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Title: DEPLETED URANIUM RISK ASSESSMENT FOR JEFFERSON PROVING GROUND USING DATA FROM ENVIRONMENTAL MONITORING AND SITE CHARACTERIZATION

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Aberdeen Proving Ground, Maryland

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Depleted Uranium Risk Assessment for Jefferson Proving Ground using Data From Environmental Monitoring and Site Characterization

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Prepared for
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Test and Evaluation Command
Aberdeen Proving Ground, Maryland

FINAL REPORT

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Table of Contents

List of Figures

List of Tables

Abstract

This report documents the third risk assessment completed for the depleted uranium (DU) munitions testing range at Jefferson Proving Ground (JPG), Indiana, for the U. S. Army Test and Evaluation command. Jefferson Proving Ground was closed in 1995 under the Base Realignment and Closure Act and the testing mission was moved to Yuma Proving Ground. As part of the closure of JPG, assessments of potential adverse health effects to humans and the ecosystem were conducted. This report integrates recent information obtained from site characterization surveys at JPG with environmental monitoring data collected from 1983 through 1994 during DU testing. Three exposure scenarios were evaluated for potential adverse effects to human health: an occasional use scenario and two farming scenarios. Human exposure was minimal from occasional use, but significant risk were predicted from the farming scenarios when contaminated groundwater was used by site occupants. The human health risk assessments do not consider the significant risk posed by accidents with unexploded ordnance. Exposures of white-tailed deer to DU were also estimated in this study, and exposure rates result in no significant increase in either toxicological or radiological risks. The results of this study indicate that remediation of the DU impact area would not substantially reduce already low risks to humans and the ecosystem, and that managed access to JPG is a reasonable model for future land use options.

1. Introduction

This report is the third of three reports on potential risk of adverse effects to humans and the ecosystem at Jefferson Proving Ground (JPG) from exposure to depleted uranium (DU) fragments. Two previous reports discussed potential adverse effects from DU fragments based on environmental monitoring data (Ebinger and Hansen, 1994) and on surface radiological survey information (Ebinger and Hansen, 1996). The three Los Alamos reports supplement information and conclusions of two reports by the Scientific Ecology Group (SEG) on surface radiological surveys at JPG (SEG, 1995, 1996). This third report integrates recently reported site characterization information (SEG, 1996).

Jefferson Proving Ground was the facility at which the Test and Evaluation Command of the U. S. Army conducted lot acceptance testing on DU munitions. JPG was closed in 1995 under the Base Realignment and Closure Act (BRAC), and the lot acceptance mission was transferred to Yuma Proving Ground. The DU risk assessments and the site characterization studies were conducted to provide information required before JPG could be released for unrestricted use under the agreements of a material license with the Nuclear Regulatory Commission (NRC) and to assess the site for possible remediation. During the course of these investigations, release of JPG for restricted use was pursued, possibly as a wildlife refuge managed by another government agency. Release for restricted use would eliminate remediation costs if little to no risk to humans due to exposure to DU fragments in the environment could be demonstrated and if little risk to the ecosystem could be shown.

In this report, we show no significant risk to humans or to the ecosystem when the site is used by occasional visitors. Such a scenario is realistic if the JPG area were managed as a wildlife refuge. The risk assessment for adverse effects on white-tailed deer showed no significant exposure to DU from food, soil ingestion, or water consumption pathways. Since uncontaminated surface water was assumed the only drinking water source for deer, only minimal exposure effects were expected. The human health risk assessment showed potential for significant risk of adverse effects, namely cancer incidence, if the area were intensively farmed and the farm products were consumed by residents. The main mechanism of exposure in the farming scenarios was through consumption of drinking water contaminated with DU. When this exposure pathway was eliminated, the overall risk form DU exposure decreased considerably. Doses to humans were only slightly above background when uncontaminated water was supplied to livestock on the site.

Farming the site also exposes humans to great risk of injury or death from accidents with unexploded ordnance (UXO). This report does not include detailed assessments of safety concerns regarding UXO, but previous surveys (Mason and Hangar, 1992) suggest that any risk from exposure to DU is minuscule compared to risk of injury or death due to accidents with UXO. While farming the JPG area is unrealistic from a safety standpoint, the farming scenarios are included in the risk assessments to illustrate potential effects of different land use strategies.

We concluded that there is little risk of adverse effects to deer at JPG from exposure to DU fragments remaining on site. Our conclusion follows from modeling the different exposure pathways to white-tailed deer at JPG. Our conclusion is supported further by data from white-tailed deer collected at Aberdeen Proving Ground (APG) that showed little DU ingestion by deer harvested from the DU firing range (Ebinger et al, 1996). Based on the pathway modeling and APG data, occasional human visitors to the site would be at little risk of adverse health effects due to exposure to DU fragments. Significant risk to humans may be introduced if the JPG area is used intensively for subsistence farming and/or if the local aquifer becomes contaminated from DU fragments and is used as the source of drinking water for resident farmers.

2. Assessment Methods

2.1. Exposure Pathway Models

Two modeling approaches were used to assess the potential effects of exposure to DU to the ecosystem and to humans. The ecosystem model was adapted from a steady-state model suggested by the NCRP (NCRP, 1984). Modifications of this model for the JPG environment and to model white-tailed deer instead of cattle were discussed elsewhere (Ebinger and Hansen, 1994) and shown conceptually in Figure 1. The steady state model was used to estimate radiological and toxicological exposures of the deer by converting the activity-based concentration ingested to mass-based concentration and conservatively assuming 5% retention of ingested DU in kidneys of deer. Potential effects of exposure to DU by humans was predicted using the RESRAD code (Yu et al, 1993). The RESRAD code estimates exposures and subsequent radiological doses absorbed by humans from a variety of pathways including ingestion, inhalation, and exposure of skin to radionuclides (Figure 2). Ingestion pathways relevant to the JPG risk assessment included consumption of meat, vegetables, dairy products and drinking water. Inhaled dust contaminated with DU accounts for the potential inhaled dose, and external exposure of skin comes from DU in the soil surface or near surface. In previous studies of DU at JPG (Ebinger and Hansen 1996, 1994), external exposure contributed almost nothing to the overall dose to humans. RESRAD accounts for decay of the source term and ingrowth of daughter products, but for DU exposure adjustments for doses from daughters is minimal.

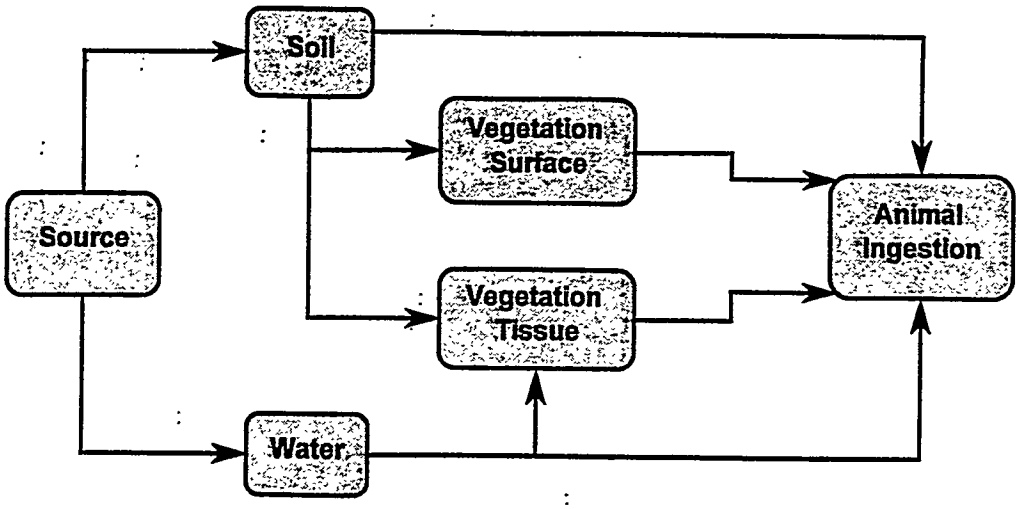

Figure 1. Schematic of the steady state model. White-tailed deer are used in the following simulations.

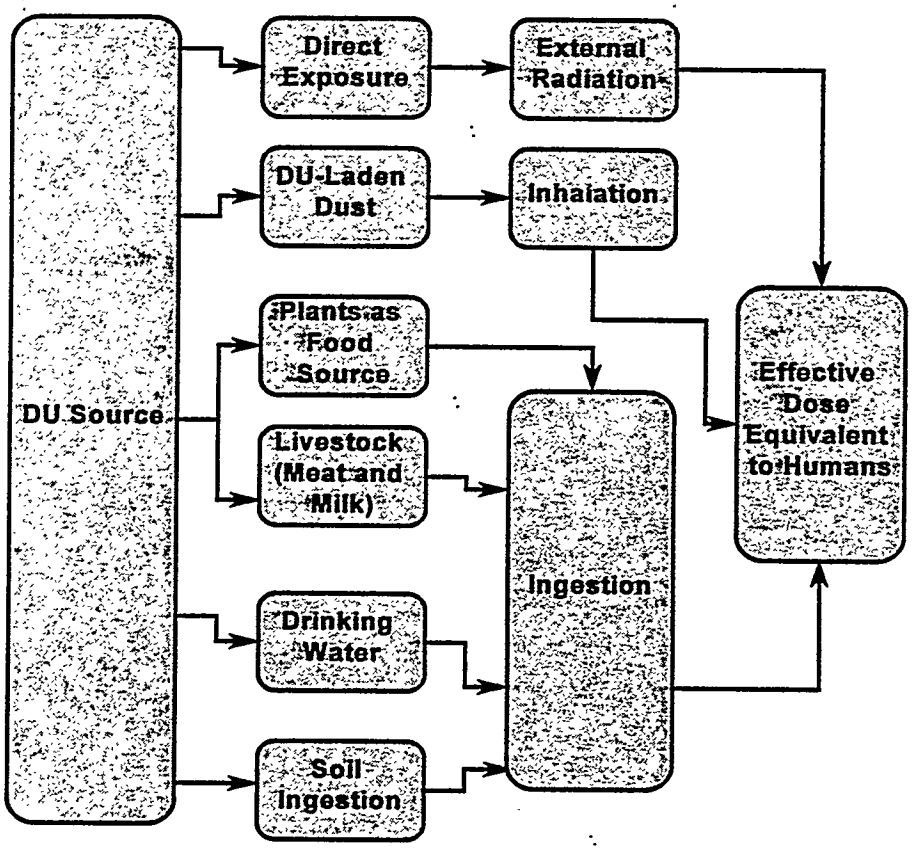

Figure 2. Schematic diagram of the RESRAD model. Diagram adapted from Yu et al (1993).

2.2. Data Requirements

2.2.3. Steady State Model

The steady state model was designed as a screening-level tool to investigate possible exposures to mammals using sparse data. The model provides estimates of exposures and absorbed doses from ingested radionuclides, but does not account for physiological processes that influence exposure over time. The minimum number of parameters needed for the steady state model are DU concentrations in soils, water, and, if available, vegetation. Exposure from DU incorporated within vegetation or deposited on plant surfaces can be simulated from soil and water data in the model. Data on DU concentration in vegetation from JPG were limited (Ebinger and Hansen, 1994; SEG, 1995, 1996; U. S. Army, 1983), thus simulated vegetation concentrations were used in the exposure assessment discussed below. Assumptions and results from the steady state model are tabulated in Appendix A.

Radiological dose rates to white-tailed deer estimated with the steady state model depend on the amounts of food and water consumed by deer in the affected area. Information on the variability of consumption of food and/or drinking water can be used in the steady state model if such data are available. Food consumption data showed that adult male deer consumed about 1.6 kg/d of dry matter, whereas adult female deer consumed about 1.2 kg/d (Alldredge et al, 1974). These values were derived from studies of western mule deer, but compare favorably with values derived from white-tailed deer studies (Mautz et al, 1976; Robbins, 1983). We used 1.6 kg/d (± 0.4) for the steady state model of JPG.

Water consumption data show a relatively large range from 1.4 to 13.5 L/d. Lautier et al (1988) report an expected value of 3.6 (± 0.24) within the range. A triangular distribution was constructed with the 3.6 L/d as the most likely value and values ranging from 1.4 to 13.5 L/d. All water available to deer within the affected area at JPG was assumed to be contaminated with DU. Water concentrations ranged from a maximum of about 2 pCi/L from DU as determined from other studies (SEG, 1996; U. S. Army, 1983).

