parameters of the scenario and provided a respective value.

The following changes were made for the revised DCGLs:

- Exposure duration was changed from 25 years to one year to reflect the actual compliance period. This parameter is used only for risk calculations, not for dose calculations.
- Inhalation (breathing) rate was changed from 11,400 m<sup>3</sup>/yr to 8400 m<sup>3</sup>/y to reflect use of the "most likely" value provided by guidance.<sup>4</sup>
- Soil ingestion was changed from 18.25 m<sup>3</sup>/yr to 18.3 m<sup>3</sup>/y to reflect use of the "most likely" value provided by guidance.<sup>3</sup>
- Drinking water intake was changed from "Not used" to 250 L/y to reflect a reasonable intake for time at work. Derivation of the intake rate is provided with Table 2 at footnote 5.

### **Conceptual Model**

The conceptual model described in the DP was not changed for this revision of the DCGLs.

#### Relative Location and Activities of the Critical Group

The relative location and activities of the critical group described in the DP were not changed for this revision of the DCGLs. These conditions were particularly reviewed previously and found acceptable.<sup>5</sup>

---

<sup>4</sup> ibid [page 5-19]

<sup>5</sup> U.S. Nuclear Regulatory Commission. Safety Evaluation Report for License Amendment Application to Approve Decommissioning. October 31, 2003. [ML033250083]

### Hydrologic and Environmental Transport Processes

The hydrologic and environmental transport process parameters described in the DP were changed for this revision of the DCGLs in order to reflect activation of the drinking water pathway. Particularly, a saturated zone was automatically added to the model. Additionally, an uncontaminated unsaturated zone was also included. The associated model parameters and a brief basis for respective value are provided in Table 2.

### Dimensions, Location, and Spatial Variability of the Source Term

The dimensions, location, and spatial variability of the source term described in the DP were not changed for this revision of the DCGLs.

### Calculations and Input Parameters

The calculations described in the DP were not changed for this revision of the DCGLs; i.e., this revision of the DCGLs used RESRAD Version 6.2.1, deterministic mode.

### Input Parameters

The DP at tables 5-4, 5-5, and 5-6 identified parameters of the scenario and provided a respective value. The following changes were made for the revised DCGLs:

- The values for the following parameters were changed because the source (reference) for the original value could not be reproduced or recreated:
  - Length parallel to aquifer flow from 275 m to 239 m.
  - Density of contaminated zone from 1.51 g/cm<sup>3</sup> to 1.52 g/cm<sup>3</sup>.
  - Contaminated zone total porosity from 0.44 to 0.425.
  - Contaminated zone hydraulic conductivity from 5500 m/y to 9.9 m/y.
  - Contaminated zone b parameter from 4.05 to 2.9.
  - Evapotranspiration coefficient from 0.99 to 0.625.
    - This change was additionally necessary in order that the value be consistent with expectation and guidance.
  - Precipitation from 1.1 m/y to 1.19 m/y.
  - Wind speed (Average Annual) from 4.52 m/s to 3.2 m/s.
  - Partition coefficients as discussed above at Chemical Form:
    - Uranium from 2.18 cm<sup>3</sup>/g to 126 cm<sup>3</sup>/g.
    - Thorium from 119 cm<sup>3</sup>/g to 5884 cm<sup>3</sup>/g.
    - Radium from 3530 cm<sup>3</sup>/g to 3533 cm<sup>3</sup>/g.
    - Lead from 2380 cm<sup>3</sup>/g to 2392 cm<sup>3</sup>/g.
    - Protactinium from 4.8 cm<sup>3</sup>/g to 380 cm<sup>3</sup>/g.
    - Actinium from 1739 cm<sup>3</sup>/g to 825 cm<sup>3</sup>/g.
  - Inhalation rate as described above at Exposure Pathways from 11,400 m<sup>3</sup>/y to 8400m<sup>3</sup>/y.
  - Mass loading for inhalation from 0.0001 g/m<sup>3</sup> to 0.00023 g/m<sup>3</sup>.
  - Exposure duration as described above at Exposure Pathways from 25 years to one year
  - Indoor dust filtration factor (Shielding Factor, Inhalation) from 0.4 to 0.58.
  - External gamma shielding factor (Shielding Factor, External Gamma) from 0.552 to 0.27.
  - Soil ingestion as described above at Exposure Pathways from 18.25 m<sup>3</sup>/y to 18.3 m<sup>3</sup>/y.

All of the parameters used by the RESRAD to evaluate the industrial worker scenario are listed in Table 2 along with the respective value and a basis for choice of the value.

## Results

The result of the dose assessment determining the DGCLs as Attachment 1 as a copy of the RESRAD Summary Report.

### **Compliance with Regulatory Criteria**

Compliance with the criteria will be demonstrated by application of DCGLs in conformance with the sum-of-fractions (unity or mixture) rule. The DCGLs are listed in Table 3.

### **Sensitivity Analysis**

A sensitivity analysis was carried out of the scenario by taking individual parameters and repeating the RESRAD calculation with the respective parameter under test set at two specified extremes. Only a single test parameter is varied at a time. An annual dose for the principal radionuclides at concentrations representing a plausible as-left condition of the site was not found to be significantly sensitive to any analyzed parameter. The results of the sensitivity analysis of the industrial worker scenario are presented in Attachment 2.



**TABLE 1**  
**INDUSTRIAL WORKER SCENARIO**  
**EXPOSURE PATHWAY SELECTIONS**

PATHWAY <sup>1</sup>	SELECTION
External Gamma	Active
Inhalation (w/o radon)	Active
Plant Ingestion	Suppressed
Meat Ingestion	Suppressed
Milk Ingestion	Suppressed
Aquatic Foods	Suppressed
Drinking Water	Active
Soil Ingestion	Active
Radon	Suppressed

<sup>1</sup> These pathways match those available from the conceptual model used in the dose assessment; i.e. RESRAD version 6.21.

**TABLE 2**  
**INDUSTRIAL WORKER SCENARIO**  
**FMRI SELECTED MODEL VALUES**

Parameter	FMRI Value	Basis for Value
Source (Soil Concentrations)		
Activity	pCi	
Dose	mrem	
Basic radiation dose limit (mrem/yr)	25	10 CFR 20.1402 Radiological criteria for unrestricted use
Nuclide concentration for U-238 (pCi/g)		To be determined for the <i>Basic radiation dose limit</i> .
Transport Distribution coefficients for U-238		
Contaminated zone (cm**3/g)	126	Suggestion from guidance for use of RESRAD. <sup>2</sup>
Unsaturated zone 1 (cm**3/g)	126	Suggestion from guidance for use of RESRAD. <sup>2</sup>
Saturated zone (cm**3/g)	126	Suggestion from guidance for use of RESRAD. <sup>2</sup>
Time since material placement (yr)	0	RESRAD default. <sup>1</sup>
Groundwater concentration (pCi/L)	---	Not available; reflects <i>Time since material placement</i> = 0. <sup>1</sup>
Solubility Limit (mol/L)	0	RESRAD default. <sup>1</sup>
Leach Rate (/yr)	0	RESRAD default. <sup>1</sup>
Nuclide concentration for U-235 (pCi/g)		To be determined for the <i>Basic radiation dose limit</i> .
Transport Distribution coefficients for U-235		
Contaminated zone (cm**3/g)	126	Suggestion from guidance for use of RESRAD. <sup>2</sup>
Unsaturated zone 1 (cm**3/g)	126	Suggestion from guidance for use of RESRAD. <sup>2</sup>
Saturated zone (cm**3/g)	126	Suggestion from guidance for use of RESRAD. <sup>2</sup>
Time since material placement (yr)	0	RESRAD default. <sup>1</sup>
Groundwater concentration (pCi/L)	---	Not available; reflects <i>Time since material placement</i> = 0. <sup>1</sup>
Solubility Limit (mol/L)	0	RESRAD default. <sup>1</sup>
Leach Rate (/yr)	0	RESRAD default. <sup>1</sup>
Nuclide concentration for Pa-231 (pCi/g)		To be determined for the <i>Basic radiation dose limit</i> .
Transport Distribution coefficients for Pa-231		
Contaminated zone (cm**3/g)	380	Suggestion from guidance for use of RESRAD. <sup>2</sup>
Unsaturated zone 1 (cm**3/g)	380	Suggestion from guidance for use of RESRAD. <sup>2</sup>
Saturated zone (cm**3/g)	380	Suggestion from guidance for use of RESRAD. <sup>2</sup>
Time since material placement (yr)	0	RESRAD default. <sup>1</sup>
Groundwater concentration (pCi/L)	---	Not available; reflects <i>Time since material placement</i> = 0. <sup>1</sup>
Solubility Limit (mol/L)	0	RESRAD default. <sup>1</sup>
Leach Rate (/yr)	0	RESRAD default. <sup>1</sup>
Nuclide concentration for Ac-227 (pCi/g)		To be determined for the <i>Basic radiation dose limit</i> .
Transport Distribution coefficients for Ac-227		
Contaminated zone (cm**3/g)	825	Suggestion from guidance for use of RESRAD. <sup>2</sup>
Unsaturated zone 1 (cm**3/g)	825	Suggestion from guidance for use of RESRAD. <sup>2</sup>
Saturated zone (cm**3/g)	825	Suggestion from guidance for use of RESRAD. <sup>2</sup>
Time since material placement (yr)	0	RESRAD default. <sup>1</sup>
Groundwater concentration (pCi/L)	---	Not available; reflects <i>Time since material placement</i> = 0. <sup>1</sup>
Solubility Limit (mol/L)	0	RESRAD default. <sup>1</sup>
Leach Rate (/yr)	0	RESRAD default. <sup>1</sup>

<b>TABLE 2</b>					
<b>INDUSTRIAL WORKER SCENARIO</b>					
<b>FMRI SELECTED MODEL VALUES</b>					
<b>Scenario</b>	<b>Model</b>	<b>Value</b>	<b>Unit</b>	<b>Source</b>	<b>Notes</b>
Baseline	1	0.0000	100%	FMRI	Assumed
	2	0.0000	100%	FMRI	Assumed
	3	0.0000	100%	FMRI	Assumed
	4	0.0000	100%	FMRI	Assumed
	5	0.0000	100%	FMRI	Assumed
	6	0.0000	100%	FMRI	Assumed
	7	0.0000	100%	FMRI	Assumed
High Growth	1	0.0000	100%	FMRI	Assumed
	2	0.0000	100%	FMRI	Assumed
	3	0.0000	100%	FMRI	Assumed
	4	0.0000	100%	FMRI	Assumed
	5	0.0000	100%	FMRI	Assumed
	6	0.0000	100%	FMRI	Assumed
	7	0.0000	100%	FMRI	Assumed
Low Growth	1	0.0000	100%	FMRI	Assumed
	2	0.0000	100%	FMRI	Assumed
	3	0.0000	100%	FMRI	Assumed
	4	0.0000	100%	FMRI	Assumed
	5	0.0000	100%	FMRI	Assumed
	6	0.0000	100%	FMRI	Assumed
	7	0.0000	100%	FMRI	Assumed

[illegible]

