



DEPARTMENT OF THE ARMY
UNITED STATES ARMY TANK - AUTOMOTIVE AND ARMAMENTS COMMAND
ARMAMENT RESEARCH, DEVELOPMENT AND ENGINEERING CENTER
PICATINNY ARSENAL, NEW JERSEY 07806-5000

May 09, 2002

Quality Evaluation and Safety Team

Docket No. 04006377
Control No. 127545

License No. SUB-348

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Nuclear Materials Safety Branch 2
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RECEIVED
REGION 1
2002 MAY 10 AM 10:43

Dear Ms. Ulrich,

This refers to your letter dated November 24, 2000 concerning re-calculation of the DCGL for building surfaces of facilities at the Building 611B site. Please review the enclosed Final Survey Plan for the TACOM-ARDEC Picatinny Arsenal Building 611B, Revision 1, January 2002 from Duratek, Inc which includes a revised DCGL for building surfaces using the computer code RESRAD-Build Version 3.0 and areas of the original plan that have been strengthened or improved

Reference to License No. SUB-348, Amendment [X] will be made in the Radiation Work Permit prior to any decommissioning action rather than to the SUB-348, Amendment No. 21 mentioned throughout the workpackage prepared by the contractor.

Should you have any questions concerning this action Mr. Fabiano or the undersigned may be reached at 1-973-724-3126/3742: jfabiano@pica.army.mil or rfliszar@pica.army.mil or fax number 1-973-724-7047.

Sincerely

RICHARD W. FLISZAR
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NMSS/RGNI MATERIALS-002

Copies Furnished (w/o encl)

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Duratek, Inc.

**Final Survey Plan
for the
TACOM – ARDEC
Picatinny Arsenal
Building 611B**

**Revision 1
January 2002**

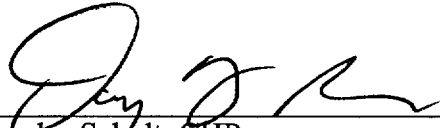
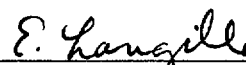
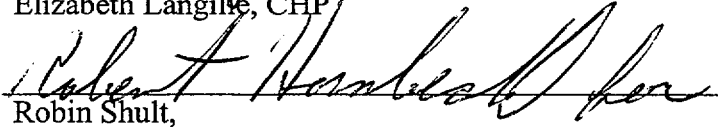
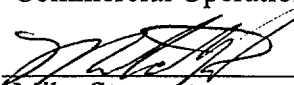


**Radioactive Field Services
Commercial Operations
628 Gallaher Road
Kingston, TN 37763**

Approvals Page

**FINAL SURVEY PLAN
for the
TACOM - ARDEC
PICATINNY ARSENAL
BUILDING 611B**

**Revision 1
January 2002**

Prepared by:	 Douglas Schult, CHP	<u>1/30/02</u> Date
Reviewed by:	 Elizabeth Langille, CHP	<u>1/30/02</u> Date
Reviewed by:	 Robin Shult, Commercial Operations General Manager	<u>1/30/02</u> Date
Approved by:	 Mike Styvaert, Army Project Manager	<u>2/1/2002</u> Date

**Radiological Field Services
Commercial Operations
628 Gallaher Road
Kingston, TN 37763**

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PREFACE

This revision to the Final Survey Plan for Building 611B addresses comments from the NRC contained in a letter dated November 24, 2000. In the referenced letter the NRC stated that the DCGL for building surfaces proposed in Revision 0 of the plan was not acceptable. Therefore this revision of the plan includes a revised DCGL for building surfaces. The computer code RESRAD-Build Version 3.0 was used to calculate the revised DCGL based on an assumed industrial exposure scenario. Included is a discussion on the assumptions made in calculating the DCGL and the computer runs used to perform the calculation.

In preparing this revision to the Final Survey Plan for Building 611B it was noted there were several areas where the plan could be strengthened or improved. Some of these areas are related to contractual requirements and some are related to experience gained since Revision 0 of the plan was issued in November 1999.

To aide those who have reviewed Revision 0 of the Final Survey Plan for Building 611B the following list outlines areas of the plan that have been strengthened or improved:

1. The DCGL for building surfaces has been revised, (Section 3.1 and Appendix C).
2. A criteria for evaluating removable activity concentrations on building surfaces has been added to support an assumption used in calculating the DCGL for building surfaces, (Sections 3.1 and 3.3).
3. The action level of "approximately 100 pCi/g" for soil has been removed and replaced with a commitment to ALARA, (Section 3.2).
4. The plan now states that direct beta measurements will be used to assess total activity concentrations on building surfaces, (Sections 1.3 and 5.4.2).
5. The plan now states that direct beta measurements will be performed using a detector calibrated to Tc-99. The detector's efficiency will ignore variations in end point beta energies and differences in beta yields, (Section 1.3).
6. The plan now states that the Wicoxon Rank Sum Test will be used, when appropriate, to evaluate direct beta measurement results collected on building surfaces. Included is the need for establishing reference background areas, (Section 4.2.1).
7. The plan now states that the Sign Test will be used, when appropriate, to evaluate soil sample results since the DCGL for soils is much larger than the expected background concentrations of the radionuclides of interest, (Section 4.2.2).
8. The plan now states that, if required, elevated measurement criteria will be used and guidance on their use is provided, (Sections 4.2.1, 4.2.2 and 4.7).

9. The plan now allows for the possibility of Class 1, Class 2, and Class 3 survey units and provides guidance on when their use would be appropriate, (Section 5.2).
10. The plan no longer requires scanning MDAs to be equal to approximately 50% of the applicable DCGL. The plan now states that if the scanning MDAs are not less than the DCGLs then the number of direct measurements or soil samples may need to be increased, (Section 4.6).
11. The plan now provides an equation for determining the scanning MDA for a sodium iodide detector, (Section 6.3).
12. The plan now includes as a reference NUREG-1727, NMSS DECOMMISSIONING STANDARD REVIEW PLAN, September 2000, (Section 10.2).

Implementation this revision of the Final Survey Plan for Building 611B will result in documentation showing that Building 611B and the surrounding ground meets the criteria for release for unrestricted use allowing Building 611B and the surrounding grounds to be removed from the Army's Radioactive Material License, License No. SUB-348.

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1.0 SITE INFORMATION

Building 611B is licensed to the US Army Tank Automotive Command (TACOM) - Armament Research, Development and Engineering Center (ARDEC) at the Picatinny Arsenal in New Jersey under the NRC Radioactive Materials License Number SUB-348, Amendment No. 21. The purpose of this final survey plan is to specify the survey protocols and subsequent data analyses necessary to show that Building 611B and the surrounding grounds meets the criteria established for release for unrestricted use. Implementation of this revision of the Final Survey Plan will result in documentation showing that Building 611B and the surrounding grounds meet the criteria for release for unrestricted use, allowing the building and surrounding ground to be removed from the Army's Radioactive Material License. The license itself is not being terminated since it authorizes the use/storage of radioactive materials at several facilities at the Picatinny Arsenal.

1.1 Site Description

Building 611B is centrally situated in a fenced area approximately 40,000 ft². The building is a single-story structure of about 1,100 ft² containing two test-firing ranges, one of which was a Depleted Uranium (DU) range while the other was designated a non-DU range. The walls of the non-DU range are constructed of concrete block; the floors are concrete and tile; and the roof is a steel, hemispherical structure that is approximately 6 feet wide, 8 feet high, and 40 feet long. The DU range is a concrete tube about 8 feet in diameter and 40 feet long. Other structures include an instrument room, foyer, and two storage rooms.

A diagram of the Building and the surrounding area is provided as Figure 1-1.

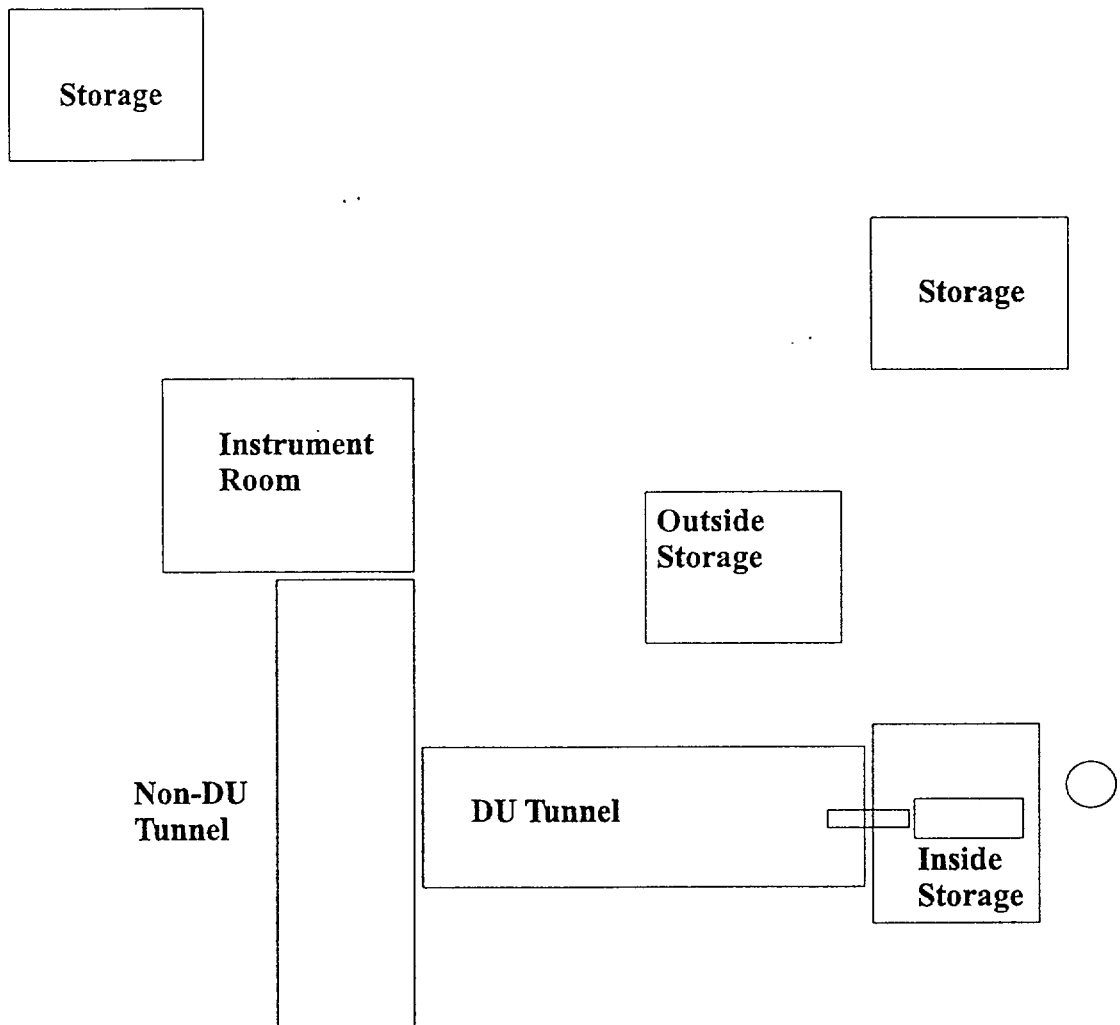
1.2 Site History

Building 611B was designed for testing of munitions and contained only non-radioactive munitions until approximately 1959 when an east-west tunnel was added to the existing structure for DU munitions testing. The site has not been used for DU munitions testing since approximately 1985 and will no longer be used for DU testing.

Depleted Uranium use within Building 611B consisted of limited DU firing within the confines of the firing range and target room of the building. The target room was ventilated thru by a High Efficiency Particulate Air (HEPA) filtered ventilation system. This system discharged cycled air after four stages of filtration to an area above the storage room located at the end of the firing range/target room.

There has been limited migration of DU from the active use areas of Building 611B to adjacent soils and areas within the facility. DU migration was identified in the characterization report where activity was identified in the soil around the building at the access points, on the interior structural surfaces of the building and areas around the building runoff locations.

Figure 1-1
Building 611B Layout



1.3 Radionuclides of Concern

The radionuclides of concern within Building 611B and surrounding structures and in the surrounding soils are those associated with depleted uranium. Depleted uranium consists of three naturally occurring, long lived uranium isotopes, uranium-234, uranium-235, and uranium-238. As compared to naturally occurring uranium, depleted uranium contains less uranium-234 and uranium-235. The relative fractions, in terms of activity concentrations, of the three long lived uranium isotopes in the depleted uranium used at the Picatinny Arsenal are:

- U-234 0.305
- U-235 0.013
- U-238 0.682

NOTE: The relative fractions of the uranium isotopes in depleted uranium assumed above are conservative. If deemed necessary this Final Survey Plan, specifically Sections 1.3 and 3.0, may be revised to take advantage of less conservative relative fractions. If this Final Survey Plan is so revised, it will be forwarded to the NRC for review along with the basis for the new relative fractions.

The half lives of uranium-234, uranium-235, and uranium-238 are 2.44E5 years, 7.04E8 years, and 4.47E9 years respectively. Uranium-238 and uranium-234 are both members of the uranium decay chain and will eventually reach equilibrium. However the time required to reach equilibrium is measured in millennia. Due to the half lives involved, the relative ratios of the three uranium isotopes in depleted uranium will remain essentially constant.

While uranium-234 and uranium-238 are both members of the uranium decay chain, uranium-235 is a member of the actinium decay chain. Table 1-1 shows the first several radionuclides of the uranium decay chain and Table 1-2 shows the first several members of the actinium decay chain.

Table 1-1
Uranium Decay Chain
(partial)

Nuclide	Half Life	Major Radiations Energies (MeV) and intensities (%)		
		Alpha	Beta	Gamma
U-238	4.51E9 years	5.15 MeV 25% 4.20 MeV 75%		
Th-234	2.41E1 days		0.103 MeV 21% 0.193 MeV 79%	0.063MeV 3.5% 0.93 MeV 4.0%
Pa-234m*	1.17E0 min		2.29 MeV 98%	0.765 MeV 0.3% 1.001 MeV 0.6%
U-234	2.27E5 years	4.72 MeV 28% 4.77 MeV 72%		0.053 MeV 0.2%
Th-230	8.0E4 years	4.62 MeV 24% 4.68 MeV 76%		0.068 MeV 0.6% 0.142 MeV 0.1%

* In the above table the fact that Pa-235m undergoes an isomeric transition to its ground state approximately 0.13 % of the time is ignored.

Table 1-2
Actinium Decay Chain
(partial)

Nuclide	Half Life	Major Radiations Energies (MeV) and intensities (%)		
		Alpha	Beta	Gamma
U-235	7.1E8 years	4.37 MeV 18% 4.40 MeV 57% 4.58 MeV 8%		0.143 MeV 11% 0.185 MeV 54% 0.204 MeV 5%
Th-231	2.55E1 hours		0.140 MeV 45% 0.220 MeV 15% 0.305 MeV 40%	0.026 MeV 2% 0.084 MeV 10%
Pa-231	3.25E4 years	4.95 MeV 22% 5.01 MeV 24% 5.02 MeV 23%		0.027 MeV 6% 0.29 MeV 6%

Based on the relative fractions of the radionuclides associated with depleted uranium and their decay chains compliance with the DCGL for building surfaces will be evaluated based on direct beta measurements collected using a detector calibrated using Tc-99. The use of a detector calibrated using Tc-99 will be conservative considering the energy and yields of the beta particles emitted during the decay of depleted uranium. Compliance with the DCGL for soil will be demonstrated by gamma spectroscopy, The gamma spectral analysis will focus on Th-234 a short lived daughter of U-238. However since U-238 accounts for only 68.2 % of the activity associated with depleted uranium, the limit for Th-234 in soil will be set at 68.2 % of the DCGL for depleted uranium in soil.

2.0 ORGANIZATION AND RESPONSIBILITIES

Duratek will implement an integrated management approach that includes project management oversight and technical support. The full resources of Duratek's Bear Creek and Gallaher Road offices, including professional engineering and quality assurance staff, will support the Project Sponsor and the on-site team to ensure successful project execution and completion.

The on-site survey team will consist of a Project Manager/Supervisor and Senior HP Technicians. These personnel will, as a minimum, be trained, qualified, and experienced in field radiological survey procedures and have current HAZWOPER training.

2.1 Project Sponsor (Off-site)

The Project Sponsor provides the project lead for any home office support on an as needed basis. He/she will assist the Project Manager with the coordination of any project activities as needed.

2.2 Project Manager/Supervisor (On-site)

The Project Manager is the primary point of contact and interface. The minimum requirements for the Project Manager are 5-10 years of health physics experience including prior management experience.

He/she will be responsible for the supervision and coordinate the daily activities including the overview of the final status surveys. In order to ensure regulatory compliance, he/she will be qualified in the use of the survey instruments used and be familiar with the aspects of surveying as described in NUREG-1575 and this Survey Plan.

2.3 Health Physics (HP) Technician(s)

The HP Technician(s) are responsible for performing the final status surveys and collecting samples as necessary. They will be qualified in the use of the survey instruments and the performance of surveys in accordance with NUREG-1575 as well as this Survey Plan.