Soil ingestion is common in all animals as a result of foraging for food. Estimated soil ingestion ranged from 10 to 30 g/d in mule deer (Arthur and Alldredge, 1979), and soil ingestion exceeded 80 g/d in other species such as jackrabbits and pronghorn (Arthur and Gates, 1988). The range of 10 to 30 g/d was used for the steady state model at JPG.

Three types of simulations were conducted with the steady state model. Simulation A used the minimal data set of the amounts of food, water, and soil ingested by deer. In simulation B, soil concentration of DU was added as a variable. Soil concentrations of DU were distributed between 35 pCi/g and 300 pCi/g with a most likely value of 91 pCi/g. The 35 pCi/g was the NRC license agreement concentration for release of the site, 300 pCi/g represented 75% of all soil concentrations measured (SEG, 1996), and 91 pCi/g was the average soil concentration calculated using Equation 1 discussed in the next section. Simulation C was the most conservative assessment and assumed a uniform distribution of soil

DU concentrations from 35 pCi/g to 700 pCi/g. The concentration of 700 pCi/g is approximately the average soil concentration reported by SEG (SEG, 1996). The simulations and distributions of input values for each are discussed in greater detail in Section 2.2.3 below and shown in Appendix A.

2.2.2 RESRAD Parameters

One parameter of direct concern in RESRAD simulations and indirectly of concern in the steady state model is the size of the affected area. The affected area is that part of the DU impact area that is contaminated with DU at or above 35 pCi/g according to the NRC license agreement. The initial estimate for the affected area was based on the target area within the impact range and was 500 m east-to-west and 6000 m north-to-south, or an area of about 3×10^6 m^2 (Ebinger and Hansen, 1994). Results from surface radiological surveys conducted by the Scientific Ecology Group (SEG, 1995, 1996) were used to refine the estimates of the affected area at JPG. We bounded the affected area between 1.2×10^6 m^2 and 2.8×10^6 m^2 (Ebinger and Hansen, 1996) using initial survey information (SEG, 1995). We refined that range to 1.5×10^6 m^2 using the updated survey results (SEG, 1996) and the refined values were used in the RESRAD and steady state predictions reported here.

Previous analysis of soil profiles showed that concentrations of DU below penetrator fragments on the surface extend to at least 20 cm in depth (Ebinger et al, 1990). While transport of DU to depths of 45 to 60 cm is reported at JPG (SEG, 1996), most of the DU from penetrators tends to be in the top 15 cm of the soil when fragments are deposited at or near the surface. We used the upper 15 cm of soil as the depth of the affected area for the purposes of the RESRAD and steady state model simulations.

The inventory of DU munitions in the affected area was conservatively estimated at 70,000 kg based on the amount of DU fired and the amount recovered (Richard Herring, YPG, personal communication). The inventory estimate represents the upper bound on the amount of DU currently in the affected area. The average concentration of DU in the affected area was estimated by dividing the inventory into the mass of soil in the affected area (Equation 1):

$$C_S = \frac{I * F}{V_S * \rho_S} \qquad (1)$$

where C_S is the average soil concentration (pCi/g-soil), I is the inventory of DU in the affected area (70,000 kg or $70{,}000 \times 10^3$ g for Equation 1), V_S is the volume of the affected area (2.3×10^5 m^3) or 1.5×10^6 m^2 * 0.15 m (depth), ρ_S is the soil bulk density (1.25×10^6 g/m^3), and F is a conversion factor (3.7×10^5 pCi/g). The average soil concentration using these values is 91 pCi/g. For the average concentration calculation, we assumed that the entire DU inventory was uniformly distributed through the top 15 cm of the affected area. This assumption was the largest source of uncertainty in the calculated average concentration.

Uniform distribution of DU was not observed during field reconnaissance trips or during DU fragment recovery programs. A uniform distribution must be assumed, however, in order to use RESRAD code or the steady state model. The soil concentration of 35 pCi/g was also used as a soil concentration in the steady state simulations to compare with simulations that used the calculated average soil concentration.

The size of the affected area and the average soil concentration significantly influenced the estimated radiation doses. Small changes in either or both parameters results in unambiguous increases or decreases in the expected doses to humans. Other input parameters have smaller yet important effects. For example, the soil texture of the contaminated zone, the uncontaminated part of the unsaturated zone, and the saturated zone influenced the water transport rate through these media. Generally, coarser textured soils cause relatively rapid drainage or water flow and will transport soluble DU more quickly than finer textured soils. In addition, the erodibility of silty soils is greater than sandy or clayey soils and will result in removal of the contaminated soils faster than for sandy or clayey soils. Finally, the water content of the unsaturated zone depends on soil texture and greatly affects water movement and transport of contaminants. The RESRAD *b*-parameter (e.g., Clapp and Hornberger, 1978) empirically relates soil texture to the unsaturated zone water content and is relatively sensitive in the RESRAD simulations. Soil textures for JPG soils range from silt loam in the upper meter to silty clay loam below 1 meter in depth (USDA, 1985; U. S. Army, 1983). These soil data were incorporated into the RESRAD simulations (Table 1), and the values used in RESRAD simulations for JPG are given in Appendix B.

Table 1. Soil texture and hydrologic parameters for RESRAD simulations at JPG.

Depth (m)	Soil Texture[1]	Hydraulic Conductivity (m/y)[2]	*b* parameter[2]	Total Porosity[2]	Effective Porosity[2]
0 to 0.15	Silt Loam	200	5.3	0.43	0.18
0.15 to 1	Silt Loam	200	5.3	0.43	0.18
1 to 3	Silty Clay Loam	32	10.4	0.43	0.13
3 to Bedrock	Silty Clay Loam	32	10.4	0.43	0.13

[1] USDA, 1984.
[2] Clapp and Hornberger, 1978.

Soil data were also used to estimate water transport parameters, such as hydraulic conductivity, total porosity, and effective porosity. Variation in the porosity parameters resulted in minor variation in the estimated doses to humans from ingestion of DU. Variation in hydraulic conductivity resulted in a shift in the time to maximum doses from ingestion of DU through different pathways, but did not significantly affect the maximum dose received. The values of these parameters are also shown in Table 1.

Three exposure scenarios were developed for the RESRAD simulations. We assumed in all scenarios that the JPG affected area was accessible to the public, either occasionally as in the case of a refuge or national park, or for unrestricted use. We also assumed that no remediation was conducted in the affected area, so the measured DU concentrations are the initial conditions. Detailed input files are presented in Appendix B.

The first scenario involves use of the JPG affected area for occasional use such as hunting programs to control wildlife populations. Currently, different areas of JPG are used in this way, and the first scenario includes use of the DU impact area. The occasional use scenario allows for consumption of game taken from the affected area. Game animals were assumed to have lived entirely within the affected area, so all food and water sources for the animals were considered contaminated or potentially contaminated. Users of the land were assumed to camp on the ground for four separate one-to-two week periods. During their stay in the area, all food and water was to come from off site and was assumed to be uncontaminated, and all game was butchered and consumed off-site.

The second and third scenarios involve different levels of farming the affected area. The second scenario involves resident farmers raising vegetables and producing dairy products for consumption by the residents. Animal feed and forage are assumed to come from fields contaminated with DU residue, and vegetables are grown in areas of possible contamination. Water for animals and for irrigation, if needed, was derived from shallow aquifers within the JPG area and is assumed contaminated with DU. This assumption was not backed by systematic data from the monitoring wells located on the affected portion of the site, only on the reported concentrations of elevated U in some wells (SEG, 1996; Ebinger and Hansen, 1996). Drinking water for human consumption was from water piped in from the city of Madison, Indiana.

The third RESRAD scenario was identical with the second scenario except that drinking water for humans was derived from an aquifer on the JPG site. Suitable water will most likely come from aquifers deeper than those sampled by the monitoring wells, thus reducing the potential of consuming DU-contaminated water. However, DU in the drinking water supply was assumed for the purposes of modeling exposures even though such an assumption is not realistic.

2.2.3. Uncertainty Estimates

Uncertainty in the predicted doses to humans and ecosystem components was estimated in different ways for the two models. Two sets of RESRAD simulations were conducted for each scenario.

The average soil concentration derived above was used in both simulations. In one set of simulations, there was no DU initially in the groundwater. Most of the data from the environmental radiation monitoring (ERM) sampling program support this assumption. However, data from the recent surveys (SEG, 1996) and from later water sampling for the ERM program indicate that as much as 2 pCi/L DU was measured. Thus, 2 pCi/L was used for the second set of simulations. These simulations bounded the doses to humans from ingestion of DU via different pathways, but did not constitute a formal uncertainty analysis. The complexity of the RESRAD code precludes more probabilistic uncertainty analysis as does the lack of site specific data on underlying parameters such as the hydraulic values reported in Table 1.

The steady state model was designed to incorporate Monte Carlo simulation of doses to mammals as long as distributions of site-specific parameters could be constructed or estimated. In Monte Carlo simulations, probability distributions are constructed for each of the input variables in the model. The model is run iteratively with single values selected at random from the distribution for each parameter. After 10,000 iterations the predicted values are also described by a probability distribution, and statistics such as mean, median, and the 95% confidence interval for the predictions can be estimated.

Three sets of simulations were conducted with the steady state model. The soil concentration was fixed at 35 pCi/g and water concentration was fixed at 3 pCi/L in the first set of simulations (Simulation A). The water concentration incorporated the highest credible value from the environmental monitoring data set (Ebinger and Hansen, 1996). The parameters that were varied were the amount of food intake by deer, the amount of water consumed, and the amount of soil ingested during feeding (Appendix A).

In the second set of simulations (Simulation B), the soil concentration was varied from 35 pCi/g to 300 pCi/g following a triangular distribution with the most likely value of 91 pCi/g. The triangular distribution was used to capture soil concentrations greater than the average soil concentration with a relatively high frequency of occurrence. The triangular distribution selected is conservative in that soil concentrations greater than 91 pCi/g would be selected more often than concentrations less than 91 pCi/g. Water concentrations varied from 0.5 to 3 pCi/L following a uniform distribution to reflect values reported in environmental monitoring data from 1983-1994 and recent data (SEG, 1996). Distributions of values for food intake, water consumption, and soil ingestion by deer were identical to those used in Simulation A (Appendix A).

The third set of simulations (Simulation C) was conducted in order to evaluate the effects of the range of soil concentrations reported in the characterization survey (SEG, 1996). The range of soil concentrations from 35 pCi/g to 700 pCi/g was used in a uniform distribution, thus all values in the range had equal probability of selection for a given iteration of the model. The range of water concentrations was from 0.5 pCi/L to 3 pCi/L. The uncertainty in the predictions from each set of simulations was shown as the 95% confidence interval of the predicted value.

3. Results and Discussion

3.1. Steady State Model

Dose rates from DU ingestion by deer were estimated with the steady state model using the three simulations discussed above. Results from Simulation A showed the lowest expected dose to deer, with a mean value of 9.6×10^{-4} mrad/d (and s.d. of $\pm 5.9 \times 10^{-4}$) and upper 95% confidence interval of 5.9×10^{-4} mrad/d to 1.9×10^{-3} mrad/d (Table 2). Figure 3 shows the distribution of the predicted dose rates for Simulation A. The results are distributed approximately normally because the deer body mass and feed intake parameters are normal distributions. A normal distribution of the predicted values was expected because DU ingestion depends on feed intake, and the dose rate is related to body mass.

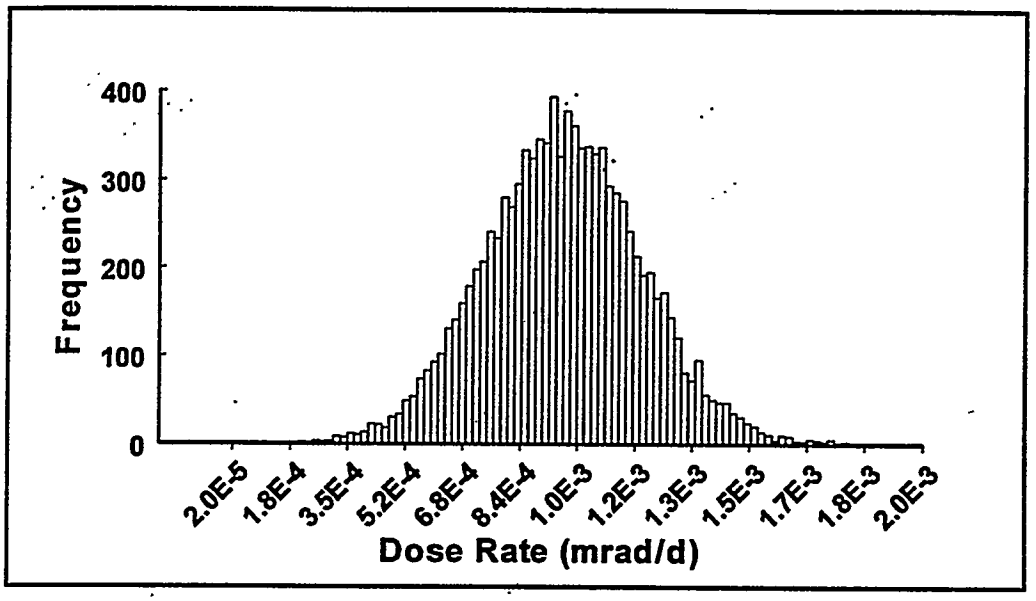

Figure 3. Results from steady state model, Simulation A. Graph is the frequency distribution of expected dose rates to white-tailed deer. Deer body mass and feed intake were the parameters that varied in this simulation.

