



**NAVAL PRODUCTS**  
20 Research Parkway Unit E  
Old Saybrook, CT 06475  
(860) 388-9311 FAX (860) 388-9546  
Email: bob.bonito@ae.ge.com

**Robert F. Bonito**  
General Manager

July 5, 2012

Ms. Laurie A. Kauffman  
US Nuclear Regulatory Commission  
Region 1  
2100 Renaissance Blvd.  
Suite 100  
King of Prussia, PA 19406-2713

Mr. Marc Ferdas  
Decommissioning Branch Chief  
US Nuclear Regulatory Commission  
Region 1  
2100 Renaissance Blvd., Suite 100  
King of Prussia, PA 19406-2713

Dear Ms. Kauffman & Mr. Ferdas:

Re: Decommissioning Plan Addendum  
Former UNC Manufacturing Facility, New Haven, CT

Attached for your review is the Decommissioning Plan Addendum for the Former UNC Manufacturing Facility located in New Haven, CT. Since the site and facility are no longer NRC licensed, it is our understanding that performance of an Environmental Assessment and development of a Federal Register notice for public comment are not required.

Please let me know if you have any questions. We look forward to your approval and completion of decommissioning at the facility.

Sincerely,

Robert Bonito  
UNC Naval Products  
20 Research Parkway  
Old Saybrook, CT 06475

License SNM-368 (Terminated)  
Docket 070-0037 (Retired)

Attachment

RECEIVED  
REGION 1  
2012 JUL -9 AM 10:18

## **Decommissioning Plan Addendum for the Former United Nuclear Corporation Manufacturing Facility, New Haven CT**

### **INTRODUCTION**

The former United Nuclear Corporation (UNC) Naval Products Manufacturing Facility located at 71 Shelton Street, New Haven, CT is currently utilizing a Decommissioning Plan (DP) submitted to the NRC dated August 17, 1998. The DP provides the necessary characterization, sampling, and decontamination activities to accomplish and meet the approved Derived Concentration Guideline Level (DCGL) of 30 pCi/g total uranium. NUREG/CR-5849 was used as the guidance for demonstrating that the NRC-approved DCGL criterion was satisfied.

Since the approval of the 1998 DP, the NRC has promulgated regulation and criteria for Decommissioning and Decontamination of sites using NUREG-1575 (the *Multi-Agency Radiation Survey and Site Investigation Manual* [MARSSIM]). MARSSIM is applied to help assure a consistent approach to planning, conducting, evaluating, and documenting final status release surveys for demonstrating compliance with dose based regulations and standards to meet Title 10 of the US Code of Federal Regulations Chapter 20 Subpart 1402 (10CFR20.1402) "Radiological criteria for unrestricted use".

NUREG-1757 (entitled *Consolidated NMSS Decommissioning Guidance*), provides approaches that may be used to help identify information needed to terminate an NRC materials license. While UNC does not currently possess an NRC license, the guidance contained within NUREG-1757 may be used in preparing license amendment requests and by the NRC in approval of such amendment requests.

Since this site and the facility are no longer NRC-licensed, it is our understanding that performance of an Environmental Assessment and development of a Federal Register notice for public comment are not required.

### **DETAILS**

The 1998 DP as applied at the UNC site is based on a conservative release criterion of 30 pCi/g total uranium in soil. The site soils in areas outside the building and in the surrounding environs affected by previous operations have been remediated and associated final status surveys meet this release criterion.

During the decommissioning process, levels of total uranium in soils beneath building structures exceeding the 30 pCi/g total uranium were found. In some cases, values exceeding an order of magnitude greater than the DP release criterion were determined. It is noted that some of the locations with elevated total uranium activity are beneath certain structural portions of Building 6H/3H and other inaccessible spaces, specifically structural footers under the former X-Ray Room, and the concrete South Trench, North Trench, and associated lateral utility tunnels beneath the concrete floor of Building 6H/3H. Removal of soil material above the DCGL from these areas is difficult at best and may require the removal of structural elements of the building to gain access and remediation capability. These areas were not specifically called out by the 1998 DP currently being implemented.

A sampling program associated with the trench and lateral areas was initiated as an evaluation process to determine the extent and magnitude of total uranium soil contamination in these largely inaccessible areas. Preliminary review of the sampling results indicated that utilizing the DP-permitted elevated concentration of up to 90 pCi/g or evaluating against a DCGL for the elevated measurement criteria (DCGL<sub>EMC</sub>), an approach outlined in MARSSIM, would not provide sufficient mitigation to satisfy the requirements in the DP for release of the site.

UNC provided the NRC with a radiation dose assessment on June 23, 2008 that utilized an exposure scenario in concurrence with NRC discussions for the site. The NRC provided exposure scenario was used in part to set the input parameters for determining the DCGL. The input parameters and methods used to develop the DCGL are consistent with the guidance provided by NUREG-1757. The computer code RESRAD (version 6.4) was used to obtain the individual radionuclide DCGLs. A copy of the 2008 transmittal letter and associated RESRAD input and output data is included as Attachment A to this addendum for your convenience.

Cabrera Services Inc. has updated this dose assessment for UNC using the most recent version of the RESRAD code (Version 6.5) with the identical input data from the 2008 determination. Attachment B to this addendum provides a copy of this Version 6.5 output file. An electronic copy of this RESRAD input file is available as requested.

The output files from both Version 6.4 and 6.5 show the same individual radionuclide DCGL values. The 19 mrem dose limit criteria DCGL was determined by ratio from the 25 mrem level. Minor differences in the calculated total uranium DCGLs from the 2008 submittal are due to rounding. The total uranium DCGL derived from the most recent RESRAD model is determined to be:

<b>Basic Radiation Dose Limit Criteria</b>	<b>Total Uranium DCGL, pCi per gram</b>
NRC Federal Level, 25 mrem/year	573
CT State Level, 19 mrem/year	435

## SUMMARY

UNC Naval Products requests NRC approval of this addendum to the existing Decommissioning Plan as submitted to the NRC dated August 17, 1998.

This includes utilizing an amended total uranium DCGL consistent with the DCGL values (outlined above) as derived from the RESRAD computer code described in this addendum. UNC is seeking to implement the Connecticut State dose limit criteria of 19 mrem per year. The DCGL associated with this level is 24 percent lower than the NRC Federal level for unrestricted use as set forth in 10 CFR 20.1402.

The DCGL value requested is protective of human health and the environment, is below the 10 CFR 20 federal limit for unrestricted use, and is consistent with the State of Connecticut dose values for unrestricted use.

There are no regulatory commitments contained in this addendum request.

# **ATTACHMENT A**

**June 23, 2008 NRC DCGL Submittal**

**NAVAL PRODUCTS**

20 Research Parkway Unit E  
Old Saybrook, CT 06475  
(800) 388-9311 FAX (860) 388-9546  
Email: bob.bonito@ae.ge.com

**Robert F. Bonito**  
General Manager

June 23, 2008

Raymond K. Lorson  
U.S. Nuclear Regulatory Commission  
Region 1  
475 Allendale Road  
King of Prussia, PA 19406-1415

Subject: UNC Naval Products, DCGLs for the former UNC Manufacturing Facility

Dear Mr. Lorson:

Enclosed is the radiation dose assessment that was revised after discussions with you and your staff on June 12, 2008. The report, *Derived Concentration Guideline Levels for Decommissioning the former UNC Manufacturing Facility*, Report No. 2002020/G-3972, Revision 1, describes the potential exposure scenario for the site and the input parameters that were used to derive the release criteria. Please approve the attached radiation dose assessment.

Please let me know if you have any questions. We look forward to your approval and working with you and your staff on this important project.

Sincerely,

Robert Bonito  
UNC Naval Products  
20 Research Parkway  
Old Saybrook, CT 06475

License SNM-368 (Terminated)  
Docket 070-0037 (Retired)

Attachment

# **Derived Concentration Guideline Levels for Decommissioning the former UNC Manufacturing Facility**

Submitted to:

***UNC Naval Products***

20 Research Parkway, Unit E  
Old Saybrook, Connecticut 06475  
(860) 388-9311

by:

***AAA Environmental, Inc.***

6679 Moore Road  
Syracuse, New York 13211  
(315) 454-2000

and

***Integrated Environmental Management, Inc.***

3124 Saddlebrook Drive, Suite 1508  
Findlay, Ohio 45840  
(419) 423-4701

Report No. 2002020/G-3972

Revision 1

June 16, 2008

## **TABLE OF CONTENTS**

<b>1 INTRODUCTION</b>	<b>1</b>
1.1 Objective	1
1.2 Approach	1
<b>2 DESCRIPTION OF THE CRITICAL GROUP</b>	<b>2</b>
<b>3 RESRAD INPUT PARAMETERS</b>	<b>3</b>
3.1 Exposure Pathways	3
3.2 Source Term	3
3.3 Key Parameter Justification	4
<b>4 RESULTS</b>	<b>7</b>
<b>5 TABLES</b>	<b>8</b>
Table 1 Potential Exposure Pathways	9
Table 2 Source Term	10
Table 3 Potential Radiation Exposures	11
Table 4 Derived Concentration Guideline Levels	12
<b>APPENDIX 1 INPUT PARAMETER LISTING</b>	<b>13</b>
<b>APPENDIX 2 RESRAD REPORT</b>	<b>14</b>



## 1 INTRODUCTION

### 1.1 Objective

This document establishes the basis for the derived concentration guideline levels (DCGLs) and potential radiation dose stemming from the future use of the former UNC Manufacturing Facility in New Haven, Connecticut. This report documents the assumptions that apply to the site and the pathways for potential exposure.

### 1.2 Approach

The parameters described and the method used to derive the release criteria for the former UNC manufacturing facility are consistent with guidance provided by the U.S. Nuclear Regulatory Commission (USNRC) and NUREG 1757.<sup>1</sup> The release criteria were derived using the computer model, RESRAD (Version 6.4), developed by Argonne National Laboratory. RESRAD was used to model radionuclide fate and transport of residual radioactivity at the site and to assess the radiation dose incurred by hypothetical receptors who may be impacted by the site after decommissioning is complete.<sup>2</sup> This code provides an estimate of the annual radiation dose beginning immediately after decommissioning is complete and extending for 1,000 years into the future. It is widely-accepted as an industry-standard tool for performing radiological dose assessments and for deriving derived concentration guideline levels (DCGLs). The dose modeling must demonstrate that the following USNRC limit will be met once decommissioning is complete:<sup>3</sup>

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

---

<sup>1</sup> U.S. Nuclear Regulatory Commission, *Consolidated NMSS Decommissioning Guidance-Decommissioning Process for Materials Licensees*, NUREG-1757, Volume 1, September, 2003.

<sup>2</sup> Yu, C, Zielen, A.J, et al, *User's Manual for RESRAD Version 6*, ANL/EAD-4, Argonne National Laboratory, Argonne, Illinois, July, 2001.

<sup>3</sup> US Nuclear Regulatory Commission, *Radiological Criteria for Unrestricted Use*, Title 10 CFR 20.1402, July 21, 1997.

## **2 DESCRIPTION OF THE CRITICAL GROUP**

The USNRC established its decision-making criteria on the use of a risk based assessment method and the resulting mean or "reasonably foreseeable" exposure to an average member of the critical exposure group. This assessment is described in NUREG-1757 and was the approach used by AAA/IEM in its assessment of the radiation dose potential at the New Haven site.<sup>4,5,6</sup>

The former UNC manufacturing facility is located on Shelton Avenue which is a residential street with houses that are occupied by families. The city of New Haven, Connecticut is an established city for more than 100 years and it is likely that the street and the surrounding houses will be used in a similar manner for the next 100 years. For the purposes of the radiation dose modeling, the potential exposure scenario and pathways for exposure were assumed to be equivalent to a suburban resident.

The critical exposure group for the suburban resident scenario is described as a hypothetical family that occupies a house constructed on the former UNC manufacturing facility. It is assumed that the house is located over or near the areas that were previously excavated, referred to as the Decon Pit and the X-ray Read Room. The family who lives in the house uses water provided by a publicly owned water supply and less than 10% of the vegetables they consume are grown on the property.<sup>7</sup> There is no consumption of meat and milk obtained from the site. The remainder of the food is purchased at a nearby grocery store and is not impacted by the subsurface of the site. The groundwater pathway was disabled because a suburban resident is most likely to secure water from a public water supply, which is regionally available, rather than drilling and maintaining a well. This is consistent with current conditions for the houses in the neighborhood, and thus is likely for the foreseeable future.<sup>8</sup>

---

<sup>4</sup> As defined in 10 CFR 20.1003, the critical group is a group of individuals expected to receive the greatest exposure to residual radioactivity for any applicable set of conditions.

<sup>5</sup> U.S. Nuclear Regulatory Commission, *Results of the License Termination Rule Analysis*, SECY 03-0069, May 2, 2003.

<sup>6</sup> U.S. Nuclear Regulatory Commission, *Consolidated Decommissioning Guidance - Characterization, Survey and Determination of Radiological Criteria*, NUREG-1757, Vol. 2, Revision 1, Appendix I, September, 2006.

<sup>7</sup> Argonne National Laboratory, *User's Manual for RESRAD Version 6*, Section 2.4.2, ANL/EAD-4, July, 2001.

<sup>8</sup> U.S. Nuclear Regulatory Commission, *Consolidated Decommissioning Guidance - Characterization, Survey and Determination of Radiological Criteria*, NUREG-1757, Vol. 2, Revision 1, Appendix M, September, 2006.

### 3 RESRAD INPUT PARAMETERS

#### 3.1 Exposure Pathways

RESRAD identifies the potential pathways for exposure to the critical group. Four (4) pathways are used for the suburban resident, including:

- direct radiation exposure;
- particulate inhalation;
- ingestion of plant foods; and
- direct ingestion of soil.

Table 1 lists the pathways that have been retained for the analysis and provides an explanation for those pathways that were not retained.

The groundwater pathway was determined to be not applicable and consequently was not retained for this radiation dose assessment. Drinking water is provided by the City of New Haven and there are no drinking water wells in the City of New Haven.<sup>9</sup> A city ordinance restricting the use of water wells is enforced; any well must be registered with the City Department of Health and comply with the requirements of the State of Connecticut Public Health Code.<sup>10</sup> The RESRAD User Manual supports the position that the suburban resident does not drink groundwater.<sup>11</sup> Consequently, the groundwater pathway in RESRAD disabled for this analysis because a public water supply is available to suburban residents who may occupy the former UNC manufacturing facility.

#### 3.2 Source Term

Table 2 describes the source term that applies to the subsurface soil. As verified during the Characterization effort in 2003, enriched uranium was present in the soil and the ratio of Uranium-234-to-235 was assumed to be 27:1.<sup>12</sup> The ratio was established by UNC and Oak Ridge Institute for Science and Education (ORISE) in 1997 for the purposes of using gamma spectroscopy as the sole analytical method.<sup>13,14</sup> No information is available about the uranium progeny that decay by

---

<sup>9</sup> Personal communication with Bill Thomas, IEM, and Mr. Gil Hawkins, City Planning and Zoning, City of New Haven, June 11, 2008.

<sup>10</sup> City of New Haven, Code of Ordinances, Title III, Chapter 55-2, *Water Wells*, 1985.