3.0 DERIVED CONCENTRATION GUIDELINE VALUES, DCGLs

Subpart E to 10 CFR 20 provides the criteria for release for unrestricted use. It states that the total effective dose equivalent (TEDE) to a member of a critical group, due to residual contamination that is distinguishable from background, shall not exceed 25 mrem/yr and that the residual contamination levels are reduced to levels that are as low as reasonably achievable (ALARA). In order to demonstrate compliance with the criteria for release for unrestricted use, DCGLs are calculated. Since residual contamination is expected within

Building 611B and in the surrounding soil, DCGLs for both building surfaces and soil will be required. The DCGLs relate activity concentrations on building surfaces (dpm/100 cm²) and in soil (pCi/g) to the TEDE of 25 mrem/yr.

Building 611B is located in a fenced area of approximately 40,000 ft². Building 611B is a single story structure of approximately 1,100 ft². It consists of two test firing ranges, an instrument room, two storage rooms, and a foyer. One of the test firing ranges is hemispherical structure approximately six feet wide, eight feet high, and 40 feet long. The other test firing range consists of a tube eight feet in diameter and 40 feet long. The area in which Building 611B contains no surface water.

3.1 Building Surfaces

Based on the physical attributes of Building 611B and its location on an active military base it was determined that a conservative exposure scenario on which to base the DCGL for DU on building surfaces was an industrial worker scenario. The computer code RESRAD-BUILD, Version 3.0 was used to calculate the DCGL. Attachment C contains a copy of the RESRAD-BUILD run. In calculating the DCGL the RESRAD-BUILD default values were used with the following exceptions:

- The evaluation times of 0, 1, 2, 5, 10, 100, 1000 years were selected.
- The exposure duration was set at 250 days
- The fraction of the exposure duration spent inside was set at 0.33 days; (250 days)(24 hours/day)(.33) = 1,980 hours.
- The removable activity fraction was set at 0.1.
- The area source type was selected.

As the RESRAD-BUILD run in Appendix C shows, an assumed DU activity concentration of 100 pCi/m² results in a maximum dose in the first year of exposure of 1.0E-2 mrem. Given that the criteria for release for unrestricted use is 25 mrem/yr the DCGL for building surfaces is:

$$DCGL = \frac{25 \text{ mrem}}{\text{yr}} * \frac{100 \text{ pCi/m}^2}{1.0\text{E}-2 \text{ mrem/yr}} * \frac{2.22 \text{ dpm}}{\text{pCi}} * \frac{\text{m}^2}{1\text{E}+4 \text{ cm}^2} * \frac{100 \text{ cm}^2}{100 \text{ cm}^2} = 5,550 \text{ dpm/100 cm}^2$$

As stated above, the DCGL for DU on building surfaces was calculated in part based on a removable activity fraction of 0.1. Therefore surveys for removable activity will be required during the final survey to show that the removable DU activity concentration is less than 550 dpm/100 cm². Since inhalation is the primary exposure pathway associated with an industrial scenario involving DU, appropriate steps will be taken to reduce removable activity concentration of DU to as low as reasonably achievable. These steps may include vacuuming, mopping, and removal of surface coverings.

3.2 Soil

Initially, a DandD code run was utilized to determine a Derived Concentration Guideline Level (DCGL) for the exterior grounds as shown in Attachment D. An arbitrary value of 100 pCi/g of DU, with the same isotopic ratios as above for building surfaces, was input using the default Residential Scenario. This resulted in a TEDE of 5129 mrem/yr, as shown in Table 3-1. Scaling to a TEDE of 25 mrem/yr results in a concentration guideline level of 0.49 pCi/g.

Table 3-1
Pathway Component of Maximum Annual Dose
from 100 pCi/g of Depleted Uranium

Pathway	TEDE (mrem)	Percentage
External	0.328	0.01
Inhalation	0.053	0.00
Agricultural	8.98	0.18
Soil	0.027	0.00
Drinking	1,230	23.96
Irrigated	2,550	49.80
Aquatic	1,340	26.06
Total	5,129.3	100

As seen in the above table, the results were extremely high, due mainly to the water pathways including groundwater irrigation of crops, consumption of aquatic foodstuff, and drinking water from a well on the site.

Appendix E of draft NUREG-1549 allows for the modification of pathways based on input from a site-specific model. For example, the aquatic pathway (the consumption of fish from a contaminated pond), can be set to zero if there is no pond or surface water that could support fish. The Building 611B site does not contain such surface water. However, the removal of this pathway increases the guideline level only about 50% to 0.66 pCi/g.

The two other major dose producing pathways, irrigation and drinking water, both assume that there is, or will be, a well on the site providing contaminated groundwater for drinking and crop irrigation. Without further information on the future uses of the site, it would be imprudent to assume that the development of a groundwater well would not occur.

In order to determine a more reasonable (and achievable) DCGL for the soils surrounding the building, it was necessary to modify the contaminated zone affecting the groundwater aquifer. The DandD code does not lend itself to this modification, so the computer code RESRAD Version 5.82 was used.

Using the same input concentrations as above for the DandD code, RESRAD was first run using all default parameters for all pathways. The result was a TEDE of 102 mrem/yr for an input concentration of 100 pCi/g. When scaled to a TEDE of 25 mrem/yr, this provides a soil concentration of 24.5 pCi/g. The resulting RESRAD output is provided as Attachment E.

The input parameters were then modified to more accurately reflect the Building 611B site conditions as follows:

1. The total area initially considered affected (above 35 pCi/g) is approximately 300 m². (Reference 8.10) The total area of the Building 611B site is approximately 4,000 m² (Reference 8.9). The RESRAD input parameter "Contaminated Zone" was changed from a default of 10,000 m² to the more conservative site-specific value of 4,000 m².
2. Characterization survey soil sample results from the Building 611B site show that the soil contamination is restricted to the top 6 inches (15 cm) of soil. The RESRAD input parameter "Thickness of contaminated zone" was changed from the default of 2 meters to a conservative site-specific value of 0.25 meters.

Using the above site-specific parameters, RESRAD was run again (Attachment F). The result was a TEDE of 13.4 mrem/yr for an input concentration of 100 pCi/g. When scaled to a TEDE of 25 mrem/yr, this provides a DCGL of 186 pCi/g.

In accordance with the ALARA philosophy, if discrete volumes of soil (< 1.0 m³) with elevated activity concentrations are encountered that approach the DCGL for soils (> 100 pCi/g) they will be remediated. This will result in less residual radioactivity and reduce the potential for having to evaluate the data using the Wilcoxon Rank Sum Test and the elevated measurement criteria.

3.3 DCGL Summary

Table 3-2 summarizes the depleted uranium DCGLs for Building 611B. The primary DCGL for building surfaces is 5,500 dpm/100 cm². This DCGL is to be interpreted in terms of total activity as evaluated using direct beta measurements. In deriving this DCGL it was assumed that the removable activity fraction was less than 10 %. Therefore a secondary DCGL, in terms of removable activity, of 550 dpm/100 cm² is also specified for building surfaces.

The DCGL for depleted uranium in soil is 186 pCi/g. This DCGL is to be interpreted as the sum of the activity concentrations of the three uranium radionuclides. In order to allow for the use of gamma spectral analysis of soil samples in demonstrating compliance with the DCGL, the DCGL for depleted uranium in soil will be equated to a Th-234 activity concentration. Th-234 is the short lived daughter ($t_{1/2} = 24.1$ days) of U-238 and under all practical applications will be in equilibrium with U-238. Since U-238 accounts for 68.2 % of the uranium activity in depleted uranium the DCGL for depleted uranium can be shown to be equivalent to approximately 125 pCi/g of Th-234.

Table 3-2
Derived Concentration Guideline Levels
For Depleted Uranium

Building 611B Surfaces and Surrounding Soils DCGLs	
Building Surface Contamination	5,500 dpm/100 cm ² (total) 550 dpm/100 cm ² (removable)
Soil Contamination	186 pCi/g (depleted uranium) 125 pCi/g (Th-234)

4.0 SURVEY OVERVIEW

This section provides the basis for developing the MARSSIM survey of the facility. In order to design the survey, several parameters must be set to ensure that the survey will stand up to and meet the statistical evaluations to justify the release of the facility. These include the establishment of the Data Quality Objectives, Release Criteria or Derived Concentration Guideline Levels, establishing the acceptable decision errors and the calculation of the Relative Shift in order to determine the number of required measurements per survey unit.

4.1 Data Quality Objectives

- To ensure the proper release of the facility, the objectives of this survey plan are:
- The selection of appropriate instrumentation to adequately detect the radionuclides of concern,
- Establish proper count times and measurement MDAs (Minimum Detectable Activities) to verify that the release criteria are met,
- Perform surveys to verify the radiological status of the facility,
- Ensure that personnel exposure from residual contamination will not exceed 25 mrem/year to an individual based on the intended use of the facility, and
- Statistically evaluate the data to ensure that sufficient data is collected to prepare a report supporting the removal of the facility from the Radioactive Materials License.

Surveys and data evaluation will be based on the guidance in NUREG-1575, *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*, and include measurements for direct surface activity, removable activity and exposure rates.

4.2 Non Parametric Statistics

4.2.1 Building Surfaces

Compliance with the DCGL for building surfaces will be demonstrated by collected direct measurements. Since these measurements are not radionuclide specific it may be necessary to use the Wilcoxon Rank Sum Test to evaluate the resulting data. The Wilcoxon Rank Sum Test will be used to evaluate survey data from survey units in which the average of the direct beta measurements are less than the DCGL but which have individual measurement results exceeding the DCGL. Each survey unit evaluated using the Wilcoxon Rank Sum Test will be compared to an appropriately chosen Reference Area.

If an individual measurement result exceeds the DCGL the area from which the measurement was collected will also be evaluated using the elevated measurement criteria.

4.2.2 Soils

Since the DCGL for depleted uranium is large compared to the expected background activity concentrations it will be assumed for the purpose of evaluating final survey data that radionuclides associated with depleted uranium are not present in background. This along with the fact that compliance with the DCGL for soils will be demonstrated by gamma spectroscopy which is a radionuclide specific analysis allows for the analysis of the final survey data, if necessary, using the Sign Test. The Sign Test does not require the use of reference background areas. The Sign Test will be used to evaluate survey data from survey units in which the average of all the discrete analyses is less than the DCGL but which have individual analysis results exceeding the DCGL.

If an individual sample analysis result exceeds the DCGL the area from which the sample was collected will also be evaluated using the elevated measurement criteria.

4.3 Decision Error

There are two types of decision error applied to analytical results: Type I (α) and Type II (β) errors. A Type I error, or false positive, is the probability that a survey result/measurement is above the release criteria when in fact it is not, while a Type II error, or false negative, is the probability of determining that a result/measurement is below the release criteria when it is not. The probability of making decision errors can be controlled by adopting an approach called hypothesis testing.

The null hypothesis (H_0) is treated like a baseline condition and is defined by MARSSIM as:

H_0 = residual radioactivity in the survey exceeds the release criterion.

This means that the site or survey area is assumed contaminated until proven otherwise. For the purpose of this Final Survey, both Type I (α) and Type II (β) will be set at 0.05 or 5 percent.

4.4 Relative Shift

The relative shift is defined as " Δ / σ " where " Δ " is the DCGL - LBGR (Lower Bound of the Gray Region) and " σ " is the standard deviation of the contaminant distribution. In order to calculate the relative shift, the DCGL must be determined and two assumptions made to estimate the LBGR and the standard deviation of the measurement distribution. MARSSIM suggests that the LBGR be set at approximately 50% of the DCGL but can be adjusted later to provide a value for the relative shift between the range of 1 to 3. The standard deviation may be calculated from preliminary survey data, prior surveys of similar areas and materials or the standard deviation of a reference background area. It should be noted that " σ " represents the standard deviation prior to release after all area decontamination is thought to be complete. If no reference data is available to make a reasonable estimate, MARSSIM suggests using 30% of the mean survey unit background.

4.5 Number of Samples/Measurements

The number of samples and/or measurements to be collected in each survey unit is dependent on the non parametric statistics to be used to test the null hypothesis, acceptable decision errors, and the relative shift. In cases where scanning sensitivities are not adequate to see the DCGLs, the samples and measurements will need to be increased. Since non radionuclide specific direct beta measurements will be used to evaluate direct beta measurements on building surfaces they will be evaluated using the Wilcoxon Rank Sum Test. The Wilcoxon Rank Sum Test requires the evaluation off appropriately chosen reference areas.

Soils samples will be evaluated by gamma spectroscopy in order to quantify the Th-234 activity concentration present. Although Th-234 is present in background, it will be assumed that all Th-234 associated with the soil samples is due to the presence of depleted uranium since the naturally occurring Th-234 will be insignificant compared to the DCGL for depleted uranium. Since the results of a gamma spectral analysis is radionuclide specific, the Sign Test used to evaluate the analysis results. The Sign Test does not require the evaluation of reference areas.

4.5.1 Wilcoxon Rank Sum Test

Once the relative shift, Δ / σ , has been determined and the decision errors defined the Table in Attachment A can be used to determine the number of measurements required to evaluate a given survey unit. The interpolated value of $N/2$ gives the number of measurements required within a given survey unit. An equal number, $N/2$, of measurements are required from within the reference area.

4.5.2 Sign Test

Once the relative shift, Δ / σ , has been determined and the decision errors defined the Table in Attachment B can be used to determine the number of samples required to evaluate a given survey unit. The interpolated value of N gives the number of measurements required within a given survey unit. When using the Sign Test, samples are not required from a reference area.

4.6 Sample/Measurement Number Reasonableness

Once the number of samples/measurements has been calculated, it must be determined whether or not the number is reasonable for the survey. It is possible, even if the MARSSIM guidance is strictly followed, that there are not enough samples to produce the desired level of “*comfort*” or the number appears to be excessive. This is performed on a case-by-case basis and if the number of samples/measurements is not reasonable, then the data quality objectives or initial assumptions will be re-evaluated.

It must also be determined if either of the scanning MDAs (beta or gamma) calculated in accordance with Sections 6.2 and 6.3 of this plan exceed the DCGLs. If either of the scanning MDAs exceed the DCGLs the number of samples/measurements to be collected in each survey unit may need to be increased to account for the lack of scanning sensitivity.

When the scanning MDA exceeds the DCGL, an Area Factor, AF, is calculated as follows:

$$AF = \frac{MDA_{\text{scanning}}}{DCGL}$$

Then the size of the area of elevated activity that corresponds to the Area Factor, AF, is determined. This is calculated by decreasing the size of the assumed area of contamination and rerunning the computer code used to calculate the DCGL. The ratio of the new run to the original run is compared to the Area Factor. When the ratio equals the Area Factor, the size of the area of elevated activity that corresponds to the Area Factor has been determined, i.e. the size of the assumed area of contamination for the appropriate computer run.

The number of samples/measurements required to account for lack of scanning sensitivity, N_s , is calculated as follows:

$$N_s = \frac{A}{A_s}$$

Where: A = Survey Unit Area
As = The size of the area of elevated activity
that corresponds to the Area Factor

If N_s exceeds the number of samples/measurements calculated using section 4.5.1 or section 4.5.2 of this plan then it represents the minimum number of samples/measurements to be collected from each survey unit.

4.7 Elevated Measurement Criteria

Measurement and sample analysis results that exceed the DCGLs will require that the area from which the result was obtained be evaluated using the elevated measurement criteria. The elevated measurement criteria is size dependent. Once the size of the area associated with the elevated activity is determined it is input, along with the elevated measurement result, into the computer code used to calculate the DCGL. The resulting annual dose divided by the criteria for release for unrestricted use, 25 mrem/yr, is the elevated measurement criteria. If the measurement/sample analysis result divided by the DCGL exceed the elevated measurement criteria the survey unit in question does not meet the criteria for release for unrestricted use.

5.0 SURVEY DESIGN AND IMPLEMENTATION

The purpose of the survey is to collect sufficient survey data to remove Building 611B from Radioactive Material License SUB-348, Amendment 21 and the NRC license application. The project team will perform surveys according to project specific Duratek procedures and this Survey Plan. Implementation of this Survey Plan will include the following:

- Survey instrumentation will be set up and source checked to ensure proper operation.
- The Project Manager/Supervisor will perform preliminary inspections of the areas to identify additional specific survey requirements.
- The Project Manager/Supervisor will develop survey packages for the survey areas.
- The project team will grid the survey areas as specified by the following survey protocols and mark or map the survey locations as applicable.
- The project team will take survey measurements and analyze samples using appropriate calibrated instruments and perform daily source and background checks before and after each day's work.
- Direct survey data collected during the project will be downloaded from the survey instrument into a database for storage and processing.
- The Project Manager will review the completed survey packages to ensure that all required surveys have been performed.

- The Project Manager will review the survey results to identify any areas exceeding the specified release criteria.

In order to support the final status surveys of the building, the facility will be cleared of all loose equipment and materials to the maximum extent possible. Surveys will then be performed as follows:

5.1 Instrumentation and Selection

Selection and use of survey instrumentation will ensure sensitivities are sufficient to detect the identified radionuclides at the minimum detection requirements. Table 4-1 provides a list of the instruments, types of radiations detected and calibration sources, which will be utilized.

Duratek will use the Ludlum Model 2350 Data Logger with a variety of detectors for direct measurements of beta surface activity as well as exposure rate measurements. The Data Logger is a portable microprocessor computer based counting instrument capable of operation with NaI(Tl) gamma scintillation, gas-flow proportional, GM and ZnS scintillation detectors.

Detector selection will depend upon the type of survey, surface contour and survey area size. The project team will typically use the 126 cm² gas-flow proportional detector for direct beta measurements for most areas and the 15.5 cm² GM detector for smaller areas in which the gas-flow proportional detector will not fit.