Table 2 Selected statistics from simulations using the steady state model to predict dose rates to deer from DU ingestion.

Simulation	Mean (mrad/d)	Median (mrad/d)	Standard Deviation (mrad/d)	95% Confidence Interval[1] (mrad/d)
A	9.6×10^{-4}	9.6×10^{-4}	2.2×10^{-4}	5.9×10^{-4} to 1.8×10^{-3}
B	1.7×10^{-3}	1.6×10^{-3}	5.4×10^{-4}	9.5×10^{-4} to 4.2×10^{-3}
C	3.3×10^{-3}	3.1×10^{-3}	1.6×10^{-3}	1.1×10^{-3} to 9.5×10^{-3}

[1] Confidence intervals were derived during Monte Carlo simulations of the steady state model using Crystal Ball (ver 3.0) software (Appendix A).

Simulation B introduces variation of the concentration of DU ins soil and water. Predicted values for Simulation B had a mean of 1.7×10^{-3} mrad/d ($\pm 5.4 \times 10^{-4}$) and the upper 95% confidence interval was 9.5×10^{-4} mrad/d to 4.2×10^{-3} mrad/d (Table 2). Figure 4 shows the predicted values for Simulation B. The distribution reflects the shape of the uniform variables as in Figure 1 and the shape of the triangular distribution used for soil concentration. The distribution shown in Figure 4 has a larger mean, median , and standard deviation than from Simulation A because of the larger variation in DU concentrations in soil and water. The distribution also reflects the normally-distributed variables and the triangular distribution of the soil DU concentrations.

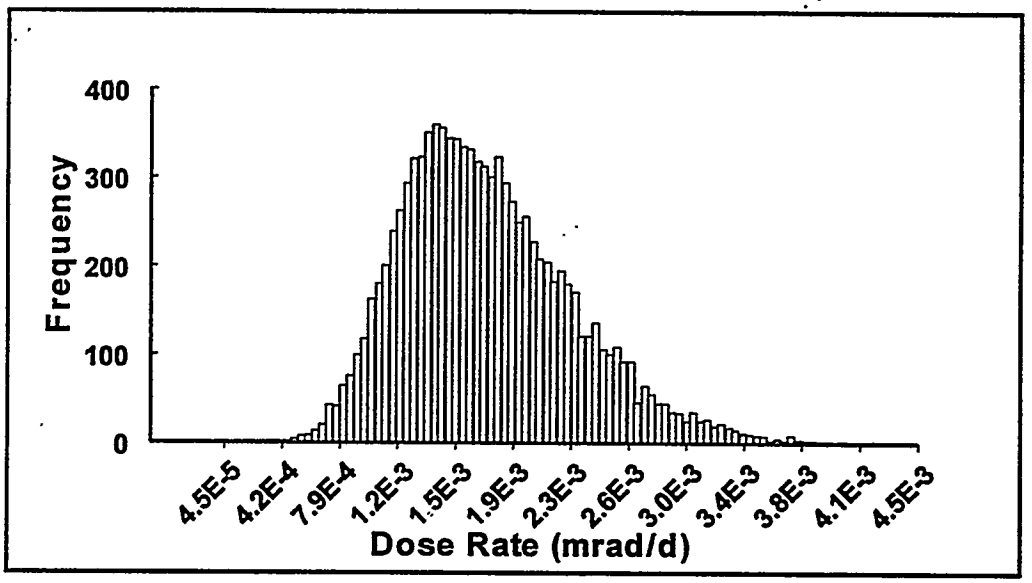

Figure 4. Results from steady state model, Simulation B. Graph is the frequency distribution of expected dose rates to white-tailed deer. Soil concentration, deer body mass, and feed intake are the main parameters in this simulation.

Soil and water concentrations were also varied in Simulation C, and uniform distributions were assumed for both soil and water concentrations. The range of soil concentrations was 35 pCi/g to 700 pCi/g to reflect the range of values measured at JPG (SEG, 1996) and the soil concentration value established in the NRC license with JPG. The mean dose rate to deer in Simulation C was 3.3×10^{-3} mrad/d ($\pm 1.6 \times 10^{-3}$) and the upper 95% confidence interval was 1.1×10^{-3} mrad/d to 9.5×10^{-3} mrad/d (Table 2). Figure 5 shows the distribution of the predicted values for Simulation C. The shape of Figure 5 reflects the normal distributions of feed intake and deer body mass, and the broader tails show the influence of the uniform distribution of soil concentration. The mean predicted value is larger than in Simulation B because of the larger range of input concentrations of DU in the soil, and the 95% confidence interval begins at larger values for the same reason.

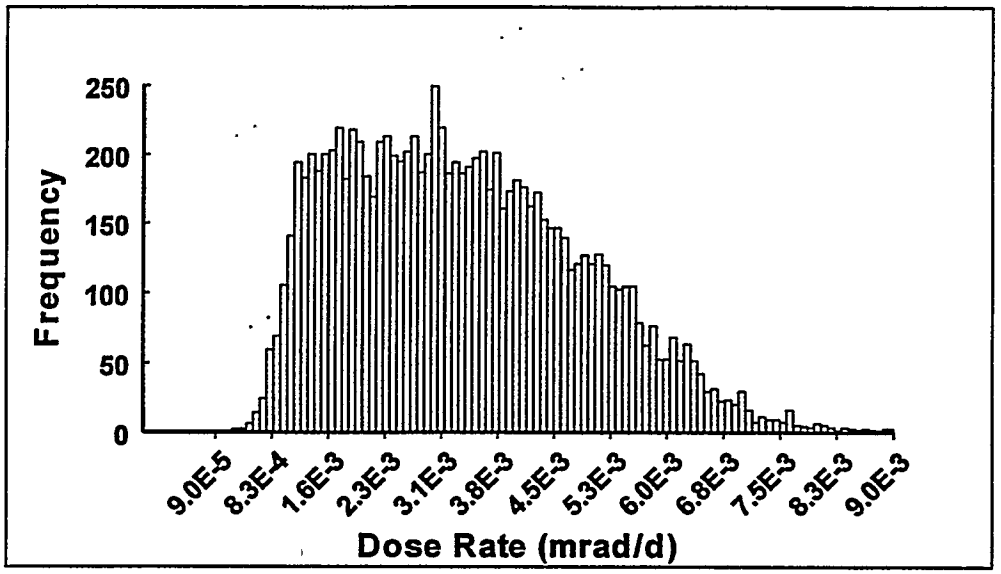

Figure 5. Results from steady state model, Simulation C. Graph is the frequency distribution of expected dose rates to white-tailed deer. Soil concentration, deer body mass, and feed intake are the parameters that were varied in this simulation.

Results for all simulations showed that the largest expected dose rate to deer was about 3.3×10^{-3} mrad/d, well below the rate of 100 mrad/d at which adverse reproductive effects are expected to occur (IAEA, 1992). The predicted values suggest that ingestion of DU by deer from soil, vegetation, and water are not enough to cause significant radiological harm at JPG. Data from Aberdeen Proving Ground (APG) from deer harvested on the B-3 range and on the eastern shore of Maryland showed that deer grazing in impact areas similar to those at JPG did not ingest significant quantities of DU (Ebinger et al, 1996). In addition, the APG data showed that DU concentrations in deer grazing the B-3 range were not significantly different than the eastern shore deer grazing areas where no DU was used.

The sensitivity of the steady state model configured for Scenario A was mainly due to the amount of feed intake by deer, as expected (Table 3). The rate of soil ingestion was also important, but the contribution to the predicted dose rate was much smaller than the contribution from feed intake. Of little importance was the contribution from water consumed by deer. In Scenarios B and C, DU concentrations in soil and water were allowed to vary. Sensitivity analysis for Scenarios B and C confirmed the expected result that the concentration of DU in soils was the most important parameter in the model related to predicted DU ingestion by deer (Table 3). The contribution from water consumed by deer was insignificant compared to the amount from the soil mainly because the amount from soil was about ten times larger than that from water.

Table 3. Results of sensitivity analyses of the steady state model from each scenario. Contribution of each variable is the percentage of the total variance in the predicted dose to deer.

Scenario	Parameter and Percentage of Variance
A	Feed Intake, 96.8%
	Soil Ingestion, 3.2%
B	Soil Concentration, 55.6%
	Feed Intake, 37.1%
	Soil Ingestion, 7.3%
C	Soil Concentration, 82.7%
	Feed Intake, 11.7%
	Soil Ingestion, 5.6%

3.2. RESRAD Simulations

Two sets of simulations were run for each scenario. In the first set, no contaminated water was included in the predictions. In the second set, groundwater was considered contaminated and use of the contaminated groundwater contributed to the dose to humans. Surface water in all scenarios was considered uncontaminated.

Hunting or Occasional Use Scenario. In the Occasional Use Scenario, site users brought all food and water onto the site, and human consumption of water from JPG was not allowed. Deer tissue was consumed off-site as a replacement for beef in the hunter's diets, and this pathway represented the only source of DU ingestion from JPG-derived products. Figure 6 shows the total dose to humans from all sources for the simulations that did not initially include DU in the groundwater. Inhalation of DU in airborne dust is the largest single source of radiation above background for this scenario. Ingestion of DU

from consumption of deer tissue was insignificant in humans. The maximum expected dose from these simulations is about 3.5 mrem/y, with essentially all of it from inhalation of DU-laden dust (Table 4). We assumed that deer drank only surface water, and the surface water contained no dissolved or suspended DU. Thus, the results for the two sets of simulations were identical for the Occasional Use Scenario.

Farming Scenario #1. For this scenario we assumed that a resident farmer grew vegetables and produced dairy products and livestock for on-site consumption, and that all drinking water for humans came from off-site and was uncontaminated. We also assumed in the first set of simulations that there is initially no DU in the groundwater. Results again show that dust inhalation is the largest contributor to total yearly dose to humans with a significant, but small, contribution from dust that remains on plant surfaces during vegetable consumption (Figure 7). The maximum dose expected for these simulations is about 11.6 mrem/y, slightly higher than for the Occasional Use Scenario because of longer duration of exposure (Table 5).

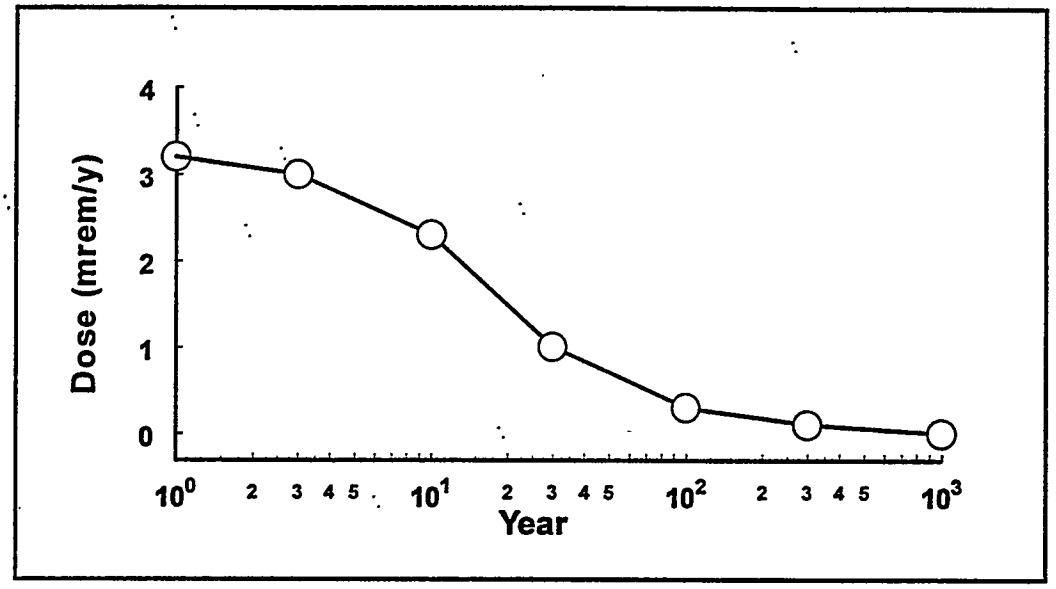

Figure 6. Results of RESRAD simulations for the Hunting or Occasional Use Scenario. Dose to humans is from inhalation of DU-containing dust only.