**TABLE 2**  
**INDUSTRIAL WORKER SCENARIO**  
**FMRI SELECTED MODEL VALUES**

Parameter	FMRI Value	Basis for Value
Nuclide concentration for Th-232 (pCi/g)		To be determined for the <i>Basic radiation dose limit</i> .
Transport Distribution coefficients for Th-232		
Contaminated zone (cm**3/g)	5884	Suggestion from guidance for use of RESRAD. <sup>2</sup>
Unsaturated zone 1 (cm**3/g)	5884	Suggestion from guidance for use of RESRAD. <sup>2</sup>
Saturated zone (cm**3/g)	5884	Suggestion from guidance for use of RESRAD. <sup>2</sup>
Time since material placement (yr)	0	RESRAD default. <sup>1</sup>
Groundwater concentration (pCi/L)	---	Not available; reflects <i>Time since material placement</i> = 0. <sup>1</sup>
Solubility Limit (mol/L)	0	RESRAD default. <sup>1</sup>
Leach Rate (/yr)	0	RESRAD default. <sup>1</sup>
Nuclide concentration for Ra-228 (pCi/g)		To be determined for the <i>Basic radiation dose limit</i> .
Transport Distribution coefficients for Ra-228		
Contaminated zone (cm**3/g)	3533	Suggestion from guidance for use of RESRAD. <sup>2</sup>
Unsaturated zone 1 (cm**3/g)	3533	Suggestion from guidance for use of RESRAD. <sup>2</sup>
Saturated zone (cm**3/g)	3533	Suggestion from guidance for use of RESRAD. <sup>2</sup>
Time since material placement (yr)	0	RESRAD default. <sup>1</sup>
Groundwater concentration (pCi/L)	---	Not available; reflects <i>Time since material placement</i> = 0. <sup>1</sup>
Solubility Limit (mol/L)	0	RESRAD default. <sup>1</sup>
Leach Rate (/yr)	0	RESRAD default. <sup>1</sup>
Nuclide concentration for Th-228 (pCi/g)		To be determined for the <i>Basic radiation dose limit</i> .
Transport Distribution coefficients for Th-228		
Contaminated zone (cm**3/g)	5884	Suggestion from guidance for use of RESRAD. <sup>2</sup>
Unsaturated zone 1 (cm**3/g)	5884	Suggestion from guidance for use of RESRAD. <sup>2</sup>
Saturated zone (cm**3/g)	5884	Suggestion from guidance for use of RESRAD. <sup>2</sup>
Time since material placement (yr)	0	RESRAD default. <sup>1</sup>
Groundwater concentration (pCi/L)	---	Not available; reflects <i>Time since material placement</i> = 0. <sup>1</sup>
Solubility Limit (mol/L)	0	RESRAD default. <sup>1</sup>
Leach Rate (/yr)	0	RESRAD default. <sup>1</sup>
Calculation Parameters (Times)		
Times for Calculations (years)	1	RESRAD default. <sup>1</sup>
Times for Calculations (years)	3	RESRAD default. <sup>1</sup>
Times for Calculations (years)	10	RESRAD default. <sup>1</sup>
Times for Calculations (years)	30	RESRAD default. <sup>1</sup>
Times for Calculations (years)	100	RESRAD default. <sup>1</sup>
Times for Calculations (years)	300	RESRAD default. <sup>1</sup>
Times for Calculations (years)	1000	RESRAD default and 10 CFR 20.1401(d)

**TABLE 2**  
**INDUSTRIAL WORKER SCENARIO**  
**FMRI SELECTED MODEL VALUES**

Parameter	FMRI Value	Basis for Value
<b>Contaminated Zone Parameters</b>		
Area of contaminated zone (m**2)	180000	Decommissioning Plan, Section 5.2.1.
Thickness of contaminated zone (m)	0.85	Decommissioning Plan, Section 5.2.1.
Length parallel to aquifer flow (m)	239	Diameter of a circle of <i>Area of contaminated zone</i> .
<b>Cover ... Contaminated Zone Hydrological Data</b>		
Cover depth (m)	0	No clean cover of surface soils.
Density of cover material (g/cm**3)	---	Not available; reflects <i>Cover depth</i> = 0. <sup>1</sup>
Cover erosion rate (m/yr)	---	Not available; reflects <i>Cover depth</i> = 0. <sup>1</sup>
Density of contaminated zone (g/cm**3)	1.52	A mean for generic soil. <sup>2</sup>
Contaminated zone erosion rate (m/yr)	0.00006	Recommendation from guidance for use of RESRAD. <sup>2</sup>
Contaminated zone total porosity	0.425	A mean for generic soil. <sup>2</sup>
Contaminated zone field capacity	0.2	RESRAD default. <sup>1</sup>
Contaminated ... hydraulic conductivity (m/yr)	9.9	A mean for generic soil. <sup>2</sup>
Contaminated zone b parameter	2.9	A mean for generic soil. <sup>2</sup>
Humidity in air (g/cm**3)	---	Not available due suppressed radon pathway. <sup>1</sup>
Evapotranspiration coefficient	0.645	Site-specific estimate. <sup>3</sup>
Wind Speed (m/sec)	3.2	Site-specific estimate. <sup>4</sup>
Precipitation (m/yr)	1.19	Site-specific estimate. <sup>4</sup>
Irrigation (m/yr)	0	Not applicable.
Irrigation mode	---	Not applicable.
Runoff coefficient	0.4	Estimate from guidance for use of RESRAD. <sup>2</sup>
Watershed ... nearby stream or pond (m**2)	180000	Site-specific estimate as <i>Area of contaminated zone</i> .
Accuracy for water/soil computations	0.001	RESRAD default. <sup>1</sup>
<b>Saturated Zone Hydrological Data</b>		
Density of saturated zone (g/cm**3)	1.52	A mean for generic soil. <sup>2</sup>
Saturated zone total porosity	0.425	A mean for generic soil. <sup>2</sup>
Saturated zone effective porosity	0.355	A mean for generic soil. <sup>2</sup>
Saturated zone field capacity	0.2	RESRAD default. <sup>1</sup>
Saturated zone hydraulic conductivity (m/yr)	9.9	A mean for generic soil. <sup>2</sup>
Saturated zone hydraulic gradient	0.021	A national average. <sup>2</sup>
Saturated zone b parameter	---	Not available; reflects <i>water table drop rate</i> equal zero <sup>1</sup>
Water table drop rate (m/yr)	0	Recognize unconfined groundwater system.
Well pump intake depth (m below water table)	10	RESRAD default. <sup>1</sup>
<b>Model for Water Transport Parameters</b>		
Nondispersion (ND) or Mass-Balance (MB)	ND	RESRAD default based on size of contaminated area. <sup>1</sup>
Well pumping rate (m**3/yr)	250	RESRAD default. <sup>1</sup>

**TABLE 2**  
**INDUSTRIAL WORKER SCENARIO**  
**FMRI SELECTED MODEL VALUES**

Parameter	FMRI Value	Basis for Value
<b>Uncontaminated Unsaturated Zone Parameters</b>		
Unsaturated Zones	1	Recognize actual site condition.
Unsaturated Zone 1, Thickness (m)	4	RESRAD default. <sup>1</sup>
Unsaturated Zone 1, Density (g/cm <sup>3</sup> )	1.52	A mean for generic soil. <sup>2</sup>
Unsaturated Zone 1, Total Porosity	0.425	A mean for generic soil. <sup>2</sup>
Unsaturated Zone 1, Effective Porosity	0.355	A mean for generic soil. <sup>2</sup>
Unsaturated zone field capacity	0.2	RESRAD default. <sup>1</sup>
Unsaturated ... , Hydraulic Conductivity (m/yr)	9.9	A mean for generic soil. <sup>2</sup>
Unsaturated Zone 1, b Parameter	2.9	A mean for generic soil. <sup>2</sup>
<b>Occupancy, Inhalation, ... External Gamma Data</b>		
Inhalation rate (m <sup>3</sup> /yr)	8400	Recommendation from guidance for use of RESRAD. <sup>2</sup>
Mass loading for inhalation (g/m <sup>3</sup> )	0.00023	Estimate median from guidance for RESRAD of PM-10. <sup>2</sup>
Exposure duration	1y	Reflects applicable compliance period.
Indoor dust filtration factor	0.58	Estimate from guidance for RESRAD of daytime PM-10. <sup>2</sup>
External gamma shielding factor	0.27	A mean value from guidance for use of RESRAD. <sup>2</sup>
Indoor time fraction	0.17	Decommissioning Plan, Section 5.2.1.
Outdoor time fraction	0.06	Decommissioning Plan, Section 5.2.1.
Shape of the contaminated zone	circular	Assumed shape of <i>Area of contaminated zone</i> .
<b>Ingestion Pathway, Dietary Data</b>		
Fruits, vegetables, grain consumption (kg/yr)	---	Not available due suppressed plant ingestion pathway. <sup>1</sup>
Leafy vegetable consumption (kg/yr)	---	Not available due suppressed plant ingestion pathway. <sup>1</sup>
Milk consumption (L/yr)	---	Not available due suppressed milk ingestion pathway. <sup>1</sup>
Meat and poultry consumption (kg/yr)	---	Not available due suppressed meat ingestion pathway. <sup>1</sup>
Fish consumption (kg/yr)	---	Not available due suppressed aquatic ... ingestion pathway. <sup>1</sup>
Other seafood consumption	---	Not available due suppressed aquatic ... ingestion pathway. <sup>1</sup>
Soil ingestion (g/yr)	18.3	Suggestion from guidance for use of RESRAD. <sup>2</sup>
Drinking water intake (L/yr)	250	A reasonable estimate for time at work. <sup>5</sup>
Contaminated fraction Drinking water	1	A conservative assumption.
Contaminated fraction Household water	---	Not available due suppressed radon pathway. <sup>1</sup>
Contaminated fraction Livestock water	---	Not available due suppressed meat ingestion pathway. <sup>1</sup>
Contaminated fraction Irrigation water	---	Not available due suppressed plant ingestion pathway. <sup>1</sup>
Contaminated fraction Aquatic food	---	Not available due suppressed aquatic ... ingestion pathway. <sup>1</sup>
Contaminated fraction Plant food	---	Not available due suppressed plant ingestion pathway. <sup>1</sup>
Contaminated fraction Meat	---	Not available due suppressed meat ingestion pathway. <sup>1</sup>
Contaminated fraction Milk	---	Not available due suppressed milk ingestion pathway. <sup>1</sup>

**TABLE 2**  
**INDUSTRIAL WORKER SCENARIO**  
**FMRI SELECTED MODEL VALUES**

Parameter	FMRI Value	Basis for Value
Ingestion Pathway, Nondietary Data		
Livestock fodder intake for meat (kg/day)	---	Not available due suppressed meat ingestion pathway. <sup>1</sup>
Livestock fodder intake for milk (kg/day)	---	Not available due suppressed milk ingestion pathway. <sup>1</sup>
Livestock water intake for meat (L/day)	---	Not available due suppressed meat ingestion pathway. <sup>1</sup>
Livestock water intake for milk (L/day)	---	Not available due suppressed milk ingestion pathway. <sup>1</sup>
Livestock soil intake (kg/day)	---	Not available due suppressed meat and milk ingestion pathways. <sup>1</sup>
Mass loading for foliar deposition (g/m**3)	---	Not available due suppressed meat and milk ingestion pathways. <sup>1</sup>
Depth of soil mixing layer (m)	0.15	RESRAD default. <sup>1</sup>
Depth of roots (m)	---	Not available due suppressed meat and milk ingestion pathways. <sup>1</sup>
Groundwater Fractional Usage Drinking water	1	No potable surface water available on site.
Groundwater fractional Usage Household ...	---	Not available due suppressed radon pathway. <sup>1</sup>
Groundwater Fractional Usage Livestock ...	---	Not available due suppressed meat and milk ingestion pathways. <sup>1</sup>
Groundwater Fractional Usage Irrigation ...	---	Not available due suppressed meat and milk ingestion pathways. <sup>1</sup>
Plant Factors		
All	---	Not available due suppressed ingestion pathways. <sup>1</sup>

<sup>1</sup> Yu, C., et. al. "User's Manual for RESRAD Version 6" Argonne, IL: Argonne National Laboratory. ANL/EAD-4. July 2001.