Exposure rate measurements and gamma scans will be performed using either a Ludlum Model 44-2 or 44-10 NaI(Tl) gamma scintillation detector.

Analysis for removable alpha and beta activity will be performed using either Tennelec gross alpha/beta counter or the Eberline BC-4 and SAC-4 scaler counters.

Table 4-1
Survey Instrumentation

Instrument/Detector	Detector Type	Radiation Detected	Calibration Source	Use
Ludlum Model 2350 wt. 43-68, 43-98 or 43-94 detector	Gas-flow proportional (126cm ²)	Alpha or beta	⁹⁹ Tc (β) ²³⁰ Th (α)	Direct beta surveys; Beta scans on solid surfaces, soil and sand.
Ludlum Model 2350 wt. 44-40 detector	Shielded GM (15.5cm ⁵)	Beta	⁹⁹ Tc (β)	Direct beta surveys; Beta scans on solid surfaces, soil and sand.
Ludlum Model 2350 wt. 44-2 or 44-10 detector	NaI(Tl) Scintillator	Gamma	¹³⁷ Cs (γ)	Gamma exposure rate and gamma scans.
Eberline SAC-4 Scaler Counter	ZnS scintillator	Alpha	²³⁰ Th (α)	Smear counting
Eberline BC-4 Scaler Counter	Shielded GM	Beta	⁹⁹ Tc (β)	Smear counting
Tennelec Planchette Counter	Shielded Gas-flow proportional	Alpha and Beta	⁹⁹ Tc (β), ²³⁰ Th (α)	Smear counting
EG&G NOMAD Gamma Spectrometer	HPGe	Gamma energy and intensity	Mixed gamma	Nuclide identification and quantification soil and sand samples.

5.1.1 Instrument Calibration

The data loggers, associated detectors and all other portable instrumentation are calibrated on a semi-annual basis using National Institute of Standards and Technology (NIST) traceable sources and calibration equipment. Calibration typically includes:

- High Voltage calibration,
- Discriminator/threshold calibration,
- Window calibration,
- Alarm operation verification, and
- Scaler calibration verification

The detector calibration includes:

- Operating voltage determination,
- Calibration constant determination, and
- Dead time correction determination

Calibration labels showing the instrument identification number, calibration date and calibration due date are attached to all portable field instruments.

5.1.2 Sources

All sources used for calibration or efficiency determinations for the survey will be representative of the instrument's response to the identified radionuclides and are traceable to NIST. The sources, used during the surveys, will include ^{99}Tc , ^{230}Th , ^{137}Cs and mixed gamma sources.

Health Physics Technicians will control radioactive sources used for instrument response checks and efficiency determination. Sources will be stored securely and signed out when needed in the field. A source sign-out log will track the location of all sources when they are removed from the Duratek field office.

5.2 Survey Unit Classification

Survey units are discrete areas, consisting of building surfaces or land areas, of a specific size and shape for which separate decisions relative to the DCGLs will be made. Survey units are defined based on the site's history, potential for residual contamination, and physical characteristics. All impacted areas are divided into survey units. Impacted areas are those areas with a potential of being contaminated. Non impacted areas are areas that do not have a potential for being contaminated and are not surveyed as part of the final survey.

Survey units are classified as Class 1, 2, or 3. A Class 1 survey unit is a survey unit that has or had prior to remediation contamination levels approaching or exceeding the DCGL. A Class 2 survey unit is a survey unit that does not have contamination approaching or exceeding the DCGL. Typically Class 2 survey units are not remediated. If remediation is required the survey unit is reclassified as Class 1. A class 3 survey unit is a survey unit that is not expected to contain contamination or is expected to contain contamination at a fraction ($< 10\%$) of the DCGL.

Survey units are limited in size to ensure adequate survey coverage. The size limits are specified in the following Table.

Survey Unit Classification	Size Limit, m ²
Class 1 Building Surfaces Land Areas	< 100 < 2,000
Class 2 Building Surfaces Land Areas	<1,000 < 10,000
Class 3 Building Surfaces Land Areas	No limit No limit

Based on the data presented in reference 10.10, the DCGL for building surfaces and the size of Building 611B all of the survey units within the building will be classified as Class 1. The building exterior and any remaining structures on the surrounding grounds will be classified as Class 2. Based on the DCGL for soils and Reference 10.10 the grounds surrounding Building 611B will be classified as Class 2.

Classifying the building exterior, remaining structures, and grounds as Class 2 reduces the required survey frequency, especially that associated with scanning. This will aid greatly in dealing with the unexploded ordinance concerns surrounding Building 611B.

The following is a list of likely survey units:

- DU tunnel,
- DU target area,
- Inside storage area,
- Non-DU tunnel,
- Instrument room and foyer,
- Outside storage areas (3),
- Building exterior (roof), and
- Grounds surrounding Building 611B.

It is possible that as remediation activities progress, in preparation for the final survey, that some of the survey units listed may be combined. It is also possible that additional survey units may be established.

5.3 Survey Package Development

For each survey area/unit, the project team will develop a package, or portfolio, by performing a walk-down and preparing a worksheet/tracking sheet outlining the general survey instructions, location codes, and any specific survey instructions for any abnormal conditions within the survey area. Completion and review signature blocks will be used to track the progress of the surveys.

During the survey, the project team will update the survey package(s) with the survey data and results of any special surveys or sample analyses performed.

5.4 Survey Protocols/Requirements

The final status survey of the building will consist of beta scans, fixed beta measurements, and smears for gross alpha and gross beta analysis. The survey of the facility grounds will consist of gamma scans and soil sampling for gamma spectroscopy analysis. Surveys will be performed as follows:

5.4.1 Surface Scans

a. Beta Scans

For class 1 survey units, beta scans will be performed over 100% of the accessible building surfaces (interior) and the roof using a gas-flow proportional detector while listening to the audible output of the instrument. For class 2 survey units, beta scans will be performed over approximately 50% of the accessible building surfaces. All areas of elevated activity will be identified for further investigation and potential decontamination. Any area exceeding the $DCGL_w$ will be identified and decontaminated. Scan speeds will be established such that contamination at levels of approximately 50% of the $DCGL_w$ will be detected.

b. Gamma Scans

Gamma scans will be performed on the open land areas surrounding Building 611B. As a minimum, 10% of the open land areas will be scanned. If unexploded ordinance concerns can be adequately addressed, the scan coverage will increase to 25%. A NaI(Tl) gamma scintillation detector will be used with the Ludlum Model 2350 to help identify any areas of residual contamination in the soil or the building interior. The detector will be moved in a serpentine manner in close proximity with the ground while listening to the audible output of the instrument. Any areas where a noticeable increase in the count rate is determined will be flagged for further investigation and/or sampling.

5.4.2 Direct Beta Measurements

Direct beta measurement will be taken on the structural surfaces of Building 611B within each survey area/unit. The number of measurements and spacing will be determined in accordance with

MARSSIM and this Plan.

a. Number of Measurements

The number of measurement for each survey unit will be determined in accordance with section 4.5.1 and 4.6 of this plan. A relative shift of between 1 and 3 should be used, resulting in approximately 10-30 measurement per survey unit.

The number of measurements determined in accordance with section 4.5.1, $N/2$, represents the number of measurements to be collected from each survey unit. An equal number of measurements, $N/2$, needs to be collected from an appropriate reference area in order to evaluate the final survey data using the Wilcoxon Rank Sum Test

5.4.3 Removable Activity Measurements

Smears will be taken at each direct measurement location for gross alpha and gross beta analysis.

5.4.4 Soil Sampling

Surface (0-15 cm) soil samples will be collected from the open land areas surrounding building 611B. The number of samples and their spacing will be determined in accordance with MARSSIM and this plan.

- a. The number of samples for each survey unit will be determined in accordance with sections 4.5.2 and 4.6 of this plan. A relative shift of between 1 and 3 should be used, resulting in approximately 10-30 samples per survey unit.

5.4.5 Sample/Measurement Grid Spacing

The grid spacing for the measurement and samples will be determined assuming a square grid pattern as follows:

$$L = \sqrt{\frac{A}{N}}$$

Where A = Survey unit Area
 N = Number of measurements

Once the number of measurements and the grid spacing are determined, a starting point for the survey must be established for each survey unit. This will be performed by selecting a reference point for the survey unit such as the corner of the room and a random number generator providing a random number between 0 and 1 for an initial offset from the reference point in both the x and y coordinates. The random number pair will be multiplied by the calculated grid spacing providing the offset from the reference point for the first grid location.

Upon establishing the first grid location, the calculated grid spacing will be used to establish a grid system throughout the survey unit. If the survey unit includes the floor, walls and ceiling, the grid is extended to all surfaces from the initial point.

Once gridded, it will be verified that the number of grid locations satisfies the calculated number of measurements. If not, then smaller grid spacing will be used to ensure the appropriate number of measurements and samples are obtained.

5.5 Survey Records

The project team will maintain records of surveys in the survey packages for each area according to project procedures. The survey package may include the following records depending upon the survey design and protocols:

- Survey Package Worksheet giving the package identification, survey location information, general survey instructions and any specific survey instructions.
- Survey Unit Diagram of the area to be surveyed as available.
- Photographs of the survey area, as necessary, to show special or unique conditions.
- Printout of laboratory analysis results (if performed).
- Ludlum Model 2350 data files and associated spreadsheets for all radiation survey measurements.

Duratek will use a proprietary computer program to download the contents and survey data from the Data Loggers memory to a database and generate a survey report that presents all raw data, converted data, and information by survey location. The survey technician and supervisor will review these reports for completeness, accuracy, suspect entries and compare the data to the guideline values in Table 3-2.

Any changes to the database tables such as detector efficiency and background, that could affect survey results will require management approval. In addition, changes to data in the primary table will require a written explanation on a change request. The change request will be attached to the survey report and maintained as a permanent record.

Data and document control will include the maintenance of the raw data files, translated data files (spreadsheets) and documentation of all corrections made to the data. The databases will be backed up on a daily basis.

6.0 MINIMUM DETECTABLE ACTIVITY, MDA

Minimum Detectable Activity (MDA) is defined as the smallest amount or concentration of radioactive material that will yield a net positive count with a 5% probability of falsely interpreting background responses as true activity. The MDA is dependent upon count times, geometry, sample size, detector efficiency background, and for scanning the scanning rate and the efficiency of the surveyor.

The MDAs for direct beta measurements, analyses for removable activity, and gamma spectroscopy will be set at 50 % or less of the DCGLs. The MDAs for beta scans and gamma scans will be set equal to or less than the appropriate DCGL. Since the MDAs for scanning will be equal to or less than the appropriate DCGLs, the scanning MDAs will not effect the number of measurements or samples required to evaluate a specific survey unit.

6.1 Direct Measurements

The equation used for calculating the MDA for direct measurements is:

$$MDA = \frac{\frac{2.71}{t_s} + 3.29 \sqrt{\frac{R_b}{t_s} + \frac{R_b}{t_b}}}{E \left(\frac{A}{100} \right)}$$

Where:

MDA	=	Minimum Detectable Activity (dpm/100 cm ²)
R _b	=	Background Count Rate (cpm)
t _b	=	Background Count Time (min)
t _s	=	Sample Count Time (min)
A	=	Detector Area (cm ²)
E	=	Detector Efficiency (c/d)

6.2 Beta Scans

The equation used for calculating the MDA for beta scans is:

$$MDA = \frac{d' * \sqrt{b_i} * \frac{60}{i}}{E_i * E_s * \sqrt{p} * \frac{A}{100}}$$

Where:

MDA	=	Minimum Detectable Activity (dpm/100 cm ²)
d'	=	Decision error taken from Table 6-5 of MARSSIM
i	=	Observation counting interval (scan speed divided by the detector width)
b _i	=	Background count per observation interval
E _i	=	Detector Efficiency (c/d)
E _s	=	Surface Efficiency (typically around 50% for beta contamination on concrete)
p	=	Surveyor Efficiency (typically 50%)
A	=	Detector Area (cm ²)

6.3 Gamma Scans

$$MDCR_{Surveyor} = \frac{d' * \sqrt{b_i} * \frac{60}{i}}{p}$$

The equation used for calculating the MDA for gamma scans is essentially the same as that for beta scans. However conversion factors are required to convert the MDCR_{Surveyor} in terms of cpm to an activity concentration in terms of pCi/g

Where:

MDCR _{Surveyor}	=	Minimum Detectable Count Rate (cpm)
d'	=	Decision error taken from Table 6-5 of MARSSIM
i	=	Observation counting interval (scan speed divided by the detector width)
b _i	=	Background count per observation interval
p	=	Surveyor Efficiency (typically 50%)

The first of the conversion factors needed to convert the $MDCR_{Surveyor}$ into an activity concentration is the exposure rate due to a volume of soil contaminated with the radionuclide of interest (depleted uranium). This conversion constant in terms of pCi/g per uR/hr can be derived using a shielding code. The second conversion factor that is needed is one that converts an exposure rate due to the radionuclide of interest to a count rate for the detector used during the scan, uR/hr per pCi/g.

$$MDA = (MDCR_{surveyor} (cpm)) * \left(\frac{uR/hr}{cpm} \right) \left(\frac{pCi/g}{uR/hr} \right)$$

Where: MDA = The minimum detectable activity (pCi/g)

7.0 DATA QUALITY ASSESSMENT AND EVALUATION

Once all the surveys are complete, the data will be assessed and evaluated to ensure that the $DCGL_w$ was met. All areas exceeding the $DCGL_w$ will be remediated, scanned and the data point re-surveyed. Once complete, the data will be evaluated following the methodology specified in MARSSIM and this Plan to re-calculate the number of measurements based on the survey standard deviation to ensure that the proper number of measurements was taken. If it is determined that enough data was not collected, the grid size may be reduced and the survey area re-gridded and re-surveyed as appropriate.

Provided an adequate number of measurements were taken and that NO measurements exceed the $DCGL_w$, the survey area/unit meets the requirements for release for unrestricted use and no further statistical tests are required. If there is data in excess of the $DCGL_w$, the area will be decontaminated unless an evaluation is made by the Project Manager showing that it is not necessary. In this case, the data must be statistically evaluated using non-parametric statistics and the elevated measurement evaluated against the $DCGL_{EMC}$.

7.1 Elevated Measurement Comparison

If elevated measurements above the $DCGL_w$ exist, an elevated measurement comparison must be performed in accordance with MARSSIM; otherwise, the area will be decontaminated.

7.2 Statistical Evaluation

If elevated measurements remain, the data must be statistically evaluated using either the Wilcoxon Rank Sum Test or the Sign Test in accordance with MARSSIM.

8.0 QUALITY ASSURANCE AND QUALITY CONTROL

Duratek's Quality Assurance/Quality Control Programs ensure that all quality and regulatory requirements are satisfied. All activities affecting quality are controlled by procedures and this plan. These documents include the following Quality Control measures as an integral part of the survey process.

8.1 Selection of Personnel

Project management and supervisory personnel are required to have extensive experience with Duratek procedures and be familiar with the requirements of MARSSIM and this Survey and Sampling Plan. Management must have prior experience with the radionuclide(s) of concern and a working knowledge of the instruments used to detect the radionuclides on site. Project management and supervision are required to maintain OSHA safety qualifications as safety is a primary concern of Duratek.

Duratek will select supervisory personnel to direct the survey based upon their experience and familiarity with the survey procedures and processes. Likewise, Health Physics technicians who will perform the surveys will be selected based upon their qualifications and experience.

8.2 Training

All project personnel will receive site-specific training to identify the specific hazards present in the work and survey areas. Training will also include a briefing and review of this Plan, Duratek procedures and the Site Safety and Health Plan.

During site orientation and training, survey personnel will become familiar with site emergency procedures. In the event of an emergency, personnel will act in accordance with all applicable site emergency procedures and the Site Safety and Health Plan.

8.3 Written Procedures

All survey tasks, which are essential to survey data quality, will be controlled by procedures and this plan.

8.4 Instrumentation Selection, Calibration and Operation

Duratek has selected instruments proven to reliably detect the radionuclides present at the facility. Duratek will calibrate instruments or qualified vendors under approved procedures using calibration sources traceable to the National Institute of Standards and Technology (NIST).

All instruments and detectors will be inspected and source checked daily when in use to verify proper operation. Control charts and/or source check criteria will be established at the beginning of the project for reference.

Procedures for calibration, maintenance, accountability, operation and quality control of radiation detection instruments implement the guidelines established in American National Standard Institute (ANSI) standard ANSI N323-1978 and ANSI N42.17A-1989.

8.5 Survey Documentation

Survey packages will be the primary method of controlling and tracking the hard copy records of survey results. Records of surveys will be documented and maintained in the survey package for each area according to Duratek procedures. Each survey measurement will be identified by the date, technician, instrument type and serial number, detector type and serial number, location code, type of measurement, mode of instrument operation, and Quality Control (QC) sample number, as applicable.

8.6 Chain of Custody

Procedures establish responsibility for the custody of samples from the time of collection until results are obtained. If samples are shipped off site for analysis, they will be accompanied by a chain-of-custody record to track each sample.

8.7 Records Management

Generation, handling and storage of survey data packages are controlled by an approved procedure.

8.8 Duplicate Review of Survey Results

The survey package and survey data from each area will be reviewed by two separate people to verify all documentation is complete and accurate. This will include the surveyor and either the Project Manager or his designee.