Table 4. Maximum dose expected and time of maximum dose in the Occasional Use Scenario.

Simulation	Maximum Dose (mrem/y)	Time of Maximum Dose (years)
No Initial DU in Water	3.5	0[1]
DU in Water	3.5	0

[1] A time of 0 years is the beginning of the simulation.

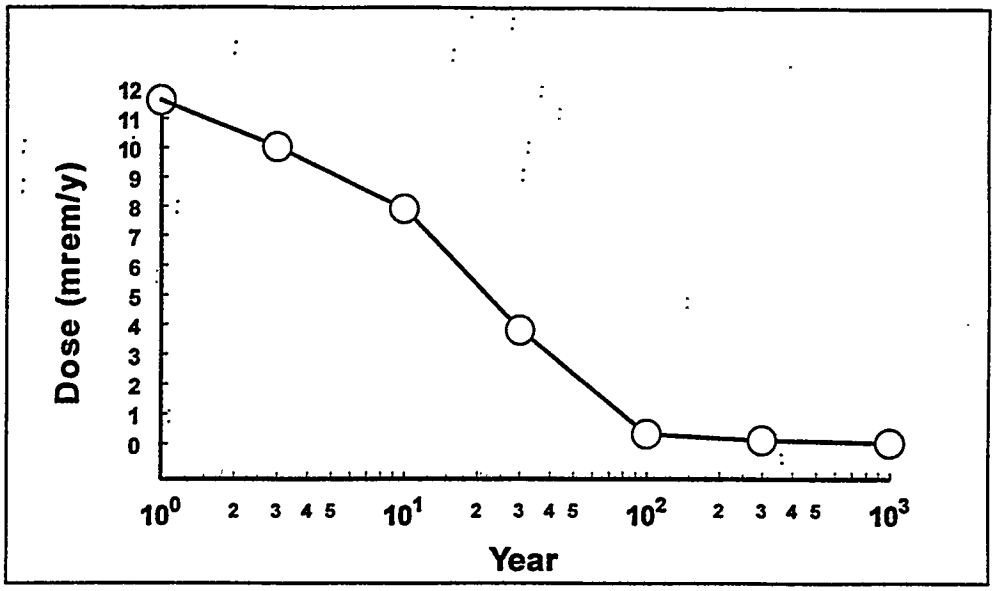

Figure 7. Results of RESRAD simulations for Farming Scenario #1 with no DU initially in groundwater. The only dose to humans is from inhalation of DU-containing dust.

Table 5. Maximum doses expected and time of maximum dose in Farming Scenario #1.

Simulation	Maximum Dose (mrem/y)	Time of Maximum Dose (years)
No Initial DU in Water	11.6	0
DU in Water[1]	47	8
DU in Water[2]	1987	20

[1] Livestock water is 90% surface (uncontaminated) water and 10% well water
[2] Livestock water is 50% surface water and 50% well water.

Doses increase significantly when DU in groundwater is included in the simulations. The increase in dose to humans is due mainly to increased intake of DU by livestock that are used as a meat source by humans. Groundwater is used only for livestock water in this scenario, and is mixed with uncontaminated surface water. The results in Table 5 show that a dose of 47 mrem/y is expected when 90% of the livestock water is surface water and 10% is from a contaminated well. The expected dose increases to nearly 2000 mrem/y when 50% of the livestock water is supplied from contaminated wells (Figure 8).

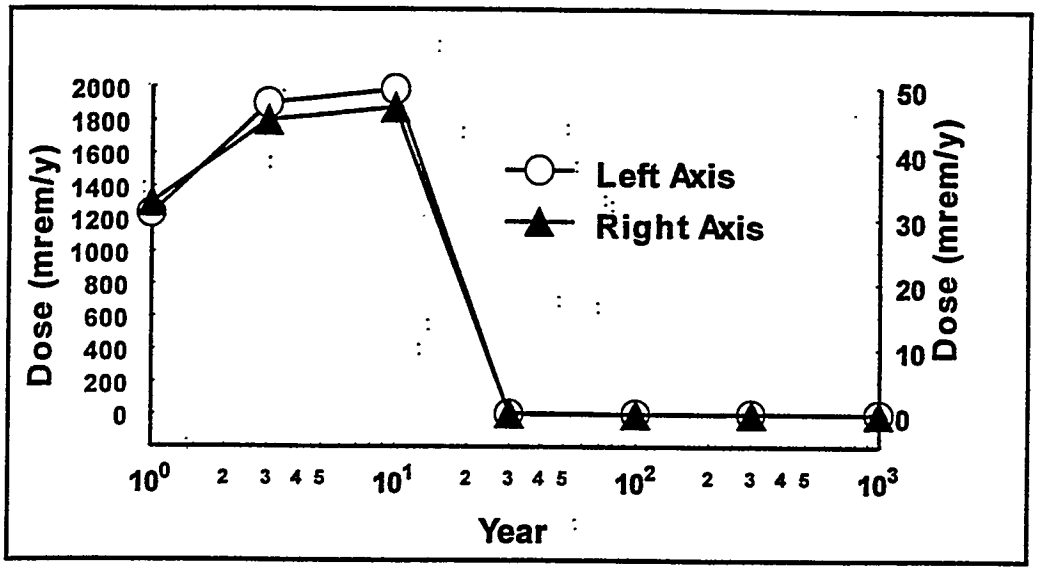

Figure 8. Results of RESRAD simulations for Farming Scenario #1 and initial DU concentration in groundwater was 2 pCi/L. Human drinking water was uncontaminated in these simulations. Left axis is the results of simulating 90% of the water available to livestock is contaminated. Right axis is the results of simulating 10% of the water available to livestock is contaminated.

The average reported DU concentration was 2.14 pCi/L (SEG, 1996) and was the basis for the initial DU concentration in the RESRAD simulations. Wells in the shallow aquifer at JPG would probably be of insufficient quality for human use because of sulfides from shales interbedded with limestone bedrock. Several samples from wells were marked by sulfur-like odors and were located within 20 feet of the soil surface. The values used for the RESRAD calculations and, therefore, the estimated doses to humans, represent the highest values expected for this scenario.

Farming Scenario #2. This scenario is similar to Farming Scenario #1 except that drinking water for resident farmers was assumed to be produced from on-site wells. Further, the wells were assumed to be potentially contaminated with DU. In the first set of simulations, no DU was initially present in the groundwater. Dose to humans from DU was due to two pathways and occurred at two different times (Figure 9; Table 6). From year 0 to about year 10 in the RESRAD simulations, a dose of about 12 mrem/y was expected from inhalation of DU-containing dust. This result is identical with Farming Scenario #1 when no DU was present initially in groundwater. Doses increase significantly after about year 200 of the simulations due to DU in drinking water. The second pathway that contributed to total dose to humans was a result of DU leaching into the aquifer and pumped out for drinking water. The time lag in the dose from the drinking water pathway was due to the time required to leach DU from the surface of the affected area to the water table.

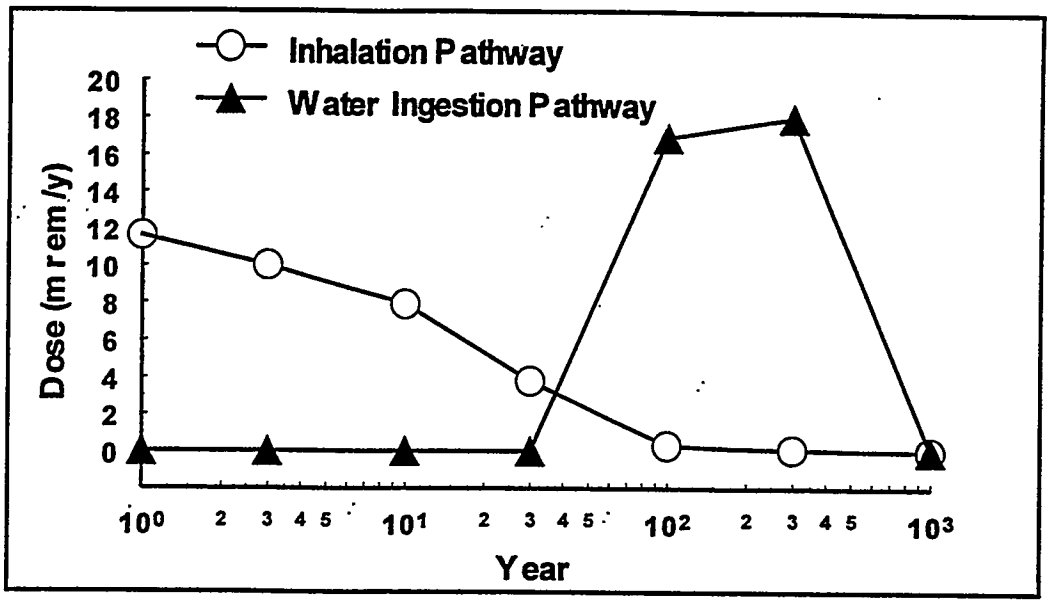

Figure 9. Results from RESRAD simulation of Farming Scenario #2, no DU initially present in groundwater. Dose to humans is from inhalation and drinking water at different times in the simulation.

In the second set of simulations we assumed that the initial DU in groundwater was 2 pCi/L. Doses from DU ingestion increase significantly, and the magnitude of the dose depends on the amount of drinking water ingested (Table 6). Doses were greatest when all human drinking water was contaminated and came from contaminated wells. The only significant contribution to the dose in Farming Scenario #2 came from the drinking water pathway (Figure 10). When the amount of contaminated drinking water is reduced, the dose to humans proportionally decreased as expected. A significant dose to humans remains, however, when uncontaminated water is used for the human drinking water and a contaminated source is used for 10% of the livestock water. The dose in the latter case is from human consumption of contaminated meat, and the source of contamination in the meat is due to consumption of contaminated drinking water and fodder. Inhalation of DU laden dust still contributes to human doses in Farming Scenario #2, but the magnitude is extremely small compared to doses from the other pathways.

Table 6. Maximum doses expected and time of maximum dose in Farming Scenario #2.

Simulation	Maximum Dose (mrem/y)	Time of Maximum Dose (years)
No Initial DU in Water	11.6[1] 18	0 750
DU in Water[2]	2×10^6	20
DU in Water[3]	5×10^5	20
DU in Water[4]	45	20

[1] 11.6 mrem/y from inhalation pathway, 18 mrem/y from drinking water pathway.
[2] All water for human and livestock consumption is contaminated, and all comes from wells.
[3] 50% of the water for human and livestock consumption is contaminated, and 50% comes from wells.
[4] Water for human consumption is uncontaminated, 10% of water for livestock consumption is contaminated and 10% comes from wells.

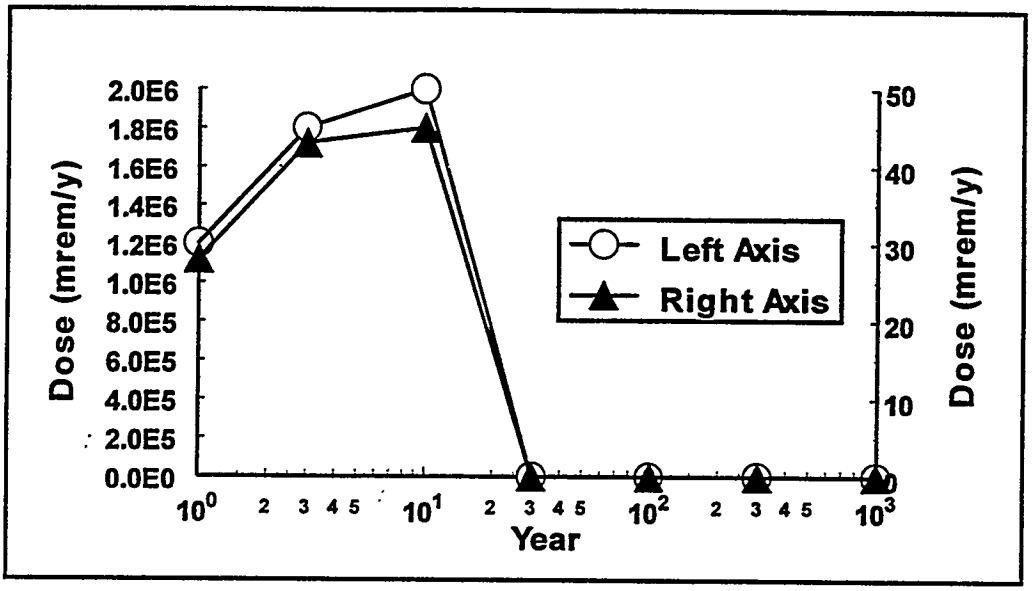

Figure 10. RESRAD results from Farming Scenario #2 showing doses to humans from two simulations. Left axis shows expected doses when contaminated drinking water is the only water source. Right axis shows the results from uncontaminated human drinking water and 10% of the water for livestock is contaminated.