<sup>2</sup> U.S. Nuclear Regulatory Commission. Development of Probabilistic RESRAD 6.0 and RESRAD-BUILD 3.0 Computer Codes. Washington, D.C.: U.S. Nuclear Regulatory Commission. NUREG/CR-6697. December 2000.

<sup>3</sup> Sanford, W. E. and Selnick, D. L. (2013), Estimation of Evapotranspiration Across the Conterminous United States Using a Regression With Climate and Land-Cover Data. JAWRA Journal of the American Water Resources Association, 49: 217-230. doi: 10.1111/jawr.12010 [Figure 13; average for Muskogee County.]

<sup>4</sup> [http://climate.ok.gov/county\\_climate/Products/County\\_Climatologies/county\\_climate\\_muskogee.pdf](http://climate.ok.gov/county_climate/Products/County_Climatologies/county_climate_muskogee.pdf)

<sup>5</sup> Two liters per day\* adjusted for 250 workdays per year and one-half of daily intake at work. \*40 CFR 141.66(d)(2)

**TABLE 3**  
**DERIVED CONCENTRATION GUIDELINE LEVELS**  
**(DCGL)**

<b>Radionuclide</b>	<b>DCGL pCi/g</b>
U-238 + D	1058
U-234	2880
U-235 + D	285
Pa-231	34.2
Ac-227 + D	39.0
Th-232	13.8
Th-230	59.0
Th-228 + D	27.5
Ra-226 + D	21.2
Ra-228 + D	24.5
Pb-210 + D	780



## **ATTACHMENT 1**

### **RESRAD SUMMARY REPORT**

#### **INDUSTRIAL WORKER SCENARIO**

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Dose Conversion Factor (and Related) Parameter Summary ...	2
Site-Specific Parameter Summary .....	5
Summary of Pathway Selections .....	10
Contaminated Zone and Total Dose Summary .....	11
Total Dose Components	
Time = 0.000E+00 .....	12
Time = 1.000E+00 .....	13
Time = 3.000E+00 .....	14
Time = 1.000E+01 .....	15
Time = 3.000E+01 .....	16
Time = 1.000E+02 .....	17
Time = 3.000E+02 .....	18
Time = 1.000E+03 .....	19
Dose/Source Ratios Summed Over All Pathways .....	20
Single Radionuclide Soil Guidelines .....	21
Dose Per Nuclide Summed Over All Pathways .....	22
Soil Concentration Per Nuclide .....	23

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

Menu	Parameter	Current Value	Default	Parameter Name
3-1	Dose conversion factors for inhalation, mrem/pCi:			
3-1	Ac-227+D	6.720E+00	6.720E+00	DCF2( 1)
3-1	Pa-231	1.280E+00	1.280E+00	DCF2( 2)
3-1	Pb-210+D	2.320E-02	2.320E-02	DCF2( 3)
3-1	Ra-226+D	8.600E-03	8.600E-03	DCF2( 4)
3-1	Ra-228+D	5.080E-03	5.080E-03	DCF2( 5)
3-1	Th-228+D	3.450E-01	3.450E-01	DCF2( 6)
3-1	Th-230	3.260E-01	3.260E-01	DCF2( 7)
3-1	Th-232	1.640E+00	1.640E+00	DCF2( 8)
3-1	U-234	1.320E-01	1.320E-01	DCF2( 9)
3-1	U-235+D	1.230E-01	1.230E-01	DCF2(10)
3-1	U-238+D	1.180E-01	1.180E-01	DCF2(11)
3-1	Dose conversion factors for ingestion, mrem/pCi:			
3-1	Ac-227+D	1.480E-02	1.480E-02	DCF3( 1)
3-1	Pa-231	1.060E-02	1.060E-02	DCF3( 2)
3-1	Pb-210+D	7.270E-03	7.270E-03	DCF3( 3)
3-1	Ra-226+D	1.330E-03	1.330E-03	DCF3( 4)
3-1	Ra-228+D	1.440E-03	1.440E-03	DCF3( 5)
3-1	Th-228+D	8.080E-04	8.080E-04	DCF3( 6)
3-1	Th-230	5.480E-04	5.480E-04	DCF3( 7)
3-1	Th-232	2.730E-03	2.730E-03	DCF3( 8)
3-1	U-234	2.830E-04	2.830E-04	DCF3( 9)
3-1	U-235+D	2.670E-04	2.670E-04	DCF3(10)
3-1	U-238+D	2.690E-04	2.690E-04	DCF3(11)
3-34	Food transfer factors:			
3-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF( 1,1)
3-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF( 1,2)
3-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF( 1,3)
3-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF( 2,1)
3-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF( 2,2)
3-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF( 2,3)
3-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF( 3,1)
3-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF( 3,2)
3-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF( 3,3)
3-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF( 4,1)
3-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF( 4,2)
3-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF( 4,3)
3-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF( 5,1)
3-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF( 5,2)
3-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF( 5,3)
3-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF( 6,1)
3-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF( 6,2)
3-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF( 6,3)

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

Menu	Parameter	Current Value	Default	Parameter Name
J-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF( 7,1)
J-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF( 7,2)
J-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF( 7,3)
J-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF( 8,1)
J-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF( 8,2)
J-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF( 8,3)
J-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF( 9,1)
J-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF( 9,2)
J-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF( 9,3)
J-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(10,1)
J-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(10,2)
J-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(10,3)
J-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(11,1)
J-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(11,2)
J-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(11,3)
J-5	Bioaccumulation factors, fresh water, L/kg:			
J-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC( 1,1)
J-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC( 1,2)
J-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC( 2,1)
J-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC( 2,2)
J-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC( 3,1)
J-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC( 3,2)
J-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC( 4,1)
J-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC( 4,2)
J-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC( 5,1)
J-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC( 5,2)
J-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC( 6,1)
J-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC( 6,2)
J-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC( 7,1)
J-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC( 7,2)
J-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC( 8,1)
J-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC( 8,2)
J-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC( 9,1)
J-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC( 9,2)
J-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(10,1)
J-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(10,2)

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(11,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(11,2)

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)	1.800E+05	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	8.500E-01	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	2.390E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	2.500E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T( 2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T( 3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T( 4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T( 5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T( 6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T( 7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T( 8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T( 9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Ac-227	1.000E+00	0.000E+00	---	S1( 1)
R012	Initial principal radionuclide (pCi/g): Pa-231	1.000E+00	0.000E+00	---	S1( 2)
R012	Initial principal radionuclide (pCi/g): Pb-210	1.000E+00	0.000E+00	---	S1( 3)
R012	Initial principal radionuclide (pCi/g): Ra-226	1.000E+00	0.000E+00	---	S1( 4)
R012	Initial principal radionuclide (pCi/g): Ra-228	1.000E+00	0.000E+00	---	S1( 5)
R012	Initial principal radionuclide (pCi/g): Th-228	1.000E+00	0.000E+00	---	S1( 6)
R012	Initial principal radionuclide (pCi/g): Th-230	1.000E+00	0.000E+00	---	S1( 7)
R012	Initial principal radionuclide (pCi/g): Th-232	1.000E+00	0.000E+00	---	S1( 8)
R012	Initial principal radionuclide (pCi/g): U-234	1.000E+00	0.000E+00	---	S1( 9)
R012	Initial principal radionuclide (pCi/g): U-235	1.000E+00	0.000E+00	---	S1(10)
R012	Initial principal radionuclide (pCi/g): U-238	1.000E+00	0.000E+00	---	S1(11)
R012	Concentration in groundwater (pCi/L): Ac-227	not used	0.000E+00	---	W1( 1)
R012	Concentration in groundwater (pCi/L): Pa-231	not used	0.000E+00	---	W1( 2)
R012	Concentration in groundwater (pCi/L): Pb-210	not used	0.000E+00	---	W1( 3)
R012	Concentration in groundwater (pCi/L): Ra-226	not used	0.000E+00	---	W1( 4)
R012	Concentration in groundwater (pCi/L): Ra-228	not used	0.000E+00	---	W1( 5)
R012	Concentration in groundwater (pCi/L): Th-228	not used	0.000E+00	---	W1( 6)
R012	Concentration in groundwater (pCi/L): Th-230	not used	0.000E+00	---	W1( 7)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	W1( 8)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1( 9)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(10)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(11)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.520E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	6.000E-05	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.250E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	9.900E+00	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	2.900E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	3.200E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	6.450E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.190E+00	1.000E+00	---	PRECIP