<sup>11</sup> Argonne National Laboratory, *User's Manual for RESRAD Version 6*, Section 2.4.2, ANL/EAD-4, July, 2001.

<sup>12</sup> AAA/IEM., *Radiological Characterization of the Former UNC Manufacturing Facility, New Haven, Connecticut*, Report Number 2002020/G-1269, May 31, 2005.

<sup>13</sup> The dominant gamma line from Uranium 235 (185 kev) is masked by the presence of radium 226 (186 kev). In addition, the activity of Uranium 238 (decay by alpha decay) is derived when using gamma spectroscopy, by assuming secular equilibrium with its progeny, Thorium 234. Alpha spectroscopy is the preferred method to identify enriched uranium, where the activity of Uranium 234, Uranium 235 and Uranium 238 can be clearly separated and quantified.

<sup>14</sup> Oak Ridge Institute for Science and Education, *Radiological Scoping Survey of Building 3H and 6H at the Former UNC Facility, New Haven Connecticut*, Final Report, January 17, 1997.

alpha emission; they were not analyzed during the Characterization effort. It is assumed that the progeny are not in equilibrium with the uranium isotopes because the uranium that was used at the site was purified and progeny were removed prior to being shipped to the former UNC manufacturing facility. For the purposes of this radiation dose assessment, it is assumed that the progeny, such as protactinium 231 (Pa231) is present at an activity of one percent (1%) to that of U235. This assumption is conservative because of the relatively short time that the processed uranium was present at the site, less than 50 years versus the half-life of Pa231 or 32,760 years. It is more likely that the presence of Pa231 is significantly less than 1% of the U235 activity. There are no short lived progeny in the decay series immediately following U234.<sup>15,16</sup> RESRAD calculates the radiation dose from any isotope with a radioactive half-life in excess of six (6) months. Consequently, Th231, Th234 and Pa234m are not included in the evaluation.<sup>17</sup>

In order to calculate the DCGLs, the unit activity for each isotope was used in the RESRAD model. The result, millirem/year per picocurie per gram, was used to derive the activity that results in the radiation dose limit. For the purposes of this evaluation, a radiation dose criterion was set at 25 millirem per year.<sup>18</sup>

### 3.3 Key Parameter Justification

Given the pathways described above, all input parameters for the RESRAD code are provided in Appendix 1. The default parameter used by RESRAD was described when no other information was available. The RESRAD defaults represent the exposure scenario of a resident farm family and will derive a higher radiation dose or a lower DCGL than for a suburban resident scenario.<sup>19</sup> The chemical and hydrogeological parameters represent average values and distributions documented across the United States and were determined to be representative of conditions that exist at the former UNC manufacturing facility. The key parameters for suburban resident exposure scenario are summarized in Table 3. Listed below is the justification for each key parameter.

- Indoor Time Fraction - The total time spent indoors at the site is assumed to 0.68 or approximately 6,000 hours per year.<sup>20</sup> This is conservative or likely to be higher than observed because the resident is assumed to work offsite and spend a significant amount of time offsite.

---

<sup>15</sup> E.W. Abelquist, *Decommissioning Health Physics - A Handbook for MARSSIM Users*, Chapter 14, Institute of Physics, 2001.

<sup>16</sup> U.S. Department of Energy, *Guide of Good Practices for Occupational Radiological Protection in Uranium Facilities*, DOE-STD-1136-2000, August, 2000.

<sup>17</sup> Argonne National Laboratory, *User's Manual for RESRAD Version 6*, Section 2.4.2, ANL/EAD-4, July, 2001.

<sup>18</sup> US Nuclear Regulatory Commission, *Radiological Criteria for Unrestricted Use*, Title 10 CFR 20.1402, July 21, 1997.

<sup>19</sup> U.S. Nuclear Regulatory Commission, *Development of Probabilistic RESRAD 6.0 and RESRAD-Build 3.0 Computer Codes*, NUREG/CR-6697, November, 2000.

<sup>20</sup> U.S. Nuclear Regulatory Commission, *Development of Probabilistic RESRAD 6.0 and RESRAD-Build 3.0 Computer Codes*, NUREG/CR-6697, Appendix C, Section 7.6, November, 2000.

- Outdoor Time Fraction - The total time spent outdoors is assumed to be 0.12 or approximately 1,050 hours.<sup>21</sup> This is likely to be lower because of time spent away from the site, either at work or other non impacted locations.
- Inhalation Rate - The inhalation rate for the suburban resident is assumed to be a short term exposure for adult males averaging 8,400 cubic meters per year. This value is equal to the RESRAD default inhalation rate based on geometric mean rate for short term exposure to adult males.<sup>22</sup> This value is conservative because it assumes that the suburban resident is walking on the property and performing tasks that are considered to be "light activity" as defined in the USEPA Exposure Factors Handbook. This volume of air assumes that the resident is on the site 100% of the time. The radiation dose associated with this value decreases as the inhalation rate drops.
- Mass loading for inhalation - The value selected for the analysis was the default value for the RESRAD code. The mass loading in air describes the airborne dust loading conditions on the site and it is assumed that the suburban resident spends some time outdoors in direct contact with the impacted soil.<sup>23</sup>
- Soil ingestion Rate - The suburban resident may ingest soil as a result of incidental contact with the soil. The RESRAD default and the value selected for this analysis, is 36.5 grams per year, or 100 milligrams per day. It is assumed that the suburban resident is engaged in non contact intensive activities. The suburban resident may ingest soil from incidental contact with the surface soil at the site. This assumption is conservative because the impacted soil is subsurface and not present on the surface of the soil where the resident has access. The average value suggested in the USEPA *Exposure Factor Handbook* is 50 mg/d, lower than the value selected.<sup>24</sup> The suburban resident does not eat any animals, and does not drink any surface water or ground water.<sup>25</sup>

---

<sup>21</sup> U.S. Nuclear Regulatory Commission, *Review of Parameter Data for the NUREG/CR-5512 Building Occupancy Scenario and Probability Distributions for the D and D Parameter Analysis*, NUREG/CR-5512, Vol.3, 1998.

<sup>22</sup> U.S. Environmental Protection Agency, *Exposure Factors Handbook, Volume I, General Factors*, EPA 600/P-95-002Fa, August, 1997.

<sup>23</sup> Argonne National Laboratory, *User's Manual for RESRAD Version 6*, July, 2001.

<sup>24</sup> U.S. Environmental Protection Agency, *Exposure Factors Handbook, Volume I, General Factors*, EPA 600/P-95-002Fa, August, 1997.

<sup>25</sup> Drinking water is provided by a publicly-owned water system where there is testing for compliance with drinking water standards for radionuclides, and there are no surface water sources or ground water wells located at the site.

- Area of the Contaminated Zone - The area of the contaminated zone is represented by footprint of the three excavations, the decon pit, the Xray Read room and the storm water line located outside of the building. These three areas are not contiguous but in order to provide a conservative estimate the area of the three areas were added together. It is assumed that the suburban resident has easy access to all three areas.
- Thickness of the Contaminated Zone - The contaminated zone of each area are the walls and floors of the excavations. Soil is removed from the area and impacted soil is packaged for disposal. The soil remaining is assumed to be at activity concentrations less than the DCGLs. Each excavation is filled with soil that is less than the DCGL. The depth of each excavation is different according to the presence of impacted soil observed at the time of the remedial work. For the purposes of this evaluation, it is assumed that the thickness of the contaminated zone is 2 meters thick or approximately 6.5 feet deep.
- Ingestion of Water - There is no surface water and no wells to provide ground water as drinking water.<sup>26</sup> It is assumed that the suburban resident uses drinking water from a POTW that is not impacted by the uranium at the site as is the condition that exists at the site today and in the foreseeable future.
- Contaminated fraction of vegetables - It is assumed that ten percent (10%) of the vegetables consumed by the suburban resident are raised onsite and grown in the soil that is potentially impacted with radioactivity.<sup>27</sup> The default parameter for the RESRAD code, 50%, is based on a resident farm family who have a larger area and spend more time on the property to grow vegetables planted in a contaminated area. It is not reasonable to assume that a suburban resident living in New Haven, Connecticut, on the Shelton Avenue property would plant and ingest more than 10% of their vegetables in the contaminated areas. The growing season in Connecticut is shorter than warmer areas found in the southern states. Also noted, the area of the contaminated zone is the sum of three separate areas which are not contiguous; the likelihood that a suburban resident would plant vegetables in all three areas is unlikely. Therefore, assuming that 10% of the vegetables are planted in the contaminated areas is conservative and likely to be much lower when averaged over a calendar year.

---

<sup>26</sup> Personal communication with Bill Thomas, IEM, and Mr. Gil Hawkins, City Planning and Zoning, City of New Haven, June 11, 2008.

<sup>27</sup> Argonne National Laboratory, *User's Manual for RESRAD Version 6*, Table 2.3, ANL/EAD-4, July, 2001.

## **4 RESULTS**

The RESRAD code was iteratively run for each of the selected scenarios to arrive at the highest uniform concentration of residual radioactivity in soil that results in a peak mean annual dose estimate to a single receptor in the critical exposure group that is equal to the regulatory limit of 25 millirem per year for a suburban resident exposure scenario. Table 3 summarizes the results. The output of the RESRAD code is provided in Appendix 2.

The dose calculated for the unit concentration was 0.04 mrem/year per pCi/gram of total enriched uranium plus progeny. The derived concentration guideline level (DCGL) is calculated to be 625 pCi/gram of total enriched uranium plus progeny and yields a potential exposure of 25 mrem/year. An activity of 475 pCi/gram of total enriched uranium plus progeny represents a potential exposure of less than 19 mrem/year. Table 4 summarizes the DCGLs for both total enriched uranium and the isotopes of uranium.

The radiation dose associated with uranium 234 represented the principal exposure, 60% for all pathways at the initial exposure period or in the first year. The dose from plant ingestion was determined to be 28% of the total dose, soil ingestion contributed 19% of the dose and inhalation of U234 in air contributed 13% of the dose.

The ingestion of contaminated vegetables, grown in a garden on the Shelton Avenue property was evaluated. The radiation dose calculated from ingesting 10% of vegetables from the contaminated zone was determined to be 0.04 mrem/year per pCi/gram of total uranium plus progeny. In the unlikely event that the suburban resident were to ingest a larger quantity of vegetables grown in the contaminated areas, the radiation dose will change. If the suburban resident consumes the same quantity of vegetables from the garden, equivalent to that of a resident farm family, or 50%, the radiation dose changes to 0.1 mrem/year per pCi/gram of total uranium plus progeny. This equates to a DCGL of 250 pCi/gram of total uranium plus progeny.

***5 TABLES***



**Table 1 Potential Exposure Pathways**

Pathway	Retained	Comments
Direct Exposure	Yes	The source term found in the site soils produces penetrating gamma radiation. Exposure from direct penetrating radiation is expected to be a significant contributor to the overall potential dose.
Particulate Inhalation	Yes	Allowance is made for soils containing radiological constituents of the source being liberated and suspended in the breathing air of the suburban resident.
Plant Ingestion	Yes	It is assumed that a portion of the plants are raised onsite (10%) and grown in the soil that is potentially impacted with radioactivity. The remainder of the plants ingested by the suburban resident (90%) are grown offsite and not impacted by radioactivity on site.
Meat Ingestion	No	The suburban resident does not raise livestock.
Milk Ingestion	No	The suburban resident does not raise livestock and does not ingest milk from cattle grazing on the site.
Aquatic Foods	No	The suburban resident does not ingest fish or shellfish raised on the site. It is assumed that all aquatic foods are raised and purchased offsite.
Drinking Water	No	It is assumed that the future resident will ingest water provided by a POTW and not drink groundwater.
Soil Ingestion	Yes	Suburban residents are assumed to spend approximately 1,050 hours of their time outdoors each year. They may ingest relatively small amounts of soil through incidental oral contact with their hands.
Radon	No	Radon is specifically excluded from consideration within the framework of the USNRC governing regulations.

**Table 2 Source Term**

Isotope	Unit Activity pCi/g	Comments
Protactinium 231	0.00037	Assumed to be less than 1% of the activity associated with U235
Protactinium 234m	0.0085	Secular equilibrium with U238
Thorium 231	0.037	Secular equilibrium with U235
Thorium 234	0.0085	Secular equilibrium with U238
Uranium 234	1	Assume U235 enrichment approximately 93%. U234:U235 activity equivalent to 27:1 <sup>28</sup>
Uranium 235	0.037	Assume U235 enrichment approximately 93%
Uranium 238	0.0085	Assume U235 enrichment approximately 93% <sup>29</sup>

Note: Enriched uranium does not contain all progeny present in natural uranium. The shortlived progeny of U238, Th234 and Pa234m will be present at the same activity concentration as U238. Pa231 is assumed to be present at an activity of less than 1% of the activity concentration as U235. There are no short lived progeny in the decay series immediately following U234.<sup>30,31</sup>

Note: RESRAD uses isotopes with a radioactive half-life of six (6) months or greater. Progeny of U238, Th234 and Pa234m, and progeny of U235, Th231, are not included in the RESRAD input file.<sup>32</sup>

<sup>28</sup> Oak Ridge Institute for Science and Education, *Radiological Scoping Survey of Building 3H and 6H at the Former UNC Facility, New Haven Connecticut*, Final Report, January 17, 1997.

<sup>29</sup> Rucker, T.L., et al, *Relationship Between Isotopic Uranium Activities and Total Uranium at Various Uranium Enrichments*, Journal of Radioanalytical and Nuclear Chemistry, Volume 235, September, 1998.

<sup>30</sup> E.W. Abelquist, *Decommissioning Health Physics - A Handbook for MARSSIM Users*, Chapter 14, Institute of Physics, 2001.

<sup>31</sup> U.S. Department of Energy, *Guide of Good Practices for Occupational Radiological Protection in Uranium Facilities*, DOE-STD-1136-2000, August, 2000.

<sup>32</sup> Argonne National Laboratory, *User's Manual for RESRAD Version 6*, ANL/EAD-4, July, 2001.

**Table 3 Potential Radiation Exposures**

Parameter	Unit	RESRAD Input File 02406.rad
Plant food	unitless	0.1
Groundwater ingestion	l/yr	0
Radiation Dose	mrem/yr/pCi/g Total Uranium plus progeny	0.04
Key Isotope Contributing to the radiation dose		U234
Key Pathway Contributing to the radiation dose		Plant Ingestion 28% Soil Ingestion 19% Inhalation 13%
Release criteria for 25 mrem/yr	pCi/g Total Uranium plus progeny	625
Release criteria for 19 mrem/yr	pCi/g Total Uranium plus progeny	475

Note: A large contaminated area was assumed to be greater than 20,000 m<sup>2</sup> for the meat and milk pathway and greater than 1,000 m<sup>2</sup> for the plant food pathway.<sup>33</sup> It was assumed that ten percent (10%) of the plants ingested by the suburban resident are grown in the on-site garden.<sup>34</sup>

Note: It is assumed there is no pathway from groundwater, milk, meat or aquatic food. It was assumed that the suburban resident ingested 36.5 grams of soil each year (default for RESRAD).

<sup>33</sup> Argonne National Laboratory, *User's Manual for RESRAD Version 6*, Section 2.4.2, ANL/EAD-4, July, 2001.

<sup>34</sup> Argonne National Laboratory, *User's Manual for RESRAD Version 6*, Table 2.3, ANL/EAD-4, July, 2001.

**Table 4 Derived Concentration Guideline Levels**

Isotope	DCGL (pCi/gram)	
	19 mrem/year	25 mrem/year
Total Uranium plus progeny	475	625
Total Uranium <sup>35,36,37</sup>	436	574
Uranium 234	417	549
Uranium 235	15	20
Uranium 238	4	5
Calculated Dose	18.6 mrem/yr	24.3 mrem/yr

<sup>35</sup> The progeny of enriched uranium, as described in Table 2, also contributes to the radiation dose. The criteria for "Total Uranium" compares directly to the release criteria established in the USNRC Branch Technical Position and the Decommissioning Plan approved for the Shelton Avenue site.

<sup>36</sup> US Nuclear Regulatory Commission Branch Technical Position, *Disposal or Onsite Storage of Thorium or Uranium Wastes from Past Operations*, SECY 81-576, Federal Register 46 FR 52601, October 23, 1981.

<sup>37</sup> U.S. Nuclear Regulatory Commission, *Site Characterization and Decommissioning Plan for 71 Shelton Avenue, New Haven, CT*, Docket 070-00371 (retired), April 6, 1999.

## **APPENDIX 1 INPUT PARAMETER LISTING**

Suburban Resident Exposure Scenario

Parameter			Central Tendency Value	Classification (D=RESRAD Default; S=Site-specific)	Justification, Source or Other Information
Description	Code	Unit			
Dose Conversion Factors	DCFX(n)	millirem/pCi	All DCFs used are RESRAD defaults	D	RESRAD defaults from FGR#11 and FGR#12, derived using ICRP 30 dosimetry model. <sup>1,2</sup> Short-lived (<180 days) radioactive progeny isotopes are accounted for through the use of the "parent+D" DCFs.
Area of Contaminated Zone	AREA	m <sup>2</sup>	1,000	S	The area of the contaminated zone is represented by the area of the three excavated areas, the Decon Pit, X-ray Read room and the Storm Water line on Argyle street. The area is determined to be approximately 650 m <sup>2</sup> ; the actual area will be established during the final status survey. The selected value of 1,000 m <sup>2</sup> is assumed to be conservative.
Thickness of the contaminated zone	THICK0	m	2	S	The residual activity is assumed to be present on the walls and floors of the excavation. The excavation will be filled with soil containing activity less than the DCGLs.
Length Parallel to Aquifer Flow	LCZPAQ	m	17.9	S	Calculated as the radius of a round area where the Area is 1,000 m <sup>2</sup> .
Basic Radiation dose limit	BRDL	mrem/yr	25	D	USNRC 10 CFR 20.1402
Time since placement of material	TI	yr	0	S	Site conditions that exist after remedial activities are complete.

<sup>1</sup> U.S. Environmental Protection Agency, *Limiting Values of Radionuclide Intake and Air Concentrations and Dose Conversion Factors for Inhalation, Submersion, and Ingestion*, Federal Guidance Report Number 11, EPA 520/1-88-020, September, 1988.

<sup>2</sup> U.S. Environmental Protection Agency, *External Exposure to Radionuclides in Air, Water and Soil*, Federal Guidance Report Number 12, EPA 402 R-93-081, September, 1993.

Suburban Resident Exposure Scenario

Parameter			Central Tendency Value	Classification (D=RESRAD Default; S=Site-specific)	Justification, Source or Other Information
Description	Code	Unit			
Calculation Times	T(n)	Yrs	1 10 100 300 500 700 900 1000	S	Evaluation at these time segments allows for consideration of the potential for conditions at the Site to evolve from the initial conditions specified and projects the changing Site conditions to the required 1000-year outlook. <sup>3,4</sup>
Protactinium-231	S1(1)	pCi/g	0.00037	S	Unit activity used to derive DCGLs. Assume Pa231 is not in secular equilibrium and less than 1% of the U235 activity
Protactinium-234m	S1(2)	pCi/g	0.0085	S	Not used. Physical half-life is less than 6 months.
Thorium-231	S1(3)	pCi/g	0.037	S	Not used. Physical half-life is less than 6 months.
Thorium-234	S1(4)	pCi/g	0.0085	S	Not used. Physical half-life is less than 6 months.
Uranium-234	S1(5)	pCi/g	1.0	S	Unit activity used to derive DCGLs
Uranium-235	S1(6)	pCi/g	0.037	S	Unit activity used to derive DCGLs
Uranium-238	S1(7)	pCi/g	0.0085	S	Unit activity used to derive DCGLs
Concentration in groundwater	W1(n)	pCi/L	0	D	
Cover Depth (thickness)	COVER0	m	0	D	No cover is assumed.

<sup>3</sup> U.S. Nuclear Regulatory Commission, *Radiological Criteria for License Termination*, Volume 62, Federal Register, page 39058, July 21, 1997.

<sup>4</sup> U.S. Nuclear Regulatory Commission, *NMSS Decommissioning Standard Review Plan*, NUREG-1727, September, 2000.

Suburban Resident Exposure Scenario

Parameter			Central Tendency Value	Classification (D=RESRAD Default; S-Site-specific)	Justification, Source or Other Information
Description	Code	Unit			
Density of cover material	DENSCV	g/m <sup>3</sup>			Not used.
cover depth erosion rate	VCV	m/yr			Not used.
Contaminated Zone Density	DENSCZ	g/cm <sup>3</sup>	1.5	D	The density of the soil in the contaminated zone is equivalent to the nominal density of soil (i.e., RESRAD default value).
Contaminated Zone Erosion Rate	VCZ	m/yr	0.001	D	
Contaminated Zone Total Porosity	TPCZ	Unitless 0 to 1	0.4	D	RESRAD default for silty clay soil was selected.
Contaminated Zone Field Capacity	FCCZ	Unitless, 0 to 1	0.2	D	This value was calculated in accordance with RESRAD guidance using the total and effective porosity for the site.
Contaminated Zone Hydraulic Conductivity	HCCZ	m/yr	10	D	
Contaminated Zone B-Parameter	BCZ	Unitless	5.3	D	The RESRAD default value for silty loam soil was selected.
Average Annual Wind Speed	WIND	m/sec	2	D	
Humidity in air	HUMID	g/m <sup>3</sup>			Not used. No cover



Suburban Resident Exposure Scenario

Parameter			Central Tendency Value	Classification (D=RESRAD Default; S=Site-specific)	Justification, Source or Other Information
Description	Code	Unit			
Evapo-transpiration Coefficient	EVAPTR	Unitless, 0 to 1	0.5	D	No value recommended by USNRC in NUREG 5512. RESRAD Default used for this parameter. Typical values in humid climates east of the Mississippi River are approximately 0.7. <sup>5</sup>
Precipitation Rate	PRECIP	m/year	1.0	D	
Irrigation	RI	m/yr	0.2	D	Uses RESRAD value for humid area where minimal irrigation is required, which is typical for Connecticut
Irrigation mode	IDITCH	unitless	Overhead	D	
Runoff Coefficient	RUNOFF	Unitless, 0 to 1	0.2	D	
Watershed Area for Nearby Stream or Pond	WAREA	m <sup>2</sup>	1,000,000	D	
Accuracy for water/soil computations	EPS	unitless	0.001	D	
Density, Saturated Zone	DENSAQ	g/cm <sup>3</sup>	1.5	D	
Total Porosity Saturated Zone	TPSZ	Unitless, 0 to 1	0.4	D	RESRAD value for silty clay soil was selected.
Effective Porosity, Saturated Zone	EPSZ	Unitless, 0 to 1	0.2	D	RESRAD value for silty clay soil was selected.
Field Capacity, Saturated Zone	FCSZ	Unitless, 0 to 1	0.2	D	RESRAD value for silty clay soil was selected.

<sup>5</sup> Argonne National Laboratory, *User's Manual for RESRAD Version 6*, July, 2001.

Suburban Resident Exposure Scenario

Parameter			Central Tendency Value	Classification (D=RESRAD Default; S=Site-specific)	Justification, Source or Other Information
Description	Code	Unit			
Hydraulic Conductivity, Saturated Zone	HCSZ	m/yr	100	D	
Hydraulic Gradient	HGWT	Unitless	0.02	D	
Saturated Zone B-Parameter	BSZ	Unitless	5.3	D	RESRAD default value for silty loam soil was used.
Water table drop rate	VWT	m/yr	0.001	D	
Well pump intake depth	DWIBWT	m (below the water table)	10	D	
Model: Nondispersion (ND) or Mass balance (MB)	MODEL	unitless	ND	D	
Well pumping rate	UW	m <sup>3</sup> /yr	250	D	
Number of unsaturated zone strata	NS	unitless	1	D	
Thickness Unsaturated Layer	H1	m	4	D	
Density, Unsaturated Layer	DENSUZ	g/cm <sup>3</sup>	1.5	D	
Total Porosity Unsaturated Layer	TPUZ	Unitless 0 to 1	0.4	D	RESRAD value for silty clay soil selected.
Effective Porosity of Unsaturated Layer	EPUZ	Unitless, 0 to 1	0.2	D	RESRAD value for silty clay soil selected.

Suburban Resident Exposure Scenario

Parameter			Central Tendency Value	Classification (D=RESRAD Default; S=Site-specific)	Justification, Source or Other Information
Description	Code	Unit			
Field Capacity Unsaturated Layer	FCUZ	Unitless, 0 to 1	0.2	D	This value was calculated in accordance with RESRAD guidance using the total and effective porosity for the site
Unsaturated Layer 1, B-Parameter	BUZ(1)	Unitless	5.3	D	RESRAD value for silty loam soil was selected.
Hydraulic Conductivity Unsaturated Layer	HCUZ	m/yr	10	D	
Distribution coefficients for Thorium					
Thorium Kd contaminated zone	DCNUCC(1)	cm <sup>3</sup> /g	60,000	D	
Thorium Kd unsaturated zone	DCNUCU(1)	cm <sup>3</sup> /g	60,000	D	
Thorium Kd saturated zone	DCNUCS(1)	cm <sup>3</sup> /g	60,000	D	
Leach rate	ALEACH(1)	/yr	0	D	
Solubility constant	SOLUBK(1)	unitless	0	D	
Distribution coefficients for Uranium					
Uranium Kd contaminated zone	DCNUCC(2)	cm <sup>3</sup> /g	50	D	
Uranium Kd unsaturated zone	DCNUCU(2)	cm <sup>3</sup> /g	50	D	
Uranium Kd saturated zone	DCNUCS(2)	cm <sup>3</sup> /g	50	D	

Suburban Resident Exposure Scenario

Parameter			Central Tendency Value	Classification (D=RESRAD Default; S=Site-specific)	Justification, Source or Other Information
Description	Code	Unit			
Leach rate	ALEACH(2)	/yr	0	D	
Solubility constant	SOLUBK(2)	unitless	0	D	
Distribution coefficients for Protactinium					
Protactinium Kd contaminated zone	DCNUCC(3)	cm <sup>3</sup> /g	50	D	
Protactinium Kd unsaturated zone	DCNUCU(3)	cm <sup>3</sup> /g	50	D	
Protactinium Kd saturated zone	DCNUCS(3)	cm <sup>3</sup> /g	50	D	
Leach rate	ALEACH(3)	/yr	0	D	
Solubility constant	SOLUBK(3)	unitless	0	D	
Inhalation Rate	INHALR	m <sup>3</sup> /yr	8,400	D	RESRAD default for a suburban resident with light work outdoors
Mass Loading for Inhalation	MLINH	g/m <sup>3</sup>	1x10 <sup>-4</sup>	D	
Exposure duration	ED	yr	30	D	
Indoor dust filtration	SHF3	unitless	0.4	D	
Shielding factor, external gamma	SHF1	unitless	0.7	D	

Suburban Resident Exposure Scenario

Parameter			Central Tendency Value	Classification (D=RESRAD Default; S=Site-specific)	Justification, Source or Other Information
Description	Code	Unit			
Indoor Time Fraction	FIND	Unitless, 0 to 1	0.68	O	The fraction of the total year (8,760hr) that is spent indoors on site, pursuant to NUREG-6697 is 6,000 hours or approximately 68% of the total exposure duration. <sup>6</sup>
Outdoor Time Fraction	FOTD	Unitless, 0 to 1	0.12	O	The fraction of the total year that is spent outdoors on site, pursuant to NUREG-5512, is 1,050 hours or approximately 12% of the total exposure duration. <sup>7</sup>
Fruits, vegetables and grain consumption	DIET(1)	kg/yr	160	D	
Leafy vegetable consumption	DIET(2)	kg/yr	14	D	
Milk consumption	DIET(3)	L/yr	92	D	
Meat and poultry consumption	DIET(4)	Kg/yr	63	D	
Fish consumption	DIET(5)	Kg/yr	5.4	D	
Other seafood consumption	DIET(6)	Kg/yr	0.9	D	
Soil Ingestion Rate	SOIL	g/y	36.5	D	
Drinking water intake	DW1	L/yr	510	S	It is assumed that the suburban resident does not ingest groundwater for the purposes of drinking. The resident is assumed to ingest non impacted water from the POTW.

<sup>6</sup> U. S. Nuclear Regulatory Commission, *Development of probabilistic RESRAD 6.0 and RESRAD-Build 3.0 computer codes*, NUREG-6697, December 2000.

<sup>7</sup> U.S. Nuclear Regulatory Commission, *Review of Parameter Data for the NUREG/CR-5512 Building Occupancy Scenario and Probability Distributions for the D and D Parameter Analysis*, NUREG/CR-5512, Vol.3, 1998.

### Suburban Resident Exposure Scenario

Description	Parameter		Central Tendency Value	Classification (D=RESRAD Default; S=Site-specific)	Justification, Source or Other Information
	Code	Unit			
Contamination fraction of drinking water	FDW	unitless	0	S	It is assumed that the suburban resident does not ingest groundwater for the purposes of drinking.
Contamination fraction of household water	FHHW	unitless	0	S	It is assumed that the suburban resident does not ingest groundwater for the purposes of drinking.
Contamination fraction of livestock water	FLW	unitless	0	S	No livestock are grazed on this property using the suburban resident scenario.
Contamination fraction of irrigation water	FIRW	unitless	0	S	It is assumed that the suburban resident does not use groundwater for the purposes of irrigating the garden.
Contamination fraction of aquatic food	FR9	unitless	0	S	No aquatic animals, such as fish or shellfish, are assumed to be located at this site.
Contamination fraction of plant food	FPLANT	unitless	0.1	S	It is assumed that the suburban resident does not use groundwater for the purposes of irrigating. The only source of contamination may stem from the migration in the soil. It is assumed that 10% of the produce ingested by the resident is grown in the resident's garden. <sup>8</sup> The remainder of the produce is grown off site in non impacted soil.
Contamination fraction of meat	FMEAT	unitless	0	S	No livestock are grazed on this property using the suburban resident scenario.
Contamination fraction of milk	FMILK	unitless	0	S	No livestock are grazed on this property using the suburban resident scenario.

<sup>8</sup> Argonne National Laboratory, *User's Manual for RESRAD Version 6*, Section 2.4.2, ANL/EAD-4, July, 2001.

Suburban Resident Exposure Scenario

Parameter			Central Tendency Value	Classification (D=RESRAD Default; S=Site-specific)	Justification, Source or Other Information
Description	Code	Unit			
Depth of Soil Mixing Layer	DM	m	0.15	D	Value based on conceptual site model for surface soil. <sup>9</sup>
Depth of Roots	DROOT	m	0.9	D	
Mass loading for foliar deposition	MLFD	g/m <sup>2</sup>	0.001	D	
Groundwater fractional usage	FGWIR	unitless	0	D	It is assumed that the suburban resident does not ingest groundwater for the purposes of drinking or irrigation. The resident is assumed to ingest non impacted water from the POTW.

<sup>9</sup> U.S. Nuclear Regulatory Commission, *Residual Radioactive Contamination from Decommissioning: Parameter Analysis*, NUREG/CR-5512, Vol.3, October 1999.

## **APPENDIX 2 RESRAD REPORT**



1RESRAD, Version 6.4      T<sub>e</sub> Limit = 180 days      04/11/2008 08:26 Page 1  
Summary : UNC New Haven Suburban Resident  
File : C:\RESRAD\_FAMILY\RESRAD\USERFILES\UNC SUB RESIDENT 02406.RAD

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 .....	20
Dose Per Nuclide Summed Over All Pathways .....	22
Soil Concentration Per Nuclide .....	23

IRESRAD, Version 6.4      T<sub>1/2</sub> Limit = 180 days      04/11/2008 08:26 Page 2  
 Summary : UNC New Haven Suburban Resident  
 File : C:\IRESRAD\_FAMILY\RESRAD\USERFILES\UNC SUB RESIDENT 02406.RAD

Dose Conversion Factor (and Related) Parameter Summary					
Dose Library: FGR 11					
Menu	Parameter	Current Value#	Base Case*	Parameter Name	
A-1	DCF's for external ground radiation, (mrem/yr) / (pCi/g)				
A-1	Ac-227 (Source: FGR 12)	4.951E-04	4.951E-04	DCF1(	1)
A-1	At-218 (Source: FGR 12)	5.847E-03	5.847E-03	DCF1(	2)
A-1	Bi-210 (Source: FGR 12)	3.606E-03	3.606E-03	DCF1(	3)
A-1	Bi-211 (Source: FGR 12)	2.559E-01	2.559E-01	DCF1(	4)
A-1	Bi-214 (Source: FGR 12)	9.808E+00	9.808E+00	DCF1(	5)
A-1	Fr-223 (Source: FGR 12)	1.980E-01	1.980E-01	DCF1(	6)
A-1	Pa-231 (Source: FGR 12)	1.906E-01	1.906E-01	DCF1(	7)
A-1	Pa-234 (Source: FGR 12)	1.155E+01	1.155E+01	DCF1(	8)
A-1	Pa-234m (Source: FGR 12)	8.967E-02	8.967E-02	DCF1(	9)
A-1	Pb-210 (Source: FGR 12)	2.447E-03	2.447E-03	DCF1(	10)
A-1	Pb-211 (Source: FGR 12)	3.064E-01	3.064E-01	DCF1(	11)
A-1	Pb-214 (Source: FGR 12)	1.341E+00	1.341E+00	DCF1(	12)
A-1	Po-210 (Source: FGR 12)	5.231E-05	5.231E-05	DCF1(	13)
A-1	Po-211 (Source: FGR 12)	4.764E-02	4.764E-02	DCF1(	14)
A-1	Po-214 (Source: FGR 12)	5.138E-04	5.138E-04	DCF1(	15)
A-1	Po-215 (Source: FGR 12)	1.016E-03	1.016E-03	DCF1(	16)
A-1	Po-218 (Source: FGR 12)	5.642E-05	5.642E-05	DCF1(	17)
A-1	Ra-223 (Source: FGR 12)	6.034E-01	6.034E-01	DCF1(	18)
A-1	Ra-226 (Source: FGR 12)	3.176E-02	3.176E-02	DCF1(	19)
A-1	Rn-219 (Source: FGR 12)	3.083E-01	3.083E-01	DCF1(	20)
A-1	Rn-222 (Source: FGR 12)	2.354E-03	2.354E-03	DCF1(	21)
A-1	Th-227 (Source: FGR 12)	5.212E-01	5.212E-01	DCF1(	22)
A-1	Th-230 (Source: FGR 12)	1.209E-03	1.209E-03	DCF1(	23)
A-1	Th-231 (Source: FGR 12)	3.643E-02	3.643E-02	DCF1(	24)
A-1	Th-234 (Source: FGR 12)	2.410E-02	2.410E-02	DCF1(	25)
A-1	Tl-207 (Source: FGR 12)	1.980E-02	1.980E-02	DCF1(	26)
A-1	Tl-210 (Source: no data)	0.000E+00	-2.000E+00	DCF1(	27)
A-1	U-234 (Source: FGR 12)	4.017E-04	4.017E-04	DCF1(	28)
A-1	U-235 (Source: FGR 12)	7.211E-01	7.211E-01	DCF1(	29)
A-1	U-238 (Source: FGR 12)	1.031E-04	1.031E-04	DCF1(	30)
B-1	Dose conversion factors for inhalation, mrem/pCi:				
B-1	Ac-227+D	6.724E+00	6.700E+00	DCF2(	1)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(	2)
B-1	Pb-210+D	2.320E-02	1.360E-02	DCF2(	3)
B-1	Ra-226+D	8.594E-03	8.580E-03	DCF2(	4)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(	5)
B-1	U-234	1.320E-01	1.320E-01	DCF2(	6)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(	7)
B-1	U-238	1.180E-01	1.180E-01	DCF2(	8)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(	9)
D-1	Dose conversion factors for ingestion, mrem/pCi:				
D-1	Ac-227+D	1.480E-02	1.410E-02	DCF3(	1)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(	2)
D-1	Pb-210+D	7.276E-03	5.370E-03	DCF3(	3)
D-1	Ra-226+D	1.321E-03	1.320E-03	DCF3(	4)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(	5)
D-1	U-234	2.930E-04	2.830E-04	DCF3(	6)

IRESRAD, Version 6.4      T= Limit = 180 days      04/11/2008 08:26 Page 3  
 Summary : UNC New Haven Suburban Resident  
 File : C:\RESRAD\_FAMILY\RESRAD\USERFILES\UNC SUB RESIDENT 02406.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)  
 Dose Library: FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-1	U-235+D	2.673E-04	2.660E-04	DCF3( 7)
D-1	U-238	2.550E-04	2.550E-04	DCF3( 8)
D-1	U-238+D	2.687E-04	2.550E-04	DCF3( 9)
D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF( 1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF( 1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF( 1,3)
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF( 2,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF( 2,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF( 2,3)
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF( 3,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF( 3,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF( 3,3)
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF( 4,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF( 4,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF( 4,3)
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF( 5,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF( 5,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF( 5,3)
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF( 6,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF( 6,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF( 6,3)
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF( 7,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF( 7,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF( 7,3)
D-34	U-238 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF( 8,1)
D-34	U-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF( 8,2)
D-34	U-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF( 8,3)
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF( 9,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF( 9,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF( 9,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC( 1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC( 1,2)
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC( 2,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC( 2,2)
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC( 3,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC( 3,2)

1RESRAD, Version 6.4      T<sub>a</sub> Limit = 190 days      04/11/2008 08:26 Page 4  
 Summary : UNC New Haven Suburban Resident  
 File : C:\RESRAD\_FAMILY\RESRAD\USERFILES\UNC SUB RESIDENT 02406.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)				
Dose Library: FGR 11				
Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC( 4,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC( 4,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC( 5,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC( 5,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC( 6,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC( 6,2)
D-5				
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC( 7,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC( 7,2)
D-5				
D-5	U-238 , fish	1.000E+01	1.000E+01	BIOFAC( 8,1)
D-5	U-238 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC( 8,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC( 9,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC( 9,2)

#For DCF1(xxx) only, factors are for infinite depth & area. See ETFG table in Ground Pathway of Detailed Report.  
 \*Base Case means Default.Lib w/o Associate Nuclide contributions.

1RESRAD, Version 6.4      T« Limit = 180 days      04/11/2008 08:26 Page 5  
 Summary : UNC New Haven Suburban Resident  
 File : C:\RESRAD\_FAMILY\RESRAD\USERFILES\UNC SUB RESIDENT 02406.RAD

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)	1.000E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	2.000E+00	2.000E+00	---	THICKO
R011	Length parallel to aquifer flow (m)	1.790E+01	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	3.000E+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): Pa-231	3.700E-04	0.000E+00	---	S1 (2)
R012	Initial principal radionuclide (pCi/g): U-234	1.000E+00	0.000E+00	---	S1 (6)
R012	Initial principal radionuclide (pCi/g): U-235	3.700E-02	0.000E+00	---	S1 (7)
R012	Initial principal radionuclide (pCi/g): U-238	8.500E-03	0.000E+00	---	S1 (8)
R012	Concentration in groundwater (pCi/L): Pa-231	not used	0.000E+00	---	W1 ( 2)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1 ( 6)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1 ( 7)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1 ( 8)
R013	Cover depth (m)	0.000E+00	3.000E+00	---	COVERO
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)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	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)	1.500E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TFSZ
R014	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ

IRESRAD, Version 6.4      T<sub>w</sub> Limit = 180 days      04/11/2008 08:26 Page 6  
 Summary : UNC New Haven Suburban Resident  
 File : C:\RESRAD\_FAMILY\RESRAD\USERFILES\UNC SUB RESIDENT 02406.RAD

Site-Specific Parameter Summary (continued)					
Menu	Parameter	User Input	Default	Used by RESRAD	Parameter Name
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VMT
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 <sup>3</sup> /yr)	2.500E+02	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 <sup>3</sup> )	1.500E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-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	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Pa-231				
R016	Contaminated zone (cm <sup>3</sup> /g)	5.000E+01	5.000E+01	---	DCNUCC( 2)
R016	Unsat. zone 1 (cm <sup>3</sup> /g)	5.000E+01	5.000E+01	---	DCNUCU( 2,1)
R016	Saturated zone (cm <sup>3</sup> /g)	5.000E+01	5.000E+01	---	DCNUCS( 2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.319E-03	ALEACH( 2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK( 2)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm <sup>3</sup> /g)	5.000E+01	5.000E+01	---	DCNUCC( 6)
R016	Unsat. zone 1 (cm <sup>3</sup> /g)	5.000E+01	5.000E+01	---	DCNUCU( 6,1)
R016	Saturated zone (cm <sup>3</sup> /g)	5.000E+01	5.000E+01	---	DCNUCS( 6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.319E-03	ALEACH( 6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK( 6)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm <sup>3</sup> /g)	5.000E+01	5.000E+01	---	DCNUCC( 7)
R016	Unsat. zone 1 (cm <sup>3</sup> /g)	5.000E+01	5.000E+01	---	DCNUCU( 7,1)
R016	Saturated zone (cm <sup>3</sup> /g)	5.000E+01	5.000E+01	---	DCNUCS( 7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.319E-03	ALEACH( 7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK( 7)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm <sup>3</sup> /g)	5.000E+01	5.000E+01	---	DCNUCC( 8)
R016	Unsat. zone 1 (cm <sup>3</sup> /g)	5.000E+01	5.000E+01	---	DCNUCU( 8,1)
R016	Saturated zone (cm <sup>3</sup> /g)	5.000E+01	5.000E+01	---	DCNUCS( 8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.319E-03	ALEACH( 8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK( 8)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm <sup>3</sup> /g)	2.000E+01	2.000E+01	---	DCNUCC( 1)
R016	Unsat. zone 1 (cm <sup>3</sup> /g)	2.000E+01	2.000E+01	---	DCNUCU( 1,1)
R016	Saturated zone (cm <sup>3</sup> /g)	2.000E+01	2.000E+01	---	DCNUCS( 1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.245E-03	ALEACH( 1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK( 1)

1RESRAD, Version 6.4      T<sub>1/2</sub> Limit = 180 days      04/11/2008 08:26 Page 7  
 Summary : UNC New Haven Suburban Resident  
 File : C:\RESRAD\_FAMILY\RESRAD\USERFILES\UNC SUB RESIDENT 02406.RAD

Site-Specific Parameter Summary (continued)					
Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC( 3)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU( 3,1)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS( 3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.663E-03	ALEACH( 3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK( 3)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC( 4)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU( 4,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS( 4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.374E-03	ALEACH( 4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK( 4)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC( 5)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU( 5,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS( 5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.778E-06	ALEACH( 5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK( 5)
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	6.800E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	1.200E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE( 1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE( 2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE( 3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE( 4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE( 5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE( 6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE( 7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE( 8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE( 9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)

1RESRAD, Version 6.4      T<sub>0</sub> Limit = 180 days      04/11/2008 08:26 Page 8  
 Summary : UNC New Haven Suburban Resident  
 File : C:\RESRAD\_FAMILY\RESRAD\USERFILES\UNC SUB RESIDENT 02406.RAD

Site-Specific Parameter Summary (continued)					
Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA( 1)
R017	Ring 2	not used	2.732E-01	---	FRACA( 2)
R017	Ring 3	not used	0.000E+00	---	FRACA( 3)
R017	Ring 4	not used	0.000E+00	---	FRACA( 4)
R017	Ring 5	not used	0.000E+00	---	FRACA( 5)
R017	Ring 6	not used	0.000E+00	---	FRACA( 6)
R017	Ring 7	not used	0.000E+00	---	FRACA( 7)
R017	Ring 8	not used	0.000E+00	---	FRACA( 8)
R017	Ring 9	not used	0.000E+00	---	FRACA( 9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	1.600E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	1.400E+01	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)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	not used	5.100E+02	---	DW1
R018	Contamination fraction of drinking water	not used	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	0.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	1.000E-01	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	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	---	LW15
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LW16
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	not used	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	0.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)



1RESRAD, Version 6.4      T<sub>w</sub> Limit = 180 days      04/11/2008 08:26 Page 9  
 Summary : UNC New Haven Suburban Resident  
 File : C:\RESRAD\_FAMILY\RESRAD\USERFILES\UNC SUB RESIDENT 02406.RAD

Site-Specific Parameter Summary (continued)					
Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	2.000E+01	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	CL2WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	CL2CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVS
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
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS

IRESRAD, Version 6.4      T« Limit = 180 days      04/11/2008 08:26 Page 10  
 Summary : UNC New Haven Suburban Resident  
 File : C:\RESRAD\_FAMILY\RESRAD\USERFILES\UNC SUB RESIDENT 02406.RAD

Site-Specific Parameter Summary (continued)					
Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	KYMAX

#### Summary of Pathway Selections

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

IRESRAD, Version 6.4      Tc Limit = 180 days      04/11/2008 08:26 Page 11  
 Summary : UNC New Haven Suburban Resident  
 File : C:\RESRAD\_FAMILY\RESRAD\USERFILES\UNC SUB RESIDENT 02406.RAD

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
-----		-----	
Area:	1000.00 square meters	Pa-231	3.700E-04
Thickness:	2.00 meters	U-234	1.000E+00
Cover Depth:	0.00 meters	U-235	3.700E-02
		U-238	8.500E-03

0

Total Dose TDOSE(t), mrem/yr								
Basic Radiation Dose Limit = 2.500E+01 mrem/yr								
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)								
-----								
t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	4.450E-02	4.439E-02	4.415E-02	4.331E-02	4.084E-02	3.284E-02	1.795E-02	4.654E-03
M(t):	1.780E-03	1.775E-03	1.766E-03	1.732E-03	1.634E-03	1.314E-03	7.179E-04	1.862E-04
Maximum TDOSE(t):	4.450E-02 mrem/yr at t = 0.000E+00 years							

IRESRAD, Version 6.4      T<sub>1/2</sub> Limit = 180 days      04/11/2008 08:26 Page 12  
 Summary : UNC New Haven Suburban Resident  
 File : C:\RESRAD\_FAMILY\RESRAD\USERFILES\UNC SUB RESIDENT 02406.RAD

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)														
	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio- Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	4.414E-05	0.0010	2.247E-05	0.0005	0.000E+00	0.0000	6.858E-04	0.0154	0.000E+00	0.0000	0.000E+00	0.0000	1.168E-04	0.0026
U-234	2.218E-04	0.0050	5.786E-03	0.1300	0.000E+00	0.0000	1.230E-02	0.2763	0.000E+00	0.0000	0.000E+00	0.0000	8.250E-03	0.1854
U-235	1.526E-02	0.3430	1.995E-04	0.0045	0.000E+00	0.0000	4.305E-04	0.0097	0.000E+00	0.0000	0.000E+00	0.0000	2.885E-04	0.0065
U-238	6.893E-04	0.0155	4.398E-05	0.0010	0.000E+00	0.0000	9.924E-05	0.0022	0.000E+00	0.0000	0.000E+00	0.0000	6.658E-05	0.0015
Total	1.622E-02	0.3644	6.052E-03	0.1360	0.000E+00	0.0000	1.351E-02	0.3036	0.000E+00	0.0000	0.000E+00	0.0000	8.722E-03	0.1960

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															
0	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*		
0	Radio- Nuclide	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	mrem/yr fract.	
	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	8.693E-04	0.0195
	U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.655E-02	0.5967
	U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.618E-02	0.3636
	U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.990E-04	0.0202
	Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.450E-02	1.0000
	0*Sum of all water independent and dependent pathways.														

0\*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.4      T<sub>1/2</sub> Limit = 180 days      04/11/2008 08:26 Page 13  
 Summary : UNC New Haven Suburban Resident  
 File : C:\RESRAD\_FAMILY\RESRAD\USERFILES\UNC SUB RESIDENT 02406.RAD

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.
Pa-231	5.624E-05	0.0013	2.573E-05	0.0006	0.000E+00	0.0000	6.910E-04	0.0156	0.000E+00	0.0000	0.000E+00	0.0000	1.213E-04	0.0027
U-234	2.211E-04	0.0050	5.767E-03	0.1299	0.000E+00	0.0000	1.226E-02	0.2761	0.000E+00	0.0000	0.000E+00	0.0000	8.223E-03	0.1853
U-235	1.521E-02	0.3427	1.989E-04	0.0045	0.000E+00	0.0000	4.305E-04	0.0097	0.000E+00	0.0000	0.000E+00	0.0000	2.878E-04	0.0065
U-238	6.870E-04	0.0155	4.383E-05	0.0010	0.000E+00	0.0000	9.891E-05	0.0022	0.000E+00	0.0000	0.000E+00	0.0000	6.636E-05	0.0015
Total	1.618E-02	0.3645	6.035E-03	0.1360	0.000E+00	0.0000	1.348E-02	0.3036	0.000E+00	0.0000	0.000E+00	0.0000	8.698E-03	0.1960

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												
Water		Fish		Radon		Plant		Meat		Milk		All Pathways*
Radio- Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
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
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
0*Sum of all water independent and dependent pathways.												

\*Sum of all water independent and dependent pathways.

1RESRAD, Version 6.4      Tc Limit = 180 days      04/11/2008 08:26 Page 14  
 Summary : UNC New Haven Suburban Resident  
 File : C:\RESRAD\_FAMILY\RESRAD\USERFILES\UNC SUB RESIDENT 02406.RAD

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.
Pa-231	7.891E-05	0.0018	1.833E-05	0.0007	0.000E+00	0.0000	7.001E-04	0.0159	0.000E+00	0.0000	0.000E+00	0.0000	1.297E-04	0.0029
U-234	2.198E-04	0.0050	5.729E-03	0.1298	0.000E+00	0.0000	1.217E-02	0.2758	0.000E+00	0.0000	0.000E+00	0.0000	8.169E-03	0.1850
U-235	1.511E-02	0.3423	1.977E-04	0.0045	0.000E+00	0.0000	4.306E-04	0.0098	0.000E+00	0.0000	0.000E+00	0.0000	2.864E-04	0.0065
U-238	6.824E-04	0.0155	4.354E-05	0.0010	0.000E+00	0.0000	9.826E-05	0.0022	0.000E+00	0.0000	0.000E+00	0.0000	6.592E-05	0.0015
Total	1.609E-02	0.3645	6.002E-03	0.1359	0.000E+00	0.0000	1.340E-02	0.3036	0.000E+00	0.0000	0.000E+00	0.0000	8.651E-03	0.1959

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.	
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	9.405E-04	0.0213	
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.629E-02	0.5955	
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.603E-02	0.3630	
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.901E-04	0.0202	
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.415E-02	1.0000	

\*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)														
Ground		Inhalation		Radon		Plant		Meat		Milk		Soil		
Radio- Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	1.440E-04	0.0033	4.932E-05	0.0011	0.000E+00	0.0000	7.236E-04	0.0167	0.000E+00	0.0000	0.000E+00	0.0000	1.534E-04	0.0035
Th-232	2.159E-04	0.0050	5.598E-05	0.0014	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.982E-03	0.1843
U-233	1.477E-02	0.3410	1.938E-04	0.0045	0.000E+00	0.0000	4.311E-04	0.0100	0.000E+00	0.0000	0.000E+00	0.0000	2.819E-04	0.0065
U-238	6.667E-04	0.0154	4.254E-05	0.0010	0.000E+00	0.0000	9.600E-05	0.0022	0.000E+00	0.0000	0.000E+00	0.0000	6.441E-05	0.0015
Total	1.579E-02	0.3647	5.884E-03	0.1359	0.000E+00	0.0000	1.315E-02	0.3036	0.000E+00	0.0000	0.000E+00	0.0000	8.482E-03	0.1959

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

Radio- Nuclide	Water		Fish		Water Dependent Pathways				Meat		Milk		All Pathways	
	mrem/yr	fract.	mrem/yr	fract.	Radon		Plant		mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
					mrem/yr	fract.	mrem/yr	fract.						
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	1.070E-03	0.0247
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.569E-04	0.5833
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.567E-02	0.3619
X-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	8.697E-04	0.0201
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.331E-02	1.0000

0\*Sum of all water independent and dependent pathways.

Water Independent Pathways (Inhalation excludes radon)

0		Water Independent Pathways (Inhalation excludes radon)														
		Ground		Inhalation		Radon		Plant		Meat		Milk		Soil		
Radio- Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	2.459E-04	0.0060	7.638E-05	0.0019	0.000E+00	0.0000	7.429E-04	0.0182	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.877E-04	0.0046
U-235	2.115E-04	0.0052	5.241E-05	0.0013	0.000E+00	0.0000	7.429E-04	0.0182	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.472E-03	0.1829
U-238	1.383E-02	0.3386	1.840E-04	0.0045	0.000E+00	0.0000	4.337E-04	0.0106	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.709E-04	0.0066
U-238	6.239E-04	0.0153	3.981E-05	0.0010	0.000E+00	0.0000	8.984E-05	0.0022	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.028E-05	0.0015
Total	1.491E-02	0.3650	5.541E-03	0.1357	0.000E+00	0.0000	1.240E-02	0.3036	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.991E-03	0.1957

As mrem/yr and Fraction of Total Dose At t = 3.000E+01 years

Radio- Nuclide	Water Dependent Pathways														All Pathways*
	Water		Fish		Radon		Plant		Meat		Milk				
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.253E-03	0.0307	
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.406E-02	0.5891	
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.472E-02	0.3603	
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.139E-04	0.0199	
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.084E-02	1.0000	

0\*Sum of all water independent and dependent pathways.



IRESRAD, Version 6.4      Te Limit = 180 days      04/11/2008 08:26 Page 17  
 Summary : UNC New Haven Suburban Resident  
 File : C:\RESRAD\_FAMILY\RESRAD\USERFILES\UNC SUB RESIDENT 02406.RAD

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)														
	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio- Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	2.695E-04	0.0082	8.084E-05	0.0025	0.000E+00	0.0000	6.324E-04	0.0193	0.000E+00	0.0000	0.000E+00	0.0000	1.784E-04	0.0054
U-234	2.557E-04	0.0078	4.162E-03	0.1267	0.000E+00	0.0000	8.854E-03	0.2696	0.000E+00	0.0000	0.000E+00	0.0000	5.933E-03	0.1807
U-235	1.100E-02	0.3349	1.569E-04	0.0048	0.000E+00	0.0000	4.355E-04	0.0133	0.000E+00	0.0000	0.000E+00	0.0000	2.399E-04	0.0073
U-238	4.946E-04	0.0151	3.157E-05	0.0010	0.000E+00	0.0000	7.123E-05	0.0022	0.000E+00	0.0000	0.000E+00	0.0000	4.779E-05	0.0015
Total	1.202E-02	0.3659	4.431E-03	0.1349	0.000E+00	0.0000	9.993E-03	0.3043	0.000E+00	0.0000	0.000E+00	0.0000	6.399E-03	0.1949

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														
	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio- Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
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	1.161E-03	0.0354
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.920E-02	0.5848
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.183E-02	0.3602
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.452E-04	0.0196
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	3.284E-02	1.0000
0*Sum of all water independent and dependent pathways.														

0\*Sum of all water independent and dependent pathways.

IRESRAD, Version 6.4      T<sub>e</sub> Limit = 180 days      04/11/2008 08:26 Page 18  
 Summary : UNC New Haven Suburban Resident  
 File : C:\RESRAD\_FAMILY\RESRAD\USERFILES\UNC SUB RESIDENT 02406.RAD

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)										
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years										
Water Independent Pathways (Inhalation excludes radon)										
Radio-	Ground	Inhalation	Radon	Plant	Meat	Milk	Soil			
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	1.413E-04	0.0079	4.231E-05	0.0024	0.000E+00	0.0000	3.261E-04	0.0182	0.000E+00	0.0000
U-234	6.662E-04	0.0371	2.160E-03	0.1204	0.000E+00	0.0000	4.746E-03	0.2644	0.000E+00	0.0000
U-235	5.722E-03	0.3188	9.868E-05	0.0055	0.000E+00	0.0000	3.624E-04	0.0202	0.000E+00	0.0000
U-238	2.546E-04	0.0142	1.626E-05	0.0009	0.000E+00	0.0000	3.670E-05	0.0020	0.000E+00	0.0000
Total	6.784E-03	0.3780	2.318E-03	0.1291	0.000E+00	0.0000	5.471E-03	0.3049	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)										
As mrem/yr and Fraction of Total Dose At t = 3.000E+02 years										
Water Dependent Pathways										
Radio-	Water	Fish	Radon	Plant	Meat	Milk	All Pathways*			
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Pa-231	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.025E-04	0.0336
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.067E-02	0.5943
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.346E-03	0.3536
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.322E-04	0.0185
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.795E-02	1.0000

\*Sum of all water independent and dependent pathways.

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

0	Water independent Pathways (Inhalation excludes radon)																	
	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.				
Radio-Nuclide																		
Pa-231	1.364E-05	0.0029	4.083E-04	0.0000	0.000E+00	0.0000	3.147E-05	0.0068	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000				
U-234	2.016E-05	0.4331	1.463E-04	0.0529	0.000E+00	0.0000	1.758E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000				
U-235	5.808E-04	0.1248	1.576E-05	0.0034	0.000E+00	0.0000	8.246E-05	0.0177	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000				
U-238	2.495E-05	0.0054	1.597E-06	0.0003	0.000E+00	0.0000	3.666E-05	0.0078	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000				
Total	2.635E-03	0.5662	2.677E-04	0.0575	0.000E+00	0.0000	1.292E-03	0.2776	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000				

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

Radio- Nuclide	Water		Fish		Radon		Water Dependent Pathways 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.
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	5.814E-05	0.0125
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.855E-03	0.8283
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.083E-04	0.1522
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.257E-05	0.0070
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.654E-03	1.0000

1RESRAD, Version 6.4      Tw Limit = 180 days      04/11/2008 08:26 Page 20  
 Summary : UNC New Haven Suburban Resident  
 File : C:\RESRAD\_FAMILY\RESRAD\USERFILES\UNC SUB RESIDENT 02406.RAD

		Dose/Source Ratios Summed Over All Pathways									
		Parent and Progeny Principal Radionuclide Contributions Indicated									
0	Parent (i)	Product (j)	Thread Fraction	DSR(j,t) At Time in Years (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
	Pa-231	Pa-231	1.000E+00	2.309E+00	2.301E+00	2.286E+00	2.233E+00	2.089E+00	1.653E+00	8.477E-01	8.180E-02
	Pa-231	Ac-227+D	1.000E+00	4.039E-02	1.156E-01	2.558E-01	6.597E-01	1.297E+00	1.485E+00	7.807E-01	7.534E-02
	Pa-231	-DSR(j)		2.349E+00	2.417E+00	2.542E+00	2.893E+00	3.386E+00	3.138E+00	1.628E+00	1.571E-01
	OU-234	U-234	1.000E+00	2.655E-02	2.647E-02	2.629E-02	2.569E-02	2.404E-02	1.905E-02	9.802E-03	9.581E-04
	U-234	Th-230	1.000E+00	1.861E-07	5.503E-07	1.274E-06	3.768E-06	1.058E-05	3.115E-05	6.920E-05	1.049E-04
	U-234	Ra-226+D	1.000E+00	4.441E-09	3.126E-08	1.651E-07	1.459E-06	1.182E-05	1.115E-04	6.765E-04	2.327E-03
	U-234	Pb-210+D	1.000E+00	9.814E-12	1.285E-10	1.364E-09	3.232E-08	6.493E-07	1.339E-05	1.181E-04	4.656E-04
	U-234	-DSR(j)		2.655E-02	2.647E-02	2.629E-02	2.569E-02	2.406E-02	1.920E-02	1.067E-02	3.855E-03
	OU-235+D	U-235+D	1.000E+00	4.373E-01	4.359E-01	4.330E-01	4.231E-01	3.959E-01	3.138E-01	1.616E-01	1.582E-02
	U-235+D	Pa-231	1.000E+00	2.353E-05	7.200E-05	1.683E-04	4.952E-04	1.348E-03	3.519E-03	5.407E-03	1.750E-03
	U-235+D	Ac-227+D	1.000E+00	2.936E-07	1.950E-06	9.815E-06	7.825E-05	4.958E-04	2.386E-03	4.528E-03	1.568E-03
	U-235+D	-DSR(j)		4.374E-01	4.360E-01	4.332E-01	4.236E-01	3.977E-01	3.197E-01	1.715E-01	1.914E-02
	OU-238	U-238	5.400E-05	1.282E-06	1.278E-06	1.270E-06	1.240E-06	1.161E-06	9.201E-07	4.737E-07	4.640E-08
	OU-238+D	U-238+D	9.999E-01	1.058E-01	1.054E-01	1.047E-01	1.023E-01	9.574E-02	7.589E-02	3.908E-02	3.827E-03
	U-238+D	U-234	9.999E-01	3.762E-08	1.125E-07	2.608E-07	7.646E-07	2.078E-06	5.428E-06	8.353E-06	2.721E-06
	U-238+D	Th-230	9.999E-01	1.782E-13	1.221E-12	6.371E-12	5.586E-11	4.500E-10	4.193E-09	2.467E-08	7.866E-08
	U-238+D	Ra-226+D	9.999E-01	3.133E-15	4.732E-14	5.521E-13	1.444E-11	3.372E-10	1.024E-08	1.734E-07	1.494E-06
	U-238+D	Pb-210+D	9.999E-01	5.836E-18	1.564E-16	3.541E-15	2.462E-13	1.457E-11	1.037E-09	2.794E-08	2.937E-07
	U-238+D	-DSR(j)		1.058E-01	1.054E-01	1.047E-01	1.023E-01	9.575E-02	7.590E-02	3.909E-02	3.832E-03

The DSR includes contributions from associated (half-life < 180 days) daughters.

		Single Radionuclide Soil Guidelines G(i,t) in pCi/g									
		Basic Radiation Dose Limit = 2.500E+01 mrem/yr									
0	ONuclide (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		
	Pa-231	1.064E+01	1.034E+01	9.835E+00	8.642E+00	7.383E+00	7.966E+00	1.535E+01	1.591E+02		
	U-234	9.415E+02	9.446E+02	9.509E+02	9.731E+02	1.039E+03	1.302E+03	2.344E+03	6.484E+03		
	U-235	5.716E+01	5.734E+01	5.771E+01	5.901E+01	6.286E+01	7.820E+01	1.458E+02	1.306E+03		
	U-238	2.364E+02	2.371E+02	2.387E+02	2.443E+02	2.611E+02	3.294E+02	6.396E+02	6.524E+03		

1RESRAD, Version 6.4      T« Limit = 180 days      04/11/2008 08:26 Page 21  
 Summary : UNC New Haven Suburban Resident  
 File : C:\RESRAD\_FAMILY\RESRAD\USERFILES\UNC SUB RESIDENT 02406.RAD

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

Radionuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin) (pCi/g)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
Pa-231	3.700E-04	47.06 A 0.09	3.474E+00	7.196E+00	2.349E+00	1.064E+01
U-234	1.000E+00	0.000E+00	2.655E-02	9.415E+02	2.655E-02	9.415E+02
U-235	3.700E-02	0.000E+00	4.374E-01	5.716E+01	4.374E-01	5.716E+01
U-238	8.500E-03	0.000E+00	1.058E-01	2.364E+02	1.058E-01	2.364E+02

IRESRAD, Version 6.4      T« Limit = 180 days      04/11/2008 08:26 Page 22  
 Summary : UNC New Haven Suburban Resident  
 File : C:\RESRAD\_FAMILY\RESRAD\USERFILES\UNC SUB RESIDENT 02406.RAD

Individual Nuclide Dose Summed Over All Pathways												
Parent Nuclide and Branch Fraction Indicated												
ONuclide (j)	Parent (i)	THF(i)	t=	DOSE(j,t), mrem/yr								
				0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03	
-----												
Pa-231	Pa-231	1.000E+00		8.544E-04	8.515E-04	8.458E-04	8.263E-04	7.729E-04	6.118E-04	3.136E-04	3.027E-05	
Pa-231	U-235	1.000E+00		8.706E-07	2.664E-06	6.226E-06	1.832E-05	4.986E-05	1.302E-04	2.000E-04	6.475E-05	
Pa-231	-DOSE(j)			8.552E-04	8.542E-04	8.521E-04	8.446E-04	8.228E-04	7.419E-04	5.137E-04	9.502E-05	
QAc-227	Pa-231	1.000E+00		1.494E-05	4.276E-05	9.466E-05	2.441E-04	4.799E-04	5.494E-04	2.889E-04	2.788E-05	
Ac-227	U-235	1.000E+00		1.086E-08	7.213E-08	3.632E-07	2.895E-06	1.834E-05	8.828E-05	1.675E-04	5.800E-05	
Ac-227	-DOSE(j)			1.496E-05	4.283E-05	9.502E-05	2.470E-04	4.983E-04	6.377E-04	4.564E-04	8.588E-05	
OU-234	U-234	1.000E+00		2.655E-02	2.647E-02	2.629E-02	2.569E-02	2.404E-02	1.905E-02	9.802E-03	9.581E-04	
U-234	U-238	9.999E-01		3.197E-10	9.564E-10	2.217E-09	6.499E-09	1.766E-08	4.613E-08	7.100E-08	2.313E-08	
U-234	-DOSE(j)			2.655E-02	2.647E-02	2.629E-02	2.569E-02	2.404E-02	1.905E-02	9.802E-03	9.581E-04	
OTH-230	U-234	1.000E+00		1.861E-07	5.503E-07	1.274E-06	3.768E-06	1.058E-05	3.115E-05	6.920E-05	1.049E-04	
Th-230	U-238	9.999E-01		1.515E-15	1.038E-14	5.415E-14	4.748E-13	3.825E-12	3.564E-11	2.097E-10	6.686E-10	
Th-230	-DOSE(j)			1.861E-07	5.503E-07	1.274E-06	3.768E-06	1.058E-05	3.115E-05	6.920E-05	1.049E-04	
ORa-226	U-234	1.000E+00		4.441E-09	3.126E-08	1.651E-07	1.459E-06	1.182E-05	1.115E-04	6.765E-04	2.327E-03	
Ra-226	U-238	9.999E-01		2.663E-17	4.023E-16	4.693E-15	1.227E-13	2.866E-12	8.707E-11	1.474E-09	1.270E-08	
Ra-226	-DOSE(j)			4.441E-09	3.126E-08	1.651E-07	1.459E-06	1.182E-05	1.115E-04	6.765E-04	2.327E-03	
OPb-210	U-234	1.000E+00		9.814E-12	1.285E-10	1.364E-09	3.232E-08	6.493E-07	1.339E-05	1.181E-04	4.656E-04	
Pb-210	U-238	9.999E-01		4.960E-20	1.329E-18	3.010E-17	2.092E-15	1.239E-13	8.819E-12	2.375E-10	2.497E-09	
Pb-210	-DOSE(j)			9.814E-12	1.285E-10	1.364E-09	3.232E-08	6.493E-07	1.339E-05	1.181E-04	4.656E-04	
OU-235	U-235	1.000E+00		1.618E-02	1.613E-02	1.602E-02	1.565E-02	1.465E-02	1.161E-02	5.978E-03	5.855E-04	
OU-238	U-238	5.400E-05		1.090E-08	1.086E-08	1.079E-08	1.054E-08	9.866E-09	7.820E-09	4.027E-09	3.944E-10	
U-238	U-238	9.999E-01		8.990E-04	8.961E-04	8.901E-04	8.697E-04	8.138E-04	6.451E-04	3.322E-04	3.253E-05	
U-238	-DOSE(j)			8.990E-04	8.961E-04	8.901E-04	8.697E-04	8.138E-04	6.451E-04	3.322E-04	3.253E-05	
-----												

THF(i) is the thread fraction of the parent nuclide.

IRESRAD, Version 6.4      T<sub>w</sub> Limit = 180 days      04/11/2008 08:26 Page 23  
 Summary : UNC New Haven Suburban Resident  
 File : C:\RESRAD\_FAMILY\RESRAD\USERFILES\UNC SUB RESIDENT 02406.RAL

		Individual Nuclide Soil Concentration									
		Parent Nuclide and Branch Fraction Indicated									
		S(j,t), pCi/g									
ONuclide	Parent	THF(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								
(j)	(i)										
Pa-231	Pa-231	1.000E+00	3.700E-04	3.688E-04	3.663E-04	3.578E-04	3.347E-04	2.649E-04	1.358E-04	1.311E-05	
Pa-231	U-235	1.000E+00	0.000E+00	7.803E-07	2.325E-06	7.572E-06	2.125E-05	5.611E-05	8.649E-05	2.803E-05	
Pa-231	-S(j):		3.700E-04	3.695E-04	3.686E-04	3.654E-04	3.560E-04	3.210E-04	2.223E-04	4.114E-05	
0Ac-227	Pa-231	1.000E+00	0.000E+00	1.153E-05	3.313E-05	9.534E-05	1.937E-04	2.237E-04	1.177E-04	1.136E-05	
Ac-227	U-235	1.000E+00	0.000E+00	1.227E-08	1.071E-07	1.070E-06	7.256E-06	3.572E-05	6.813E-05	2.362E-05	
Ac-227	-S(j):		0.000E+00	1.154E-05	3.323E-05	9.641E-05	2.010E-04	2.595E-04	1.858E-04	3.498E-05	
OU-234	U-234	1.000E+00	1.000E+00	9.967E-01	9.901E-01	9.673E-01	9.051E-01	7.173E-01	3.691E-01	3.608E-02	
U-234	U-238	9.999E-01	0.000E+00	2.402E-08	7.157E-08	2.331E-07	6.543E-07	1.729E-06	2.670E-06	8.707E-07	
U-234	-S(j):		1.000E+00	9.967E-01	9.901E-01	9.673E-01	9.051E-01	7.173E-01	3.691E-01	3.608E-02	
0Th-230	U-234	1.000E+00	0.000E+00	8.987E-06	2.687E-05	8.854E-05	2.570E-04	7.655E-04	1.706E-03	2.589E-03	
Th-230	U-238	9.999E-01	0.000E+00	1.082E-13	9.696E-13	1.061E-11	9.135E-11	8.715E-10	5.163E-09	1.650E-08	
Th-230	-S(j):		0.000E+00	8.987E-06	2.687E-05	8.854E-05	2.570E-04	7.655E-04	1.706E-03	2.590E-03	
0Ra-226	U-234	1.000E+00	0.000E+00	1.946E-09	1.744E-08	1.910E-07	1.651E-06	1.593E-05	9.733E-05	3.355E-04	
Ra-226	U-238	9.999E-01	0.000E+00	1.562E-17	4.199E-16	1.530E-14	3.940E-13	1.239E-11	2.117E-10	1.831E-09	
Ra-226	-S(j):		0.000E+00	1.946E-09	1.744E-08	1.910E-07	1.651E-06	1.593E-05	9.733E-05	3.355E-04	
0Pb-210	U-234	1.000E+00	0.000E+00	2.001E-11	5.299E-10	1.836E-08	4.137E-07	8.880E-06	7.916E-05	3.129E-04	
Pb-210	U-238	9.999E-01	0.000E+00	1.207E-19	9.612E-18	1.120E-15	7.734E-14	5.813E-12	1.588E-10	1.677E-09	
Pb-210	-S(j):		0.000E+00	2.001E-11	5.299E-10	1.836E-08	4.137E-07	8.880E-06	7.916E-05	3.129E-04	
OU-235	U-235	1.000E+00	3.700E-02	3.688E-02	3.663E-02	3.579E-02	3.349E-02	2.655E-02	1.367E-02	1.339E-03	
OU-238	U-238	5.400E-05	4.590E-07	4.575E-07	4.545E-07	4.440E-07	4.155E-07	3.294E-07	1.696E-07	1.661E-08	
U-238	U-238	9.999E-01	8.500E-03	8.471E-03	8.415E-03	8.222E-03	7.694E-03	6.099E-03	3.140E-03	3.075E-04	
U-238	-S(j):		8.500E-03	8.472E-03	8.416E-03	8.223E-03	7.694E-03	6.099E-03	3.140E-03	3.076E-04	

THF(i) is the thread fraction of the parent nuclide.  
 ORESRAD.EXE execution time = 8.22 seconds

This report was prepared under the direction of  
UNC Naval Products  
by  
Billy R. Thomas, C.H.P., C.I.H.  
Integrated Environmental Management, Inc.  
3124 Saddlebrook Drive, Suite 1508  
Findlay, Ohio 45840  
(419) 423-4701  
[BRThomas@IEM-inc.com](mailto:BRThomas@IEM-inc.com)

and

William Songer  
AAA Environmental, Inc.  
6679 Moore Road  
Syracuse, New York 13211  
(315) 454-2000  
[aaa-exec@worldnet.att.net](mailto:aaa-exec@worldnet.att.net)



## **ATTACHMENT B**

**2012 RESRAD Version 6.5 DCGL**

# 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 .....	20
Dose Per Nuclide Summed Over All Pathways .....	22
Soil Concentration Per Nuclide .....	23

Dose Conversion Factor (and Related) Parameter Summary  
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
A-1	DCF's for external ground radiation, (mrem/yr)/(pCi/g)			
A-1	Ac-227 (Source: FGR 12)	4.951E-04	4.951E-04	DCF1( 1)
A-1	At-218 (Source: FGR 12)	5.847E-03	5.847E-03	DCF1( 2)
A-1	Bi-210 (Source: FGR 12)	3.606E-03	3.606E-03	DCF1( 3)
A-1	Bi-211 (Source: FGR 12)	2.559E-01	2.559E-01	DCF1( 4)
A-1	Bi-214 (Source: FGR 12)	9.808E+00	9.808E+00	DCF1( 5)
A-1	Fr-223 (Source: FGR 12)	1.980E-01	1.980E-01	DCF1( 6)
A-1	Pa-231 (Source: FGR 12)	1.906E-01	1.906E-01	DCF1( 7)
A-1	Pa-234 (Source: FGR 12)	1.155E+01	1.155E+01	DCF1( 8)
A-1	Pa-234m (Source: FGR 12)	8.967E-02	8.967E-02	DCF1( 9)
A-1	Pb-210 (Source: FGR 12)	2.447E-03	2.447E-03	DCF1( 10)
A-1	Pb-211 (Source: FGR 12)	3.064E-01	3.064E-01	DCF1( 11)
A-1	Pb-214 (Source: FGR 12)	1.341E+00	1.341E+00	DCF1( 12)
A-1	Po-210 (Source: FGR 12)	5.231E-05	5.231E-05	DCF1( 13)
A-1	Po-211 (Source: FGR 12)	4.764E-02	4.764E-02	DCF1( 14)
A-1	Po-214 (Source: FGR 12)	5.138E-04	5.138E-04	DCF1( 15)
A-1	Po-215 (Source: FGR 12)	1.016E-03	1.016E-03	DCF1( 16)
A-1	Po-218 (Source: FGR 12)	5.642E-05	5.642E-05	DCF1( 17)
A-1	Ra-223 (Source: FGR 12)	6.034E-01	6.034E-01	DCF1( 18)
A-1	Ra-226 (Source: FGR 12)	3.176E-02	3.176E-02	DCF1( 19)
A-1	Rn-219 (Source: FGR 12)	3.083E-01	3.083E-01	DCF1( 20)
A-1	Rn-222 (Source: FGR 12)	2.354E-03	2.354E-03	DCF1( 21)
A-1	Th-227 (Source: FGR 12)	5.212E-01	5.212E-01	DCF1( 22)
A-1	Th-230 (Source: FGR 12)	1.209E-03	1.209E-03	DCF1( 23)
A-1	Th-231 (Source: FGR 12)	3.643E-02	3.643E-02	DCF1( 24)
A-1	Th-234 (Source: FGR 12)	2.410E-02	2.410E-02	DCF1( 25)
A-1	Tl-207 (Source: FGR 12)	1.980E-02	1.980E-02	DCF1( 26)
A-1	Tl-210 (Source: no data)	0.000E+00	-2.000E+00	DCF1( 27)
A-1	U-234 (Source: FGR 12)	4.017E-04	4.017E-04	DCF1( 28)
A-1	U-235 (Source: FGR 12)	7.211E-01	7.211E-01	DCF1( 29)
A-1	U-238 (Source: FGR 12)	1.031E-04	1.031E-04	DCF1( 30)
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.724E+00	6.700E+00	DCF2( 1)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2( 2)
B-1	Pb-210+D	2.320E-02	1.360E-02	DCF2( 3)
B-1	Ra-226+D	8.594E-03	8.580E-03	DCF2( 4)
B-1	Th-230	3.260E-01	3.260E-01	DCF2( 5)
B-1	U-234	1.320E-01	1.320E-01	DCF2( 6)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2( 7)
B-1	U-238	1.180E-01	1.180E-01	DCF2( 8)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2( 9)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.410E-02	DCF3( 1)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3( 2)
D-1	Pb-210+D	7.276E-03	5.370E-03	DCF3( 3)
D-1	Ra-226+D	1.321E-03	1.320E-03	DCF3( 4)
D-1	Th-230	5.480E-04	5.480E-04	DCF3( 5)
D-1	U-234	2.830E-04	2.830E-04	DCF3( 6)

Dose Conversion Factor (and Related) Parameter Summary (continued)  
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-1	U-235+D	2.673E-04	2.660E-04	DCF3( 7)
D-1	U-238	2.550E-04	2.550E-04	DCF3( 8)
D-1	U-238+D	2.687E-04	2.550E-04	DCF3( 9)
D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF( 1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF( 1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF( 1,3)
D-34				
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF( 2,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF( 2,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF( 2,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF( 3,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF( 3,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF( 3,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF( 4,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF( 4,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF( 4,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF( 5,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF( 5,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF( 5,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF( 6,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF( 6,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF( 6,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF( 7,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF( 7,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF( 7,3)
D-34				
D-34	U-238 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF( 8,1)
D-34	U-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF( 8,2)
D-34	U-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF( 8,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF( 9,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF( 9,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF( 9,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC( 1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC( 1,2)
D-5				
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC( 2,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC( 2,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC( 3,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC( 3,2)

Dose Conversion Factor (and Related) Parameter Summary (continued)  
Dose Library: FGR 12 & FGR 11

Menu	Parameter	Current Value#	Base Case*	Parameter Name
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC( 4,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC( 4,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC( 5,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC( 5,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC( 6,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC( 6,2)
D-5				
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC( 7,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC( 7,2)
D-5				
D-5	U-238 , fish	1.000E+01	1.000E+01	BIOFAC( 8,1)
D-5	U-238 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC( 8,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC( 9,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC( 9,2)

#For DCF1(xxx) only, factors are for infinite depth & area. See ETFG table in Ground Pathway of Detailed Report.

\*Base Case means Default.Lib w/o Associate Nuclide contributions.

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)	1.000E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	2.000E+00	2.000E+00	---	THICK0
R011	Fraction of contamination that is submerged	0.000E+00	0.000E+00	---	SUBMFRACT
R011	Length parallel to aquifer flow (m)	1.790E+01	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	3.000E+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): Pa-231	3.700E-04	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): U-234	1.000E+00	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): U-235	3.700E-02	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): U-238	8.500E-03	0.000E+00	---	S1(8)
R012	Concentration in groundwater (pCi/L): Pa-231	not used	0.000E+00	---	W1( 2)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1( 6)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1( 7)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1( 8)
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)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	2.000E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	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)	1.500E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VNT
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)	2.500E+02	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)	1.500E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-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	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC( 2)
R016	Unsat. zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU( 2,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS( 2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.319E-03	ALEACH( 2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK( 2)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC( 6)
R016	Unsat. zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU( 6,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS( 6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.319E-03	ALEACH( 6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK( 6)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC( 7)
R016	Unsat. zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU( 7,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS( 7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.319E-03	ALEACH( 7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK( 7)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC( 8)
R016	Unsat. zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU( 8,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS( 8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.319E-03	ALEACH( 8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK( 8)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC( 1)
R016	Unsat. zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU( 1,1)
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCS( 1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.245E-03	ALEACH( 1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK( 1)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC( 3)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU( 3,1)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS( 3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.663E-03	ALEACH( 3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK( 3)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC( 4)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU( 4,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS( 4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.374E-03	ALEACH( 4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK( 4)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC( 5)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU( 5,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS( 5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.778E-06	ALEACH( 5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK( 5)
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	6.800E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	1.200E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE( 1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE( 2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE( 3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE( 4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE( 5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE( 6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE( 7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE( 8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE( 9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)



Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA( 1)
R017	Ring 2	not used	2.732E-01	---	FRACA( 2)
R017	Ring 3	not used	0.000E+00	---	FRACA( 3)
R017	Ring 4	not used	0.000E+00	---	FRACA( 4)
R017	Ring 5	not used	0.000E+00	---	FRACA( 5)
R017	Ring 6	not used	0.000E+00	---	FRACA( 6)
R017	Ring 7	not used	0.000E+00	---	FRACA( 7)
R017	Ring 8	not used	0.000E+00	---	FRACA( 8)
R017	Ring 9	not used	0.000E+00	---	FRACA( 9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	1.600E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	1.400E+01	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)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	not used	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	not used	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	0.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	1.000E-01	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	not used	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	0.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	2.000E+01	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSNI
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSNI
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
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	KYMAX

Summary of Pathway Selections

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

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	1000.00 square meters	Pa-231	3.700E-04
Thickness:	2.00 meters	U-234	1.000E+00
Cover Depth:	0.00 meters	U-235	3.700E-02
		U-238	8.500E-03

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

t (years):	0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	4.450E-02	4.439E-02	4.415E-02	4.331E-02	4.084E-02	3.284E-02	1.795E-02	4.654E-03
M(t):	1.780E-03	1.775E-03	1.766E-03	1.732E-03	1.634E-03	1.314E-03	7.179E-04	1.862E-04

Maximum TDOSE(t): 4.450E-02 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.
Pa-231	4.414E-05	0.0010	2.247E-05	0.0005	0.000E+00	0.0000	6.858E-04	0.0154	0.000E+00	0.0000	0.000E+00	0.0000	1.168E-04	0.0026
U-234	2.218E-04	0.0050	5.786E-03	0.1300	0.000E+00	0.0000	1.230E-02	0.2763	0.000E+00	0.0000	0.000E+00	0.0000	8.250E-03	0.1854
U-235	1.526E-02	0.3430	1.995E-04	0.0045	0.000E+00	0.0000	4.305E-04	0.0097	0.000E+00	0.0000	0.000E+00	0.0000	2.885E-04	0.0065
U-238	6.893E-04	0.0155	4.398E-05	0.0010	0.000E+00	0.0000	9.924E-05	0.0022	0.000E+00	0.0000	0.000E+00	0.0000	6.658E-05	0.0015
Total	1.622E-02	0.3644	6.052E-03	0.1360	0.000E+00	0.0000	1.351E-02	0.3036	0.000E+00	0.0000	0.000E+00	0.0000	8.722E-03	0.1960

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.
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	8.693E-04	0.0195
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.655E-02	0.5967
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.618E-02	0.3636
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.990E-04	0.0202
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.450E-02	1.0000

\*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)  
As mrem/yr and Fraction of Total Dose At t = 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.
Pa-231	5.624E-05	0.0013	2.573E-05	0.0006	0.000E+00	0.0000	6.910E-04	0.0156	0.000E+00	0.0000	0.000E+00	0.0000	1.213E-04	0.0027
U-234	2.211E-04	0.0050	5.767E-03	0.1299	0.000E+00	0.0000	1.226E-02	0.2761	0.000E+00	0.0000	0.000E+00	0.0000	8.223E-03	0.1853
U-235	1.521E-02	0.3427	1.989E-04	0.0045	0.000E+00	0.0000	4.305E-04	0.0097	0.000E+00	0.0000	0.000E+00	0.0000	2.878E-04	0.0065
U-238	6.870E-04	0.0155	4.383E-05	0.0010	0.000E+00	0.0000	9.891E-05	0.0022	0.000E+00	0.0000	0.000E+00	0.0000	6.636E-05	0.0015
Total	1.618E-02	0.3645	6.035E-03	0.1360	0.000E+00	0.0000	1.348E-02	0.3036	0.000E+00	0.0000	0.000E+00	0.0000	8.698E-03	0.1960

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.
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	8.943E-04	0.0201
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.647E-02	0.5963
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.613E-02	0.3634
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.961E-04	0.0202
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.439E-02	1.0000

\*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)  
As mrem/yr and Fraction of Total Dose At t = 3.000E+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.
Pa-231	7.891E-05	0.0018	3.183E-05	0.0007	0.000E+00	0.0000	7.001E-04	0.0159	0.000E+00	0.0000	0.000E+00	0.0000	1.297E-04	0.0029
U-234	2.198E-04	0.0050	5.729E-03	0.1298	0.000E+00	0.0000	1.217E-02	0.2758	0.000E+00	0.0000	0.000E+00	0.0000	8.169E-03	0.1850
U-235	1.511E-02	0.3423	1.977E-04	0.0045	0.000E+00	0.0000	4.306E-04	0.0098	0.000E+00	0.0000	0.000E+00	0.0000	2.864E-04	0.0065
U-238	6.824E-04	0.0155	4.354E-05	0.0010	0.000E+00	0.0000	9.826E-05	0.0022	0.000E+00	0.0000	0.000E+00	0.0000	6.592E-05	0.0015
Total	1.609E-02	0.3645	6.002E-03	0.1359	0.000E+00	0.0000	1.340E-02	0.3036	0.000E+00	0.0000	0.000E+00	0.0000	8.651E-03	0.1959

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.
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	9.405E-04	0.0213
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.629E-02	0.5955
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.603E-02	0.3630
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.901E-04	0.0202
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.415E-02	1.0000

\*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)  
 As mrem/yr and Fraction of Total Dose At t = 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.
Pa-231	1.440E-04	0.0033	4.932E-05	0.0011	0.000E+00	0.0000	7.236E-04	0.0167	0.000E+00	0.0000	0.000E+00	0.0000	1.534E-04	0.0035
U-234	2.159E-04	0.0050	5.598E-03	0.1293	0.000E+00	0.0000	1.190E-02	0.2747	0.000E+00	0.0000	0.000E+00	0.0000	7.982E-03	0.1843
U-235	1.477E-02	0.3410	1.938E-04	0.0045	0.000E+00	0.0000	4.311E-04	0.0100	0.000E+00	0.0000	0.000E+00	0.0000	2.819E-04	0.0065
U-238	6.667E-04	0.0154	4.254E-05	0.0010	0.000E+00	0.0000	9.600E-05	0.0022	0.000E+00	0.0000	0.000E+00	0.0000	6.441E-05	0.0015
Total	1.579E-02	0.3647	5.884E-03	0.1359	0.000E+00	0.0000	1.315E-02	0.3036	0.000E+00	0.0000	0.000E+00	0.0000	8.482E-03	0.1959

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.
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	1.070E-03	0.0247
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.569E-02	0.5933
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.567E-02	0.3619
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.697E-04	0.0201
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.331E-02	1.0000

\*Sum of all water independent and dependent pathways.



Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)  
As mrem/yr and Fraction of Total Dose At t = 3.000E+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.
Pa-231	2.459E-04	0.0060	7.638E-05	0.0019	0.000E+00	0.0000	7.429E-04	0.0182	0.000E+00	0.0000	0.000E+00	0.0000	1.877E-04	0.0046
U-234	2.111E-04	0.0052	5.241E-03	0.1283	0.000E+00	0.0000	1.113E-02	0.2726	0.000E+00	0.0000	0.000E+00	0.0000	7.472E-03	0.1829
U-235	1.383E-02	0.3386	1.840E-04	0.0045	0.000E+00	0.0000	4.337E-04	0.0106	0.000E+00	0.0000	0.000E+00	0.0000	2.709E-04	0.0066
U-238	6.239E-04	0.0153	3.981E-05	0.0010	0.000E+00	0.0000	8.984E-05	0.0022	0.000E+00	0.0000	0.000E+00	0.0000	6.028E-05	0.0015
Total	1.491E-02	0.3650	5.541E-03	0.1357	0.000E+00	0.0000	1.240E-02	0.3036	0.000E+00	0.0000	0.000E+00	0.0000	7.991E-03	0.1957

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.
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	1.253E-03	0.0307
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.406E-02	0.5891
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.472E-02	0.3603
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.139E-04	0.0199
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.084E-02	1.0000

\*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)  
As mrem/yr and Fraction of Total Dose At t = 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.
Pa-231	2.695E-04	0.0082	8.084E-05	0.0025	0.000E+00	0.0000	6.324E-04	0.0193	0.000E+00	0.0000	0.000E+00	0.0000	1.784E-04	0.0054
U-234	2.557E-04	0.0078	4.162E-03	0.1267	0.000E+00	0.0000	8.854E-03	0.2696	0.000E+00	0.0000	0.000E+00	0.0000	5.933E-03	0.1807
U-235	1.100E-02	0.3349	1.569E-04	0.0048	0.000E+00	0.0000	4.355E-04	0.0133	0.000E+00	0.0000	0.000E+00	0.0000	2.399E-04	0.0073
U-238	4.946E-04	0.0151	3.157E-05	0.0010	0.000E+00	0.0000	7.123E-05	0.0022	0.000E+00	0.0000	0.000E+00	0.0000	4.779E-05	0.0015
Total	1.202E-02	0.3659	4.431E-03	0.1349	0.000E+00	0.0000	9.993E-03	0.3043	0.000E+00	0.0000	0.000E+00	0.0000	6.399E-03	0.1949

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.
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	1.161E-03	0.0354
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.920E-02	0.5848
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.183E-02	0.3602
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.452E-04	0.0196
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	3.284E-02	1.0000

\*Sum of all water independent and dependent pathways.

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

Water Independent Pathways (Inhalation excludes radon)

Radio- Nuclide	Ground		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.
Pa-231	1.413E-04	0.0079	4.231E-05	0.0024	0.000E+00	0.0000	3.261E-04	0.0182	0.000E+00	0.0000	0.000E+00	0.0000	9.274E-05	0.0052
U-234	6.662E-04	0.0371	2.160E-03	0.1204	0.000E+00	0.0000	4.746E-03	0.2644	0.000E+00	0.0000	0.000E+00	0.0000	3.093E-03	0.1724
U-235	5.722E-03	0.3188	9.868E-05	0.0055	0.000E+00	0.0000	3.624E-04	0.0202	0.000E+00	0.0000	0.000E+00	0.0000	1.628E-04	0.0091
U-238	2.546E-04	0.0142	1.626E-05	0.0009	0.000E+00	0.0000	3.670E-05	0.0020	0.000E+00	0.0000	0.000E+00	0.0000	2.462E-05	0.0014
Total	6.784E-03	0.3780	2.318E-03	0.1291	0.000E+00	0.0000	5.471E-03	0.3049	0.000E+00	0.0000	0.000E+00	0.0000	3.373E-03	0.1880

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.
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	6.025E-04	0.0336
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.067E-02	0.5943
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.346E-03	0.3536
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.322E-04	0.0185
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.795E-02	1.0000

\*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)  
As mrem/yr and Fraction of Total Dose At t = 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.
Pa-231	1.364E-05	0.0029	4.083E-06	0.0009	0.000E+00	0.0000	3.147E-05	0.0068	0.000E+00	0.0000	0.000E+00	0.0000	8.950E-06	0.0019
U-234	2.016E-03	0.4331	2.463E-04	0.0529	0.000E+00	0.0000	1.175E-03	0.2524	0.000E+00	0.0000	0.000E+00	0.0000	4.186E-04	0.0899
U-235	5.808E-04	0.1248	1.576E-05	0.0034	0.000E+00	0.0000	8.246E-05	0.0177	0.000E+00	0.0000	0.000E+00	0.0000	2.929E-05	0.0063
U-238	2.495E-05	0.0054	1.597E-06	0.0003	0.000E+00	0.0000	3.606E-06	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	2.417E-06	0.0005
Total	2.635E-03	0.5662	2.677E-04	0.0575	0.000E+00	0.0000	1.292E-03	0.2776	0.000E+00	0.0000	0.000E+00	0.0000	4.592E-04	0.0987

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.
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	5.814E-05	0.0125
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.855E-03	0.8283
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.083E-04	0.1522
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.257E-05	0.0070
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.654E-03	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)	Thread Fraction	DSR(j,t) At Time in Years (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	
Pa-231	Pa-231	1.000E+00	2.309E+00	2.301E+00	2.286E+00	2.233E+00	2.089E+00	1.653E+00	8.477E-01	8.180E-02	
Pa-231	Ac-227+D	1.000E+00	4.039E-02	1.156E-01	2.558E-01	6.597E-01	1.297E+00	1.485E+00	7.807E-01	7.534E-02	
Pa-231	ΣDSR(j)		2.349E+00	2.417E+00	2.542E+00	2.893E+00	3.386E+00	3.138E+00	1.628E+00	1.571E-01	
U-234	U-234	1.000E+00	2.655E-02	2.647E-02	2.629E-02	2.569E-02	2.404E-02	1.905E-02	9.802E-03	9.581E-04	
U-234	Th-230	1.000E+00	1.861E-07	5.503E-07	1.274E-06	3.768E-06	1.058E-05	3.115E-05	6.920E-05	1.049E-04	
U-234	Ra-226+D	1.000E+00	4.441E-09	3.126E-08	1.651E-07	1.459E-06	1.182E-05	1.115E-04	6.765E-04	2.327E-03	
U-234	Pb-210+D	1.000E+00	9.814E-12	1.285E-10	1.364E-09	3.232E-08	6.493E-07	1.339E-05	1.181E-04	4.656E-04	
U-234	ΣDSR(j)		2.655E-02	2.647E-02	2.629E-02	2.569E-02	2.406E-02	1.920E-02	1.067E-02	3.855E-03	
U-235+D	U-235+D	1.000E+00	4.373E-01	4.359E-01	4.330E-01	4.231E-01	3.959E-01	3.138E-01	1.616E-01	1.582E-02	
U-235+D	Pa-231	1.000E+00	2.353E-05	7.200E-05	1.683E-04	4.952E-04	1.348E-03	3.519E-03	5.407E-03	1.750E-03	
U-235+D	Ac-227+D	1.000E+00	2.936E-07	1.950E-06	9.815E-06	7.825E-05	4.958E-04	2.386E-03	4.528E-03	1.568E-03	
U-235+D	ΣDSR(j)		4.374E-01	4.360E-01	4.332E-01	4.236E-01	3.977E-01	3.197E-01	1.715E-01	1.914E-02	
U-238	U-238	5.400E-05	1.282E-06	1.278E-06	1.270E-06	1.240E-06	1.161E-06	9.201E-07	4.737E-07	4.640E-08	
U-238+D	U-238+D	9.999E-01	1.058E-01	1.054E-01	1.047E-01	1.023E-01	9.574E-02	7.589E-02	3.908E-02	3.827E-03	
U-238+D	U-234	9.999E-01	3.762E-08	1.125E-07	2.608E-07	7.646E-07	2.078E-06	5.428E-06	8.353E-06	2.721E-06	
U-238+D	Th-230	9.999E-01	1.782E-13	1.221E-12	6.371E-12	5.586E-11	4.500E-10	4.193E-09	2.467E-08	7.866E-08	
U-238+D	Ra-226+D	9.999E-01	3.133E-15	4.732E-14	5.521E-13	1.444E-11	3.372E-10	1.024E-08	1.734E-07	1.494E-06	
U-238+D	Pb-210+D	9.999E-01	5.836E-18	1.564E-16	3.541E-15	2.462E-13	1.457E-11	1.037E-09	2.794E-08	2.937E-07	
U-238+D	ΣDSR(j)		1.058E-01	1.054E-01	1.047E-01	1.023E-01	9.575E-02	7.590E-02	3.909E-02	3.832E-03	

The DSR includes contributions from associated (half-life ≤ 180 days) 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
Pa-231	1.064E+01	1.034E+01	9.835E+00	8.642E+00	7.383E+00	7.966E+00	1.535E+01	1.591E+02	
U-234	9.415E+02	9.446E+02	9.509E+02	9.731E+02	1.039E+03	1.302E+03	2.344E+03	6.484E+03	
U-235	5.716E+01	5.734E+01	5.771E+01	5.901E+01	6.286E+01	7.820E+01	1.458E+02	1.306E+03	
U-238	2.364E+02	2.371E+02	2.387E+02	2.443E+02	2.611E+02	3.294E+02	6.396E+02	6.524E+03	

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)  
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g  
at tmin = time of minimum single radionuclide soil guideline  
and at tmax = time of maximum total dose = 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)
Pa-231	3.700E-04	47.11 ± 0.09	3.474E+00	7.196E+00	2.349E+00	1.064E+01
U-234	1.000E+00	0.000E+00	2.655E-02	9.415E+02	2.655E-02	9.415E+02
U-235	3.700E-02	0.000E+00	4.374E-01	5.716E+01	4.374E-01	5.716E+01
U-238	8.500E-03	0.000E+00	1.058E-01	2.364E+02	1.058E-01	2.364E+02

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

Nuclide (j)	Parent (i)	THF(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
Pa-231	Pa-231	1.000E+00	8.544E-04	8.515E-04	8.458E-04	8.263E-04	7.729E-04	6.118E-04	3.136E-04	3.027E-05
Pa-231	U-235	1.000E+00	8.706E-07	2.664E-06	6.226E-06	1.832E-05	4.986E-05	1.302E-04	2.000E-04	6.475E-05
Pa-231	ΣDOSE(j)		8.552E-04	8.542E-04	8.521E-04	8.446E-04	8.228E-04	7.419E-04	5.137E-04	9.502E-05
Ac-227	Pa-231	1.000E+00	1.494E-05	4.276E-05	9.466E-05	2.441E-04	4.799E-04	5.494E-04	2.889E-04	2.788E-05
Ac-227	U-235	1.000E+00	1.086E-08	7.213E-08	3.632E-07	2.895E-06	1.834E-05	8.828E-05	1.675E-04	5.800E-05
Ac-227	ΣDOSE(j)		1.496E-05	4.283E-05	9.502E-05	2.470E-04	4.983E-04	6.377E-04	4.564E-04	8.588E-05
U-234	U-234	1.000E+00	2.655E-02	2.647E-02	2.629E-02	2.569E-02	2.404E-02	1.905E-02	9.802E-03	9.581E-04
U-234	U-238	9.999E-01	3.197E-10	9.564E-10	2.217E-09	6.499E-09	1.766E-08	4.613E-08	7.100E-08	2.313E-08
U-234	ΣDOSE(j)		2.655E-02	2.647E-02	2.629E-02	2.569E-02	2.404E-02	1.905E-02	9.802E-03	9.581E-04
Th-230	U-234	1.000E+00	1.861E-07	5.503E-07	1.274E-06	3.768E-06	1.058E-05	3.115E-05	6.920E-05	1.049E-04
Th-230	U-238	9.999E-01	1.515E-15	1.038E-14	5.415E-14	4.748E-13	3.825E-12	3.564E-11	2.097E-10	6.686E-10
Th-230	ΣDOSE(j)		1.861E-07	5.503E-07	1.274E-06	3.768E-06	1.058E-05	3.115E-05	6.920E-05	1.049E-04
Ra-226	U-234	1.000E+00	4.441E-09	3.126E-08	1.651E-07	1.459E-06	1.182E-05	1.115E-04	6.765E-04	2.327E-03
Ra-226	U-238	9.999E-01	2.663E-17	4.023E-16	4.693E-15	1.227E-13	2.866E-12	8.707E-11	1.474E-09	1.270E-08
Ra-226	ΣDOSE(j)		4.441E-09	3.126E-08	1.651E-07	1.459E-06	1.182E-05	1.115E-04	6.765E-04	2.327E-03
Pb-210	U-234	1.000E+00	9.814E-12	1.285E-10	1.364E-09	3.232E-08	6.493E-07	1.339E-05	1.181E-04	4.656E-04
Pb-210	U-238	9.999E-01	4.960E-20	1.329E-18	3.010E-17	2.092E-15	1.239E-13	8.819E-12	2.375E-10	2.497E-09
Pb-210	ΣDOSE(j)		9.814E-12	1.285E-10	1.364E-09	3.232E-08	6.493E-07	1.339E-05	1.181E-04	4.656E-04
U-235	U-235	1.000E+00	1.618E-02	1.613E-02	1.602E-02	1.565E-02	1.465E-02	1.161E-02	5.978E-03	5.855E-04
U-238	U-238	5.400E-05	1.090E-08	1.086E-08	1.079E-08	1.054E-08	9.866E-09	7.820E-09	4.027E-09	3.944E-10
U-238	U-238	9.999E-01	8.990E-04	8.961E-04	8.901E-04	8.697E-04	8.138E-04	6.451E-04	3.322E-04	3.253E-05
U-238	ΣDOSE(j)		8.990E-04	8.961E-04	8.901E-04	8.697E-04	8.138E-04	6.451E-04	3.322E-04	3.253E-05

THF(i) is the thread fraction of the parent nuclide.

Individual Nuclide Soil Concentration  
Parent Nuclide and Branch Fraction Indicated

Nuclide Parent (j)	THF(i) (i)		S(j,t), pCi/g							
			t= 0.000E+00	1.000E+00	3.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
Pa-231	Pa-231	1.000E+00	3.700E-04	3.688E-04	3.663E-04	3.578E-04	3.347E-04	2.649E-04	1.358E-04	1.311E-05
Pa-231	U-235	1.000E+00	0.000E+00	7.803E-07	2.325E-06	7.572E-06	2.125E-05	5.611E-05	8.649E-05	2.803E-05
Pa-231	ΣS(j):		3.700E-04	3.695E-04	3.686E-04	3.654E-04	3.560E-04	3.210E-04	2.223E-04	4.114E-05
Ac-227	Pa-231	1.000E+00	0.000E+00	1.153E-05	3.313E-05	9.534E-05	1.937E-04	2.237E-04	1.177E-04	1.136E-05
Ac-227	U-235	1.000E+00	0.000E+00	1.227E-08	1.071E-07	1.070E-06	7.256E-06	3.572E-05	6.813E-05	2.362E-05
Ac-227	ΣS(j):		0.000E+00	1.154E-05	3.323E-05	9.641E-05	2.010E-04	2.595E-04	1.858E-04	3.498E-05
U-234	U-234	1.000E+00	1.000E+00	9.967E-01	9.901E-01	9.673E-01	9.051E-01	7.173E-01	3.691E-01	3.608E-02
U-234	U-238	9.999E-01	0.000E+00	2.402E-08	7.157E-08	2.331E-07	6.543E-07	1.729E-06	2.670E-06	8.707E-07
U-234	ΣS(j):		1.000E+00	9.967E-01	9.901E-01	9.673E-01	9.051E-01	7.173E-01	3.691E-01	3.608E-02
Th-230	U-234	1.000E+00	0.000E+00	8.987E-06	2.687E-05	8.854E-05	2.570E-04	7.655E-04	1.706E-03	2.589E-03
Th-230	U-238	9.999E-01	0.000E+00	1.082E-13	9.696E-13	1.061E-11	9.135E-11	8.715E-10	5.163E-09	1.650E-08
Th-230	ΣS(j):		0.000E+00	8.987E-06	2.687E-05	8.854E-05	2.570E-04	7.655E-04	1.706E-03	2.590E-03
Ra-226	U-234	1.000E+00	0.000E+00	1.946E-09	1.744E-08	1.910E-07	1.651E-06	1.593E-05	9.733E-05	3.355E-04
Ra-226	U-238	9.999E-01	0.000E+00	1.562E-17	4.199E-16	1.530E-14	3.940E-13	1.239E-11	2.117E-10	1.831E-09
Ra-226	ΣS(j):		0.000E+00	1.946E-09	1.744E-08	1.910E-07	1.651E-06	1.593E-05	9.733E-05	3.355E-04
Pb-210	U-234	1.000E+00	0.000E+00	2.001E-11	5.299E-10	1.836E-08	4.137E-07	8.880E-06	7.916E-05	3.129E-04
Pb-210	U-238	9.999E-01	0.000E+00	1.207E-19	9.612E-18	1.120E-15	7.734E-14	5.813E-12	1.588E-10	1.677E-09
Pb-210	ΣS(j):		0.000E+00	2.001E-11	5.299E-10	1.836E-08	4.137E-07	8.880E-06	7.916E-05	3.129E-04
U-235	U-235	1.000E+00	3.700E-02	3.688E-02	3.663E-02	3.579E-02	3.349E-02	2.655E-02	1.367E-02	1.339E-03
U-238	U-238	5.400E-05	4.590E-07	4.575E-07	4.545E-07	4.440E-07	4.155E-07	3.294E-07	1.696E-07	1.661E-08
U-238	U-238	9.999E-01	8.500E-03	8.471E-03	8.415E-03	8.222E-03	7.694E-03	6.099E-03	3.140E-03	3.075E-04
U-238	ΣS(j):		8.500E-03	8.472E-03	8.416E-03	8.223E-03	7.694E-03	6.099E-03	3.140E-03	3.076E-04

THF(i) is the thread fraction of the parent nuclide.

RESRAD.EXE execution time = 0.80 seconds