4. Conclusions

Risk of Adverse Effects to White-tailed Deer

The results of the steady state model show that there is little expected adverse effect to deer from ingesting DU from vegetation, soil ingestion, and water. The model results show that the soil concentration and the amount of food consumed by deer, respectively, affect the predicted dose to deer the most, with a small contribution from soil ingestion and almost no contribution from water consumption. The steady state model showed considerably less dose to deer than suggested in the RESRAD simulations because water consumption rates for deer were less than those for cattle. Also, vegetation was consumed by livestock and residents in the RESRAD scenarios and not in the steady state model simulations. Results of the steady state model also compare favorably to field data obtained from white tailed deer at Aberdeen Proving Ground (Ebinger et al, 1996). The results of model simulations and compared to field data on deer exposure to DU do not support extensive remediation of the affected area at JPG. In other words, the high cost of remediation would produce only small benefit by reducing already low risk estimates.

The RESRAD results for resident farmers suggested that supplying water from contaminated wells may increase the DU ingested by livestock on a small farm within the affected area. Both farming scenarios were unrealistic since they did not account for hazards associated with UXO. However, the scenarios illustrated the potential for adverse effects in ecosystem receptors if intensive uses of the affected area are considered.

Risk of Adverse Effects to Humans

The RESRAD simulations indicate different potentials for adverse effects to humans, and the possibility of adverse effects depends on land use. The results of modeling the occasional use scenario suggested that immeasurable increase of adverse effects, such as cancer incidence, might occur in occasional visitors to the affected area who consume all game animals hunted at the site. These results suggested that hunting programs at JPG could continue without endangering the health of site users due to DU exposure.

Intensive use of the affected area, however, increased the predicted risk of DU exposure significantly. Increased time on the site resulted in slight increases in DU ingestion mainly through the inhalation pathway. Large increases in doses to humans occurred when: 1) meat and vegetables produced on-site are consumed by the resident farmers; and 2) residents used for drinking local groundwater that had been contaminated with DU. As mentioned above, doses to humans increased significantly even when drinking water is uncontaminated but livestock consume contaminated water and food. Thus, intensive use of the impact area is not recommended.

Farming and other intensive activities are not likely at JPG because of the high concentration of unexploded ordnance remaining on-site (Mason and Hangar, 1992). Buried ordnance are a significant hazard to human health, and the hazards of UXO dwarf those of DU ingestion. Hunting should be directed away from areas of highest UXO concentrations as is currently done. The farming scenarios, while illustrative, are unrealistic from the standpoint of safety, and are not recommended as future land use options without extensive UXO cleanup.

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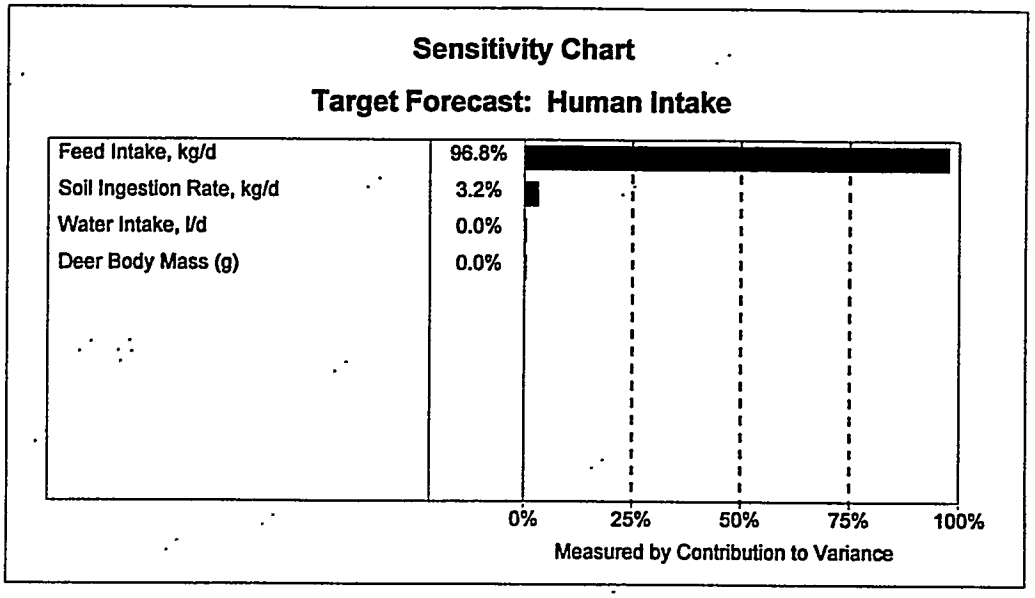
Appendix A

Input, Output, and Assumptions for Steady State Model

Crystal Ball Report
Simulation started on 9/30/96 at 22:36:17
Simulation stopped on 9/30/96 at 22:41:36

Scenario A, Steady State Model



Forecast: Human Intake **Cell: B63**

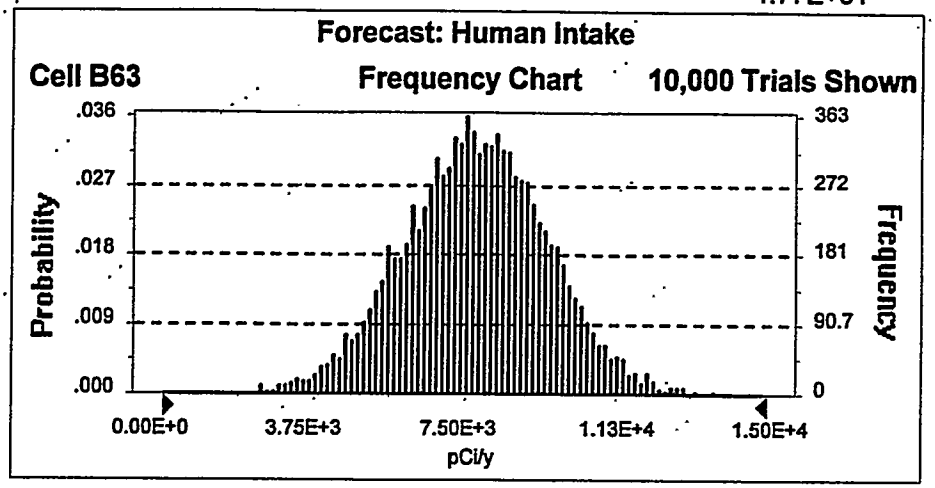
Summary:

Display Range is from 0.00E+0 to 1.50E+4 pCi/y
Entire Range is from 1.24E+3 to 1.45E+4 pCi/y
After 10,000 Trials, the Std. Error of the Mean is 1.77E+1

Statistics:

	Value
Trials	10000
Mean	7.80E+03
Median (approx.)	7.81E+03
Mode (approx.)	7.54E+03
Standard Deviation	1.77E+03
Variance	3.15E+06
Skewness	-1.69E-02
Kurtosis	3.04E+00
Coeff. of Variability	2.27E-01
Range Minimum	1.24E+03
Range Maximum	1.45E+04
Range Width	1.33E+04

Mean Std. Error 1.77E+01



Forecast: Human Intake (cont'd) **Cell: B63**

Percentiles:

Percentile	pCi/y (approx.)
0%	1.24E+03
20%	6.30E+03
40%	7.37E+03
60%	8.27E+03
80%	9.29E+03
100%	1.45E+04

End of Forecast

Forecast: Dose to Deer **Cell: E50**

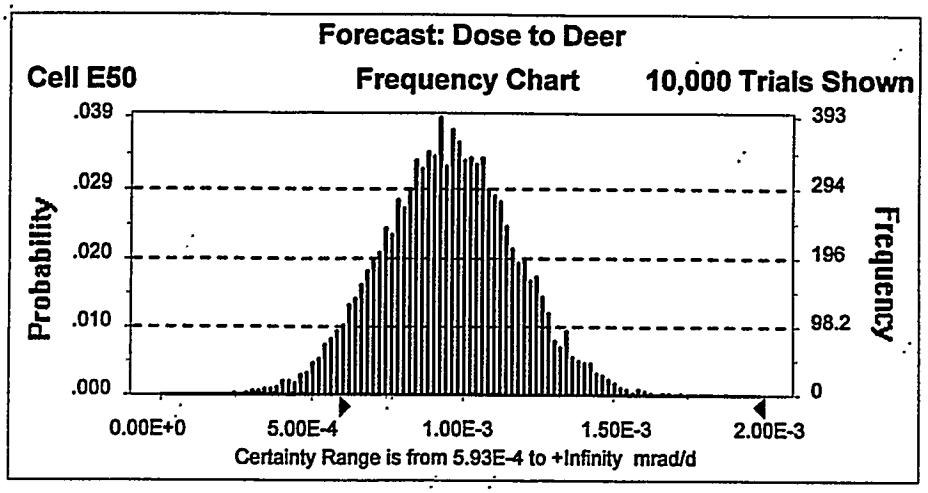
Summary:

Certainty Level is 9.50E+1%
Certainty Range is from 5.93E-4 to +Infinity mrad/d
Display Range is from 0.00E+0 to 2.00E-3 mrad/d
Entire Range is from 1.55E-4 to 1.81E-3 mrad/d
After 10,000 Trials, the Std. Error of the Mean is 2.24E-6

Statistics:

	Value
Trials	10000
Mean	9.59E-04
Median (approx.)	9.58E-04
Mode (approx.)	9.25E-04
Standard Deviation	2.24E-04
Variance	5.01E-08

Skewness	5.19E-02
Kurtosis	3.05E+00
Coeff. of Variability	2.33E-01
Range Minimum	1.55E-04
Range Maximum	1.81E-03
Range Width	1.66E-03
Mean Std. Error	2.24E-06



Forecast: Dose to Deer (cont'd) **Cell: E50**

Percentiles:

Percentile	mrad/d (approx.)
0%	1.55E-04
20%	7.71E-04
40%	9.02E-04
60%	1.01E-03
80%	1.14E-03
100%	1.81E-03

End of Forecast

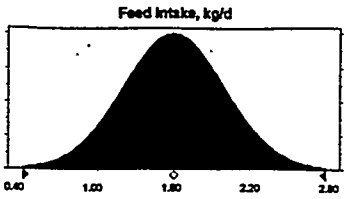
Assumptions

Assumption: Feed Intake, kg/d **Cell: B15**

Normal distribution with parameters:

Mean	1.60
Standard Dev.	0.40

Selected range is from -Infinity to +Infinity
Mean value in simulation was 1.60

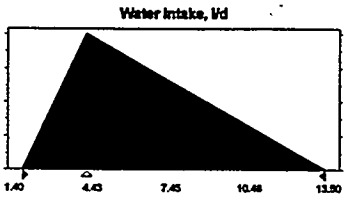


Assumption: Water Intake, l/d **Cell: B18**

Triangular distribution with parameters:

Minimum	1.40
Likeliest	4.00
Maximum	13.50

Selected range is from 1.40 to 13.50
Mean value in simulation was 6.29

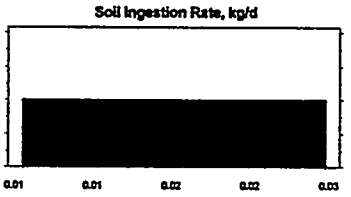


Assumption: Soil Ingestion Rate, kg/d **Cell: B35**

Uniform distribution with parameters:

Minimum	0.01
Maximum	0.03

Mean value in simulation was 0.02

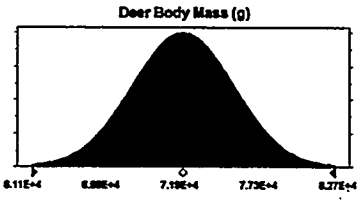


Assumption: Deer Body Mass (g) **Cell: B21**

Normal distribution with parameters:

Mean	7.19E+04
Standard Dev.	3.60E+03

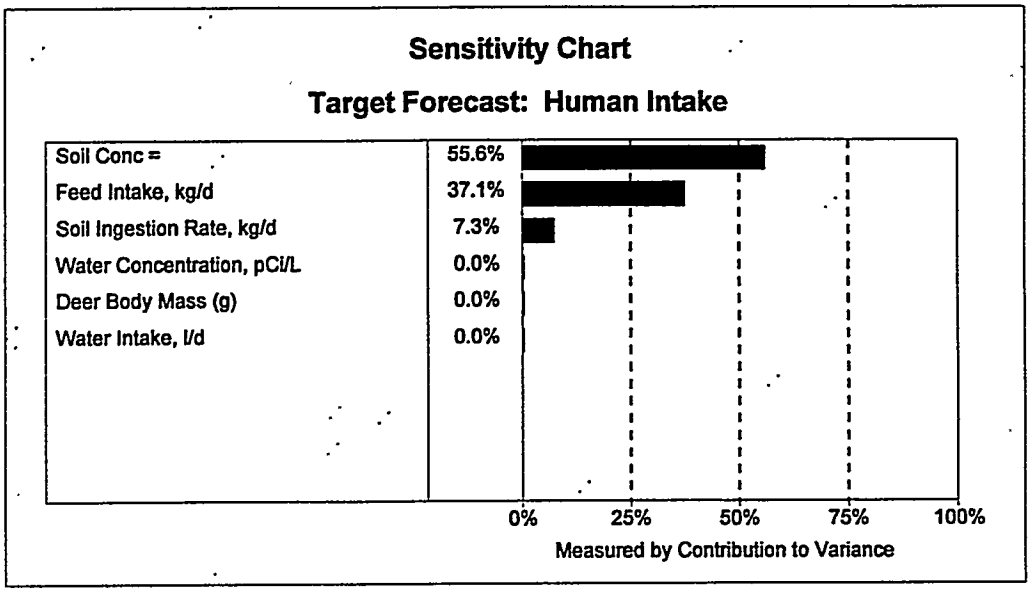
Selected range is from -Infinity to +Infinity
Mean value in simulation was 7.19E+4



End of Assumptions

Crystal Ball Report
Simulation started on 9/30/96 at 22:52:11
Simulation stopped on 9/30/96 at 22:57:59

Scenario B, Steady State Model



Forecast: Human Intake **Cell: B63**

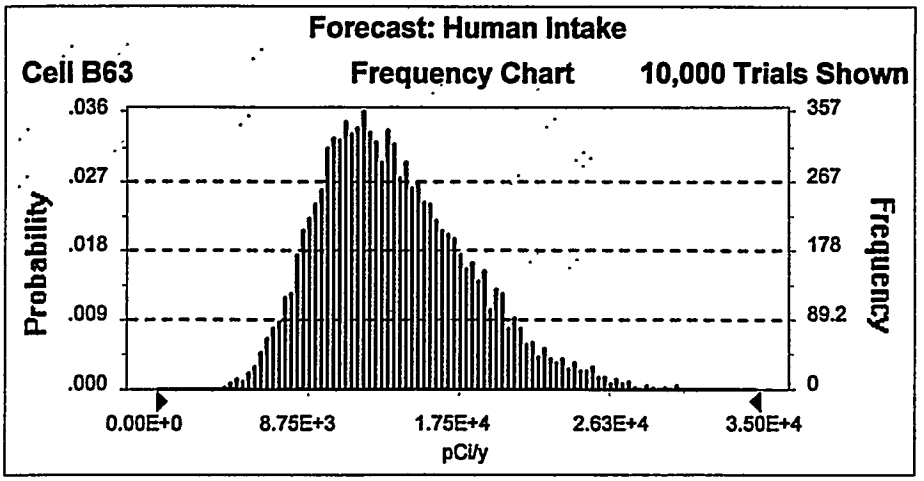
Summary:

Display Range is from 0.00E+0 to 3.50E+4 pCi/y
Entire Range is from 1.73E+3 to 3.32E+4 pCi/y
After 10,000 Trials, the Std. Error of the Mean is 4.37E+1

Statistics:

	Value
Trials	10000
Mean	1.39E+04
Median (approx.)	1.33E+04
Mode (approx.)	1.23E+04
Standard Deviation	4.37E+03
Variance	1.91E+07
Skewness	6.30E-01
Kurtosis	3.28E+00
Coeff. of Variability	3.15E-01
Range Minimum	1.73E+03
Range Maximum	3.32E+04
Range Width	3.15E+04

Mean Std. Error 4.37E+01



Forecast: Human Intake (cont'd) **Cell: B63**

Percentiles:

Percentile	pCi/y (approx.)
0%	1.73E+03
20%	1.01E+04
40%	1.22E+04
60%	1.45E+04
80%	1.75E+04
100%	3.32E+04

End of Forecast

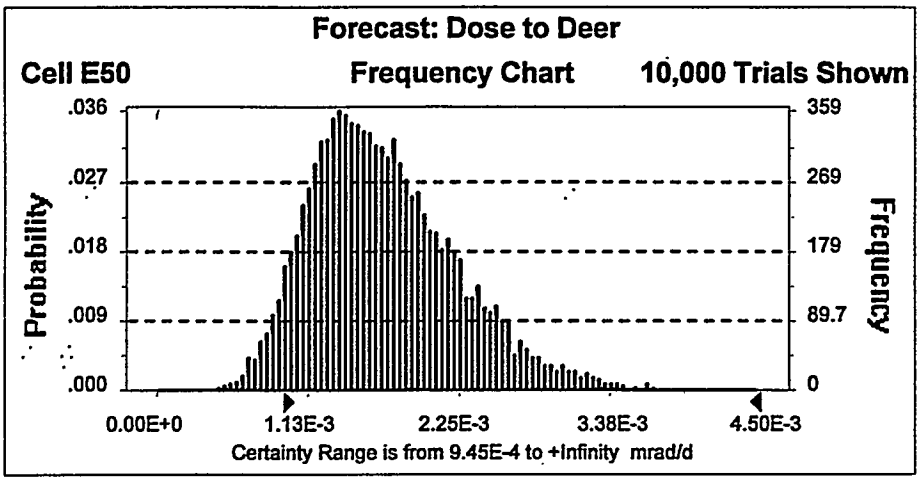
Forecast: Dose to Deer **Cell: E50**

Summary:

Certainty Level is 9.51E+1%
Certainty Range is from 9.45E-4 to +Infinity mrad/d
Display Range is from 0.00E+0 to 4.50E-3 mrad/d
Entire Range is from 2.19E-4 to 4.20E-3 mrad/d
After 10,000 Trials, the Std. Error of the Mean is 5.43E-6

Statistics:	Value
Trials	10000
Mean	1.71E-03
Median (approx.)	1.63E-03
Mode (approx.)	1.39E-03
Standard Deviation	5.43E-04
Variance	2.95E-07

Skewness	6.49E-01
Kurtosis	3.33E+00
Coeff. of Variability	3.18E-01
Range Minimum	2.19E-04
Range Maximum	4.20E-03
Range Width	3.99E-03
Mean Std. Error	5.43E-06



Forecast: Dose to Deer (cont'd) **Cell: E50**

Percentiles:

Percentile	mrad/d (approx.)
0%	2.19E-04
20%	1.24E-03
40%	1.50E-03
60%	1.78E-03
80%	2.15E-03
100%	4.20E-03

End of Forecast

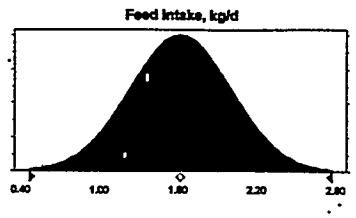
Assumptions

Assumption: Feed Intake, kg/d **Cell: B15**

Normal distribution with parameters:

Mean	1.60
Standard Dev.	0.40

Selected range is from -Infinity to +Infinity
Mean value in simulation was 1.60

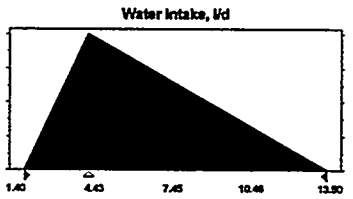


Assumption: Water Intake, l/d **Cell: B18**

Triangular distribution with parameters:

Minimum	1.40
Likeliest	4.00
Maximum	13.50

Selected range is from 1.40 to 13.50
Mean value in simulation was 6.30

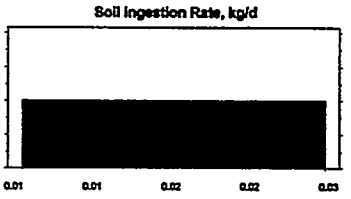


Assumption: Soil Ingestion Rate, kg/d **Cell: B35**

Uniform distribution with parameters:

Minimum	0.01
Maximum	0.03

Mean value in simulation was 0.02

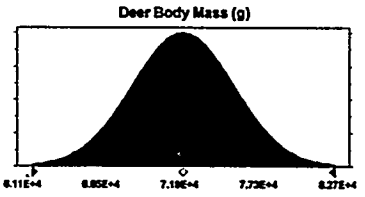


Assumption: Deer Body Mass (g) **Cell: B21**

Normal distribution with parameters:

Mean	7.19E+04
Standard Dev.	3.60E+03

Selected range is from -Infinity to +Infinity
Mean value in simulation was 7.19E+4

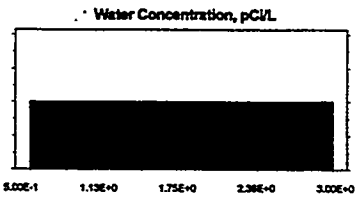


Assumption: Water Concentration, pCi/L **Cell: B24**

Uniform distribution with parameters:

Minimum	5.00E-01
Maximum	3.00E+00

Mean value in simulation was 1.74E+0

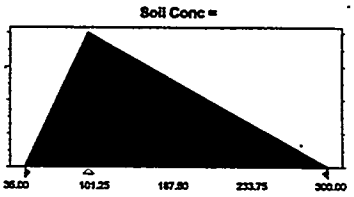


Assumption: Soil Conc = **Cell: B33**

Triangular distribution with parameters:

Minimum	35.00
Likeliest	91.00
Maximum	300.00

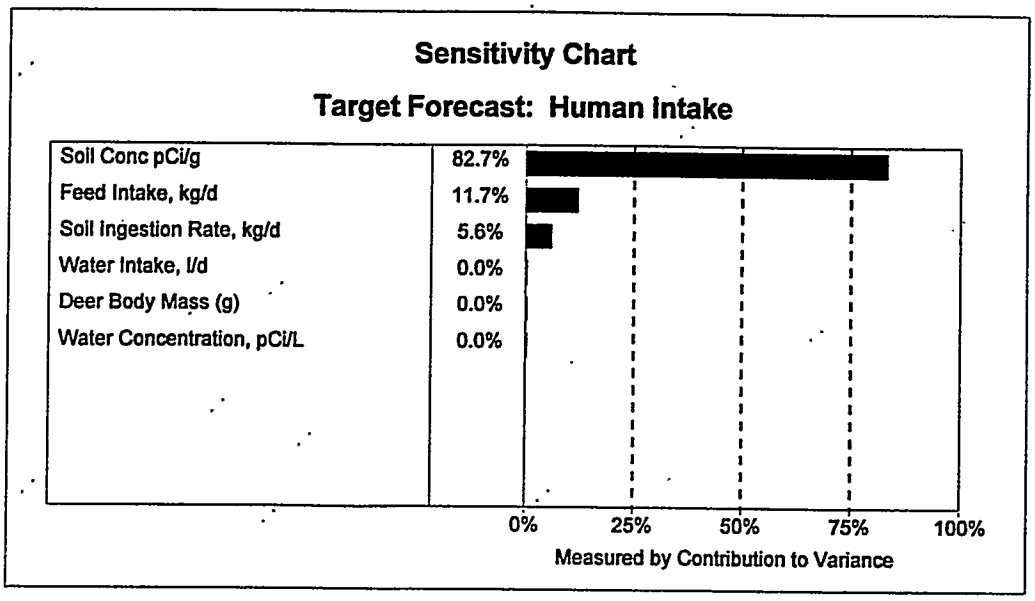
Selected range is from 35.00 to 300.00
Mean value in simulation was 142.13



End of Assumptions

Crystal Ball Report
Simulation started on 9/30/96 at 23:03:44
Simulation stopped on 9/30/96 at 23:09:30