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	4.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.800E+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)	1.520E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.250E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	3.550E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	9.900E+00	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.100E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	not used	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	0.000E+00	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	4.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.520E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.250E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	3.550E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	2.000E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	2.900E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	9.900E+00	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Ac-227				
R016	Contaminated zone (cm**3/g)	8.250E+02	2.000E+01	---	DCNUCC( 1)
R016	Unsat. zone 1 (cm**3/g)	8.250E+02	2.000E+01	---	DCNUCU( 1,1)
R016	Saturated zone (cm**3/g)	8.250E+02	2.000E+01	---	DCNUCS( 1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.377E-04	ALEACH( 1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK( 1)
R016	Distribution coefficients for Pa-231				
R016	Contaminated zone (cm**3/g)	3.800E+02	5.000E+01	---	DCNUCC( 2)
R016	Unsat. zone 1 (cm**3/g)	3.800E+02	5.000E+01	---	DCNUCU( 2,1)
R016	Saturated zone (cm**3/g)	3.800E+02	5.000E+01	---	DCNUCS( 2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.160E-04	ALEACH( 2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK( 2)
R016	Distribution coefficients for Pb-210				
R016	Contaminated zone (cm**3/g)	2.392E+03	1.000E+02	---	DCNUCC( 3)
R016	Unsat. zone 1 (cm**3/g)	2.392E+03	1.000E+02	---	DCNUCU( 3,1)
R016	Saturated zone (cm**3/g)	2.392E+03	1.000E+02	---	DCNUCS( 3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.201E-05	ALEACH( 3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK( 3)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Ra-226				
R016	Contaminated zone (cm**3/g)	3.533E+03	7.000E+01	---	DCNUCC( 4)
R016	Unsaturated zone 1 (cm**3/g)	3.533E+03	7.000E+01	---	DCNUCU( 4,1)
R016	Saturated zone (cm**3/g)	3.533E+03	7.000E+01	---	DCNUCS( 4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.553E-05	ALEACH( 4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK( 4)
R016	Distribution coefficients for Ra-228				
R016	Contaminated zone (cm**3/g)	3.533E+03	7.000E+01	---	DCNUCC( 5)
R016	Unsaturated zone 1 (cm**3/g)	3.533E+03	7.000E+01	---	DCNUCU( 5,1)
R016	Saturated zone (cm**3/g)	3.533E+03	7.000E+01	---	DCNUCS( 5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.553E-05	ALEACH( 5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK( 5)
R016	Distribution coefficients for Th-228				
R016	Contaminated zone (cm**3/g)	5.884E+03	6.000E+04	---	DCNUCC( 6)
R016	Unsaturated zone 1 (cm**3/g)	5.884E+03	6.000E+04	---	DCNUCU( 6,1)
R016	Saturated zone (cm**3/g)	5.884E+03	6.000E+04	---	DCNUCS( 6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.334E-05	ALEACH( 6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK( 6)
R016	Distribution coefficients for Th-230				
R016	Contaminated zone (cm**3/g)	5.884E+03	6.000E+04	---	DCNUCC( 7)
R016	Unsaturated zone 1 (cm**3/g)	5.884E+03	6.000E+04	---	DCNUCU( 7,1)
R016	Saturated zone (cm**3/g)	5.884E+03	6.000E+04	---	DCNUCS( 7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.334E-05	ALEACH( 7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK( 7)
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	5.884E+03	6.000E+04	---	DCNUCC( 8)
R016	Unsaturated zone 1 (cm**3/g)	5.884E+03	6.000E+04	---	DCNUCU( 8,1)
R016	Saturated zone (cm**3/g)	5.884E+03	6.000E+04	---	DCNUCS( 8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.334E-05	ALEACH( 8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK( 8)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	1.260E+02	5.000E+01	---	DCNUCC( 9)
R016	Unsaturated zone 1 (cm**3/g)	1.260E+02	5.000E+01	---	DCNUCU( 9,1)
R016	Saturated zone (cm**3/g)	1.260E+02	5.000E+01	---	DCNUCS( 9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.555E-03	ALEACH( 9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK( 9)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	1.260E+02	5.000E+01	---	DCNUCC(10)
R016	Unsaturated zone 1 (cm**3/g)	1.260E+02	5.000E+01	---	DCNUCU(10,1)
R016	Saturated zone (cm**3/g)	1.260E+02	5.000E+01	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.555E-03	ALEACH(10)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10)



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)	1.260E+02	5.000E+01	---	DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	1.260E+02	5.000E+01	---	DCNUCU(11,1)
R016	Saturated zone (cm**3/g)	1.260E+02	5.000E+01	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.555E-03	ALEACH(11)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	2.300E-04	1.000E-04	---	MLINH
R017	Exposure duration	1.000E+00	3.000E+01	---	ED
R017	Shielding factor, inhalation	5.800E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	2.700E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	1.700E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	6.000E-02	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)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	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)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	1.830E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	2.500E+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	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-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	---	LF15
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LF16
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)	not used	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	not used	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	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	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)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	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	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	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	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	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	not used	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 (l/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (l/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
3TOR	Storage times of contaminated foodstuffs (days):				

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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)
FITL	Number of graphical time points	32	---	---	NPTS
FITL	Maximum number of integration points for dose	17	---	---	LYMAX
FITL	Maximum number of integration points for risk	1	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	suppressed
4 -- meat ingestion	suppressed
5 -- milk ingestion	suppressed
6 -- aquatic foods	suppressed
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:	180000.00 square meters	Ac-227	1.000E+00
Thickness:	0.85 meters	Pa-231	1.000E+00
Cover Depth:	0.00 meters	Pb-210	1.000E+00
		Ra-226	1.000E+00
		Ra-228	1.000E+00
		Th-228	1.000E+00
		Th-230	1.000E+00
		Th-232	1.000E+00
		U-234	1.000E+00
		U-235	1.000E+00
		U-238	1.000E+00

Total Dose TDOSE(t), mrem/yr							
Basic Radiation Dose Limit = 2.500E+01 mrem/yr							
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)							
t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02
TDOSE(t):	3.949E+00	3.949E+00	3.948E+00	3.943E+00	3.931E+00	3.884E+00	3.758E+00
M(t):	1.580E-01	1.579E-01	1.579E-01	1.577E-01	1.572E-01	1.554E-01	1.503E-01
Maximum TDOSE(t):	3.949E+00 mrem/yr	at t = 0.000E+00 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- 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.
Ac-227	2.072E-01	0.0525	3.724E-01	0.0943	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.130E-02	0.0155
Pa-231	2.335E-02	0.0059	7.801E-02	0.0198	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.558E-02	0.0115
Pb-210	6.377E-04	0.0002	1.286E-03	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.013E-02	0.0076
Ra-226	1.166E+00	0.2952	5.042E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.067E-03	0.0015
Ra-228	7.505E-01	0.1900	3.274E-03	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.236E-03	0.0016
Th-228	8.898E-01	0.2253	1.630E-02	0.0041	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.853E-03	0.0007
Th-230	3.802E-04	0.0001	1.836E-02	0.0046	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.308E-03	0.0006
Th-232	4.297E-02	0.0109	9.248E-02	0.0234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.186E-02	0.0030
J-234	4.248E-05	0.0000	7.427E-03	0.0019	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.190E-03	0.0003
J-235	7.943E-02	0.0201	6.921E-03	0.0018	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.123E-03	0.0003
J-238	1.586E-02	0.0040	6.639E-03	0.0017	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.131E-03	0.0003
Total	3.176E+00	0.8042	6.036E-01	0.1528	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.698E-01	0.0430

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.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.409E-01	0.1623
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.469E-01	0.0372
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.205E-02	0.0081
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.172E+00	0.2968
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.600E-01	0.1924
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.089E-01	0.2301
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.104E-02	0.0053
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.473E-01	0.0373
J-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.659E-03	0.0022
J-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.747E-02	0.0221
J-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.363E-02	0.0060
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.949E+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.
Ac-227	2.007E-01	0.0508	3.606E-01	0.0913	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.937E-02	0.0150
Pa-231	2.983E-02	0.0076	8.963E-02	0.0227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.748E-02	0.0120
Pb-210	6.181E-04	0.0002	1.247E-03	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.920E-02	0.0074
Ra-226	1.165E+00	0.2951	5.433E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.986E-03	0.0018
Ra-228	9.191E-01	0.2328	7.550E-03	0.0019	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.341E-03	0.0016
Rh-228	6.193E-01	0.1568	1.134E-02	0.0029	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.986E-03	0.0005
Rh-230	8.851E-04	0.0002	1.835E-02	0.0046	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.310E-03	0.0006
Rh-232	1.448E-01	0.0367	9.315E-02	0.0236	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.262E-02	0.0032
J-234	4.242E-05	0.0000	7.415E-03	0.0019	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.188E-03	0.0003
J-235	7.931E-02	0.0201	6.912E-03	0.0018	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.123E-03	0.0003
J-238	1.583E-02	0.0040	6.629E-03	0.0017	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.130E-03	0.0003
Total	3.176E+00	0.8042	6.034E-01	0.1528	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.697E-01	0.0430

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.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.207E-01	0.1572
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.669E-01	0.0423
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.107E-02	0.0079
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.173E+00	0.2970
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.330E-01	0.2363
Rh-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.327E-01	0.1602
Rh-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.155E-02	0.0055
Rh-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.506E-01	0.0635
J-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.646E-03	0.0022
J-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.734E-02	0.0221
J-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.359E-02	0.0060
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.949E+00	1.0000

\*Sum of all water independent and dependent pathways.

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

Radio- Nuclide	Ground		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.
Ac-227	1.882E-01	0.0477	3.382E-01	0.0857	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.568E-02	0.0141
Pa-231	4.217E-02	0.0107	1.118E-01	0.0283	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.109E-02	0.0129
Pb-210	5.808E-04	0.0001	1.171E-03	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.744E-02	0.0070
Ra-226	1.164E+00	0.2949	6.179E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.738E-03	0.0022
Ra-228	1.002E+00	0.2537	1.105E-02	0.0028	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.878E-03	0.0015
Th-228	3.000E-01	0.0760	5.495E-03	0.0014	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.620E-04	0.0002
Th-230	1.894E-03	0.0005	1.835E-02	0.0046	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.317E-03	0.0006
Th-232	3.813E-01	0.0966	9.549E-02	0.0242	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.411E-02	0.0036
J-234	4.231E-05	0.0000	7.392E-03	0.0019	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.185E-03	0.0003
J-235	7.906E-02	0.0200	6.895E-03	0.0017	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.121E-03	0.0003
J-238	1.578E-02	0.0040	6.608E-03	0.0017	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.126E-03	0.0003
Total	3.175E+00	0.8043	6.030E-01	0.1528	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.696E-01	0.0430

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

Radio- Nuclide	Water		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.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.821E-01	0.1475
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.050E-01	0.0519
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.919E-02	0.0074
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.173E+00	0.2973
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.019E+00	0.2580
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.065E-01	0.0776
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.256E-02	0.0057
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.909E-01	0.1244
J-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.620E-03	0.0022
J-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.708E-02	0.0221
J-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.352E-02	0.0060
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.948E+00	1.0000

\*Sum of all water independent and dependent pathways.

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

Radio- Nuclide	Ground		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.
Ac-227	1.504E-01	0.0381	2.702E-01	0.0685	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.448E-02	0.0113
Pa-231	7.951E-02	0.0202	1.787E-01	0.0453	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.199E-02	0.0157
Pb-210	4.670E-04	0.0001	9.418E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.206E-02	0.0056
Ra-226	1.160E+00	0.2942	8.443E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.406E-02	0.0036
Ra-228	5.883E-01	0.1492	7.640E-03	0.0019	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.033E-03	0.0008
Th-228	2.375E-02	0.0060	4.349E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.614E-05	0.0000
Th-230	5.417E-03	0.0014	1.835E-02	0.0047	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.351E-03	0.0006
Th-232	1.070E+00	0.2714	1.039E-01	0.0264	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.783E-02	0.0045
J-234	4.208E-05	0.0000	7.313E-03	0.0019	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.172E-03	0.0003
J-235	7.822E-02	0.0198	6.842E-03	0.0017	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.117E-03	0.0003
J-238	1.561E-02	0.0040	6.537E-03	0.0017	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.114E-03	0.0003
Total	3.172E+00	0.8045	6.018E-01	0.1526	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.693E-01	0.0429

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.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.651E-01	0.1179
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.202E-01	0.0812
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.347E-02	0.0060
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.175E+00	0.2980
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.990E-01	0.1519
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.426E-02	0.0062
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.612E-02	0.0066
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.192E+00	0.3023
J-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.528E-03	0.0022
J-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.618E-02	0.0219
J-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.326E-02	0.0059
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.943E+00	1.0000

\*Sum of all water independent and dependent pathways.



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

Radio- Nuclide	Ground		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.
Ac-227	7.918E-02	0.0201	1.423E-01	0.0362	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.342E-02	0.0060
Pa-231	1.489E-01	0.0379	3.030E-01	0.0771	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.211E-02	0.0209
Pb-210	2.504E-04	0.0001	5.049E-04	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.183E-02	0.0030
Ra-226	1.149E+00	0.2923	1.269E-03	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.408E-02	0.0061
Ra-228	5.590E-02	0.0142	7.427E-04	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.820E-04	0.0001
Th-228	1.692E-05	0.0000	3.098E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.424E-08	0.0000
Th-230	1.541E-02	0.0039	1.834E-02	0.0047	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.519E-03	0.0006
Th-232	1.625E+00	0.4135	1.112E-01	0.0283	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.065E-02	0.0053
J-234	4.264E-05	0.0000	7.092E-03	0.0018	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.137E-03	0.0003
J-235	7.587E-02	0.0193	6.736E-03	0.0017	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.114E-03	0.0003
J-238	1.513E-02	0.0038	6.337E-03	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.080E-03	0.0003
Total	3.165E+00	0.8052	5.975E-01	0.1520	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.682E-01	0.0428

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.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.449E-01	0.0623
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.341E-01	0.1359
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.258E-02	0.0032
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.175E+00	0.2988
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.692E-02	0.0145
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.728E-05	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.628E-02	0.0092
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.757E+00	0.4470
J-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.272E-03	0.0021
J-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.372E-02	0.0213
J-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.255E-02	0.0057
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.931E+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- 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.
Ac-227	8.386E-03	0.0022	1.507E-02	0.0039	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.481E-03	0.0006
Pa-231	2.119E-01	0.0546	4.150E-01	0.1068	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.935E-02	0.0256
Pb-210	2.826E-05	0.0000	5.699E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.335E-03	0.0003
Ra-226	1.111E+00	0.2859	1.663E-03	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.350E-02	0.0086
Ra-228	1.206E-05	0.0000	1.602E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.081E-08	0.0000
Th-228	1.632E-16	0.0000	2.988E-18	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.232E-19	0.0000
Th-230	4.958E-02	0.0128	1.834E-02	0.0047	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.438E-03	0.0009
Th-232	1.677E+00	0.4318	1.117E-01	0.0287	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.088E-02	0.0054
J-234	5.789E-05	0.0000	6.371E-03	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.021E-03	0.0003
J-235	6.832E-02	0.0176	6.577E-03	0.0017	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.132E-03	0.0003
J-238	1.357E-02	0.0035	5.685E-03	0.0015	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.687E-04	0.0002
Total	3.140E+00	0.8083	5.804E-01	0.1494	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.641E-01	0.0422

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.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.594E-02	0.0067
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.262E-01	0.1870
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.420E-03	0.0004
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.146E+00	0.2950
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.228E-05	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.667E-16	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.135E-02	0.0184
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.810E+00	0.4659
J-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.449E-03	0.0019
J-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.603E-02	0.0196
J-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.023E-02	0.0052
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.884E+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+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.
Ac-227	1.373E-05	0.0000	2.467E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.062E-06	0.0000
Pa-231	1.979E-01	0.0527	3.863E-01	0.1028	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.147E-02	0.0243
Pb-210	5.549E-08	0.0000	1.119E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.621E-06	0.0000
Ra-226	1.007E+00	0.2681	1.561E-03	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.160E-02	0.0084
Ra-228	4.034E-16	0.0000	5.361E-18	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.035E-18	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	1.405E-01	0.0374	1.832E-02	0.0049	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.254E-03	0.0017
Th-232	1.666E+00	0.4434	1.109E-01	0.0295	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.074E-02	0.0055
J-234	1.943E-04	0.0001	4.694E-03	0.0012	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.553E-04	0.0002
J-235	5.081E-02	0.0135	6.291E-03	0.0017	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.178E-03	0.0003
J-238	9.945E-03	0.0026	4.168E-03	0.0011	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.103E-04	0.0002
Total	3.073E+00	0.8177	5.323E-01	0.1417	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.527E-01	0.0406

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

Radio- Nuclide	Water		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.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.247E-05	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.757E-01	0.1798
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.789E-06	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.040E+00	0.2769
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.108E-16	0.0000
Th-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.650E-01	0.0439
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.798E+00	0.4784
J-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.643E-03	0.0015
J-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.828E-02	0.0155
J-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.482E-02	0.0039
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.758E+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+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.
Ac-227	2.440E-15	0.0000	4.384E-15	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.218E-16	0.0000
Pa-231	1.359E-01	0.0398	2.653E-01	0.0777	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.281E-02	0.0184
Pb-210	1.862E-17	0.0000	3.755E-17	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.795E-16	0.0000
Ra-226	7.155E-01	0.2095	1.109E-03	0.0003	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.245E-02	0.0066
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Rh-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Rh-230	3.910E-01	0.1145	1.818E-02	0.0053	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.406E-02	0.0041
Rh-232	1.628E+00	0.4766	1.084E-01	0.0317	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.026E-02	0.0059
J-234	1.200E-03	0.0004	1.648E-03	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.964E-04	0.0001
J-235	1.855E-02	0.0054	4.929E-03	0.0014	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.062E-03	0.0003
J-238	3.350E-03	0.0010	1.407E-03	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.397E-04	0.0001
Total	2.893E+00	0.8471	4.009E-01	0.1174	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.212E-01	0.0355

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.
Ac-227	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.546E-15	0.0000
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.640E-01	0.1359
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.357E-16	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.390E-01	0.2164
Ra-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Rh-228	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Rh-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.233E-01	0.1239
Rh-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.756E+00	0.5143
J-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.145E-03	0.0009
J-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.454E-02	0.0072
J-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.997E-03	0.0015
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.415E+00	1.0000

\*Sum of all water independent and dependent pathways.

Dose/Source Ratios Summed Over All Pathways											
Parent and Progeny Principal Radionuclide Contributions Indicated											
Parent (i)	Product (j)	Branch Fraction*	t=	DSR(j,t) (mrem/yr)/(pCi/g)							
				0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Ac-227	Ac-227	1.000E+00		6.409E-01	6.207E-01	5.821E-01	4.651E-01	2.449E-01	2.594E-02	4.247E-05	7.546E-15
Pa-231	Pa-231	1.000E+00		1.367E-01	1.366E-01	1.365E-01	1.360E-01	1.345E-01	1.295E-01	1.163E-01	7.988E-02
Pa-231	Ac-227	1.000E+00		1.025E-02	3.032E-02	6.855E-02	1.843E-01	3.996E-01	5.967E-01	5.594E-01	3.841E-01
Pa-231	EDSR(j)			1.469E-01	1.669E-01	2.050E-01	3.202E-01	5.341E-01	7.262E-01	6.757E-01	4.640E-01
Pb-210	Pb-210	1.000E+00		3.205E-02	3.107E-02	2.919E-02	2.347E-02	1.258E-02	1.420E-03	2.789E-06	9.357E-16
Ra-226	Ra-226	1.000E+00		1.172E+00	1.171E+00	1.170E+00	1.166E+00	1.155E+00	1.116E+00	1.012E+00	7.188E-01
Ra-226	Pb-210	1.000E+00		5.006E-04	1.481E-03	3.351E-03	9.036E-03	1.975E-02	2.996E-02	2.848E-02	2.023E-02
Ra-226	EDSR(j)			1.172E+00	1.173E+00	1.173E+00	1.175E+00	1.175E+00	1.146E+00	1.040E+00	7.390E-01
Ra-228	Ra-228	1.000E+00		5.924E-01	5.251E-01	4.126E-01	1.774E-01	1.590E-02	3.427E-06	1.147E-16	0.000E+00
Ra-228	Th-228	1.000E+00		1.676E-01	4.078E-01	6.060E-01	4.216E-01	4.103E-02	8.850E-06	2.961E-16	0.000E+00
Ra-228	EDSR(j)			7.600E-01	9.330E-01	1.019E+00	5.990E-01	5.692E-02	1.228E-05	4.108E-16	0.000E+00
Th-228	Th-228	1.000E+00		9.089E-01	6.327E-01	3.065E-01	2.426E-02	1.728E-05	1.667E-16	0.000E+00	0.000E+00
Th-230	Th-230	1.000E+00		2.079E-02	2.079E-02	2.079E-02	2.078E-02	2.076E-02	2.070E-02	2.053E-02	1.993E-02
Th-230	Ra-226	1.000E+00		2.538E-04	7.614E-04	1.776E-03	5.317E-03	1.536E-02	4.969E-02	1.410E-01	3.927E-01
Th-230	Pb-210	1.000E+00		7.248E-08	5.028E-07	2.605E-06	2.170E-05	1.513E-04	9.612E-04	3.514E-03	1.061E-02
Th-230	EDSR(j)			2.104E-02	2.155E-02	2.256E-02	2.612E-02	3.628E-02	7.135E-02	1.650E-01	4.233E-01
Th-232	Th-232	1.000E+00		1.039E-01	1.039E-01	1.039E-01	1.038E-01	1.038E-01	1.035E-01	1.029E-01	1.005E-01
Th-232	Ra-228	1.000E+00		3.643E-02	1.037E-01	2.162E-01	4.512E-01	6.122E-01	6.267E-01	6.225E-01	6.081E-01
Th-232	Th-228	1.000E+00		7.005E-03	4.298E-02	1.708E-01	6.371E-01	1.041E+00	1.080E+00	1.073E+00	1.048E+00
Th-232	EDSR(j)			1.473E-01	2.506E-01	4.909E-01	1.192E+00	1.757E+00	1.810E+00	1.798E+00	1.756E+00
J-234	U-234	1.000E+00		8.659E-03	8.646E-03	8.619E-03	8.525E-03	8.264E-03	7.410E-03	5.427E-03	1.824E-03
J-234	Th-230	1.000E+00		9.352E-08	2.804E-07	6.532E-07	1.949E-06	5.571E-06	1.737E-05	4.460E-05	9.239E-05
J-234	Ra-226	1.000E+00		7.614E-10	5.327E-09	2.812E-08	2.503E-07	2.082E-06	2.154E-05	1.682E-04	1.196E-03
J-234	Pb-210	1.000E+00		1.633E-13	2.433E-12	2.794E-11	7.005E-10	1.471E-08	3.356E-07	3.835E-06	3.166E-05
J-234	EDSR(j)			8.659E-03	8.646E-03	8.620E-03	8.528E-03	8.272E-03	7.449E-03	5.643E-03	3.145E-03
J-235	U-235	1.000E+00		8.747E-02	8.734E-02	8.707E-02	8.612E-02	8.349E-02	7.488E-02	5.487E-02	1.848E-02
J-235	Pa-231	1.000E+00		1.445E-06	4.332E-06	1.009E-05	3.004E-05	8.547E-05	2.618E-04	6.373E-04	1.061E-03
J-235	Ac-227	1.000E+00		7.249E-08	5.025E-07	2.599E-06	2.153E-05	1.476E-04	8.873E-04	2.779E-03	5.005E-03
J-235	EDSR(j)			8.747E-02	8.734E-02	8.708E-02	8.618E-02	8.372E-02	7.603E-02	5.828E-02	2.454E-02
J-238	U-238	1.000E+00		2.363E-02	2.359E-02	2.352E-02	2.326E-02	2.255E-02	2.022E-02	1.482E-02	4.991E-03
J-238	U-234	1.000E+00		1.227E-08	3.676E-08	8.552E-08	2.538E-07	7.146E-07	2.112E-06	4.625E-06	5.181E-06
J-238	Th-230	1.000E+00		8.836E-14	6.179E-13	3.260E-12	2.895E-11	2.390E-10	2.412E-09	1.757E-08	9.920E-08
J-238	Ra-226	1.000E+00		5.395E-16	8.087E-15	9.418E-14	2.482E-12	5.962E-11	2.001E-09	4.475E-08	9.091E-07
J-238	Pb-210	1.000E+00		9.270E-20	2.856E-18	7.102E-17	5.296E-15	3.299E-13	2.622E-11	9.375E-10	2.347E-08
J-238	EDSR(j)			2.363E-02	2.359E-02	2.352E-02	2.326E-02	2.255E-02	2.023E-02	1.482E-02	4.997E-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	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Ac-227	3.901E+01	4.028E+01	4.295E+01	5.376E+01	1.021E+02	9.639E+02	5.887E+05	*7.230E+13
Pa-231	1.701E+02	1.498E+02	1.219E+02	7.807E+01	4.681E+01	3.442E+01	3.700E+01	5.388E+01
Pb-210	7.800E+02	8.047E+02	8.564E+02	1.065E+03	1.987E+03	1.760E+04	8.964E+06	*7.631E+13
Ra-226	2.133E+01	2.132E+01	2.130E+01	2.127E+01	2.129E+01	2.182E+01	2.403E+01	3.383E+01
Ra-228	3.289E+01	2.680E+01	2.454E+01	4.174E+01	4.392E+02	2.036E+06	*2.726E+14	*2.726E+14
Rh-228	2.750E+01	3.952E+01	8.157E+01	1.031E+03	1.447E+06	*8.192E+14	*8.192E+14	*8.192E+14
Rh-230	1.188E+03	1.160E+03	1.108E+03	9.572E+02	6.891E+02	3.504E+02	1.515E+02	5.906E+01
Rh-232	1.697E+02	9.977E+01	5.093E+01	2.097E+01	1.423E+01	1.381E+01	1.391E+01	1.423E+01
J-234	2.887E+03	2.892E+03	2.900E+03	2.932E+03	3.022E+03	3.356E+03	4.430E+03	7.950E+03
J-235	2.858E+02	2.862E+02	2.871E+02	2.901E+02	2.986E+02	3.288E+02	4.289E+02	1.019E+03
J-238	1.058E+03	1.060E+03	1.063E+03	1.075E+03	1.109E+03	1.236E+03	1.687E+03	5.003E+03

\*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)  
 and Single Radionuclide Soil Guidelines G(i,t) in pCi/g  
 at tmin = time of minimum single radionuclide soil guideline  
 and at tmax = time of maximum total dose = 0.000E+00 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Ac-227	1.000E+00	0.000E+00	6.409E-01	3.901E+01	6.409E-01	3.901E+01
Pa-231	1.000E+00	123.2 ± 0.2	7.307E-01	3.422E+01	1.469E-01	1.701E+02
Pb-210	1.000E+00	0.000E+00	3.205E-02	7.800E+02	3.205E-02	7.800E+02
Ra-226	1.000E+00	17.64 ± 0.04	1.176E+00	2.126E+01	1.172E+00	2.133E+01
Ra-228	1.000E+00	2.717 ± 0.005	1.020E+00	2.450E+01	7.600E-01	3.289E+01
Rh-228	1.000E+00	0.000E+00	9.089E-01	2.750E+01	9.089E-01	2.750E+01
Rh-230	1.000E+00	1.000E+03	4.233E-01	5.906E+01	2.104E-02	1.188E+03
Rh-232	1.000E+00	69.3 ± 0.1	1.811E+00	1.380E+01	1.473E-01	1.697E+02
J-234	1.000E+00	0.000E+00	8.659E-03	2.887E+03	8.659E-03	2.887E+03
J-235	1.000E+00	0.000E+00	8.747E-02	2.858E+02	8.747E-02	2.858E+02
J-238	1.000E+00	0.000E+00	2.363E-02	1.058E+03	2.363E-02	1.058E+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	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Ac-227	Ac-227	1.000E+00	6.409E-01	6.207E-01	5.821E-01	4.651E-01	2.449E-01	2.594E-02	4.247E-05	7.546E-15
Ac-227	Pa-231	1.000E+00	1.025E-02	3.032E-02	6.855E-02	1.843E-01	3.996E-01	5.967E-01	5.594E-01	3.841E-01
Ac-227	U-235	1.000E+00	7.249E-08	5.025E-07	2.599E-06	2.153E-05	1.476E-04	8.873E-04	2.779E-03	5.005E-03
Ac-227	ΣDOSE(j)		6.512E-01	6.510E-01	6.507E-01	6.493E-01	6.446E-01	6.235E-01	5.622E-01	3.891E-01
Pa-231	Pa-231	1.000E+00	1.367E-01	1.366E-01	1.365E-01	1.360E-01	1.345E-01	1.295E-01	1.163E-01	7.988E-02
Pa-231	U-235	1.000E+00	1.445E-06	4.332E-06	1.009E-05	3.004E-05	8.547E-05	2.618E-04	6.373E-04	1.061E-03
Pa-231	ΣDOSE(j)		1.367E-01	1.366E-01	1.365E-01	1.360E-01	1.346E-01	1.298E-01	1.170E-01	8.094E-02
Pb-210	Pb-210	1.000E+00	3.205E-02	3.107E-02	2.919E-02	2.347E-02	1.258E-02	1.420E-03	2.789E-06	9.357E-16
Pb-210	Ra-226	1.000E+00	5.006E-04	1.481E-03	3.351E-03	9.036E-03	1.975E-02	2.996E-02	2.848E-02	2.023E-02
Pb-210	Th-230	1.000E+00	7.248E-08	5.028E-07	2.605E-06	2.170E-05	1.513E-04	9.612E-04	3.514E-03	1.061E-02
Pb-210	U-234	1.000E+00	1.633E-13	2.433E-12	2.794E-11	7.005E-10	1.471E-08	3.356E-07	3.835E-06	3.166E-05
Pb-210	U-238	1.000E+00	9.270E-20	2.856E-18	7.102E-17	5.296E-15	3.299E-13	2.622E-11	9.375E-10	2.347E-08
Pb-210	ΣDOSE(j)		3.255E-02	3.255E-02	3.254E-02	3.253E-02	3.248E-02	3.235E-02	3.200E-02	3.087E-02
Ra-226	Ra-226	1.000E+00	1.172E+00	1.171E+00	1.170E+00	1.166E+00	1.155E+00	1.116E+00	1.012E+00	7.188E-01
Ra-226	Th-230	1.000E+00	2.538E-04	7.614E-04	1.776E-03	5.317E-03	1.536E-02	4.969E-02	1.410E-01	3.927E-01
Ra-226	U-234	1.000E+00	7.614E-10	5.327E-09	2.812E-08	2.503E-07	2.082E-06	2.154E-05	1.682E-04	1.196E-03
Ra-226	U-238	1.000E+00	5.395E-16	8.087E-15	9.418E-14	2.482E-12	5.962E-11	2.001E-09	4.475E-08	9.091E-07
Ra-226	ΣDOSE(j)		1.172E+00	1.172E+00	1.172E+00	1.171E+00	1.170E+00	1.166E+00	1.153E+00	1.113E+00
Ra-228	Ra-228	1.000E+00	5.924E-01	5.251E-01	4.126E-01	1.774E-01	1.590E-02	3.427E-06	1.147E-16	0.000E+00
Ra-228	Th-232	1.000E+00	3.643E-02	1.037E-01	2.162E-01	4.512E-01	6.122E-01	6.267E-01	6.225E-01	6.081E-01
Ra-228	ΣDOSE(j)		6.289E-01	6.288E-01	6.288E-01	6.286E-01	6.281E-01	6.267E-01	6.225E-01	6.081E-01
Rh-228	Ra-228	1.000E+00	1.676E-01	4.078E-01	6.060E-01	4.216E-01	4.103E-02	8.850E-06	2.961E-16	0.000E+00
Rh-228	Th-228	1.000E+00	9.089E-01	6.327E-01	3.065E-01	2.426E-02	1.728E-05	1.667E-16	0.000E+00	0.000E+00
Rh-228	Th-232	1.000E+00	7.005E-03	4.298E-02	1.708E-01	6.371E-01	1.041E+00	1.080E+00	1.073E+00	1.048E+00
Rh-228	ΣDOSE(j)		1.084E+00	1.083E+00	1.083E+00	1.083E+00	1.082E+00	1.080E+00	1.073E+00	1.048E+00
Rh-230	Th-230	1.000E+00	2.079E-02	2.079E-02	2.079E-02	2.078E-02	2.076E-02	2.070E-02	2.053E-02	1.993E-02
Rh-230	U-234	1.000E+00	9.352E-08	2.804E-07	6.532E-07	1.949E-06	5.571E-06	1.737E-05	4.460E-05	9.239E-05
Rh-230	U-238	1.000E+00	8.836E-14	6.179E-13	3.260E-12	2.895E-11	2.390E-10	2.412E-09	1.757E-08	9.920E-08
Rh-230	ΣDOSE(j)		2.079E-02	2.079E-02	2.079E-02	2.078E-02	2.077E-02	2.072E-02	2.057E-02	2.002E-02
Rh-232	Th-232	1.000E+00	1.039E-01	1.039E-01	1.039E-01	1.038E-01	1.038E-01	1.035E-01	1.029E-01	1.005E-01
J-234	U-234	1.000E+00	8.659E-03	8.646E-03	8.619E-03	8.525E-03	8.264E-03	7.410E-03	5.427E-03	1.824E-03
J-234	U-238	1.000E+00	1.227E-08	3.676E-08	8.552E-08	2.538E-07	7.146E-07	2.112E-06	4.625E-06	5.181E-06
J-234	ΣDOSE(j)		8.659E-03	8.646E-03	8.619E-03	8.526E-03	8.265E-03	7.412E-03	5.431E-03	1.829E-03
J-235	U-235	1.000E+00	8.747E-02	8.734E-02	8.707E-02	8.612E-02	8.349E-02	7.488E-02	5.487E-02	1.848E-02
J-238	U-238	1.000E+00	2.363E-02	2.359E-02	2.352E-02	2.326E-02	2.255E-02	2.022E-02	1.482E-02	4.991E-03

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	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02
Ac-227	Ac-227	1.000E+00	1.000E+00	9.684E-01	9.083E-01	7.256E-01	3.821E-01	4.047E-02	6.626E-05	1.177E-14
Ac-227	Pa-231	1.000E+00	0.000E+00	3.132E-02	9.098E-02	2.716E-01	6.077E-01	9.158E-01	8.592E-01	5.899E-01
Ac-227	U-235	1.000E+00	0.000E+00	3.330E-07	2.930E-06	3.013E-05	2.204E-04	1.354E-03	4.261E-03	7.685E-03
Ac-227	ΣS(j):		1.000E+00	9.998E-01	9.992E-01	9.972E-01	9.899E-01	9.577E-01	8.635E-01	5.976E-01
Pa-231	Pa-231	1.000E+00	1.000E+00	9.995E-01	9.984E-01	9.946E-01	9.840E-01	9.477E-01	8.512E-01	5.844E-01
Pa-231	U-235	1.000E+00	0.000E+00	2.114E-05	6.328E-05	2.094E-04	6.152E-04	1.907E-03	4.656E-03	7.759E-03
Pa-231	ΣS(j):		1.000E+00	9.995E-01	9.985E-01	9.949E-01	9.846E-01	9.496E-01	8.558E-01	5.922E-01
Pb-210	Pb-210	1.000E+00	1.000E+00	9.693E-01	9.107E-01	7.322E-01	3.926E-01	4.431E-02	8.701E-05	2.919E-14
Pb-210	Ra-226	1.000E+00	0.000E+00	3.060E-02	8.896E-02	2.664E-01	6.007E-01	9.200E-01	8.750E-01	6.215E-01
Pb-210	Th-230	1.000E+00	0.000E+00	6.662E-06	5.872E-05	6.074E-04	4.515E-03	2.933E-02	1.078E-01	3.259E-01
Pb-210	U-234	1.000E+00	0.000E+00	2.004E-11	5.321E-10	1.862E-08	4.315E-07	1.019E-05	1.174E-04	9.719E-04
Pb-210	U-238	1.000E+00	0.000E+00	1.422E-17	1.136E-15	1.337E-13	9.511E-12	7.914E-10	2.866E-08	7.202E-07
Pb-210	ΣS(j):		1.000E+00	9.999E-01	9.998E-01	9.992E-01	9.978E-01	9.937E-01	9.830E-01	9.484E-01
Ra-226	Ra-226	1.000E+00	1.000E+00	9.995E-01	9.985E-01	9.951E-01	9.854E-01	9.523E-01	8.636E-01	6.134E-01
Ra-226	Th-230	1.000E+00	0.000E+00	4.331E-04	1.299E-03	4.321E-03	1.289E-02	4.219E-02	1.201E-01	3.350E-01
Ra-226	U-234	1.000E+00	0.000E+00	1.949E-09	1.751E-08	1.936E-07	1.719E-06	1.820E-05	1.431E-04	1.020E-03
Ra-226	U-238	1.000E+00	0.000E+00	1.841E-15	4.961E-14	1.826E-12	4.841E-11	1.683E-09	3.801E-08	7.747E-07
Ra-226	ΣS(j):		1.000E+00	9.999E-01	9.998E-01	9.994E-01	9.983E-01	9.945E-01	9.839E-01	9.494E-01
Ra-228	Ra-228	1.000E+00	1.000E+00	8.864E-01	6.964E-01	2.994E-01	2.683E-02	5.785E-06	1.936E-16	0.000E+00
Ra-228	Th-232	1.000E+00	0.000E+00	1.136E-01	3.034E-01	7.002E-01	9.720E-01	9.965E-01	9.899E-01	9.670E-01
Ra-228	ΣS(j):		1.000E+00	9.999E-01	9.998E-01	9.995E-01	9.988E-01	9.965E-01	9.899E-01	9.670E-01
Rh-228	Ra-228	1.000E+00	0.000E+00	2.853E-01	5.384E-01	4.087E-01	4.019E-02	8.670E-06	2.901E-16	0.000E+00
Rh-228	Th-228	1.000E+00	1.000E+00	6.960E-01	3.372E-01	2.669E-02	1.901E-05	1.834E-16	0.000E+00	0.000E+00
Rh-228	Th-232	1.000E+00	0.000E+00	1.864E-02	1.243E-01	5.642E-01	9.586E-01	9.965E-01	9.899E-01	9.670E-01
Rh-228	ΣS(j):		1.000E+00	1.000E+00	9.999E-01	9.996E-01	9.988E-01	9.965E-01	9.899E-01	9.670E-01
Rh-230	Th-230	1.000E+00	1.000E+00	1.000E+00	9.999E-01	9.996E-01	9.987E-01	9.958E-01	9.874E-01	9.585E-01
Rh-230	U-234	1.000E+00	0.000E+00	8.995E-06	2.694E-05	8.930E-05	2.637E-04	8.318E-04	2.143E-03	4.443E-03
Rh-230	U-238	1.000E+00	0.000E+00	1.275E-11	1.145E-10	1.263E-09	1.113E-08	1.149E-07	8.426E-07	4.769E-06
Rh-230	ΣS(j):		1.000E+00	1.000E+00	9.999E-01	9.997E-01	9.990E-01	9.966E-01	9.895E-01	9.630E-01
Rh-232	Th-232	1.000E+00	1.000E+00	1.000E+00	9.999E-01	9.997E-01	9.990E-01	9.967E-01	9.900E-01	9.672E-01
J-234	U-234	1.000E+00	1.000E+00	9.984E-01	9.953E-01	9.845E-01	9.543E-01	8.558E-01	6.267E-01	2.106E-01
J-234	U-238	1.000E+00	0.000E+00	2.831E-06	8.465E-06	2.791E-05	8.117E-05	2.426E-04	5.332E-04	5.980E-04
J-234	ΣS(j):		1.000E+00	9.984E-01	9.953E-01	9.846E-01	9.544E-01	8.560E-01	6.272E-01	2.112E-01
J-235	U-235	1.000E+00	1.000E+00	9.984E-01	9.953E-01	9.846E-01	9.544E-01	8.560E-01	6.272E-01	2.112E-01
J-238	U-238	1.000E+00	1.000E+00	9.984E-01	9.953E-01	9.846E-01	9.544E-01	8.560E-01	6.272E-01	2.112E-01

BRF(i) is the branch fraction of the parent nuclide.  
RESRAD.EXE execution time = 91.86 seconds



## **ATTACHMENT 2**

### **SENSITIVITY ANALYSES**

#### **INDUSTRIAL WORKER SCENARIO**

##### **Evaluation of annual dose**

## SENSITIVITY ANALYSES

### Introduction

To ensure that the results of the revised DCGLs are unlikely to significantly underestimate potential dose, the analyses used realistically conservative scenarios and conceptual model. As well, prudently conservative values were used for key parameters. Sensitivity analyses were subsequently completed for which the primary objective was to identify input parameters that were major contributors to variation in the calculated doses.

### Description

#### General

The sensitivity analyses were of a deterministic technique; i.e. the change in the output result of peak dose was determined with respect to a change in the independent input parameters. The sensitivity analyses were performed after completing the RESRAD calculations used to determine the DCGLs. The sensitivity analyses were performed by taking each parameter and repeating the RESRAD calculation with the parameter under test set at two previously chosen extremes. Only one parameter is varied at a time.

The RESRAD parameters available for input to evaluate the industrial worker scenario are listed in Table 1. The parameters evaluated in the sensitivity analyses are marked accordingly in Table 1.

Several parameters, although available to the RESRAD sensitivity analysis, were not evaluated. Each such parameter and the reason it was not evaluated is included in Table 2.

Several parameters were not available to the sensitivity analysis provided by the RESRAD software: they were either turned off by the software based on the active exposure pathways (e.g. "Density of cover material"; there is no cover in the model), or the software did not allow a sensitivity analysis of the parameter due to suppressed pathway (e.g. "Plant Factors"). The parameters not available to the RESRAD sensitivity analysis are listed in Table 3.

The basis for the range over which the sensitivity analyses were completed is described in Table 4.

The sensitivity analyses were completed for total dose from summed radionuclides and summed pathways.

#### Radionuclide Concentrations

The sensitivity analyses were performed against summed radionuclides using an hypothetical source term construed to represent a plausible as-left condition with regard to concentrations of radionuclides in soil. The hypothetical source term was determined by dividing the DCGL of each radionuclide by the DCGL for Th-232. This maintained two fundamental conditions: 1) all of the radionuclides are present for the sensitivity analyses, and 2) the sum-of-fractions compliance is represented. The resulting dose for this modeled condition is 15 mrem/y.

### Conclusion

The results of the sensitivity analyses are summarized in Table 5. The annual dose was found to not be significantly sensitive to any evaluated parameter.

**Table 1**  
**(1 of 2)**

**PARAMETERS OF INDUSTRIAL WORKER SCENARIO AVAILABLE FOR  
SENSITIVITY ANALYSIS**

PARAMETER CATEGORY	PARAMETER DESCRIPTION	SENSITIVITY ANALYSIS PERFORMED
Source	Transport Distribution coefficient: {All zones}	
	Transport Solubility Limit	
	Transport Leach Rate	
Contaminated Zone	Area of contaminated zone	
	Thickness of contaminated zone	
	Length parallel to aquifer flow	√
Cover and Contaminated Zone Hydrological Data	Cover depth	
	Density of contaminated zone	√
	Contaminated zone erosion rate	√
	Contaminated zone total porosity	√
	Contaminated zone field capacity	√
	Contaminated zone hydraulic conductivity	√
	Contaminated zone b parameter	√
	Evapotranspiration coefficient	√
	Wind speed	√
	Precipitation	√
	Irrigation	√
	Runoff coefficient	√
	Watershed area for nearby stream or pond	
	Accuracy for soil/water computations	
Saturated Zone Hydrological Data	Density of saturated zone	√
	Saturated zone total porosity	√
	Saturated zone effective porosity	√
	Saturated zone field capacity	√
	Saturated zone hydraulic conductivity	√
	Saturated zone hydraulic gradient	√
	Water table drop rate	
	Well pump intake depth	
	Well pumping rate	

**Table 1**  
**(2 of 2)**

**PARAMETERS OF INDUSTRIAL WORKER SCENARIO AVAILABLE FOR  
SENSITIVITY ANALYSIS**

PARAMETER CATEGORY	PARAMETER DESCRIPTION	SENSITIVITY ANALYSIS PERFORMED
Uncontaminated Unsaturated Zone Parameters	Unsaturated Zone Thickness	
	Unsaturated Zone Density	
	Unsaturated Zone Total Porosity	
	Unsaturated Zone Effective Porosity	
	Unsaturated Zone Hydraulic Conductivity	
	Unsaturated Zone b Parameter	
Occupancy, Inhalation, And External Gamma Data	Inhalation rate	√
	Mass loading for inhalation	√
	Exposure duration	
	Indoor dust filtration factor	√
	External gamma shielding factor	√
	Indoor time fraction	
	Outdoor time fraction	
Ingestion Pathway, Dietary Data	Soil ingestion	√
	Drinking water intake	√
	Contaminated fraction Drinking water	
	Depth of soil mixing layer	√
	Groundwater Fractional Usage Drinking Water	
Storage Times Before Use Data	Well water	
	Surface water	

**Table 2**  
**(1 of 2)**

**Parameters of Industrial worker Scenario Available for Sensitivity Analysis but not Evaluated**

**Transport Distribution**

Coefficient:	A best available value was chosen as input for this parameter. This parameter estimates the relative transport speed of radionuclides in soil to that of water. The NRC has previously evaluated the effects of excluding the groundwater pathway from the DCGL development and concluded that such will not significantly contribute to the dose from residual radioactivity remaining in soils at the site. <sup>a</sup>
Transport Solubility Limit:	This parameter was not used by RESRAD since a distribution coefficient was provided.
Transport Leach Rate:	This parameter was not used by RESRAD since a distribution coefficient was provided.
Area of contaminated zone:	The NRC has previously examined this parameter input and found change does not significantly influence the DCGLs. <sup>1</sup>
Thickness of contaminated zone:	The NRC has previously examined this parameter input and found change does not significantly influence the DCGLs. <sup>a</sup>
Cover depth:	The dose assessment included the conservative assumption that no cover will be applied.
Irrigation:	Not applicable for industrial worker scenario.
Watershed area ...	The dose assessment included the actual value for this parameter.
Accuracy ... computations:	A sufficient value for accuracy was chosen.
Water table drop rate:	The dose assessment included the actual condition that the groundwater system is unconfined.
Well pump intake depth:	The NRC has previously evaluated the effects of excluding the groundwater pathway from the DCGL development and concluded that such will not significantly contribute to the dose from residual radioactivity remaining in soils at the site. <sup>a</sup>
Well pumping rate:	See well pump intake depth (previous).
Unsaturated zone parameters:	These parameters affect only the time until exposure and not the degree of exposure under the given exposure scenario.

---

<sup>1</sup> U.S. Nuclear Regulatory Commission. SAFETY EVALUATION REPORT FOR LICENSE AMENDMENT APPLICATION TO APPROVE DECOMMISSIONING DATED JULY 24, 2003. Fansteel, Inc., Docket 040-7580, October 31, 2003.

**Table 2**  
**(2 of 2)**

**Parameters of Industrial worker Scenario Available for Sensitivity Analysis but not Evaluated**

Exposure duration:	This parameter is not applicable since the model result is evaluated as peak dose and not total dose or risk.
Indoor time fraction:	By implication of NRC review of the parameter input for outdoor time fraction (see next), the input is reasonable for an industrial land-use scenario.
Outdoor time fraction:	The NRC has previously examined this parameter input and found the input reasonable for an industrial land-use scenario. <sup>a</sup>
Contaminated fraction	
Drinking water:	The dose assessment in this case represents the bounding assumption that contaminated drinking water is used on site.
Groundwater fractional	
Usage Drinking Water:	The dose assessment in this case represents the bounding assumption that contaminated drinking water is used on site.
Storage Times Before Use:	These parameters are not applicable since the scenario does not include any water storage.

**Table 3**

**PARAMETERS OF INDUSTRIAL WORKER SCENARIO NOT AVAILABLE FOR  
SENSITIVITY ANALYSIS**

PARAMETER CATEGORY	PARAMETER DESCRIPTION
Source	Basic Radiation Dose Limit
	Transport Time since material placement
	Transport Groundwater concentration
Calculation Parameters	Times for Calculation
Cover and Contaminated Zone Hydrological Data	Density of cover material
	Cover erosion rate
	Humidity in air
	Irrigation mode
Saturated Zone Hydrological Data	Saturated zone b parameter
	Model for Water Transport Parameters
Occupancy, Inhalation, And External Gamma Data	Shape of the contaminated zone
Ingestion Pathway, Dietary Data	{All} consumption
	Contaminated fractions {All, except Drinking water}
Ingestion Pathway, Nondietary Data	Livestock ... intake for {All}
	Mass loading for foliar deposition
	Depth of roots
	Groundwater Fractional Usage {All, except Drinking water}
	Plant Factors {All}
Radon	{ All }

**Table 4**  
**(1 of 2)**

**VALUE AND BASIS OF MULTIPLIER FOR SENSITIVITY ANALYSIS RANGE**

DOSE ASSESSMENT PARAMETER	VALUE OF PARAMETER		
	MODEL	MULTIPLIER	
Length parallel to aquifer flow, m		239	10
Basis for value of multiplier	Arbitrary as an order of magnitude.		
Density of contaminated zone, g/cm <sup>3</sup>		1.52	1.3
Basis for value of multiplier	A maximum expected variation.		
Contaminated zone erosion rate, m/y		0.0006	10
Basis for value of multiplier	Arbitrary as an order of magnitude.		
Contaminated zone total porosity, dimensionless		0.425	2
Basis for value of multiplier	A maximum expected variation.		
Contaminated zone field capacity, dimensionless		0.2	4
Basis for value of multiplier	A maximum expected variation.		
Contaminated zone hydraulic conductivity, m/y		9.9	10
Basis for value of multiplier	Arbitrary as an order of magnitude.		
Contaminated zone b parameter, dimensionless		2.9	5
Basis for value of multiplier	Reflects an upper limit of RESRAD.		
Evapotranspiration coefficient, dimensionless		0.645	1.16
Basis for value of multiplier	A maximum expected variation. <sup>1</sup>		
Wind Speed, m/s		3.2	1.5
Basis for value of multiplier	A maximum expected variation.		
Precipitation, m/y		1.19	1.5
Basis for value of multiplier	A maximum expected variation.		
Runoff coefficient, dimensionless		0.4	1.5
Basis for value of multiplier	A maximum expected variation. <sup>1</sup>		



**Table 4**  
**(2 of 2)**

**VALUE AND BASIS OF MULTIPLIER FOR SENSITIVITY ANALYSIS RANGE**

DOSE ASSESSMENT PARAMETER	VALUE OF PARAMETER MODEL MULTIPLIER	
Density of saturated zone, g/m <sup>3</sup>	1.52	1.3
Basis for value of multiplier	A maximum expected variation.	
Saturated zone total porosity, dimensionless	0.425	2.3
Basis for value of multiplier	A maximum possible variation.	
Saturated zone effective porosity, dimensionless	0.355	2.8
Basis for value of multiplier	A maximum possible variation.	
Saturated zone field capacity, dimensionless	0.2	4
Basis for value of multiplier	A maximum expected variation.	
Saturated zone hydraulic conductivity, m/y	9.9	10
Basis for value of multiplier	Arbitrary as an order of magnitude.	
Saturated zone hydraulic gradient, dimensionless	0.021	5
Basis for value of multiplier	A maximum expected variation.	
Inhalation rate, m <sup>3</sup> /y	8400	1.36
Basis for value of multiplier	An expected variation.	
Mass loading for inhalation, g/m <sup>3</sup>	0.00023	1.5
Basis for value of multiplier	An expected variation. <sup>1</sup>	
Indoor dust filtration factor, dimensionless	0.58	1.7
Basis for value of multiplier	A maximum expected variation. <sup>1</sup>	
External gamma shielding factor, dimensionless	0.27	1.5
Basis for value of multiplier	An expected variation. <sup>1</sup>	
Soil ingestion, g/y	18.3	2
Basis for value of multiplier	A maximum expected variation. <sup>1</sup>	
Drinking water intake, L/y	250	2
Basis for value of multiplier	A maximum expected variation.	
Depth of soil mixing layer, m	0.15	4
Basis for value of multiplier	A maximum expected variation. <sup>1</sup>	

<sup>1</sup> U.S. Nuclear Regulatory Commission. Development of Probabilistic RESRAD 6.0 and RESRAD-BUILD 3.0 Computer Codes. Washington, D.C.: U.S. Nuclear Regulatory Commission. NUREG/CR-6697. December 2000.

**Table 5**  
**(1 of 2)**

**SUMMARY OF SENSITIVITY ANALYSIS FOR INDUSTRIAL WORKER SCENARIO**

DOSE ASSESSMENT PARAMETER	VALUE OF PARAMETER		
	LOW	MODEL	HIGH
Length parallel to aquifer flow, m	24	239	2400
	15	15	15
Density of contaminated zone, g/cm <sup>3</sup>	1.17	1.52	1.96
Maximum Dose, mrem/y	15	15	15
Contaminated zone erosion rate, m/y	0.000006	0.00006	0.0006
Maximum Dose, mrem/y	15	15	15
Contaminated zone total porosity, dimensionless	0.2125	0.425	0.85
Maximum Dose, mrem/y	15	15	15
Contaminated zone field capacity, dimensionless	0.05	0.2	0.8
Maximum Dose, mrem/y	15	15	15
Contaminated zone hydraulic conductivity, m/y	0.99	9.9	99
Maximum Dose, mrem/y	15	15	15
Contaminated zone b parameter, dimensionless	0.58	2.9	14.5
Maximum Dose, mrem/y	15	15	15
Evapotranspiration coefficient, dimensionless	0.56	0.645	0.75
Maximum Dose, mrem/y	15	15	15
Wind Speed, m/s	2.1	3.2	4.8
Maximum Dose, mrem/y	13	15	16
Precipitation, m/y	0.79	1.19	1.79
Maximum Dose, mrem/y	15	15	15
Runoff coefficient, dimensionless	0.27	0.4	0.6
Maximum Dose, mrem/y	15	15	15

**Table 5**  
**(2 of 2)**

**SUMMARY OF SENSITIVITY ANALYSIS FOR INDUSTRIAL WORKER SCENARIO**

DOSE ASSESSMENT PARAMETER	VALUE OF PARAMETER		
	LOW	MODEL	HIGH
Density of saturated zone, g/m <sup>3</sup>	1.17	1.52	1.98
Maximum Dose, mrem/y	15	15	15
Saturated zone total porosity, dimensionless	0.18	0.425	0.98
Maximum Dose, mrem/y	15	15	15
Saturated zone effective porosity, dimensionless	0.13	0.355	0.99
Maximum Dose, mrem/y	15	15	15
Saturated zone field capacity, dimensionless	0.05	0.2	0.8
Maximum Dose, mrem/y	15	15	15
Saturated zone hydraulic conductivity, m/y	0.99	9.9	99
Maximum Dose, mrem/y	15	15	15
Saturated zone hydraulic gradient, dimensionless	0.0042	0.021	0.11
Maximum Dose, mrem/y	15	15	15
Inhalation rate, m <sup>3</sup> /y	6180	8400	11400
Maximum Dose, mrem/y	13	15	16
Mass loading for inhalation, g/m <sup>3</sup>	0.00015	0.00023	0.0035
Maximum Dose, mrem/y	13	15	16
Indoor dust filtration factor, dimensionless	0.34	0.58	0.99
Maximum Dose, mrem/y	14	15	16
External gamma shielding factor, dimensionless	0.18	0.27	0.41
Maximum Dose, mrem/y	13	15	16
Soil ingestion, g/y	9.15	18.3	36.6
Maximum Dose, mrem/y	13	15	17
Drinking water intake, L/y	125	250	500
Maximum Dose, mrem/y	15	15	15
Depth of soil mixing layer, m	0.04	0.15	0.6
Maximum Dose, mrem/y	15	15	15