8.9 Sample Analysis

Duratek will perform quality assurance and quality control checks on 5% of all sample analyses (except smears). This will consist of the analysis of split and/or duplicate samples. Split samples will be analyzed if an ample amount of material is collected in a sample. The sample will be homogenized and split into two separate samples for analysis. Duplicate analysis will be performed on samples where there was not enough material collected to prepare two separate samples. The same sample will be analyzed twice at different times and different detectors

if possible to check the quality of the analyses.

9.0 SURVEY REPORT

Duratek may begin preparing the Survey Report during the surveys. General information can be drafted early to expedite report preparation when work is completed. The report will contain brief descriptions of the site and the surveys performed, photographs of the survey and sample locations as necessary and survey results in tabular and graphical form.

Duratek will submit a draft report for comment after completing site activities and receiving all sample analyses. The final report will be submitted following resolution of all comments.

10.0 REFERENCES

- 10.1 NUREG-1575, *Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)*, December 1997
- 10.2 NUREG-1727, *MNSS Decommissioning Standard Review Plan*, September 2000
- 10.3 Draft NUREG-1549, *Using Decision Methods for Dose Assessment to Comply with Radiological Criteria for License Termination*
- 10.4 Federal Register, Volume 63, No. 222, Wednesday, November 18, 1998, pages 64132-64134
- 10.5 USNRC, DandD code, Version 1.0
- 10.6 RESRAD BUILD Version 3.0
- 10.7 RESRAD Version 5.82
- 10.8 10 CFR20, *Standards for Protection Against Radiation*
- 10.9 *Decommissioning Plan for Building 611B, Picatinny Arsenal-ARDEC*, Duratek, October 1999
- 10.10 *Report of Radiological Characterization, Building 611B, ARDEC-Picatinny Arsenal*, GPI, May, 1997

ATTACHMENT A

Values for N/2 for a Given Relative Shift (Δ/σ) and decision errors α and β when a Contaminant is Present in the Background.

	$\alpha=0.01$					$\alpha=0.025$					$\alpha=0.05$					$\alpha=0.1$					$\alpha=0.25$				
	β					β					β					β					B				
	0.01	0.025	0.05	0.1	0.25	0.01	0.025	0.05	0.1	0.25	0.01	0.025	0.05	0.1	0.25	0.01	0.025	0.05	0.1	0.25	0.01	0.025	0.05	0.1	0.25
0.1	5452	4627	3972	3278	2268	4627	3870	3273	2646	1748	3972	3273	2726	2157	1355	3278	2646	2157	1655	964	2268	1748	1355	964	459
0.2	1370	1163	998	824	370	1163	973	823	665	440	998	823	685	542	341	824	665	542	416	243	570	440	341	243	116
0.3	614	521	448	670	256	521	436	369	298	197	448	359	307	243	153	370	298	243	187	109	256	197	153	109	52
0.4	350	297	255	211	146	297	248	210	170	112	255	210	175	139	87	211	170	139	106	62	146	112	87	62	30
0.5	227	193	166	137	95	193	162	137	111	73	166	137	114	90	57	137	111	90	69	41	95	73	57	41	20
0.6	161	137	117	97	67	137	114	97	78	52	117	97	81	64	40	97	78	64	49	29	67	52	40	29	14
0.7	121	103	88	73	51	103	86	73	59	39	88	73	61	48	30	73	59	46	37	22	51	39	30	22	11
0.8	95	81	69	57	40	81	68	57	46	31	69	57	48	38	24	57	46	38	29	17	40	31	24	17	8
0.9	77	66	56	47	32	66	55	46	38	25	56	46	39	31	20	47	38	31	24	14	32	25	20	14	7
1.0	64	55	47	39	27	55	46	39	32	21	47	39	32	26	16	39	32	28	20	12	27	21	16	12	6
1.1	55	47	40	33	23	47	39	33	27	18	40	33	28	22	14	33	27	22	17	10	23	18	14	10	5
1.2	48	41	35	29	20	41	34	29	24	16	35	29	24	19	12	29	24	19	15	9	20	16	12	9	4
1.3	43	36	31	26	18	36	30	26	21	14	31	26	22	17	11	28	21	17	13	8	18	14	11	8	4
1.4	38	32	28	23	16	32	27	23	19	13	28	23	19	15	10	23	19	15	12	7	16	13	10	7	4
1.5	35	30	25	21	15	30	25	21	17	11	25	21	18	14	9	21	17	14	11	7	15	11	9	7	3
1.6	32	27	23	19	14	27	23	19	16	11	23	19	16	13	8	19	16	13	10	6	14	11	8	6	3
1.7	30	25	22	18	13	25	21	18	15	10	22	18	15	12	8	18	15	12	9	6	13	10	8	6	3
1.8	28	24	20	17	12	24	20	17	14	9	20	17	14	11	7	17	14	11	9	5	12	9	7	5	3
1.9	26	22	19	16	11	22	19	16	13	9	19	16	13	11	7	16	13	11	8	5	11	9	7	5	3
2.0	25	21	18	15	11	21	18	15	12	8	18	15	13	10	7	15	12	10	8	5	11	8	7	5	3
2.25	22	19	16	14	10	19	18	14	11	8	16	14	11	9	6	14	11	9	7	4	10	8	6	4	2
2.5	21	18	15	13	9	18	15	13	10	7	15	13	11	9	6	13	10	9	7	4	9	7	6	4	2
2.75	20	17	15	12	9	17	14	12	10	7	15	12	10	8	5	12	10	8	6	4	9	7	5	4	2
3.0	19	16	14	12	8	16	14	12	10	6	14	12	10	8	5	12	10	8	6	4	8	6	5	4	2
3.5	18	16	13	11	8	16	13	11	9	6	13	11	9	8	5	11	9	8	6	4	8	6	5	4	2
4.0	18	15	13	11	8	15	13	11	9	6	13	11	9	7	5	11	9	7	6	4	8	6	5	4	2

ATTACHMENT B

Values for N for a Given Relative Shift (Δ/σ) and decision errors α and β when a Contaminant is NOT Present in the Background.

	$\alpha=0.01$					$\alpha=0.025$					$\alpha=0.05$					$\alpha=0.1$					$\alpha=0.25$				
	β					β					β					β					β				
	0.01	0.025	0.05	0.1	0.25	0.01	0.025	0.05	0.1	0.25	0.01	0.025	0.05	0.1	0.25	0.01	0.025	0.05	0.1	0.25	0.01	0.025	0.05	0.1	0.25
0.1	4095	3476	2984	2463	1704	3476	2907	2459	1989	1313	2984	2459	2048	1620	1018	2463	1989	1620	1244	725	1704	1313	1018	725	345
0.2	1035	879	754	623	431	879	735	622	503	333	754	622	518	410	258	623	503	410	315	184	431	333	258	184	88
0.3	468	398	341	282	195	398	333	281	227	150	341	281	234	185	117	282	227	185	143	83	195	150	117	83	40
0.4	270	230	197	162	113	230	191	162	131	87	197	162	136	107	68	162	131	107	82	48	113	87	68	48	23
0.5	178	152	130	107	75	152	126	107	87	58	130	107	89	71	45	107	87	71	54	33	75	58	45	33	16
0.6	129	110	94	77	54	110	92	77	63	42	94	77	65	52	33	77	63	52	40	23	54	42	33	23	11
0.7	99	83	72	59	41	83	70	59	48	33	72	59	50	40	26	59	48	40	30	18	41	33	26	18	9
0.8	80	68	58	48	34	68	57	48	39	26	58	48	40	32	21	48	39	32	24	15	34	26	21	15	8
0.9	66	57	48	40	28	57	47	40	33	22	48	40	34	27	17	40	33	27	21	12	28	22	17	12	6
1.0	57	48	41	34	24	48	40	34	28	18	41	34	29	23	15	34	28	23	18	11	24	18	15	11	5
1.1	50	42	36	30	21	42	35	30	24	17	36	30	26	21	14	30	24	21	16	10	21	17	14	10	5
1.2	45	38	33	27	20	38	32	27	22	15	33	27	23	18	12	27	22	18	15	9	20	15	12	9	5
1.3	41	35	30	26	17	35	29	24	21	14	30	24	21	17	11	26	21	17	14	8	17	14	11	8	4
1.4	38	33	28	23	16	33	27	23	18	12	28	23	20	16	10	23	18	16	12	8	16	12	10	8	4
1.5	35	30	27	22	15	30	26	22	17	12	27	22	18	15	10	22	17	15	11	8	15	12	10	8	4
1.6	34	29	24	21	15	29	24	21	17	11	24	21	17	14	9	21	17	14	11	6	15	11	9	6	4
1.7	33	28	24	20	14	28	23	20	16	11	24	20	17	14	9	20	16	14	10	6	14	11	9	6	4
1.8	32	27	23	20	14	27	22	20	16	11	23	20	16	12	9	20	16	12	10	6	14	11	9	6	4
1.9	30	26	22	18	14	26	22	18	15	10	22	18	16	12	9	18	15	12	10	6	14	10	9	6	4
2.0	29	26	22	18	12	26	21	18	15	10	22	18	15	12	8	18	15	12	10	6	12	10	8	6	3
2.5	28	23	21	17	12	23	20	17	14	10	21	17	15	11	8	17	14	11	9	5	12	10	8	5	3
3.0	27	23	20	17	12	23	20	17	14	9	20	17	14	11	8	17	14	11	9	5	12	9	8	5	3

ATTACHMENT C
RESRAD-BUILD Version 3.0 Run

Title : PICITTINY

Input File : sitel.inp

```

iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
fff                                                                    fff
fff      RESRAD-BUILD Table of Contents      fff
fff                                                                    fff
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii

```

Input Parameters.....	0-1
For Each Time (I) :.....	
Time Specific Parameters.....	I-1
Receptor-Source Dose Summary.....	I-2
Dose by Pathway Detail.....	I-3
Dose by Nuclide Detail.....	I-4
Full Summary.....	F-1

```

iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iii
iii      RESRAD-BUILD Input Parameters      iii
iii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
  
```

```

Number of Sources : 1
Number of Receptors: 1
Total Time : 2.500000E+02 days
Fraction Inside : 3.300000E-01
  
```

iiiiiiiiiii Receptor Information iiiiiiiiiiii

Receptor	Room	x [m]	y [m]	z [m]	FracTime	Inhalation [m3/day]	Ingestion(Dust) [m2/hr]
1	1	1.000	1.000	1.000	1.000	1.80E+01	1.00E-04

iii Receptor-Source Shielding Relationship iii

Receptor	Source	Density [g/cm3]	Thickness [cm]	Material
1	1	2.40E+00	0.00E+00	Concrete

iiiiiiii Building Information iiiiiiii

Building Air Exchange Rate: 8.00E-01 1/hr

Height[m]	Air Exchanges [m3/hr]	
Area [m2]		

	*	*
	*	*
	*	<=Q01: 7.20E+01
H1: 2.500	Room 1	Q10 : 7.20E+01
	LAMBDA: 8.00E-01	
Area 36.000	*	*
	*	*

Deposition velocity: 1.00E-02 [m/s] Resuspension Rate: 5.00E-07 [1/s]

Source Information

Source: 1

Location:: Room : 1 x: 0.00 y: 0.00 z: 0.00[m]
 Geometry:: Type: Area Area:3.60E+01 [m2] Direction: x
 Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 1.000E-01
 Removable fraction: 1.000E-01
 Time to Remove: 3.650E+02 [day]
 Radon Release Fraction: 1.000E-01

Contamination::

Nuclide Concentration

Dose Conversion Factors

AA

	Ingestion	Inhalation	External (Surface)	External (Volume)	Submersion
[pCi/m2]	[mrem/pCi]	[mrem/pCi]	[mrem/yr/ (pCi/m2)]	[mrem/yr/ (pCi/m3)]	[mrem/yr/ (pCi/m3)]

U-238	6.820E+01	2.690E-04	1.180E-01	3.530E-06	9.510E-08	1.600E-04
U-235	1.300E+00	2.670E-04	1.230E-01	1.950E-05	4.740E-07	9.030E-04
U-234	3.050E+01	2.830E-04	1.320E-01	8.750E-08	2.520E-10	8.930E-07
PA-231	0.000E+00	1.060E-02	1.280E+00	4.760E-06	1.190E-07	2.010E-04
TH-230	0.000E+00	5.480E-04	3.260E-01	8.780E-08	7.570E-10	2.040E-06
AC-227	0.000E+00	1.480E-02	6.720E+00	4.530E-05	1.260E-06	2.160E-03
RA-226	0.000E+00	1.330E-03	8.600E-03	1.940E-04	7.000E-06	1.040E-02
PB-210	0.000E+00	7.270E-03	2.320E-02	4.140E-07	3.820E-09	1.430E-05

Title : PICITTINY

Input File : sitel.inp

Evaluation Time: 0.000000 years

```

iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
fff      Assessment for Time: 1      fff
fff      Time =0.00E+00 yr      fff
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
    
```

iiiiiiii Source Information iiii

Source: 1

```

Location:: Room : 1 x: 0.00 y: 0.00 z: 0.00 [m]
Geometry:: Type: Area Area:3.60E+01 [m2] Direction: x
Pathway ::
  Direct Ingestion Rate: 0.000E+00 [1/hr]
  Fraction released to air: 1.000E-01
  Removable fraction: 0.000E+00
  Time to Remove: 3.650E+02 [day]
    
```

Contamination::	Nuclide	Concentration [pCi/m2]
	U-238	6.586E+01
	U-235	1.255E+00
	U-234	2.946E+01
	PA-231	8.983E-06
	TH-230	8.967E-05
	AC-227	6.463E-08
	RA-226	8.810E-09
	PB-210	4.636E-11

Title : PICITTINY

Input File : sitel.inp Evaluation Time: 0.000000 years

```

iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iii
iii RESRAD-BUILD Dose Tables iii
iii iii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii

```

Source Contributions to Receptor Doses

ii

[mrem]

	Source	Total
	1	
Receptor 1	1.0E-02	1.0E-02
Total	1.0E-02	1.0E-02

Title : PICITTINY

Input File : sitel.inp

Evaluation Time: 0.000000 years

Pathway Detail of Doses

ii

[mrem]

Source: 1

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	1.26E-05	1.53E-07	1.56E-09	1.04E-02	1.25E-14	6.18E-05
Total	1.26E-05	1.53E-07	1.56E-09	1.04E-02	1.25E-14	6.18E-05

[mrem]

Source: 1

Nuclide	Receptor 1	Total
U-238		
U-238	6.87E-03	6.87E-03
U-234	7.45E-09	7.45E-09
TH-230	2.83E-14	2.83E-14
RA-226	7.93E-20	7.93E-20
PB-210	0.00E+00	0.00E+00
U-235		
U-235	1.37E-04	1.37E-04
PA-231	8.70E-09	8.70E-09
AC-227	3.14E-10	3.14E-10
U-234		
U-234	3.43E-03	3.43E-03
TH-230	2.17E-08	2.17E-08
RA-226	1.62E-13	1.62E-13
PB-210	1.43E-15	1.43E-15

Title : PICITTINY

Input File : sitel.inp

Evaluation Time: 1.00000 years

```

iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iii      Assessment for Time: 2      iii
iii      Time =1.00E+00 yr      iii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
    
```

iiiiiiii Source Information iiii

Source: 1

```

Location:: Room : 1 x: 0.00 y: 0.00 z: 0.00 [m]
Geometry:: Type: Area      Area:3.60E+01 [m2] Direction: x
Pathway ::
  Direct Ingestion Rate: 0.000E+00 [1/hr]
  Fraction released to air: 1.000E-01
  Removable fraction: 0.000E+00
  Time to Remove: 3.650E+02 [day]
    
```

Contamination::	Nuclide	Concentration [pCi/m2]
	U-238	6.138E+01
	U-235	1.170E+00
	U-234	2.745E+01
	PA-231	3.323E-05
	TH-230	3.317E-04
	AC-227	7.455E-07
	RA-226	1.027E-07
	PB-210	1.583E-09

Title : PICITTINY

Input File : sitel.inp

Evaluation Time:

1.00000

years

```

ffffffffffffffffffffffffffffffffffffffff
ffffffffffffffffffffffffffffffffffffffff
fff                                     fff
fff      RESRAD-BUILD Dose Tables      fff
fff                                     fff
ffffffffffffffffffffffffffffffffffffffff
. ffffffffffffffffffffffffffffffffffffffff
    
```

Source Contributions to Receptor Doses

ffffffffffffffffffffffffffffffff

[mrem]

	Source	Total
	1	
Receptor 1	1.2E-05	1.2E-05
Total	1.2E-05	1.2E-05

Title : PICITTINY

Input File : sitel.inp

Evaluation Time: 1.00000 years

Pathway Detail of Doses
iiiiiiiiiiiiiiiiiiiiiiiiiiiiii
[mrem]

Source: 1

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	1.17E-05	0.00E+00	0.00E+00	0.00E+00	1.46E-13	0.00E+00
Total	1.17E-05	0.00E+00	0.00E+00	0.00E+00	1.46E-13	0.00E+00

Title : PICITTINY

Input File : sitel.inp

Evaluation Time:

1.00000

years

Nuclide Detail of Doses

ffffffffffffffffffffffff

[mrem]

Source: 1

Nuclide	Receptor	Total
	1	
U-238		
U-238	1.04E-05	1.04E-05
U-234	2.65E-12	2.65E-12
TH-230	1.13E-17	1.13E-17
RA-226	3.25E-18	3.25E-18
PB-210	0.00E+00	0.00E+00
U-235		
U-235	1.04E-06	1.04E-06
PA-231	8.83E-12	8.83E-12
AC-227	1.58E-12	1.58E-12
U-234		
U-234	3.12E-07	3.12E-07
TH-230	2.66E-12	2.66E-12
RA-226	1.13E-12	1.13E-12
PB-210	5.92E-17	5.92E-17

Title : PICITTINY

Input File : sitel.inp Evaluation Time: 2.00000 years

```

iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
fff          Assessment for Time: 3          fff
fff          Time =2.00E+00 yr          fff
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii

```

iiiiiiii Source Information iiiiiiii

Source: 1

Location:: Room : 1 x: 0.00 y: 0.00 z: 0.00 [m]
Geometry:: Type: Area Area:3.60E+01 [m2] Direction: x
Pathway ::
 Direct Ingestion Rate: 0.000E+00 [1/hr]
 Fraction released to air: 1.000E-01
 Removable fraction: 0.000E+00
 Time to Remove: 3.650E+02 [day]

Contamination::	Nuclide	Concentration [pCi/m2]
	U-238	6.138E+01
	U-235	1.170E+00
	U-234	2.745E+01
	PA-231	5.798E-05
	TH-230	5.788E-04
	AC-227	2.156E-06
	RA-226	2.998E-07
	PB-210	7.436E-09

Title : PICITTINY

Input File : sitel.inp

Evaluation Time:

2.00000

years

```

iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iii                                     iii
iii      RESRAD-BUILD Dose Tables      iii
iii                                     iii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
    
```

Source Contributions to Receptor Doses

ii

[mrem]

	Source	Total
	1	
Receptor 1	1.2E-05	1.2E-05
Total	1.2E-05	1.2E-05

Title : PICITTINY

Input File : sitel.inp

Evaluation Time: 2.00000 years

Pathway Detail of Doses
iiiiiiiiiiiiiiiiiiiiiiiiiiiiii
[mrem]

Source: 1

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	1.17E-05	0.00E+00	0.00E+00	0.00E+00	4.27E-13	0.00E+00
Total	1.17E-05	0.00E+00	0.00E+00	0.00E+00	4.27E-13	0.00E+00

Title : PICITTINY

Input File : sitel.inp

Evaluation Time: 2.00000 years

Nuclide Detail of Doses

iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii

[mrem]

Source: 1

Nuclide	Receptor	Total
	1	
U-238		
U-238	1.04E-05	1.04E-05
U-234	4.63E-12	4.63E-12
TH-230	3.45E-17	3.45E-17
RA-226	1.64E-17	1.64E-17
PB-210	1.04E-21	1.04E-21
U-235		
U-235	1.04E-06	1.04E-06
PA-231	1.54E-11	1.54E-11
AC-227	4.56E-12	4.56E-12
U-234		
U-234	3.12E-07	3.12E-07
TH-230	4.64E-12	4.64E-12
RA-226	3.31E-12	3.31E-12
PB-210	2.78E-16	2.78E-16

Title : PICITTINY

Input File : sitel.inp

Evaluation Time:

5.00000

years

```

ffffffffffffffffffffffffffffffffffffffff
ffffffffffffffffffffffffffffffffffffffff
fff      Assessment for Time: 4      fff
fff      Time =5.00E+00 yr      fff
ffffffffffffffffffffffffffffffffffffffff
ffffffffffffffffffffffffffffffffffffffff
    
```

ffffff Source Information fffffff

Source: 1

```

Location:: Room : 1 x: 0.00 y: 0.00 z: 0.00 [m]
Geometry:: Type: Area Area:3.60E+01 [m2] Direction: x
Pathway ::
  Direct Ingestion Rate: 0.000E+00 [1/hr]
  Fraction released to air: 1.000E-01
  Removable fraction: 0.000E+00
  Time to Remove: 3.650E+02 [day]
    
```

Contamination::	Nuclide	Concentration [pCi/m2]
	U-238	6.138E+01
	U-235	1.170E+00
	U-234	2.745E+01
	PA-231	1.322E-04
	TH-230	1.320E-03
	AC-227	1.069E-05
	RA-226	1.533E-06
	PB-210	8.206E-08

Title : PICITTINY

Input File : sitel.inp

Evaluation Time:

5.00000

years

```

iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
fff                                                                    fff
fff          RESRAD-BUILD Dose Tables                                fff
fff                                                                    fff
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
    
```

Source Contributions to Receptor Doses

ii

[mrem]

	Source	Total
	1	
Receptor 1	1.2E-05	1.2E-05
Total	1.2E-05	1.2E-05

Title : PICITTINY

Input File : sitel.inp Evaluation Time: 5.00000 years

Pathway Detail of Doses
 ffffffffffffffffffffffffff
 [mrem]

Source: 1

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	1.17E-05	0.00E+00	0.00E+00	0.00E+00	2.18E-12	0.00E+00
Total	1.17E-05	0.00E+00	0.00E+00	0.00E+00	2.18E-12	0.00E+00

Title : PICITTINY

Input File : sitel.inp

Evaluation Time:

5.00000

years

Nuclide Detail of Doses

ii

[mrem]

Source: 1

Nuclide	Receptor	Total
	1	
U-238		
U-238	1.04E-05	1.04E-05
U-234	1.06E-11	1.06E-11
TH-230	1.79E-16	1.79E-16
RA-226	1.91E-16	1.91E-16
PB-210	2.60E-20	2.60E-20
U-235		
U-235	1.04E-06	1.04E-06
PA-231	3.51E-11	3.51E-11
AC-227	2.26E-11	2.26E-11
U-234		
U-234	3.12E-07	3.12E-07
TH-230	1.06E-11	1.06E-11
RA-226	1.69E-11	1.69E-11
PB-210	3.07E-15	3.07E-15

Title : PICITTINY

Input File : sitel.inp Evaluation Time: 10.0000 years

```

iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iii      Assessment for Time: 5      iii
iii      Time =1.00E+01 yr      iii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
    
```

iiiiiiii Source Information iiii

Source: 1

```

Location:: Room : 1 x: 0.00 y: 0.00 z: 0.00 [m]
Geometry:: Type: Area Area:3.60E+01 [m2] Direction: x
Pathway ::
  Direct Ingestion Rate: 0.000E+00 [1/hr]
  Fraction released to air: 1.000E-01
  Removable fraction: 0.000E+00
  Time to Remove: 3.650E+02 [day]
    
```

Contamination::	Nuclide	Concentration [pCi/m2]
	U-238	6.138E+01
	U-235	1.170E+00
	U-234	2.745E+01
	PA-231	2.560E-04
	TH-230	2.556E-03
	AC-227	3.797E-05
	RA-226	5.723E-06
	PB-210	5.682E-07

Title : PICITTINY

Input File : sitel.inp Evaluation Time: 10.0000 years

```

iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iii
iii RESRAD-BUILD Dose Tables iii
iii iii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
    
```

Source Contributions to Receptor Doses

ii

[mrem]

	Source	Total
	1	
Receptor 1	1.2E-05	1.2E-05
Total	1.2E-05	1.2E-05

Title : PICITTINY

Input File : sitel.inp

Evaluation Time: 10.0000 years

Pathway Detail of Doses
ffffffffffffffffffffffff
[mrem]

Source: 1

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	1.17E-05	0.00E+00	0.00E+00	0.00E+00	8.15E-12	0.00E+00
Total	1.17E-05	0.00E+00	0.00E+00	0.00E+00	8.15E-12	0.00E+00

Title : PICITTINY

Input File : sitel.inp

Evaluation Time: 10.0000 years

Nuclide Detail of Doses

ffffffffffffffffffffffff

[mrem]

Source: 1

Nuclide	Receptor	Total
	1	
U-238		
U-238	1.04E-05	1.04E-05
U-234	2.04E-11	2.04E-11
TH-230	6.72E-16	6.72E-16
RA-226	1.38E-15	1.38E-15
PB-210	3.54E-19	3.54E-19
U-235		
U-235	1.04E-06	1.04E-06
PA-231	6.80E-11	6.80E-11
AC-227	8.03E-11	8.03E-11
U-234		
U-234	3.12E-07	3.12E-07
TH-230	2.05E-11	2.05E-11
RA-226	6.31E-11	6.31E-11
PB-210	2.13E-14	2.13E-14

Title : PICITTINY

Input File : sitel.inp Evaluation Time: 100.000 years

```

iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
ííí Assessment for Time: 6 ííí
ííí Time =1.00E+02 yr ííí
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
    
```

íííííííí Source Information íííííííí

Source: 1

```

Location:: Room : 1 x: 0.00 y: 0.00 z: 0.00 [m]
Geometry:: Type: Area Area:3.60E+01 [m2] Direction: x
Pathway ::
Direct Ingestion Rate: 0.000E+00 [1/hr]
Fraction released to air: 1.000E-01
Removable fraction: 0.000E+00
Time to Remove: 3.650E+02 [day]
    
```

Contamination::	Nuclide	Concentration [pCi/m2]
	U-238	6.138E+01
	U-235	1.170E+00
	U-234	2.746E+01
	PA-231	2.481E-03
	TH-230	2.479E-02
	AC-227	1.738E-03
	RA-226	5.311E-04
	PB-210	2.956E-04

Title : PICITTINY

Input File : sitel.inp Evaluation Time: 100.000 years

```

iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iii
iii RESRAD-BUILD Dose Tables iii
iii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii

```

Source Contributions to Receptor Doses

ii

[mrem]

	Source	Total
	1	
Receptor 1	1.2E-05	1.2E-05
Total	1.2E-05	1.2E-05

Title : PICITTINY

Input File : sitel.inp

Evaluation Time: 100.000 years

Pathway Detail of Doses
iiiiiiiiiiiiiiiiiiiiiiiiiiiiii
[mrem]

Source: 1

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	1.17E-05	0.00E+00	0.00E+00	0.00E+00	7.56E-10	0.00E+00
Total	1.17E-05	0.00E+00	0.00E+00	0.00E+00	7.56E-10	0.00E+00

Title : PICITTINY

Input File : sitel.inp

Evaluation Time:

100.000

years

Nuclide Detail of Doses

iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii

[mrem]

Source: 1

Nuclide	Receptor	Total
	1	
U-238		
U-238	1.04E-05	1.04E-05
U-234	1.98E-10	1.98E-10
TH-230	6.32E-14	6.32E-14
RA-226	1.25E-12	1.25E-12
PB-210	1.97E-15	1.97E-15
U-235		
U-235	1.04E-06	1.04E-06
PA-231	6.59E-10	6.59E-10
AC-227	3.67E-09	3.67E-09
U-234		
U-234	3.12E-07	3.12E-07
TH-230	1.99E-10	1.99E-10
RA-226	5.85E-09	5.85E-09
PB-210	1.11E-11	1.11E-11

Title : PICITTINY

Input File : sitel.inp Evaluation Time: 1000.00 years

```

iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iii      Assessment for Time: 7      iii
iii      Time =1.00E+03 yr      iii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii
iiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiiii

```

iiiiiiii Source Information iiii

Source: 1

```

Location:: Room : 1 x: 0.00 y: 0.00 z: 0.00 [m]
Geometry:: Type: Area Area:3.60E+01 [m2] Direction: x
Pathway ::
  Direct Ingestion Rate: 0.000E+00 [1/hr]
  Fraction released to air: 1.000E-01
  Removable fraction: 0.000E+00
  Time to Remove: 3.650E+02 [day]

```

Contamination::	Nuclide	Concentration [pCi/m2]
	U-238	6.138E+01
	U-235	1.170E+00
	U-234	2.755E+01
	PA-231	2.450E-02
	TH-230	2.465E-01
	AC-227	2.374E-02
	RA-226	4.651E-02
	PB-210	4.379E-02

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 fff RESRAD-BUILD Dose Tables fff
 fff
 ff
 ff

Source Contributions to Receptor Doses
 ffffffffffffffffffffffffffffff
 [mrem]

	Source	Total
	1	
Receptor 1	1.2E-05	1.2E-05
Total	1.2E-05	1.2E-05

Title : PICITTINY

Input File : sitel.inp

Evaluation Time: 1000.00 years

Pathway Detail of Doses
ffffffffffffffffffffffff
[mrem]

Source: 1

Receptor	External	Deposition	Immersion	Inhalation	Radon	Ingestion
1	1.22E-05	0.00E+00	0.00E+00	0.00E+00	6.62E-08	0.00E+00
Total	1.22E-05	0.00E+00	0.00E+00	0.00E+00	6.62E-08	0.00E+00

years

Nuclide Detail of Doses

iiiiiii

[mrem]

Source: 1

Nuclide	Receptor 1	Total
U-238		
U-238	1.04E-05	1.04E-05
U-234	1.98E-09	1.98E-09
TH-230	6.26E-12	6.26E-12
RA-226	1.12E-09	1.12E-09
PB-210	3.47E-12	3.47E-12
U-235		
U-235	1.04E-06	1.04E-06
PA-231	6.51E-09	6.51E-09
AC-227	5.02E-08	5.02E-08
U-234		
U-234	3.11E-07	3.11E-07
TH-230	1.97E-09	1.97E-09
RA-226	5.12E-07	5.12E-07
PB-210	1.64E-09	1.64E-09

(mrem)

(mrem/yr)

0.00E+00	1.00E+00	2.00E+00	5.00E+00	1.00E+01	1.00E+02	1.00E+03
1.53E-02	1.71E-05	1.71E-05	1.71E-05	1.71E-05	1.71E-05	1.80E-05

ATTACHMENT D
USNRC DandD Code Run
(Residential Scenario, Default Parameters)

Program : DandD Version 1.0 .
Session : Picatinny Guidelines
Description :
DU Surface contamination guidelines

Computed : 10/12/99 at 10:38:07

NRC Report

Residential Input Section

Execution Options

=====

History file will be generated.

Implicit progeny doses will not be included with explicit parent.

Concentration data will be calculated.

Initial Radionuclide Activities

=====

Chain pCi/gram

=====

234U 30.50

235U 1.30

238U 68.20

Code-Generated Radionuclide Activities

=====

Chain pCi/gram

=====

234U 3.0500E+001

230Th 0.0000E+000

226Ra 0.0000E+000

222Rn 0.0000E+000

218Po 0.0000E+000

214Pb 0.0000E+000

218At 0.0000E+000

214Bi 0.0000E+000

214Po 0.0000E+000

210Pb 0.0000E+000

210Bi 0.0000E+000

210Po 0.0000E+000

235U 1.3000E+000

231Th 0.0000E+000

231Pa 0.0000E+000

227Ac 0.0000E+000

223Fr 0.0000E+000

227Th 0.0000E+000

223Ra 0.0000E+000

219Rn 0.0000E+000

215Po 0.0000E+000

211Pb 0.0000E+000

211Bi 0.0000E+000

211Po 0.0000E+000

207Tl 0.0000E+000

238U 6.8200E+001

234Th	0.0000E+000
234mPa	0.0000E+000
234Pa	0.0000E+000
234U	0.0000E+000
230Th	0.0000E+000
226Ra	0.0000E+000
222Rn	0.0000E+000
218Po	0.0000E+000
214Pb	0.0000E+000
218At	0.0000E+000
214Bi	0.0000E+000
214Po	0.0000E+000
210Pb	0.0000E+000
210Bi	0.0000E+000
210Po	0.0000E+000

Basic Parameters

Name	Value	Units	Default
'Floor Dust'	0.1599	g/m ²	0.1599
'Unsaturated Zone'	1.2288	m	1.2288
'Layer Porosity'	0.4599	None	0.4599
'Unsaturated Porosity'	0.4599	None	0.4599
'Surface Layer Ratio'	0.1626	None	0.1626
'Unsaturated Ratio'	0.1626	None	0.1626
'Infiltration Rate'	0.2526	m/year	0.2526

Residential Output Section

Maximum Annual TEDE

This scenario started 0.00 year(s) from now
and ran for 1000.00 year(s).

The peak dose of 5.13E+003 TEDE (mrem) occurred 4.00 year(s) after
license termination.

Pathway Component of Maximum Annual Dose

Pathway	TEDE (mrem)	Percentage
External	3.28E-001	0.01
Residential	5.33E-002	0.00
Agricult.	8.98E+000	0.18
Soil	2.73E-002	0.00
Drinking	1.23E+003	23.96
Irrigated	2.55E+003	49.80
Aquatic	1.34E+003	26.06

Total 5.13E+003 100.00

Radionuclide Component of
Maximum Annual Dose

```
=====
Radionuclide      TEDE (mrem)      Percentage
=====
234U              1.62E+003      31.52
230Th              3.87E-002      0.00
226Ra              3.35E-005      0.00
222Rn              2.04E-010      0.00
218Po              4.73E-012      0.00
214Pb              1.35E-007      0.00
218At              0.00E+000      0.00
214Bi              7.91E-007      0.00
214Po              4.31E-011      0.00
210Pb              5.29E-006      0.00
210Bi              4.50E-009      0.00
210Po              2.80E-006      0.00
235U              6.47E+001      1.26
231Th              4.07E-001      0.01
231Pa              1.00E-001      0.00
227Ac              4.19E-003      0.00
223Fr              3.65E-008      0.00
227Th              1.40E-005      0.00
223Ra              2.10E-004      0.00
219Rn              1.05E-007      0.00
215Po              3.38E-010      0.00
211Pb              2.66E-007      0.00
211Bi              8.66E-008      0.00
211Po              4.27E-011      0.00
207Tl              6.43E-009      0.00
238U              3.24E+003      63.29
234Th              2.01E+002      3.91
234mPa             1.88E-001      0.00
234Pa              1.12E-001      0.00
-----
Total              5.13E+003      100.00
```

ATTACHMENT E
RESRAD Version 5.82 Code Runs
(Residential Scenario, Default Parameters)

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Time = 1.000E+01	13
Time = 3.000E+01	14
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Dose Conversion Factor (and Related) Parameter Summary
 File: DOSFAC.BIN

Menu	Parameter	Current Value	Default	Parameter Name
-1	Dose conversion factors for inhalation, mrem/pCi:			
-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
-1	Pa-231	1.280E+00	1.280E+00	DCF2(2)
-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(3)
-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(4)
-1	Th-230	3.260E-01	3.260E-01	DCF2(5)
-1	U-234	1.320E-01	1.320E-01	DCF2(6)
-1	U-235+D	1.230E-01	1.230E-01	DCF2(7)
-1	U-238+D	1.180E-01	1.180E-01	DCF2(8)
-1	Dose conversion factors for ingestion, mrem/pCi:			
-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
-1	Pa-231	1.060E-02	1.060E-02	DCF3(2)
-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(3)
-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(4)
-1	Th-230	5.480E-04	5.480E-04	DCF3(5)
-1	U-234	2.830E-04	2.830E-04	DCF3(6)
-1	U-235+D	2.670E-04	2.670E-04	DCF3(7)
-1	U-238+D	2.690E-04	2.690E-04	DCF3(8)
-34	Food transfer factors:			
-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(2,2)
-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(2,3)
-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(3,1)
-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(3,2)
-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(3,3)
-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(5,1)
-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(5,2)
-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(5,3)
-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(6,2)
-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(6,3)
-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(7,1)
-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(7,2)
-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(7,3)

Dose Conversion Factor (and Related) Parameter Summary (continued)
 File: DOSFAC.BIN

Menu	Parameter	Current Value	Default	Parameter Name
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(8,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(8,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(8,3)
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)
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	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	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	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	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(8,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(8,2)

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.000E+04	1.000E+04	----	AREA
R011	Thickness of contaminated zone (m)	2.000E+00	2.000E+00	----	THICK0
R011	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	----	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	3.000E+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)	4.000E+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): U-234	3.050E+01	0.000E+00	----	S1(6)
R012	Initial principal radionuclide (pCi/g): U-235	1.300E+00	0.000E+00	----	S1(7)
R012	Initial principal radionuclide (pCi/g): U-238	6.820E+01	0.000E+00	----	S1(8)
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 effective porosity	2.000E-01	2.000E-01	----	EPCZ
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 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
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	----	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	----	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	----	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	----	UW

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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, 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 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)
R016	Distribution coefficients for daughter 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 daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(3)
R016	Unsat. 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)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC (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	5.000E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	2.500E-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 (
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE (
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE (
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE (
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE (
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE (
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE (
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE (
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE (
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE (
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE (1
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE (1
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)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R018	Leafy vegetable consumption (kg/yr)	1.400E+01	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	9.200E+01	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	6.300E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	5.400E+00	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	5.100E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT
R018	Contamination fraction of meat	-1	-1	0.500E+00	FMEAT
R018	Contamination fraction of milk	-1	-1	0.500E+00	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LF15
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LF16
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LW15
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LW16
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	1.000E+00	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	1.100E+00	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)	8.000E-02	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	1.000E+00	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	2.500E-01	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	2.500E-01	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

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
TOR	Storage times of contaminated foodstuffs (days):				
TOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
TOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
TOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
TOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
TOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
TOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
TOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
TOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
TOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR
021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
021	Diffusion coefficient for radon gas (m/sec):				
021	in cover material	not used	2.000E-06	---	DIFCV
021	in foundation material	not used	3.000E-07	---	DIFFL
021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
021	Building interior area factor	not used	0.000E+00	---	FAI
021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)

Summary of Pathway Selections

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

Contaminated Zone Dimensions

Area: 10000.00 square meters
 Thickness: 2.00 meters
 Cover Depth: 0.00 meters

Initial Soil Concentrations, pCi/g

U-234 3.050E+01
 U-235 1.300E+00
 U-238 6.820E+01

Total Dose TDOSE(t), mrem/yr

Basic Radiation Dose Limit = 30 mrem/yr

Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+00	4.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
TDOSE(t):	1.401E+01	1.396E+01	1.383E+01	1.356E+01	1.269E+01	1.009E+01	5.359E+00	1.006E+02
M(t):	4.670E-01	4.655E-01	4.609E-01	4.519E-01	4.232E-01	3.364E-01	1.786E-01	3.353E+00

Maximum TDOSE(t): 1.006E+02 mrem/yr at t = 1.000E+03 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
U-234	7.131E-03	0.0005	2.576E-01	0.0184	0.000E+00	0.0000	1.878E+00	0.1341	6.197E-02	0.0044	1.519E-01	0.0108	2.363E-01
U-235	5.621E-01	0.0401	1.023E-02	0.0007	0.000E+00	0.0000	7.553E-02	0.0054	2.492E-03	0.0002	6.110E-03	0.0004	9.502E-03
U-238	5.287E+00	0.3774	5.150E-01	0.0368	0.000E+00	0.0000	3.992E+00	0.2849	1.317E-01	0.0094	3.229E-01	0.0230	5.022E-01
Total	5.856E+00	0.4180	7.829E-01	0.0559	0.000E+00	0.0000	5.946E+00	0.4244	1.962E-01	0.0140	4.810E-01	0.0343	7.480E-01

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 Path
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
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	2.593E+00
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	6.660E-01
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	1.075E+01
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	1.401E+01

*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.	
U-234	7.108E-03	0.0005	2.568E-01	0.0184	0.000E+00	0.0000	1.872E+00	0.1341	6.178E-02	0.0044	1.514E-01	0.0108	2.355E-01
U-235	5.603E-01	0.0401	1.020E-02	0.0007	0.000E+00	0.0000	7.554E-02	0.0054	2.533E-03	0.0002	6.090E-03	0.0004	9.479E-03
U-238	5.269E+00	0.3773	5.133E-01	0.0368	0.000E+00	0.0000	3.979E+00	0.2850	1.313E-01	0.0094	3.219E-01	0.0231	5.006E-01
Total	5.837E+00	0.4180	7.803E-01	0.0559	0.000E+00	0.0000	5.927E+00	0.4244	1.956E-01	0.0140	4.794E-01	0.0343	7.455E-01

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 Path
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	
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	2.585E+00
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	6.641E-01
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	1.072E+01
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	1.396E+01

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
 As mrem/yr and Fraction of Total Dose At t = 4.000E+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
U-234	7.043E-03	0.0005	2.543E-01	0.0184	0.000E+00	0.0000	1.854E+00	0.1341	6.117E-02	0.0044	1.499E-01	0.0108	2.332E-01
U-235	5.547E-01	0.0401	1.011E-02	0.0007	0.000E+00	0.0000	7.556E-02	0.0055	2.669E-03	0.0002	6.030E-03	0.0004	9.411E-03
U-238	5.217E+00	0.3773	5.082E-01	0.0368	0.000E+00	0.0000	3.940E+00	0.2849	1.300E-01	0.0094	3.187E-01	0.0230	4.956E-01
Total	5.779E+00	0.4179	7.726E-01	0.0559	0.000E+00	0.0000	5.869E+00	0.4245	1.938E-01	0.0140	4.747E-01	0.0343	7.382E-01

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
 As mrem/yr and Fraction of Total Dose At t = 4.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Path
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
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	2.559E+00
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	6.585E-01
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	1.061E+01
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	1.383E+01

*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.	
U-234	6.936E-03	0.0005	2.493E-01	0.0184	0.000E+00	0.0000	1.817E+00	0.1340	5.996E-02	0.0044	1.470E-01	0.0108	2.286E-01
U-235	5.439E-01	0.0401	9.937E-03	0.0007	0.000E+00	0.0000	7.565E-02	0.0056	2.932E-03	0.0002	5.912E-03	0.0004	9.284E-03
U-238	5.114E+00	0.3772	4.982E-01	0.0367	0.000E+00	0.0000	3.862E+00	0.2849	1.274E-01	0.0094	3.124E-01	0.0230	4.858E-01
Total	5.665E+00	0.4179	7.574E-01	0.0559	0.000E+00	0.0000	5.755E+00	0.4245	1.903E-01	0.0140	4.653E-01	0.0343	7.237E-01

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 Path
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	
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	2.509E+00
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	6.476E-01
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	1.040E+01
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	1.356E+01

*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
U-234	6.778E-03	0.0005	2.334E-01	0.0184	0.000E+00	0.0000	1.701E+00	0.1340	5.612E-02	0.0044	1.375E-01	0.0108	2.140E-01
U-235	5.092E-01	0.0401	9.434E-03	0.0007	0.000E+00	0.0000	7.609E-02	0.0060	3.728E-03	0.0003	5.535E-03	0.0004	8.921E-03
U-238	4.786E+00	0.3770	4.662E-01	0.0367	0.000E+00	0.0000	3.615E+00	0.2847	1.193E-01	0.0094	2.924E-01	0.0230	4.547E-01
Total	5.302E+00	0.4176	7.090E-01	0.0559	0.000E+00	0.0000	5.392E+00	0.4247	1.791E-01	0.0141	4.355E-01	0.0343	6.776E-01

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 Path
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
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	2.349E+00
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	6.129E-01
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	9.733E+00
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	1.269E+01

*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.	
U-234	8.208E-03	0.0008	1.853E-01	0.0184	0.000E+00	0.0000	1.353E+00	0.1340	4.461E-02	0.0044	1.091E-01	0.0108	1.699E-01
U-235	4.050E-01	0.0401	8.044E-03	0.0008	0.000E+00	0.0000	7.645E-02	0.0076	5.689E-03	0.0006	4.400E-03	0.0004	7.899E-03
U-238	3.794E+00	0.3759	3.697E-01	0.0366	0.000E+00	0.0000	2.866E+00	0.2839	9.456E-02	0.0094	2.318E-01	0.0230	3.605E-01
Total	4.207E+00	0.4168	5.630E-01	0.0558	0.000E+00	0.0000	4.295E+00	0.4255	1.449E-01	0.0144	3.453E-01	0.0342	5.383E-01

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 Path
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	
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	1.870E+00
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	5.075E-01
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.716E+00
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	1.009E+01

*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.	
U-234	2.146E-02	0.0040	9.620E-02	0.0179	0.000E+00	0.0000	7.250E-01	0.1353	2.386E-02	0.0045	5.684E-02	0.0106	8.859E-02
U-235	2.107E-01	0.0393	5.059E-03	0.0009	0.000E+00	0.0000	6.368E-02	0.0119	6.939E-03	0.0013	2.286E-03	0.0004	5.362E-03
U-238	1.953E+00	0.3645	1.905E-01	0.0355	0.000E+00	0.0000	1.476E+00	0.2755	4.872E-02	0.0091	1.194E-01	0.0223	1.857E-01
Total	2.185E+00	0.4078	2.917E-01	0.0544	0.000E+00	0.0000	2.265E+00	0.4226	7.952E-02	0.0148	1.786E-01	0.0333	2.797E-01

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 Path
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	
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	1.012E+00
U-235	7.313E-02	0.0136	7.026E-04	0.0001	0.000E+00	0.0000	5.616E-03	0.0010	1.553E-05	0.0000	3.416E-05	0.0000	3.736E-01
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	3.974E+00
Total	7.313E-02	0.0136	7.026E-04	0.0001	0.000E+00	0.0000	5.616E-03	0.0010	1.553E-05	0.0000	3.416E-05	0.0000	5.359E+00

*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
U-234	6.510E-02	0.0006	1.096E-02	0.0001	0.000E+00	0.0000	1.795E-01	0.0018	5.782E-03	0.0001	8.191E-03	0.0001	1.198E-02
U-235	2.140E-02	0.0002	8.078E-04	0.0000	0.000E+00	0.0000	1.450E-02	0.0001	2.041E-03	0.0000	2.309E-04	0.0000	9.658E-04
U-238	1.914E-01	0.0019	1.870E-02	0.0002	0.000E+00	0.0000	1.451E-01	0.0014	4.786E-03	0.0000	1.172E-02	0.0001	1.823E-02
Total	2.779E-01	0.0028	3.047E-02	0.0003	0.000E+00	0.0000	3.391E-01	0.0034	1.261E-02	0.0001	2.015E-02	0.0002	3.118E-02

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 Path
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
U-234	2.768E+01	0.2751	3.430E-02	0.0003	0.000E+00	0.0000	2.129E+00	0.0212	1.028E-01	0.0010	3.877E-01	0.0039	3.061E+01
U-235	5.112E+00	0.0508	3.230E-02	0.0003	0.000E+00	0.0000	3.932E-01	0.0039	5.377E-02	0.0005	1.703E-02	0.0002	5.648E+00
U-238	5.836E+01	0.5802	6.181E-02	0.0006	0.000E+00	0.0000	4.489E+00	0.0446	2.125E-01	0.0021	8.204E-01	0.0082	6.433E+01
Total	9.115E+01	0.9061	1.284E-01	0.0013	0.000E+00	0.0000	7.012E+00	0.0697	3.690E-01	0.0037	1.225E+00	0.0122	1.006E+02

*Sum of all water independent and dependent pathways.

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

Parent (i)	Product (j)	Branch Fraction*	t=	0.000E+00	1.000E+00	4.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00		8.502E-02	8.475E-02	8.391E-02	8.225E-02	7.697E-02	6.100E-02	3.139E-02	9.837E-01
U-234	Th-230	1.000E+00		0.000E+00	7.916E-07	3.077E-06	7.580E-06	2.196E-05	6.535E-05	1.456E-04	2.272E-04
U-234	Ra-226	1.000E+00		0.000E+00	2.123E-08	3.465E-07	2.150E-06	1.862E-05	1.799E-04	1.099E-03	6.711E-03
U-234	Pb-210	1.000E+00		0.000E+00	1.782E-10	9.242E-09	1.303E-07	2.874E-06	6.122E-05	5.447E-04	1.303E-02
U-234	ΣDSR(j)			8.502E-02	8.475E-02	8.391E-02	8.226E-02	7.701E-02	6.130E-02	3.318E-02	1.004E+00
U-235	U-235	1.000E+00		5.123E-01	5.106E-01	5.056E-01	4.956E-01	4.638E-01	3.676E-01	1.893E-01	9.464E-01
U-235	Pa-231	1.000E+00		0.000E+00	2.367E-04	9.659E-04	2.381E-03	6.700E-03	1.771E-02	2.730E-02	8.057E-01
U-235	Ac-227	1.000E+00		0.000E+00	2.041E-06	2.771E-05	1.540E-04	1.032E-03	5.057E-03	7.079E-02	2.593E+00
U-235	ΣDSR(j)			5.123E-01	5.109E-01	5.066E-01	4.981E-01	4.715E-01	3.904E-01	2.874E-01	4.345E+00
U-238	U-238	1.000E+00		1.576E-01	1.571E-01	1.556E-01	1.525E-01	1.427E-01	1.131E-01	5.824E-02	9.405E-01
U-238	U-234	1.000E+00		0.000E+00	2.403E-07	9.515E-07	2.332E-06	6.546E-06	1.729E-05	2.671E-05	2.793E-03
U-238	Th-230	1.000E+00		0.000E+00	1.155E-12	1.755E-11	1.072E-10	9.192E-10	8.756E-09	5.185E-08	1.789E-07
U-238	Ra-226	1.000E+00		0.000E+00	1.974E-14	1.302E-12	2.022E-11	5.226E-10	1.645E-08	2.813E-07	7.816E-06
U-238	Pb-210	1.000E+00		0.000E+00	1.342E-16	2.696E-14	9.450E-13	6.345E-11	4.721E-09	1.286E-07	2.110E-05
U-238	ΣDSR(j)			1.576E-01	1.571E-01	1.556E-01	1.525E-01	1.427E-01	1.131E-01	5.827E-02	9.433E-01

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

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
 Basic Radiation Dose Limit = 30 mrem/yr

Nuclide (i)	t=	0.000E+00	1.000E+00	4.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234		3.528E+02	3.540E+02	3.575E+02	3.647E+02	3.896E+02	4.894E+02	9.042E+02	2.989E+01
U-235		5.856E+01	5.872E+01	5.922E+01	6.022E+01	6.363E+01	7.685E+01	1.044E+02	6.905E+00
U-238		1.903E+02	1.909E+02	1.928E+02	1.967E+02	2.102E+02	2.652E+02	5.148E+02	3.180E+01

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
 and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
 at tmin = time of minimum single radionuclide soil guideline
 and at tmax = time of maximum total dose = 1.000E+03 years

Nuclide (i)	Initial pCi/g	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
U-234	3.050E+01	1.000E+03	1.004E+00	2.989E+01	1.004E+00	2.989E+01
U-235	1.300E+00	1.000E+03	4.345E+00	6.905E+00	4.345E+00	6.905E+00
U-238	6.820E+01	1.000E+03	9.433E-01	3.180E+01	9.433E-01	3.180E+01

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

Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr							
			t= 0.000E+00	1.000E+00	4.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00	2.593E+00	2.585E+00	2.559E+00	2.509E+00	2.347E+00	1.860E+00	9.573E-01	3.000E+01
U-234	U-238	1.000E+00	0.000E+00	1.639E-05	6.489E-05	1.590E-04	4.464E-04	1.180E-03	1.821E-03	1.905E-01
U-234	ΣDOSE(j):		2.593E+00	2.585E+00	2.559E+00	2.509E+00	2.348E+00	1.862E+00	9.592E-01	3.019E+01
Th-230	U-234	1.000E+00	0.000E+00	2.415E-05	9.385E-05	2.312E-04	6.696E-04	1.993E-03	4.441E-03	6.928E-03
Th-230	U-238	1.000E+00	0.000E+00	7.879E-11	1.197E-09	7.311E-09	6.269E-08	5.972E-07	3.536E-06	1.220E-05
Th-230	ΣDOSE(j):		0.000E+00	2.415E-05	9.385E-05	2.312E-04	6.697E-04	1.994E-03	4.445E-03	6.940E-03
Ra-226	U-234	1.000E+00	0.000E+00	6.476E-07	1.057E-05	6.558E-05	5.680E-04	5.486E-03	3.352E-02	2.047E-01
Ra-226	U-238	1.000E+00	0.000E+00	1.346E-12	8.882E-11	1.379E-09	3.564E-08	1.122E-06	1.919E-05	5.331E-04
Ra-226	ΣDOSE(j):		0.000E+00	6.476E-07	1.057E-05	6.558E-05	5.680E-04	5.487E-03	3.354E-02	2.052E-01
Pb-210	U-234	1.000E+00	0.000E+00	5.436E-09	2.819E-07	3.975E-06	8.766E-05	1.867E-03	1.661E-02	3.973E-01
Pb-210	U-238	1.000E+00	0.000E+00	9.151E-15	1.838E-12	6.445E-11	4.327E-09	3.219E-07	8.774E-06	1.439E-03
Pb-210	ΣDOSE(j):		0.000E+00	5.436E-09	2.819E-07	3.975E-06	8.767E-05	1.868E-03	1.662E-02	3.988E-01
U-235	U-235	1.000E+00	6.660E-01	6.638E-01	6.572E-01	6.443E-01	6.029E-01	4.779E-01	2.461E-01	1.230E+00
Pa-231	U-235	1.000E+00	0.000E+00	3.077E-04	1.256E-03	3.095E-03	8.710E-03	2.302E-02	3.549E-02	1.047E+00
Ac-227	U-235	1.000E+00	0.000E+00	2.653E-06	3.602E-05	2.002E-04	1.341E-03	6.574E-03	9.202E-02	3.371E+00
U-238	U-238	1.000E+00	1.075E+01	1.072E+01	1.061E+01	1.040E+01	9.732E+00	7.715E+00	3.972E+00	6.414E+01

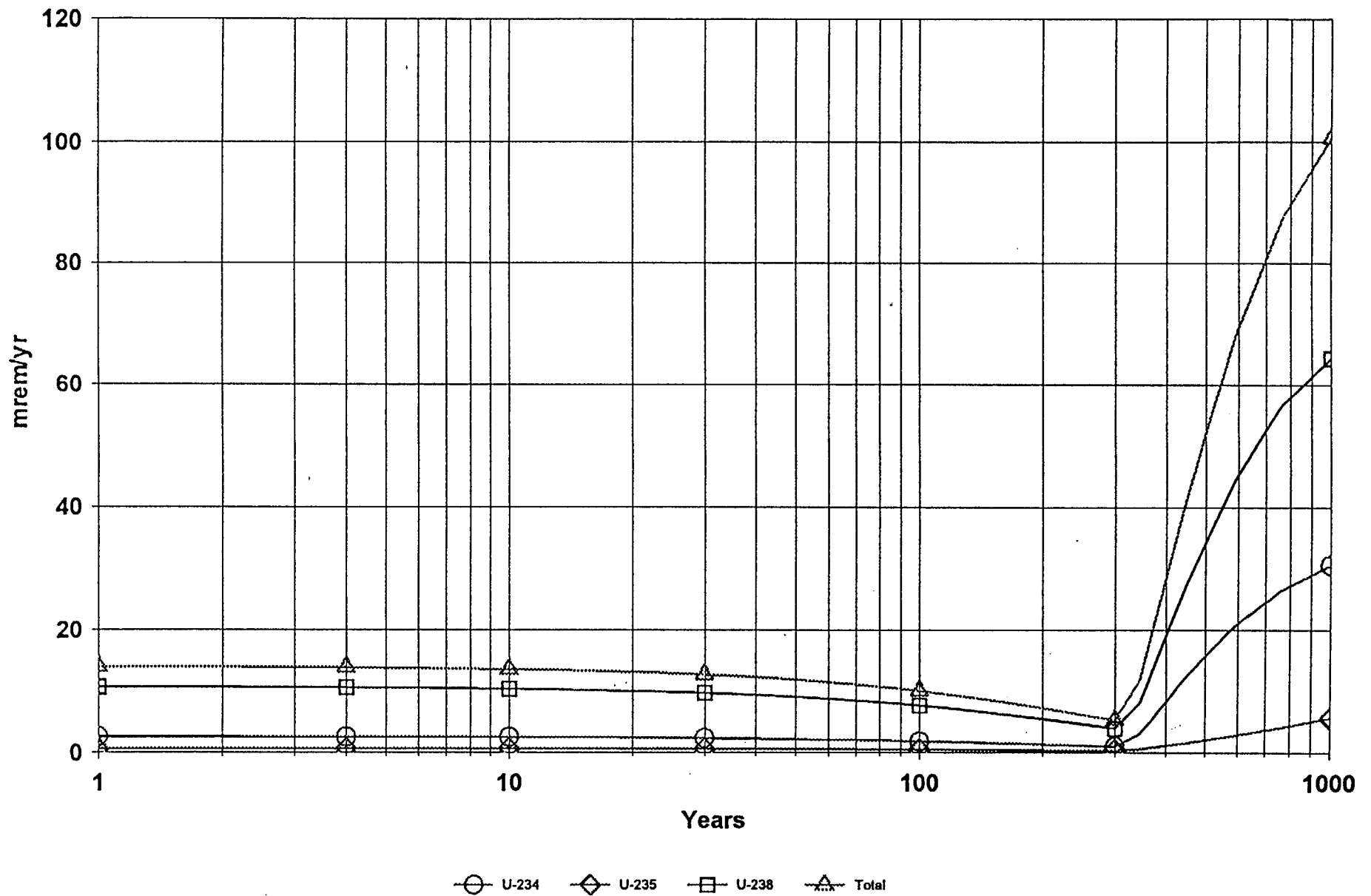
BRF(i) is the branch fraction of the parent nuclide.

Individual Nuclide Soil Concentration
 Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g								
			t=	0.000E+00	1.000E+00	4.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00		3.050E+01	3.040E+01	3.010E+01	2.950E+01	2.761E+01	2.188E+01	1.126E+01	1.100E+00
U-234	U-238	1.000E+00		0.000E+00	1.927E-04	7.632E-04	1.870E-03	5.250E-03	1.387E-02	2.142E-02	6.986E-03
U-234	ΣS(j):			3.050E+01	3.040E+01	3.010E+01	2.951E+01	2.761E+01	2.189E+01	1.128E+01	1.107E+00
Th-230	U-234	1.000E+00		0.000E+00	2.741E-04	1.091E-03	2.700E-03	7.838E-03	2.335E-02	5.203E-02	7.898E-02
Th-230	U-238	1.000E+00		0.000E+00	8.683E-10	1.380E-08	8.512E-08	7.330E-07	6.993E-06	4.143E-05	1.324E-04
Th-230	ΣS(j):			0.000E+00	2.741E-04	1.091E-03	2.700E-03	7.839E-03	2.335E-02	5.207E-02	7.911E-02
Ra-226	U-234	1.000E+00		0.000E+00	5.935E-08	9.438E-07	5.827E-06	5.035E-05	4.859E-04	2.969E-03	1.023E-02
Ra-226	U-238	1.000E+00		0.000E+00	1.254E-13	7.967E-12	1.227E-10	3.161E-09	9.939E-08	1.699E-06	1.469E-05
Ra-226	ΣS(j):			0.000E+00	5.935E-08	9.438E-07	5.827E-06	5.035E-05	4.860E-04	2.970E-03	1.025E-02
Pb-210	U-234	1.000E+00		0.000E+00	6.102E-10	3.794E-08	5.601E-07	1.262E-05	2.708E-04	2.414E-03	9.543E-03
Pb-210	U-238	1.000E+00		0.000E+00	9.666E-16	2.417E-13	8.986E-12	6.206E-10	4.664E-08	1.275E-06	1.346E-05
Pb-210	ΣS(j):			0.000E+00	6.102E-10	3.794E-08	5.601E-07	1.262E-05	2.709E-04	2.416E-03	9.556E-03
U-235	U-235	1.000E+00		1.300E+00	1.296E+00	1.283E+00	1.258E+00	1.177E+00	9.328E-01	4.803E-01	4.704E-02
Pa-231	U-235	1.000E+00		0.000E+00	2.741E-05	1.086E-04	2.661E-04	7.467E-04	1.972E-03	3.039E-03	9.848E-04
Ac-227	U-235	1.000E+00		0.000E+00	4.311E-07	6.586E-06	3.760E-05	2.550E-04	1.255E-03	2.394E-03	8.299E-04
U-238	U-238	1.000E+00		6.820E+01	6.797E+01	6.730E+01	6.597E+01	6.174E+01	4.894E+01	2.520E+01	2.468E+00

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

DOSE: All Nuclides Summed, All Pathways Summed



ATTACHMENT F
RESRAD Version 5.82 Code Run
(Residential Scenario, Building 611B Site Specific Parameters)

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Dose Conversion Factor (and Related) Parameter Summary
 File: DOSFAC.BIN

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(2)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(3)
B-1	Ra-226+D	8.600E-03	8.600E-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+D	1.180E-01	1.180E-01	DCF2(8)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(2)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(3)
D-1	Ra-226+D	1.330E-03	1.330E-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)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(7)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(8)
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)

Dose Conversion Factor (and Related) Parameter Summary (continued)
 File: DOSFAC.BIN

Menu	Parameter	Current Value	Default	Parameter Name
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(8,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(8,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(8,3)
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)
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	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	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	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	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(8,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(8,2)

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	* 4.000E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	* 2.500E-01	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	3.000E+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)	4.000E+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): U-234	3.050E+01	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): U-235	1.300E+00	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): U-238	6.820E+01	0.000E+00	---	S1(8)
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 effective porosity	2.000E-01	2.000E-01	---	EPCZ
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 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
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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, 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 U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(6)
R016	Unsaturated 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	2.655E-02	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	Unsaturated 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	2.655E-02	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	Unsaturated 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	2.655E-02	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	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.596E-02	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(2)
R016	Unsaturated 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	2.655E-02	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
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	1.330E-02	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for 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	1.899E-02	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	2.222E-05	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	5.000E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	2.500E-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 (
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE (
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE (
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE (
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE (
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE (
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE (
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE (
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE (
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE (1
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE (1
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE (1
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)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R018	Leafy vegetable consumption (kg/yr)	1.400E+01	1.400E+01	---	DIET (2)
R018	Milk consumption (L/yr)	9.200E+01	9.200E+01	---	DIET (3)
R018	Meat and poultry consumption (kg/yr)	6.300E+01	6.300E+01	---	DIET (4)
R018	Fish consumption (kg/yr)	5.400E+00	5.400E+00	---	DIET (5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET (6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	5.100E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT
R018	Contamination fraction of meat	-1	-1	0.200E+00	FMEAT
R018	Contamination fraction of milk	-1	-1	0.200E+00	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	1.000E+00	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	1.100E+00	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)	8.000E-02	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	1.000E+00	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	2.500E-01	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	2.500E-01	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

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
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	---	FLOOR
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)

Summary of Pathway Selections

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

		Total Dose TDOSE(t), mrem/yr							
		Basic Radiation Dose Limit = 30 mrem/yr							
		Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)							
t (years):	0.000E+00	1.000E+00	4.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03	
TDOSE(t):	9.102E+00	8.857E+00	8.157E+00	6.918E+00	3.990E+00	5.673E-01	4.052E-02	1.344E+01	
M(t):	3.034E-01	2.952E-01	2.719E-01	2.306E-01	1.330E-01	1.891E-02	1.351E-03	4.480E-01	
Maximum TDOSE(t):		1.344E+01 mrem/yr at t = 1.000E+03 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.	
U-234	7.003E-03	0.0008	2.344E-01	0.0258	0.000E+00	0.0000	5.223E-01	0.0574	2.025E-02	0.0022	5.131E-02	0.0056	2.363E-01
U-235	5.619E-01	0.0617	9.312E-03	0.0010	0.000E+00	0.0000	2.100E-02	0.0023	8.142E-04	0.0001	2.063E-03	0.0002	9.502E-03
U-238	5.192E+00	0.5705	4.686E-01	0.0515	0.000E+00	0.0000	1.110E+00	0.1220	4.303E-02	0.0047	1.091E-01	0.0120	5.022E-01
Total	5.761E+00	0.6330	7.124E-01	0.0783	0.000E+00	0.0000	1.653E+00	0.1817	6.409E-02	0.0070	1.624E-01	0.0178	7.480E-01

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 Path
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	
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	1.072E+00
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	6.046E-01
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.425E+00
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	9.102E+00

*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.	
U-234	6.820E-03	0.0008	2.283E-01	0.0258	0.000E+00	0.0000	5.071E-01	0.0573	1.974E-02	0.0022	4.997E-02	0.0056	2.301E-01
U-235	5.472E-01	0.0618	9.070E-03	0.0010	0.000E+00	0.0000	2.046E-02	0.0023	8.054E-04	0.0001	2.009E-03	0.0002	9.261E-03
U-238	5.055E+00	0.5707	4.564E-01	0.0515	0.000E+00	0.0000	1.078E+00	0.1217	4.197E-02	0.0047	1.062E-01	0.0120	4.891E-01
Total	5.609E+00	0.6333	6.937E-01	0.0783	0.000E+00	0.0000	1.606E+00	0.1813	6.251E-02	0.0071	1.582E-01	0.0179	7.284E-01

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 Path
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	
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	1.042E+00
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	5.888E-01
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.226E+00
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	8.857E+00

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
 As mrem/yr and Fraction of Total Dose At t = 4.000E+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.	
U-234	6.303E-03	0.0008	2.108E-01	0.0258	0.000E+00	0.0000	4.627E-01	0.0567	1.821E-02	0.0022	4.610E-02	0.0057	2.125E-01
U-235	5.053E-01	0.0619	8.383E-03	0.0010	0.000E+00	0.0000	1.886E-02	0.0023	7.771E-04	0.0001	1.854E-03	0.0002	8.575E-03
U-238	4.664E+00	0.5717	4.214E-01	0.0517	0.000E+00	0.0000	9.834E-01	0.1206	3.871E-02	0.0047	9.799E-02	0.0120	4.516E-01
Total	5.175E+00	0.6344	6.406E-01	0.0785	0.000E+00	0.0000	1.465E+00	0.1796	5.770E-02	0.0071	1.459E-01	0.0179	6.727E-01

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
 As mrem/yr and Fraction of Total Dose At t = 4.000E+00 years

Water Dependent Pathways

Radio- Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Path
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	
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	9.566E-01
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	5.437E-01
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	6.657E+00
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	8.157E+00

*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
U-234	5.402E-03	0.0008	1.798E-01	0.0260	0.000E+00	0.0000	3.850E-01	0.0556	1.550E-02	0.0022	3.924E-02	0.0057	1.812E-01
U-235	4.308E-01	0.0623	7.166E-03	0.0010	0.000E+00	0.0000	1.602E-02	0.0023	7.190E-04	0.0001	1.578E-03	0.0002	7.358E-03
U-238	3.970E+00	0.5738	3.594E-01	0.0519	0.000E+00	0.0000	8.182E-01	0.1183	3.294E-02	0.0048	8.342E-02	0.0121	3.851E-01
Total	4.406E+00	0.6368	5.463E-01	0.0790	0.000E+00	0.0000	1.219E+00	0.1762	4.916E-02	0.0071	1.242E-01	0.0180	5.737E-01

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 Path
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.061E-01
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	4.636E-01
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.649E+00
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	6.918E+00

*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.	
U-234	3.366E-03	0.0008	1.058E-01	0.0265	0.000E+00	0.0000	2.076E-01	0.0520	9.052E-03	0.0023	2.294E-02	0.0057	1.066E-01
U-235	2.530E-01	0.0634	4.264E-03	0.0011	0.000E+00	0.0000	9.262E-03	0.0023	5.301E-04	0.0001	9.231E-04	0.0002	4.432E-03
U-238	2.315E+00	0.5803	2.113E-01	0.0530	0.000E+00	0.0000	4.411E-01	0.1105	1.924E-02	0.0048	4.877E-02	0.0122	2.265E-01
Total	2.572E+00	0.6446	3.214E-01	0.0805	0.000E+00	0.0000	6.579E-01	0.1649	2.882E-02	0.0072	7.264E-02	0.0182	3.375E-01

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 Path
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	
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	4.554E-01
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	2.724E-01
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	3.262E+00
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	3.990E+00

*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.	
-234	1.335E-03	0.0024	1.665E-02	0.0294	0.000E+00	0.0000	2.235E-02	0.0394	1.385E-03	0.0024	3.509E-03	0.0062	1.677E-02
-235	3.849E-02	0.0678	6.978E-04	0.0012	0.000E+00	0.0000	1.225E-03	0.0022	1.349E-04	0.0002	1.412E-04	0.0002	7.539E-04
-238	3.383E-01	0.5964	3.295E-02	0.0581	0.000E+00	0.0000	4.693E-02	0.0827	2.926E-03	0.0052	7.451E-03	0.0131	3.531E-02
total	3.782E-01	0.6666	5.030E-02	0.0887	0.000E+00	0.0000	7.050E-02	0.1243	4.446E-03	0.0078	1.110E-02	0.0196	5.283E-02

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 Path
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	
-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	6.200E-02
-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	4.144E-02
-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.639E-01
total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.673E-01

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
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00

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 Path
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00
U-235	3.749E-02	0.9251	1.441E-04	0.0036	0.000E+00	0.0000	2.879E-03	0.0710	3.183E-06	0.0001	7.005E-06	0.0002	4.052E-02
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00
Total	3.749E-02	0.9251	1.441E-04	0.0036	0.000E+00	0.0000	2.879E-03	0.0710	3.183E-06	0.0001	7.005E-06	0.0002	4.052E-02

*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
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00
U-235	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00

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 Path
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr
U-234	3.783E+00	0.2815	1.993E-03	0.0001	0.000E+00	0.0000	2.911E-01	0.0217	5.669E-03	0.0004	2.117E-02	0.0016	4.103E+00
U-235	6.784E-01	0.0505	1.693E-03	0.0001	0.000E+00	0.0000	5.219E-02	0.0039	2.922E-03	0.0002	9.228E-04	0.0001	7.361E-01
U-238	7.930E+00	0.5901	3.360E-03	0.0003	0.000E+00	0.0000	6.100E-01	0.0454	1.155E-02	0.0009	4.459E-02	0.0033	8.600E+00
Total	1.239E+01	0.9221	7.047E-03	0.0005	0.000E+00	0.0000	9.533E-01	0.0709	2.014E-02	0.0015	6.669E-02	0.0050	1.344E+01

*Sum of all water independent and dependent pathways.

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

Parent (i)	Product (j)	Branch Fraction*	t=	DSR(j,t) (mrem/yr)/(pCi/g)							
				0.000E+00	1.000E+00	4.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00		3.513E-02	3.417E-02	3.136E-02	2.643E-02	1.491E-02	1.984E-03	0.000E+00	1.319E-01
U-234	Th-230	1.000E+00		0.000E+00	4.358E-07	1.651E-06	3.786E-06	8.705E-06	1.354E-05	0.000E+00	1.147E-06
U-234	Ra-226	1.000E+00		0.000E+00	1.422E-08	2.187E-07	1.243E-06	8.147E-06	3.175E-05	0.000E+00	5.582E-04
U-234	Pb-210	1.000E+00		0.000E+00	5.077E-11	2.550E-09	3.278E-08	5.234E-07	3.625E-06	0.000E+00	2.088E-03
U-234	ΣDSR(j)			3.513E-02	3.417E-02	3.137E-02	2.643E-02	1.493E-02	2.033E-03	0.000E+00	1.345E-01
U-235	U-235	1.000E+00		4.651E-01	4.528E-01	4.180E-01	3.560E-01	2.084E-01	3.138E-02	0.000E+00	1.248E-01
U-235	Pa-231	1.000E+00		0.000E+00	6.977E-05	2.612E-04	5.488E-04	9.081E-04	3.592E-04	0.000E+00	1.051E-01
U-235	Ac-227	1.000E+00		0.000E+00	9.888E-07	1.277E-05	5.846E-05	2.056E-04	1.389E-04	3.117E-02	3.364E-01
U-235	ΣDSR(j)			4.651E-01	4.529E-01	4.182E-01	3.566E-01	2.096E-01	3.188E-02	3.117E-02	5.663E-01
U-238	U-238	1.000E+00		1.089E-01	1.060E-01	9.761E-02	8.282E-02	4.783E-02	6.801E-03	0.000E+00	1.257E-01
U-238	U-234	1.000E+00		0.000E+00	9.686E-08	3.557E-07	7.492E-07	1.268E-06	5.625E-07	0.000E+00	3.744E-04
U-238	Th-230	1.000E+00		0.000E+00	6.243E-13	9.230E-12	5.137E-11	3.217E-10	1.156E-09	0.000E+00	2.298E-09
U-238	Ra-226	1.000E+00		0.000E+00	1.332E-14	8.161E-13	1.141E-11	2.116E-10	2.188E-09	0.000E+00	9.262E-07
U-238	Pb-210	1.000E+00		0.000E+00	3.797E-17	7.355E-15	2.324E-13	1.082E-11	2.200E-10	0.000E+00	3.401E-06
U-238	ΣDSR(j)			1.089E-01	1.060E-01	9.761E-02	8.282E-02	4.783E-02	6.802E-03	0.000E+00	1.261E-01

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

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 30 mrem/yr

Nuclide (i)	t=	0.000E+00	1.000E+00	4.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	8.539E+02		8.780E+02	9.565E+02	1.135E+03	2.009E+03	1.476E+04	*6.245E+09	2.230E+02
U-235	6.451E+01		6.624E+01	7.173E+01	8.412E+01	1.432E+02	9.412E+02	9.625E+02	5.298E+01
U-238	2.755E+02		2.831E+02	3.073E+02	3.622E+02	6.272E+02	4.410E+03	*3.360E+05	2.379E+02

*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at t_{min} = time of minimum single radionuclide soil guideline
and at t_{max} = time of maximum total dose = 1.000E+03 years

Nuclide (i)	Initial pCi/g	t _{min} (years)	DSR(i,t _{min})	G(i,t _{min}) (pCi/g)	DSR(i,t _{max})	G(i,t _{max}) (pCi/g)
U-234	3.050E+01	1.000E+03	1.345E-01	2.230E+02	1.345E-01	2.230E+02
U-235	1.300E+00	1.000E+03	5.663E-01	5.298E+01	5.663E-01	5.298E+01
U-238	6.820E+01	1.000E+03	1.261E-01	2.379E+02	1.261E-01	2.379E+02

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

Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr							
			t= 0.000E+00	1.000E+00	4.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00	1.072E+00	1.042E+00	9.566E-01	8.060E-01	4.549E-01	6.051E-02	0.000E+00	4.023E+00
U-234	U-238	1.000E+00	0.000E+00	6.606E-06	2.426E-05	5.109E-05	8.651E-05	3.836E-05	0.000E+00	2.554E-02
U-234	ΣDOSE(j):		1.072E+00	1.042E+00	9.566E-01	8.060E-01	4.549E-01	6.054E-02	0.000E+00	4.048E+00
Th-230	U-234	1.000E+00	0.000E+00	1.329E-05	5.035E-05	1.155E-04	2.655E-04	4.130E-04	0.000E+00	3.499E-05
Th-230	U-238	1.000E+00	0.000E+00	4.258E-11	6.295E-10	3.503E-09	2.194E-08	7.885E-08	0.000E+00	1.567E-07
Th-230	ΣDOSE(j):		0.000E+00	1.329E-05	5.035E-05	1.155E-04	2.655E-04	4.130E-04	0.000E+00	3.514E-05
Ra-226	U-234	1.000E+00	0.000E+00	4.336E-07	6.670E-06	3.790E-05	2.485E-04	9.685E-04	0.000E+00	1.703E-02
Ra-226	U-238	1.000E+00	0.000E+00	9.084E-13	5.566E-11	7.779E-10	1.443E-08	1.493E-07	0.000E+00	6.317E-05
Ra-226	ΣDOSE(j):		0.000E+00	4.336E-07	6.670E-06	3.790E-05	2.485E-04	9.686E-04	0.000E+00	1.709E-02
Pb-210	U-234	1.000E+00	0.000E+00	1.549E-09	7.777E-08	9.998E-07	1.596E-05	1.106E-04	0.000E+00	6.370E-02
Pb-210	U-238	1.000E+00	0.000E+00	2.589E-15	5.016E-13	1.585E-11	7.379E-10	1.500E-08	0.000E+00	2.319E-04
Pb-210	ΣDOSE(j):		0.000E+00	1.549E-09	7.777E-08	9.999E-07	1.596E-05	1.106E-04	0.000E+00	6.393E-02
U-235	U-235	1.000E+00	6.046E-01	5.887E-01	5.433E-01	4.628E-01	2.710E-01	4.079E-02	0.000E+00	1.622E-01
Pa-231	U-235	1.000E+00	0.000E+00	9.071E-05	3.395E-04	7.134E-04	1.180E-03	4.670E-04	0.000E+00	1.367E-01
Ac-227	U-235	1.000E+00	0.000E+00	1.285E-06	1.660E-05	7.599E-05	2.673E-04	1.806E-04	4.052E-02	4.373E-01
U-238	U-238	1.000E+00	7.425E+00	7.226E+00	6.657E+00	5.649E+00	3.262E+00	4.639E-01	0.000E+00	8.574E+00

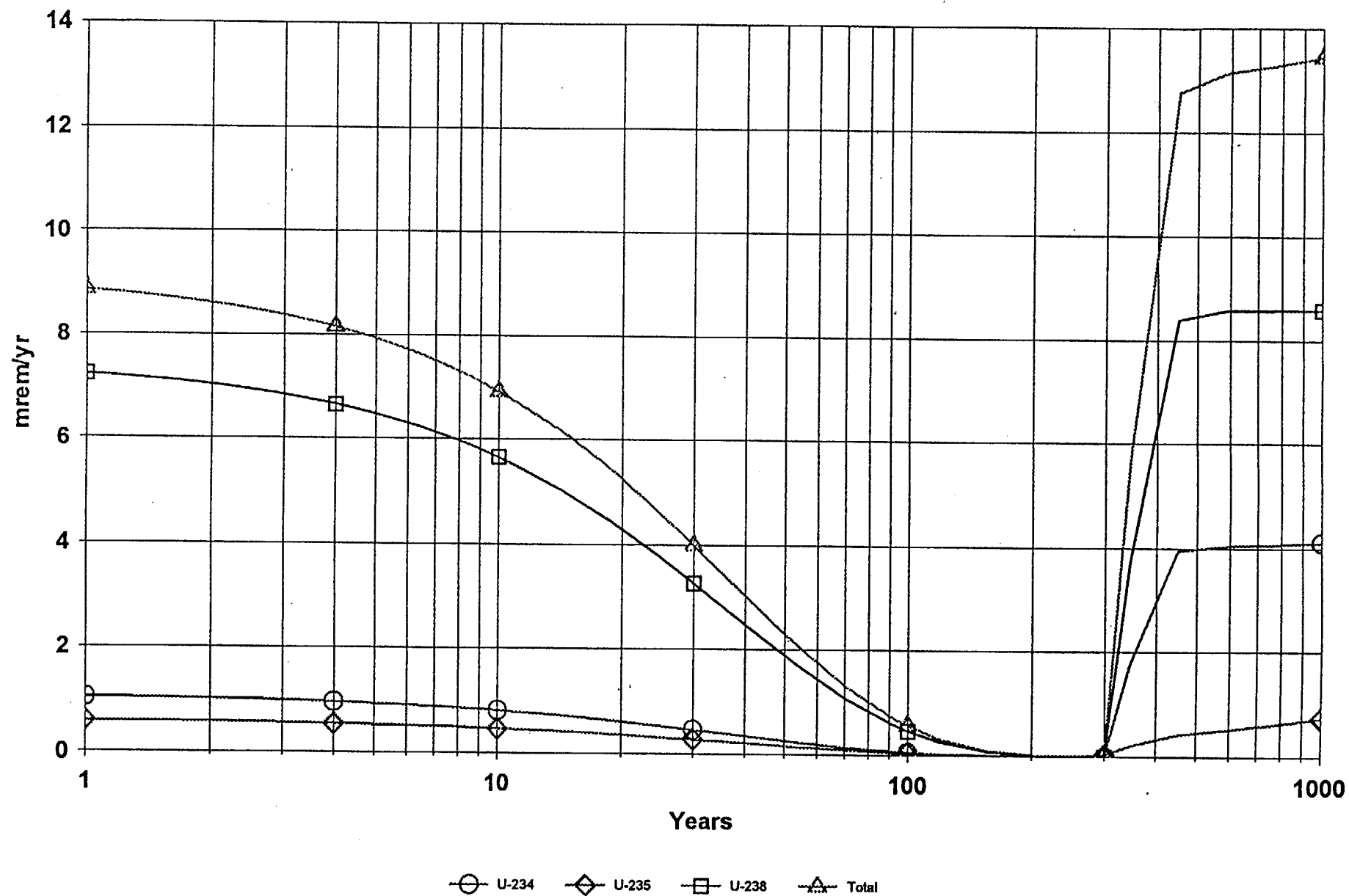
BRF(i) is the branch fraction of the parent nuclide.

Individual Nuclide Soil Concentration
 Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	t=	S(j,t), pCi/g							
				0.000E+00	1.000E+00	4.000E+00	1.000E+01	3.000E+01	1.000E+02	3.000E+02	1.000E+03
U-234	U-234	1.000E+00		3.050E+01	2.970E+01	2.743E+01	2.339E+01	1.375E+01	2.143E+00	1.058E-02	8.938E-11
U-234	U-238	1.000E+00		0.000E+00	1.883E-04	6.954E-04	1.483E-03	2.615E-03	1.359E-03	2.012E-05	5.674E-11
U-234	ΣS(j):			3.050E+01	2.970E+01	2.743E+01	2.339E+01	1.375E+01	2.144E+00	1.060E-02	8.994E-11
Th-230	U-234	1.000E+00		0.000E+00	2.709E-04	1.042E-03	2.411E-03	5.675E-03	9.592E-03	1.025E-02	1.003E-02
Th-230	U-238	1.000E+00		0.000E+00	8.550E-10	1.298E-08	7.304E-08	4.688E-07	1.831E-06	2.443E-06	2.398E-06
Th-230	ΣS(j):			0.000E+00	2.709E-04	1.042E-03	2.411E-03	5.675E-03	9.593E-03	1.025E-02	1.004E-02
Ra-226	U-234	1.000E+00		0.000E+00	5.857E-08	8.952E-07	5.110E-06	3.428E-05	1.514E-04	2.268E-04	2.241E-04
Ra-226	U-238	1.000E+00		0.000E+00	1.234E-13	7.481E-12	1.049E-10	1.991E-09	2.333E-08	5.316E-08	5.357E-08
Ra-226	ΣS(j):			0.000E+00	5.857E-08	8.952E-07	5.110E-06	3.428E-05	1.514E-04	2.268E-04	2.242E-04
Pb-210	U-234	1.000E+00		0.000E+00	6.024E-10	3.604E-08	4.928E-07	8.640E-06	8.282E-05	1.578E-04	1.571E-04
Pb-210	U-238	1.000E+00		0.000E+00	9.542E-16	2.277E-13	7.742E-12	3.982E-10	1.123E-08	3.658E-08	3.754E-08
Pb-210	ΣS(j):			0.000E+00	6.024E-10	3.604E-08	4.928E-07	8.641E-06	8.283E-05	1.578E-04	1.571E-04
U-235	U-235	1.000E+00		1.300E+00	1.266E+00	1.169E+00	9.968E-01	5.861E-01	9.136E-02	4.512E-04	3.820E-12
Pa-231	U-235	1.000E+00		0.000E+00	2.678E-05	9.893E-05	2.109E-04	3.719E-04	1.931E-04	2.855E-06	7.998E-14
Ac-227	U-235	1.000E+00		0.000E+00	4.164E-07	5.741E-06	2.684E-05	9.762E-05	7.419E-05	1.216E-06	3.524E-14
U-238	U-238	1.000E+00		6.820E+01	6.641E+01	6.133E+01	5.230E+01	3.075E+01	4.793E+00	2.367E-02	2.004E-10

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

DOSE: All Nuclides Summed, All Pathways Summed



This is to acknowledge the receipt of your letter/application dated

05-09-02, and to inform you that the initial processing which includes an administrative review has been performed.

☒ *Amend* 040-06377
There were no administrative omissions. Your application was assigned to a technical reviewer. Please note that the technical review may identify additional omissions or require additional information.

☐ Please provide to this office within 30 days of your receipt of this card

A copy of your action has been forwarded to our License Fee & Accounts Receivable Branch, who will contact you separately if there is a fee issue involved.

Your action has been assigned Mail Control Number 131469.
When calling to inquire about this action, please refer to this control number.
You may call us on (610) 337-5398, or 337-5260.

Sincerely,
Licensing Assistance Team Leader

BETWEEN:

License Fee Management Branch, ARM
and
Regional Licensing Sections

: (FOR LFMS USE)
: INFORMATION FROM LTS
: -----
:

: Program Code: 11300
: Status Code: 0
: Fee Category: EX 2C
: Exp. Date: 20110731
: Fee Comments: NOT SHIELDING
: Decom Fin Assur Req'd: Y
: ::::::::::::::::::::::::::::::::::::::

LICENSE FEE TRANSMITTAL

A. REGION

1. APPLICATION ATTACHED

Applicant/Licensee: ARMY, DEPARTMENT OF THE
Received Date: 20020510
Docket No: 4006377
Control No.: 131469
License No.: SUB-348
Action Type: Amendment

2. FEE ATTACHED

Amount: _____
Check No.: _____

3. COMMENTS

Signed *R. J. Brown*
Date *05/18/02*

B. LICENSE FEE MANAGEMENT BRANCH (Check when milestone 03 is entered /__ /)

1. Fee Category and Amount: _____

2. Correct Fee Paid. Application may be processed for:

Amendment _____
Renewal _____
License _____

3. OTHER _____

Signed _____
Date _____