Sceanrio C, Steady State Model



Forecast: Human Intake **Cell: B63**

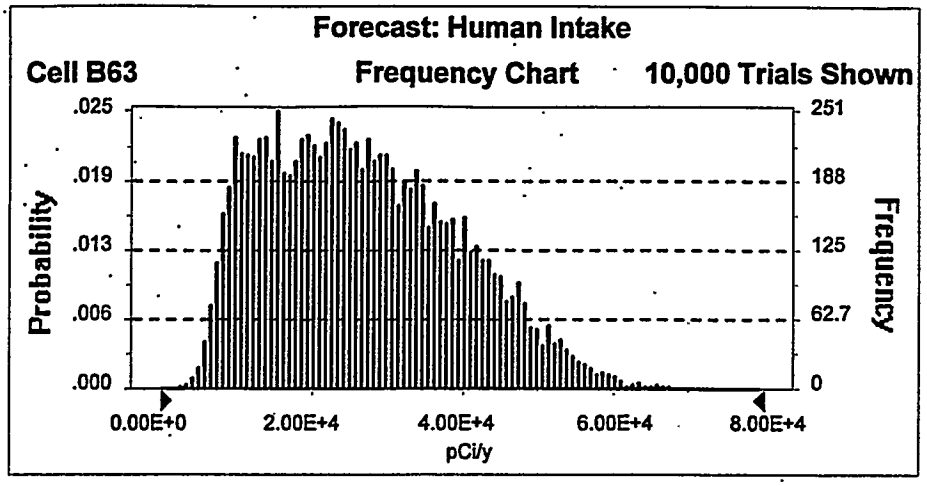
Summary:

Display Range is from 0.00E+0 to 8.00E+4 pCi/y
Entire Range is from 2.75E+3 to 7.22E+4 pCi/y
After 10,000 Trials, the Std. Error of the Mean is 1.25E+2

Statistics:

	Value
Trials	10000
Mean	2.68E+04
Median (approx.)	2.55E+04
Mode (approx.)	1.56E+04
Standard Deviation	1.25E+04
Variance	1.57E+08
Skewness	4.39E-01
Kurtosis	2.50E+00
Coeff. of Variability	4.68E-01
Range Minimum	2.75E+03
Range Maximum	7.22E+04
Range Width	6.94E+04

Mean Std. Error 1.25E+02



Forecast: Human Intake (cont'd) **Cell: B63**

Percentiles:

Percentile	pCi/y (approx.)
0%	2.75E+03
20%	1.47E+04
40%	2.21E+04
60%	2.93E+04
80%	3.82E+04
100%	7.22E+04

End of Forecast

Forecast: Dose to Deer **Cell: E50**

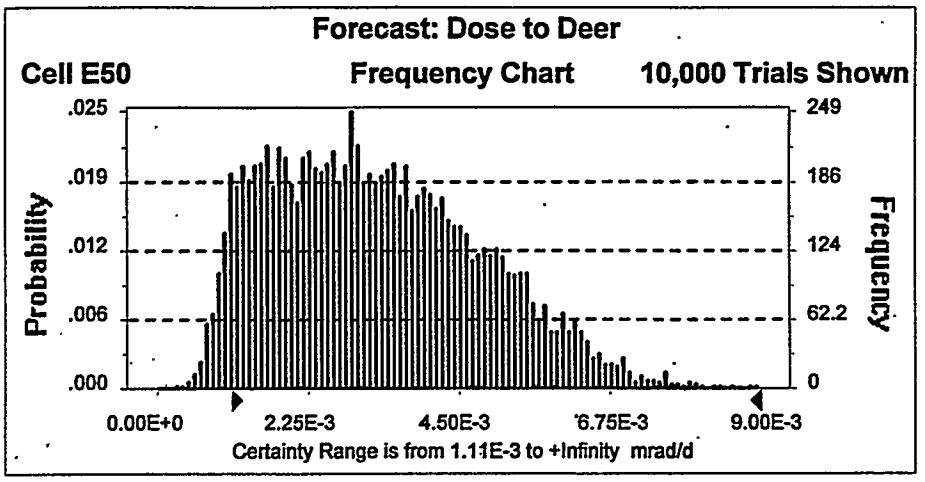
Summary:

Certainty Level is 9.52E+1%
Certainty Range is from 1.11E-3 to +Infinity mrad/d
Display Range is from 0.00E+0 to 9.00E-3 mrad/d
Entire Range is from 3.47E-4 to 8.99E-3 mrad/d
After 10,000 Trials, the Std. Error of the Mean is 1.55E-5

Statistics:

	Value
Trials	10000
Mean	3.30E-03
Median (approx.)	3.13E-03
Mode (approx.)	2.90E-03
Standard Deviation	1.55E-03
Variance	2.41E-06

Skewness	4.72E-01
Kurtosis	2.60E+00
Coeff. of Variability	4.71E-01
Range Minimum	3.47E-04
Range Maximum	8.99E-03
Range Width	8.65E-03
Mean Std. Error	1.55E-05



Forecast: Dose to Deer (cont'd) **Cell: E50**

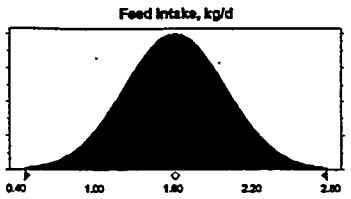
Percentiles:

Percentile	mrad/d (approx.)
0%	3.47E-04
20%	1.81E-03
40%	2.70E-03
60%	3.60E-03
80%	4.69E-03
100%	8.99E-03

End of Forecast

Assumptions

Assumption: Feed Intake, kg/d **Cell: B15**

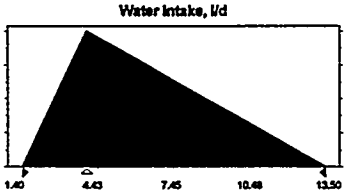


Normal distribution with parameters:

Mean	1.60
Standard Dev.	0.40

Selected range is from -Infinity to +Infinity
Mean value in simulation was 1.60

Assumption: Water Intake, l/d **Cell: B18**



Triangular distribution with parameters:

Minimum	1.40
Likeliest	4.00
Maximum	13.50

Selected range is from 1.40 to 13.50
Mean value in simulation was 6.32

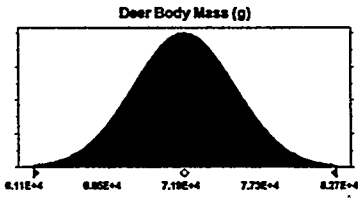
Assumption: Soil Ingestion Rate, kg/d **Cell: B35**

Uniform distribution with parameters:

Minimum	0.01
Maximum	0.03

Mean value in simulation was 0.02

Assumption: Deer Body Mass (g) **Cell: B21**



Normal distribution with parameters:

Mean	7.19E+04
Standard Dev.	3.60E+03

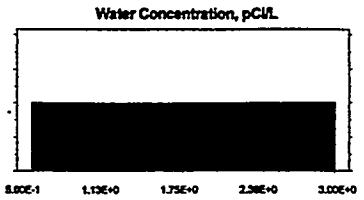
Selected range is from -Infinity to +Infinity
Mean value in simulation was 7.19E+4

Assumption: Water Concentration, pCi/L **Cell: B24**

Uniform distribution with parameters:

Minimum	5.00E-01
Maximum	3.00E+00

Mean value in simulation was 1.75E+0

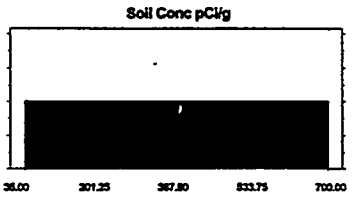


Assumption: Soil Conc pCi/g **Cell: B33**

Uniform distribution with parameters:

Minimum	35.00
Maximum	700.00

Mean value in simulation was 369.11



End of Assumptions

Appendix B

RESRAD Input for All Scenarios

RESRAD, Version 5.61 T< Limit = 0.5 year 10/01/96 10:58 Page 1
Summary : SEG Case A, Mod.4, Hunting Scenario File: SEGA4.DAT

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines.

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

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.530E+06	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	1.500E-01	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	6.500E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	1.000E+01	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): U-234	7.490E+00	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): U-238	8.110E+01	0.000E+00	---	S1(5)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(4)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(5)
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)	1.250E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-06	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.300E-01	4.000E-01	---	TPCZ
R013	Contaminated zone effective porosity	1.800E-01	2.000E-01	---	EPCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	2.000E+02	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Humidity in air (g/cm**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	9.400E-01	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	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+08	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	0.000E+00	1.000E-03	Zero shows Simpson's rule.	EPS
R014	Density of saturated zone (g/cm**3)	1.250E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.300E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	1.300E-01	2.000E-01	---	EPSZ
R014	Saturated zone hydraulic conductivity (m/yr)	3.200E+01	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	1.040E+01	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	2	1	---	NS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R015	Unsat. zone 1, thickness (m)	1.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.250E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.300E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	1.800E-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)	2.000E+02	1.000E+01	---	HCUZ(1)
R015	Unsat. zone 2, thickness (m)	3.000E+00	0.000E+00	---	H(2)
R015	Unsat. zone 2, soil density (g/cm**3)	1.250E+00	1.500E+00	---	DENSUZ(2)
R015	Unsat. zone 2, total porosity	4.300E-01	4.000E-01	---	TPUZ(2)
R015	Unsat. zone 2, effective porosity	1.300E-01	2.000E-01	---	EPUZ(2)
R015	Unsat. zone 2, soil-specific b parameter	1.040E+01	5.300E+00	---	BUZ(2)
R015	Unsat. zone 2, hydraulic conductivity (m/yr)	3.200E+01	1.000E+01	---	HCUZ(2)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(4,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(4,2)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.993E-02	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(5,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(5,2)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.993E-02	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	5.500E+02	1.000E+02	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	5.500E+02	1.000E+02	---	DCNUCU(1,1)
R016	Unsaturated zone 2 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(1,2)
R016	Saturated zone (cm**3/g)	5.500E+02	1.000E+02	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.645E-03	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	9.100E+03	7.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	9.100E+03	7.000E+01	---	DCNUCU(2,1)
R016	Unsaturated zone 2 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(2,2)
R016	Saturated zone (cm**3/g)	9.100E+03	7.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.204E-04	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)

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 Th-230				
R016	Contaminated zone (cm**3/g)	5.800E+03	6.000E+04	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	5.800E+03	6.000E+04	---	DCNUCU(3,1)
R016	Unsaturated zone 2 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(3,2)
R016	Saturated zone (cm**3/g)	5.800E+03	6.000E+04	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.457E-04	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	2.000E-04	2.000E-04	---	MLINH
R017	Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00	---	LM
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-02	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	1.000E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	0.000E+00	1.000E+00	1 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	1.600E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	1.400E+01	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	6.300E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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	0.000E+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	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT
R018	Contamination fraction of meat	-1	-1	0.100E+01	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	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	0.000E+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
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
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	not used	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	not used	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	not used	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

Site-Specific Parameter Summary (continued)

Menu.	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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 annual wind speed (m/sec)	not used	2.000E+00	---	WIND
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	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed

Farming Scenario #1, No Initial DU in Grounewater

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

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

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.530E+06	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	1.500E-01	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	6.500E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	1.000E+01	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1:000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(1*)
R012	Initial principal radionuclide (pCi/g): U-234	7.490E+00	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): U-238	8.110E+01	0.000E+00	---	S1(5)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(4)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(5)
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)	1.250E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-06	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.300E-01	4.000E-01	---	TPCZ
R013	Contaminated zone effective porosity	1.800E-01	2.000E-01	---	EPCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	2.000E+02	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Humidity in air (g/cm**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	9.400E-01	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	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+08	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	0.000E+00	1.000E-03	Zero shows Simpson's rule.	EPS
R014	Density of saturated zone (g/cm**3)	1.250E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.300E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	1.300E-01	2.000E-01	---	EPSZ
R014	Saturated zone hydraulic conductivity (m/yr)	3.200E+01	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	1.040E+01	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	2	1	---	NS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R015	Unsat. zone 1, thickness (m)	1.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.250E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.300E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	1.800E-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)	2.000E+02	1.000E+01	---	HCUZ(1)
R015	Unsat. zone 2, thickness (m)	3.000E+00	0.000E+00	---	H(2)
R015	Unsat. zone 2, soil density (g/cm**3)	1.250E+00	1.500E+00	---	DENSUZ(2)
R015	Unsat. zone 2, total porosity	4.300E-01	4.000E-01	---	TPUZ(2)
R015	Unsat. zone 2, effective porosity	1.300E-01	2.000E-01	---	EPUZ(2)
R015	Unsat. zone 2, soil-specific b parameter	1.040E+01	5.300E+00	---	BUZ(2)
R015	Unsat. zone 2, hydraulic conductivity (m/yr)	3.200E+01	1.000E+01	---	HCUZ(2)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(4,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(4,2)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.993E-02	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(5,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(5,2)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.993E-02	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	5.500E+02	1.000E+02	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	5.500E+02	1.000E+02	---	DCNUCU(1,1)
R016	Unsaturated zone 2 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(1,2)
R016	Saturated zone (cm**3/g)	5.500E+02	1.000E+02	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.645E-03	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	9.100E+03	7.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	9.100E+03	7.000E+01	---	DCNUCU(2,1)
R016	Unsaturated zone 2 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(2,2)
R016	Saturated zone (cm**3/g)	9.100E+03	7.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.204E-04	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)

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 Th-230				
R016	Contaminated zone (cm**3/g)	5.800E+03	6.000E+04	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	5.800E+03	6.000E+04	---	DCNUCU(3,1)
R016	Unsaturated zone 2 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(3,2)
R016	Saturated zone (cm**3/g)	5.800E+03	6.000E+04	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.457E-04	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	2.000E-04	2.000E-04	---	MLINH
R017	Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00	---	LM
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)	3.000E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	0.000E+00	1.000E+00	1 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	1.600E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	1.400E+01	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	6.300E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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	0.000E+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	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	1.000E+00	-1	---	FPLANT
R018	Contamination fraction of meat	1.000E+00	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	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	0.000E+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
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
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	not used	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	not used	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	not used	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

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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 annual wind speed (m/sec)	not used	2.000E+00	---	WIND
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	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed

Farming Scenario #1, Intial DU Concentration 2 pCi/L in Groundwater

Summary : SEG Case A, Mod.8 (from mod.5) Farm #1 Scen. , U solub., 2 pCi/L GW
File : SEGA11.DAT

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

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

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

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

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.530E+06	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	1.500E-01	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	6.500E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	1.000E+01	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): U-234	7.490E+00	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): U-238	8.110E+01	0.000E+00	---	S1(5)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(4)
R012	Concentration in groundwater (pCi/L): U-238	2.000E+00	0.000E+00	0.000E+00	W1(5)
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)	1.250E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-06	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.300E-01	4.000E-01	---	TPCZ
R013	Contaminated zone effective porosity	1.800E-01	2.000E-01	---	EPCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	2.000E+02	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Humidity in air (g/cm**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	9.400E-01	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	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+08	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	0.000E+00	1.000E-03	Zero shows Simpson's rule.	EPS
R014	Density of saturated zone (g/cm**3)	1.250E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.300E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	1.300E-01	2.000E-01	---	EPSZ
R014	Saturated zone hydraulic conductivity (m/yr)	3.200E+01	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	1.040E+01	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	2	1	---	NS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R015	Unsat. zone 1, thickness (m)	1.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.250E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.300E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	1.800E-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)	2.000E+02	1.000E+01	---	HCUZ(1)
R015	Unsat. zone 2, thickness (m)	3.000E+00	0.000E+00	---	H(2)
R015	Unsat. zone 2, soil density (g/cm**3)	1.250E+00	1.500E+00	---	DENSUZ(2)
R015	Unsat. zone 2, total porosity	4.300E-01	4.000E-01	---	TPUZ(2)
R015	Unsat. zone 2, effective porosity	1.300E-01	2.000E-01	---	EPUZ(2)
R015	Unsat. zone 2, soil-specific b parameter	1.040E+01	5.300E+00	---	BUZ(2)
R015	Unsat. zone 2, hydraulic conductivity (m/yr)	3.200E+01	1.000E+01	---	HCUZ(2)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(4,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(4,2)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.993E-02	ALEACH(4)
R016	Solubility constant	1.000E-05	0.000E+00	---	SOLUBK(4)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	1.011E+02	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(5,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(5,2)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.024E-01	ALEACH(5)
R016	Solubility constant	1.000E-05	0.000E+00	---	SOLUBK(5)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	5.500E+02	1.000E+02	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	5.500E+02	1.000E+02	---	DCNUCU(1,1)
R016	Unsaturated zone 2 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(1,2)
R016	Saturated zone (cm**3/g)	5.500E+02	1.000E+02	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.645E-03	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	9.100E+03	7.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	9.100E+03	7.000E+01	---	DCNUCU(2,1)
R016	Unsaturated zone 2 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(2,2)
R016	Saturated zone (cm**3/g)	9.100E+03	7.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.204E-04	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)

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 Th-230				
R016	Contaminated zone (cm**3/g)	5.800E+03	6.000E+04	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	5.800E+03	6.000E+04	---	DCNUCU(3,1)
R016	Unsaturated zone 2 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(3,2)
R016	Saturated zone (cm**3/g)	5.800E+03	6.000E+04	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.457E-04	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	2.000E-04	2.000E-04	---	MLINH
R017	Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00	---	LM
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)	3.000E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	0.000E+00	1.000E+00	1 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	1.600E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	1.400E+01	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	6.300E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	5.100E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	0.000E+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-01	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	1.000E+00	-1	---	FPLANT
R018	Contamination fraction of meat	1.000E+00	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	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	0.000E+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
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
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	not used	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	not used	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	not used	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

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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 annual wind speed (m/sec)	not used	2.000E+00	---	WIND
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	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed

Farming Scenario #2, no DU Initially in Groundwater

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

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

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.530E+06	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	1.500E-01	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	6.500E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	1.000E+01	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): U-234	7.490E+00	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): U-238	8.110E+01	0.000E+00	---	S1(5)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(4)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(5)
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)	1.250E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-06	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.300E-01	4.000E-01	---	TPCZ
R013	Contaminated zone effective porosity	1.800E-01	2.000E-01	---	EPCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	2.000E+02	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Humidity in air (g/cm**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	9.400E-01	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	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+08	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	0.000E+00	1.000E-03	Zero shows Simpson's rule.	EPS
R014	Density of saturated zone (g/cm**3)	1.250E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.300E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	1.300E-01	2.000E-01	---	EPSZ
R014	Saturated zone hydraulic conductivity (m/yr)	3.200E+01	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	1.040E+01	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	2	1	---	NS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R015	Unsat. zone 1, thickness (m)	1.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.250E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.300E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	1.800E-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)	2.000E+02	1.000E+01	---	HCUZ(1)
R015	Unsat. zone 2, thickness (m)	3.000E+00	0.000E+00	---	H(2)
R015	Unsat. zone 2, soil density (g/cm**3)	1.250E+00	1.500E+00	---	DENSUZ(2)
R015	Unsat. zone 2, total porosity	4.300E-01	4.000E-01	---	TPUZ(2)
R015	Unsat. zone 2, effective porosity	1.300E-01	2.000E-01	---	EPUZ(2)
R015	Unsat. zone 2, soil-specific b parameter	1.040E+01	5.300E+00	---	BUZ(2)
R015	Unsat. zone 2, hydraulic conductivity (m/yr)	3.200E+01	1.000E+01	---	HCUZ(2)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(4,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(4,2)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.993E-02	ALEACH(4)
R016	Solubility constant	1.000E-05	0.000E+00	---	SOLUBK(4)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	1.011E+02	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(5,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(5,2)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.978E-02	ALEACH(5)
R016	Solubility constant	1.000E-05	0.000E+00	---	SOLUBK(5)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	5.500E+02	1.000E+02	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	5.500E+02	1.000E+02	---	DCNUCU(1,1)
R016	Unsaturated zone 2 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(1,2)
R016	Saturated zone (cm**3/g)	5.500E+02	1.000E+02	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.645E-03	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	9.100E+03	7.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	9.100E+03	7.000E+01	---	DCNUCU(2,1)
R016	Unsaturated zone 2 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(2,2)
R016	Saturated zone (cm**3/g)	9.100E+03	7.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.204E-04	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)

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 Th-230				
R016	Contaminated zone (cm**3/g)	5.800E+03	6.000E+04	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	5.800E+03	6.000E+04	---	DCNUCU(3,1)
R016	Unsaturated zone 2 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(3,2)
R016	Saturated zone (cm**3/g)	5.800E+03	6.000E+04	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.457E-04	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	2.000E-04	2.000E-04	---	MLINH
R017	Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00	---	LM
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)	3.000E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	0.000E+00	1.000E+00	1 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	1.600E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	1.400E+01	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	6.300E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	1.000E+00	-1	---	FPLANT
R018	Contamination fraction of meat	1.000E+00	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	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
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
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	not used	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	not used	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	not used	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

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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 annual wind speed (m/sec)	not used	2.000E+00	---	WIND
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	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed

Farming Scenario #2, Initial DU Concentration 2 pCi/L in Groundwater

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

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

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

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

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.530E+06	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	1.500E-01	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	6.500E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.500E+01	3.000E+01	---	BRDL
R011	Time since placement of material (yr)	1.000E+01	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+01	1.000E+01	---	T(4)
R011	Times for calculations (yr)	3.000E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	1.000E+02	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.000E+03	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
		not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): U-234	7.490E+00	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): U-238	8.110E+01	0.000E+00	---	S1(5)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(4)
R012	Concentration in groundwater (pCi/L): U-238	2.000E+00	0.000E+00	0.000E+00	W1(5)
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)	1.250E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-06	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.300E-01	4.000E-01	---	TPCZ
R013	Contaminated zone effective porosity	1.800E-01	2.000E-01	---	EPCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	2.000E+02	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Humidity in air (g/cm**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	9.400E-01	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	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+08	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	0.000E+00	1.000E-03	Zero shows Simpson's rule.	EPS
R014	Density of saturated zone (g/cm**3)	1.250E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.300E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	1.300E-01	2.000E-01	---	EPSZ
R014	Saturated zone hydraulic conductivity (m/yr)	3.200E+01	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	1.040E+01	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	2	1	---	NS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R015	Unsat. zone 1, thickness (m)	1.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.250E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.300E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	1.800E-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)	2.000E+02	1.000E+01	---	HCUZ(1)
R015	Unsat. zone 2, thickness (m)	3.000E+00	0.000E+00	---	H(2)
R015	Unsat. zone 2, soil density (g/cm**3)	1.250E+00	1.500E+00	---	DENSUZ(2)
R015	Unsat. zone 2, total porosity	4.300E-01	4.000E-01	---	TPUZ(2)
R015	Unsat. zone 2, effective porosity	1.300E-01	2.000E-01	---	EPUZ(2)
R015	Unsat. zone 2, soil-specific b parameter	1.040E+01	5.300E+00	---	BUZ(2)
R015	Unsat. zone 2, hydraulic conductivity (m/yr)	3.200E+01	1.000E+01	---	HCUZ(2)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(4,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(4,2)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.993E-02	ALEACH(4)
R016	Solubility constant	1.000E-05	0.000E+00	---	SOLUBK(4)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	1.011E+02	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(5,1)
R016	Unsaturated zone 2 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(5,2)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.024E-01	ALEACH(5)
R016	Solubility constant	1.000E-05	0.000E+00	---	SOLUBK(5)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	5.500E+02	1.000E+02	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	5.500E+02	1.000E+02	---	DCNUCU(1,1)
R016	Unsaturated zone 2 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(1,2)
R016	Saturated zone (cm**3/g)	5.500E+02	1.000E+02	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.645E-03	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	9.100E+03	7.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	9.100E+03	7.000E+01	---	DCNUCU(2,1)
R016	Unsaturated zone 2 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(2,2)
R016	Saturated zone (cm**3/g)	9.100E+03	7.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.204E-04	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)

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 Th-230				
R016	Contaminated zone (cm**3/g)	5.800E+03	6.000E+04	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	5.800E+03	6.000E+04	---	DCNUCU(3,1)
R016	Unsaturated zone 2 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(3,2)
R016	Saturated zone (cm**3/g)	5.800E+03	6.000E+04	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.457E-04	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	2.000E-04	2.000E-04	---	MLINH
R017	Dilution length for airborne dust, inhalation (m)	3.000E+00	3.000E+00	---	LM
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)	3.000E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	0.000E+00	1.000E+00	1 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	1.600E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	1.400E+01	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	6.300E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	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	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	1.000E+00	-1	---	FPLANT
R018	Contamination fraction of meat	1.000E+00	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	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	5.000E-01	1.000E+00	---	FGWIR
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	not used	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	not used	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	not used	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	not used	2.000E-01	---	AVFG5
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	not used	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	not used	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	not used	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

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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 annual wind speed (m/sec)	not used	2.000E+00	---	WIND
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	suppressed
6 -- aquatic foods	suppressed
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed