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Title: DEPLETED URANIUM HUMAN HEALTH RISK ASSESSMENT, JEFFERSON PROVING GROUND, INDIANA

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Depleted Uranium Human Health Risk Assessment, Jefferson Proving Ground, Indiana

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Abstract

The risk to human health from fragments of depleted uranium (DU) at Jefferson Proving Ground (JPG) was estimated using two types of ecosystem pathway models. A steady-state model of the JPG area was developed to examine the effects of DU in soils, water, and vegetation on deer that were hunted and consumed by humans. The RESRAD code was also used to estimate the effects of farming the impact area and consuming the products derived from the farm. The steady-state model showed that minimal doses to humans are expected from consumption of deer that inhabit the impact area. Median values for doses to humans range from about 1 mrem (± 2.4) to 0.04 mrem (± 0.13) and translate to less than 1×10^{-6} detriments (excess cancers) in the population. Monte Carlo simulation of the steady-state model was used to derive the probability distributions from which the median values were drawn. Sensitivity analyses of the steady-state model showed that the amount of DU in airborne dust and, therefore, the amount of DU on the vegetation surface, controlled the amount of DU ingested by deer and by humans. Human doses from the RESRAD estimates ranged from less than 1 mrem/y to about 6.5 mrem/y in a hunting scenario and subsistence farming scenario, respectively. The human doses exceeded the 100 mrem/y dose limit when drinking water for the farming scenario was obtained from the on-site aquifer that was presumably contaminated with DU. The two farming scenarios were unrealistic land uses because the additional risk to humans due to unexploded ordnance in the impact area was not figured into the risk estimate. The doses estimated with RESRAD translated to less than 1×10^{-6} detriments to about 1×10^{-3} detriments. The higher risks were associated only with the farming scenario in which drinking water was obtained on-site.

INTRODUCTION

The purpose of this report is to estimate the human health risk of DU fragments in the environment at Jefferson Proving Ground (JPG), Indiana. Supporting information for the risk assessment is site-specific environmental monitoring data, knowledge of testing programs that occurred there, and personal knowledge of the site related by those who work there regularly. The goals of this project were to show that the JPG environmental data can be used satisfactorily for risk assessments if the data are collected according to a well designed sampling plan; to estimate the human health risks of DU fragments from munitions testing left in the environment after closure of JPG; and to test ecosystem models developed for the DU risk assessment at Aberdeen Proving Ground (APG) against data from a site in a slightly different climate but with similar deposition of DU fragments. This study was not supplemented with environmental sampling specifically designed to obtain data for a risk assessment.

The environmental data and knowledge of JPG DU impact areas available for this risk assessment is an important resource. The main source of environmental data is a summary report of the environmental radiation monitoring plan (Abbott *et al*, 1983) and the environmental data collected to 1989. Important information was given to us by Mr. Richard Herring about the occurrence of different animals in the impact area as well as some of the peculiarities of the DU deposition in the impact area.

The Environmental Monitoring Plan (ERM) data include information on DU concentrations in aquatic and terrestrial animals, water and soils, and human urine samples collected from workers on the impact area. The summary report also discusses relevant geological, hydrological, and soil morphology of JPG, and resulted in more reliable estimates of parameters related to contaminant-environment interactions. The values used in the modeling discussed below are tabulated in Appendices A and B, whereas the entire ERM data set is given elsewhere (Abbott *et al*, 1983).

Two models were developed for this risk assessment. A steady-state model was used to estimate the DU transfer to deer and to humans via consumption of deer tissue. A risk

assessment program written for DOE applications, RESRAD, was also used for this risk assessment. Briefly, RESRAD estimated the human health risk of specific contaminants and uses site-specific parameters supplied by the user. RESRAD gives the broadest look at contaminant transfer to humans, but has less emphasis on the ecological risk of the same contaminants.

Estimates of doses and/or risks derived from the models are of limited value unless the uncertainty in the estimates are also given. Uncertainty in the estimates arises from variation in the input parameters for each model and from conceptual inadequacies of any model. The data cited throughout this report show variation from one time to the next or from one sample to the next at a given time. Thus, the values used in the model estimates are not point estimates but probability distributions based on the range and expected values reported in the ERM data. The natural variation of the data was incorporated in the modeling conducted for this risk assessment.

The sensitivity of different models or parts of models is related to uncertainty. We needed to know which parameters most affected the estimated DU concentration or risk estimates calculated by each model in order to better understand and quantify model uncertainty. Sensitivity information helped identify those parameters or processes that could result in significant change in the risk estimates if the values for those parameters is under- or over-estimated. Sensitivity analyses for each model will be presented as will the methodology for determining both sensitivity and uncertainty.

JPG Environment--Overview

The environment at JPG is characterized by deciduous forests incised by several surface streams and rivers, and aquatic and terrestrial biota supported by the forests. Rainfall averages about 37 inches annually with most precipitation in the winter and spring. Average yearly temperature is about 50° F and the mean monthly temperatures range from about 31° to 76° F.

The surface geology of JPG is dominated by Quaternary glacial activity. Glacially altered deposits generally overlie limestone bedrock, and the bedrock is exposed in some areas,

especially in stream channels. Soils tend to have fragipans owing to development in loess deposits under slightly acidic conditions since the last (Wisconsin) glaciation. Surface water is mainly in streams and rivers that incise JPG and flow from NE to SW, and there are several small ponds and two larger lakes on the JPG reservation. Surface water collects and conveys runoff from the site and includes runoff from agricultural lands that surround most of JPG. Surface waters also support populations of aquatic and terrestrial animals including white-tailed deer, raccoons, cottontail rabbit, foxes, small- and large-mouth bass, crappie, carp, and a diversity of birds. Groundwater at JPG is generally found close to the surface and tends to be found near the contact with the limestone bedrock. Depths from the surface to bedrock from several test wells on the site ranged from about 5 feet to about 27 feet, and water tables were observed in the same wells at approximately the same depths as the contact with bedrock. Utilization of game animals (*i.e.*, birds, fish, and mammals) occurs and is an important pathway to investigate for potential DU transfer to humans. More detailed discussion of the JPG environment before and since DU testing is found in the JPG environmental review (Abbott *et al*, 1983).

EXPOSURE MODELS

The most time-efficient and systematic means of estimating the effects of contaminants on ecosystems and/or humans is to develop mathematical models that describe the interactions between organisms in a particular environment. The organisms described by a model are considered compartments or components of the model. The purpose of models is to understand the flow of a contaminant, in this case depleted uranium, through the compartments of the system.

In the following sections two modeling approaches are described, discussed, and the results from using the models are presented. These approaches are 1) steady-state, and 2) detailed environmental pathway analysis. The steady-state model requires the least amount of data and can be used even when several parameters are estimated. The environmental pathway

approach quantifies the interactions between compartments more realistically and demands more complete knowledge of the system being studied. The pathway approach also affords the program user a more detailed examination of the interactions between compartments, thereby making it possible to know more about contaminant transfer throughout the system of interest. Each approach used in the risk assessment of DU at JPG will be presented below.

Steady-State Model

The steady-state model was based on the two-component, steady-state model described by the NCRP (NCRP, 1984). The NCRP model was developed for estimating radionuclide uptake by plants and animals in the vicinity of nuclear power plants and includes intake of radionuclides by animals grazing from foliar surfaces and from radionuclides internally deposited in the plants. The NCRP model was readily adapted for use in the JPG risk assessment by including a term for soil ingestion by animals, changing the animal of interest from cattle to deer, modifying the feed and water intake rates accordingly, and including the transfer of DU to man by way of consumption of deer tissue. Figure 1 is the schematic of the JPG steady-state model.

DU transfer between system compartments is quantified in Equation 1:

$$C_i = F_a\left[(C_a + C_d)f_p f_f Q_f + f_s C_s Q_s + C_w f_w Q_w\right] \qquad (1)$$

where C_i is the concentration of DU in deer tissue, F_a is the transfer coefficient from ingested DU to deer tissue, C_a is the DU concentration that passes into plant roots from soil and is incorporated in the plant tissue, C_d is the DU concentration deposited on the surface of plants eaten by deer, f_p is the fraction of time deer spend on the contaminated area, f_f is the fraction of the fodder supply that is contaminated, Q_f is the consumption rate of vegetation by deer, f_s is the fraction of the ingested soil that is contaminated with DU, C_s is the DU concentration in the soil,

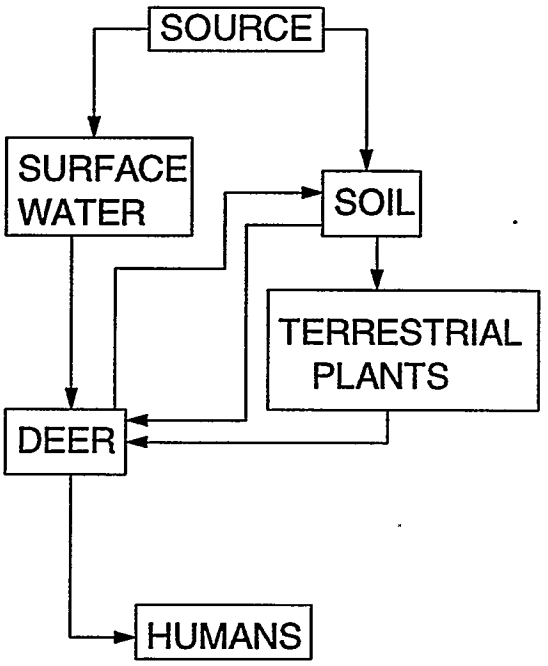

Figure 1. Schematic diagram of Steady-State Model. Source is DU deposited in soil, arrows indicate DU migration from one component to another.

Q_s is the soil ingestion rate by deer, C_w is the DU concentration in water drunk by deer, f_w is the fraction of the water that is contaminated, and Q_w is the consumption rate of water by deer. The term $f_s C_s Q_s$ describes the soil ingestion component of C_i, the $C_w f_w Q_w$ term describes the water ingestion component of C_i, and the remaining term describes the contribution of DU from plants.

The DU concentration in plant tissue, C_a, is calculated by Equation 2 as

$$C_a = \frac{B_1 d}{P}\left(\frac{1-\exp(-\lambda_1 t_b)}{\lambda_1}\right) \qquad (2)$$

where d is the estimated deposition rate from air, B_1 is the bioconcentration factor for soil to plants (NCRP 1984), P is the soil bulk density within the plow layer, λ_1 is the removal rate or leaching rate of DU from the soil, and t_b is the time the DU accumulates in the contaminated area. The deposition rate from air is the amount of DU that is deposited after a penetrator impacts contaminated soil and lifts the soil into the air. Ambient winds also result in resuspended DU but at lower frequncy than resuspension from penetrator impacts. The deposition amount and rate depend on the soil concentration of DU in the area where the penetrators impact and on the amount of DU in particles small enough to be transported in the air. From measurements and field observations at APG, only a fraction of the total inventory is available for transport by resuspension because some of the fragments are deposited in areas of infrequent impact, and some fragments are too large to be deposited on plant surfaces.

We used data from YPG (Price, 1991) and APG to estimate probable locations within the JPG impact areas that would result in the largest surface deposition rate and therefore the largest DU deposition on plant surfaces. The location at YPG that is most likely to result in large values of d is at about 2500 m downrange from GP 17A (Price, 1991, Appendix A). Assuming that the impact area of GP 17A is as indicated in Price's Appendix A (Price, 1991), then the area of greatest concentration is conservatively estimated at 5% of the total impact area. The total DU concentration in the affected area is no greater than about 10% of the total inventory in the

environment. Using this information, the deposition rate was calculated by taking the fraction of the total inventory that is available for redistribution and dividing it by the amount of area that is available for deposition. DU recovery data from APG showed that there are two areas that could be most susceptible to conditions favoring resuspension of small particles.

The DU removal rate in Equation 2 is defined by Equation 3 as

$$\lambda_1 = \lambda_t + \lambda_L + \lambda_H \tag{3}$$

where λ_t is the loss of DU due to radioactive decay, λ_L is the loss of DU due to leaching through the soil, and λ_H is loss of DU due to harvest and removal of vegetation from the food supply. Since DU has an extremely long half-life ($^{235}U = 7.1 \times 10^8$ years, $^{234}U = 2.5 \times 10^5$ years, and $^{238}U = 4.5 \times 10^9$ years), the amount of DU lost per unit time (per day in the model) is small and does not contribute significantly to λ_1. There is no harvest or weed removal reported at JPG, except for vegetation consumed by deer and other animals, so the loss rate due to harvest is 0. Thus, λ_1 depends only on leaching of DU through the soil. A simple leaching model was used (NCRP, 1984; Hoffman and Baes, 1974) and is given as Equation 4:

$$\lambda_1 = \lambda_L = \frac{V_w}{d_s\left[1+\left(\frac{\rho}{\theta}K_d\right)\right]} \tag{4}$$

where V_w is the velocity of water percolating downward through the soil, d_s is the depth of the root zone, ρ is the soil bulk density, θ is the volumetric water content of the soil, and K_d is the distribution coefficient or the ratio of DU on the soil particles to the DU concentration in the soil water at equilibrium.

The concentration on the surface of foliage, C_d in Equation 1, was calculated using Equation 5:

$$C_d = \frac{f_r T_v d}{Y_v} \frac{1-\exp(-\lambda_E t_e)}{\lambda_E} \quad (5)$$

where f_r is the fraction of the material intercepted by the plant surface, T_v is the translocation factor to edible portions of the plant, d is the deposition rate as defined in Equation (2), Y_v is the standing plant biomass at the end of the growing season, λ_E is the removal constant of DU from the plant surface, and t_e is the time the plant has been exposed to DU at the rate specified by d. λ_E is calculated using Equation 6:

$$\lambda_E = \lambda_t + \frac{\ln 2}{t_w} \quad (6)$$

where λ_t is the radioactive half-life as defined in Equation (3) and t_w is the time required for one-half the deposited DU to be lost from the surface of the plant. Since λ_t (per day) is small with respect to the second term of Equation 6, λ_E is effectively a function only of t_w. The values, ranges, and statistical distributions of the variables listed in Equations 1 - 6 are too numerous to list in this text. Instead, these values are tabulated in Appendix A.

Sensitivity and Uncertainty Analyses. Estimating the DU concentration in deer meat consumed by humans (C_i, Equation 1) also requires estimating the uncertainty or the statistical distribution of C_i. The calculations detailed above were used in a Monte Carlo simulation to show the effects of variation in the input parameters on the estimated DU concentration in deer tissue. The Monte Carlo simulation is an iterative approach to determining the uncertainty in the estimate of C_i, and assumes that all the parameters are random variables with a probability distribution of values within known ranges. The probability distribution of each of the parameters is also important information used in the Monte Carlo simulation. Each parameter can take on a value within a given range; parameters that are relatively well known will also have information about the distribution of the values for the specific parameter.

In a Monte Carlo simulation, one value of each parameter in the model (Equation 1 including the contributions from Equations 2 - 6) is chosen at random from the range and within the probability distribution of that parameter. The chosen values are then used to calculate a single point-estimate of C_i in Equation 1. After the first calculation, new values are chosen at random for each parameter and a new value of C_i is calculated. The Monte Carlo simulation continues for any number of iterations.. The important result of the Monte Carlo simulation is a probability distribution of values of C_i. The distribution has an expected value and a characteristic shape that indicates the error or uncertainty in the estimate. Estimates of the uncertainty in C_i are better determined as the number of iterations increases.

We used the values and distributions in Appendix A to estimate the uncertainty in the predicted concentration C_i (Figure 2 and Table 1). The results of 10,000 iterations were used to generate Figure 2. Table 1 shows that the distribution is positively skewed, indicating that the probability of a value less than the mean is much greater than the probability of a value greater than the mean. The median value of C_i in Table 1 shows that there are equal numbers of occurrences above and below 17.1×10^{-3} pCi/g, and the mode shows that the most probable estimate of C_i is about 14.2×10^{-3} pCi/g. The standard deviation of the mean is slightly larger than the mean (23.5×10^{-3} pCi/g) and suggests that there is equal probability that an estimated value of C_i could be 0 or about 50×10^{-3} pCi/g.

Of equal importance is determining the parameters that most influence the estimated values of C_i. Monte Carlo simulation was used to examine those parameters that are the most sensitive. To estimate the sensitivity of the model the parameters were allowed to vary at random within their ranges as they were in the uncertainty analysis. However, only one parameter per simulation was varied while the remaining parameters were held at a fixed value. Ten thousand iterations were run, then the probability distribution was constructed and statistics were calculated for the calculated C_i's. One of the statistics, the standard deviation, was one measure of how much variation one parameter caused in the estimated C_i's. A parameter that

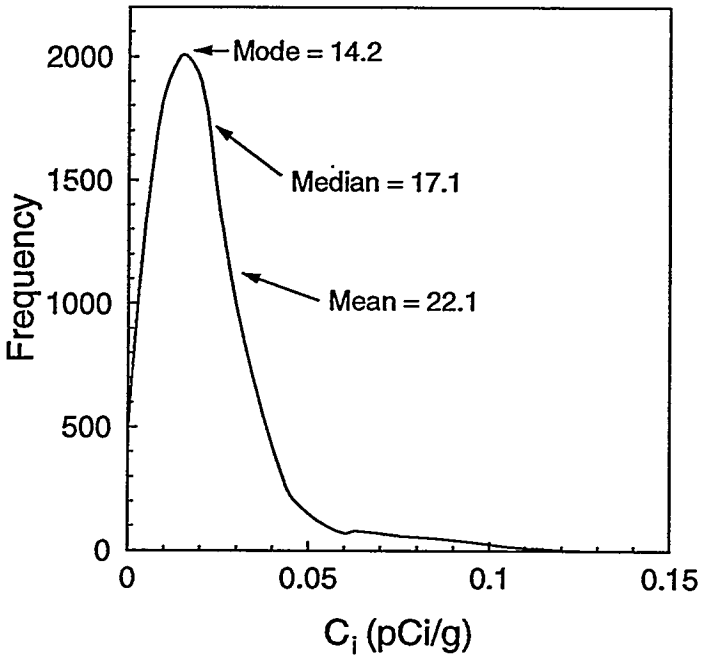

Figure 2. Frequency distribution of DU concentrations in deer tissue, C_i, calculated from the steady-state model. The distribution of C_i values was obtained from 10,000 simulations of Equation 1. Values for the parameters were randomly selected from their own distributions for each simulation.

Table 1. Selected statistics from Monte Carlo simulation of DU in deer tissue, C_i. See Also Figure 2.

Number of Trials	10,000
Mean	22.1
Median	17.1
Mode	14.2
Standard Deviation	23.5
Range Minimum	0
Range Maximum	500.0
Skewness	6.38

resulted in a large standard deviation about the mean was considered to indicate more sensitivity of the model to that parameter.

Ranking the standard deviations calculated from each Monte Carlo simulation gave the relative sensitivity of the model to variations in parameters. Figure 3 shows that soil ingestion is the most sensitive parameter in the C_i calculated using Equation 1. The standard deviations for each parameter in Figure 3 were obtained by estimating C_i and allowing only the parameter of interest to vary within its range. A large standard deviation indicates more sensitivity of C_i to variation in the input parameter. Figure 4 shows the mean, median, and mode of C_i calculated with one of the three paramters varying and the other two held constant. The contributions of soil ingestion and water consumption to C_i are clearly more dignificant than the contriobution from consumption of vegetation. Table 2 and Figure 5 show the results of C_i calculations using all three paramaters simultaneously.

The results of the sensitivity analysis depend on the assumptions about the DU deposition rate as discussed above. If the deposition rate is inaccurately estimated, the amount of DU on plants could significantly alter the C_i estimates. For instance, if 50% of the inventory were resuspended from the entire impact area of the site, the values reported in Table 1 would increase, and the importance of ingested plant material would dominate the estimates of C_i.

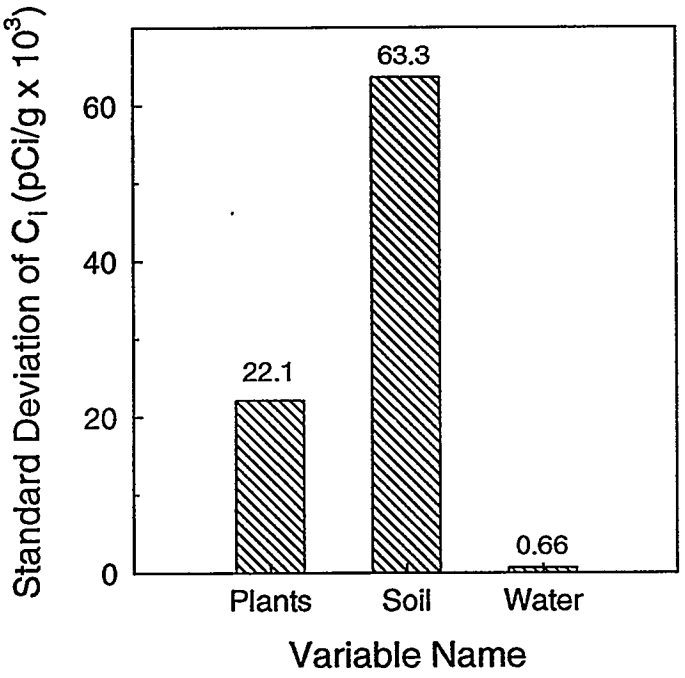

Figure 3. Standard deviations of calculated C_i values when only plant consumption, soil ingestion, or water consumption pathways were varied in the model. Soil ingestion pathway showed the largest standard deviation and thus is the most sensitive parameter under the conditions of this simulation.

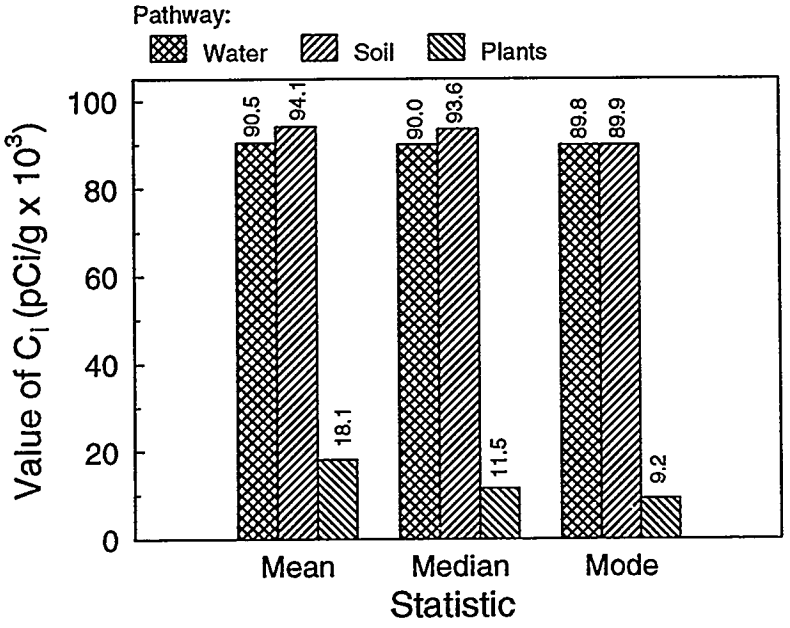

Figure 4. Mean, median, and mode of C_i for the three pathways in the Steady-State model. C_i was calculated with Equation 1 by varying either water, soil, or plant uptake. Simlutions were for 10,000 iteration with Equation 1.

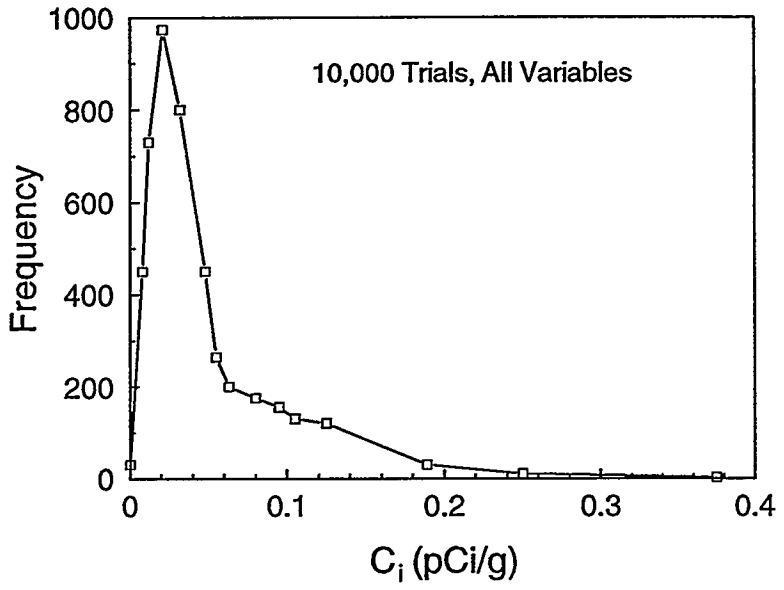

Figure 5. Distribution of DU concentrations in deer tissue, C_i, if uniform concentration of DU fragments is assumed for entire impact area. Simulation conditions were similar to those used for Figure 2.

Table 2. Selected statistics from Monte Carlo simulation of DU in deer tissue, C_i. Entire impact area used as area of resuspension. See also Figure 5.

Number of Trials	10,000
Mean	59.6
Median	37.6
Mode	20.8
Standard Deviation	62.5
Range Minimum	0
Range Maximum	1170
Skewness	2.68

Soil ingestion is the parameter with the largest contribution of the three components described by Equation 1. The magnitude of the soil ingestion term depends mainly on the soil concentration of DU, whereas the soil ingestion rate plays a secondary role. Figure 6 illustrates the dominance of C_s in the soil ingestion term. DU ingested from drinking water is the second-most important term in Equation 1 and depends on the water concentration of DU. The quantity of water consumed and the amount of water that is consumed from contaminated sources are of secondary importance as shown in Figure 7.

While the contribution from the plant term is small, there are several factors that should be discussed. Equation 2 shows the effect of DU internally deposited in plants through plant roots. The small magnitude of the bioconcentration factor indicates there is little DU taken into the plant through the roots. Higher soil concentrations, lower leaching rate (λ_1), DU in finer-divided particles, and more extensive root systems in the contaminated soils would increase the amount of DU absorbed across plant roots. Relatively high concentrations of U and other metals have been found in plants, but high plant concentrations occur mainly in areas of much greater U availability in soils (Ibrahim and Whicker, 1988).

The contribution of DU deposited on plant surfaces, C_d, is more significant in this model than the DU absorbed through the root membranes. Equation 5 shows the factors that go into the calculation of surface deposited DU (Figure 8). The most sensitive factors are the size of the

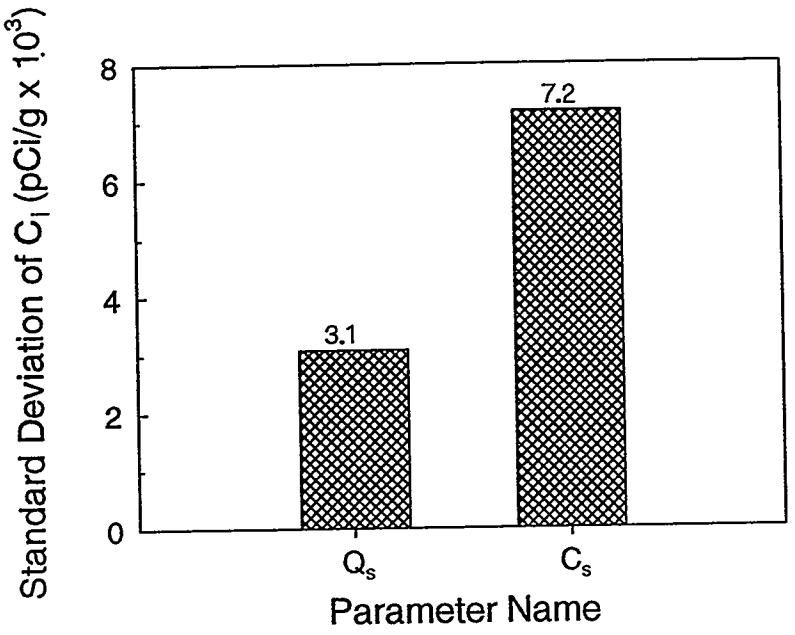

Figure 6. Standard deviation of C_i due to variation in the soil ingestion pathway parameters only. The actual standard deviations are given above each bar. Values were obtained by allowing only one parameter, Q_s or C_s, to vary during 10,000 simulations, then repeating the simulations letting the other parameter vary.

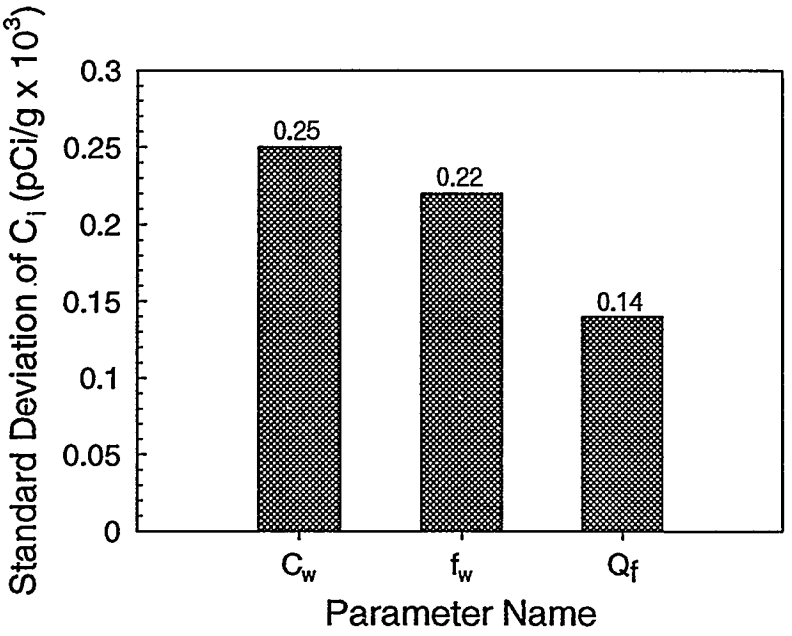

Figure 7. Standard deviations of C_i due to variation in water consumption pathway parameters. The actual standard deviations are given above each bar. Values were obtained by allowing only one parameter to vary and holding the others constant during 10,000 simulations, then repeating the simulations letting the other parameters vary one at a time.

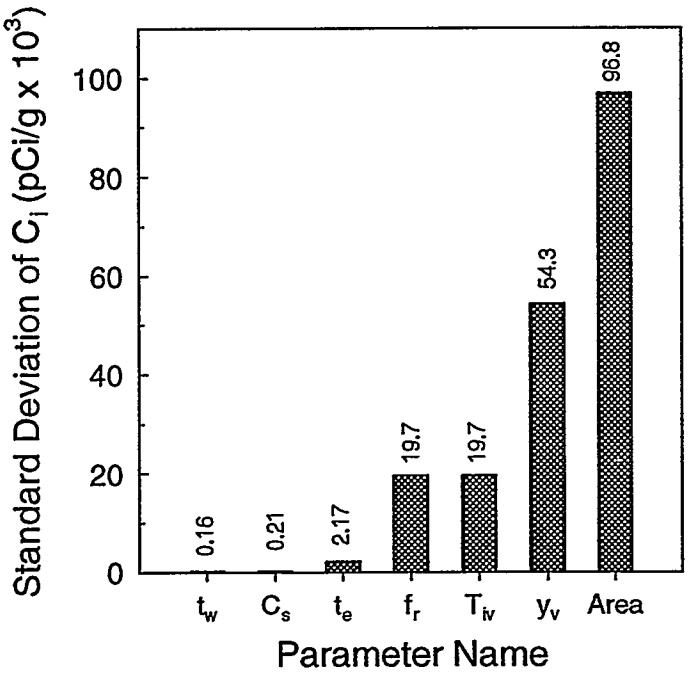

Figure 8. Standard deviations of C_i due to variation in the DU ingested from plant surfaces. The actual standard deviations are given above each bar. Values were obtained by allowing only one parameter to vary and holding the others constant during 10,000 simulations, then repeating the simulations letting the other parameters vary one at a time.

area from which the available DU comes, discussed previously, and the biomass that is available as the depositional surface for DU and, therefore, as food for the deer. The interception fraction of the plants, f_r, and the translocation factor, T_v, are important but less so than the biomass and area of contamination parameters. The dependency of C_d on the resuspension area, biomass, translocation factor, and interception fraction shows the importance of the density of the plants used for food and the amount of area covered by the plants. These factors interact sufficiently to alter the model output if a larger area for resuspension is used in the modeling or if large biomass is associated with any area.

RESRAD Model

The RESRAD model was developed for the DOE and is an acronym for Residual Radioactive Material Guidelines (Yu, et al, 1993). RESRAD is based on the same principles as the steady-state model but is far more complex in its handling of environmental pathways. The steady-state model described transport of DU (or other contaminants) from the source (deposition on the soil) through plants, soil, and water to deer and eventually to humans; RESRAD also models similar contaminant flow, but at a different level of detail. RESRAD describes the flow of DU from soil through many of the same pathways and also includes dose to humans from radon, resuspended DU inhaled directly from airborne dust and DU incorporated with plants, DU added to plants via irrigation, and dose due to irradiation from contaminated soil. Dose assessments to humans, and therefore risks of detriments to humans, are the focus of the RESRAD calculations and only limited information on the dose or exposure to the environment can be obtained.

RESRAD requires more data than the steady-state model because of the large number of compartments and interactions that are included. The ERM data were used extensively as input for the RESRAD simulations, but there are several additional parameters that are not explicitly described in the environmental report. For example, the soil porosity and volumetric water content are not discussed specifically in the environmental report, but there is sufficient

information about soil types that reasonable estimates of these parameters could be made. Critical parameters such as concentrations of DU in soil and water were readily obtained from the environmental report. Appendix B is a tabulation of all the values used for the various RESRAD simulations that will be presented below.

RESRAD can be modified in order to simulate different land-use scenarios ranging from occasional site use, such as hunting several times of year to subsistence farming on the site by a resident family. Three scenarios were simulated in this report: 1) occasional use from hunting deer or other terrestrial animals four times per year for one week each time; 2) a family farming the site and obtaining all food (meat, milk, and vegetables) from the farm, but bringing drinking water for human consumption from an uncontaminated source; 3) the same scenario as 2) but all the drinking water is derived from wells on-site. These three scenarios bracket potential future use of the JPG DU impact area.

The input data for each scenario are presented in Appendix B and will be briefly discussed in this text. The environmental report provided enough data to estimate the average and maximum soil and water concentrations at JPG. The mean, standard deviation, and range in the environmental data are given in Table 3 for ^{234}U and ^{238}U. Most of the other inputs were estimated from other information presented in the environmental report. Estimated values included the DU concentration in suspended dust; the amount of DU deposited on the surfaces of foliage used for food by animals and man; soil parameters including volumetric water content, erosivity indexes, and mineralogy; and the size of the area that was contaminated. The latter was an important parameter to estimate. Initially the contaminated area was set as that part of the impact area that contained most of the DU fragments, *i.e.*, the majority of the impact area at JPG. The initial dimensions were 500 m (E-W) by 6000 m (N-S, along the firing line) or about 3×10^6 m^2 and were based on the JPG controlled area. DU recovery data from APG showed that most of the fragments were recovered in two 500 m-wide sections of the impact area extending from 1200 m to 2100 m beyond the B-3 catch box and from 2300 to 3100 m beyond the catch box, an area of about 8.5×10^5 m^2. It is assumed that the amount recovered is proportional to

Table 3. Range, mean, and standard deviations for soil and water concentrations from Abbott et al (1983). Concentrations are ^{238}U and ^{234}U activities as pCi/g or pCi/L.

	^{234}U	^{238}U	$\sum U^1$
Soils			
Mean	1.61	6.99	8.60
Standard Deviation	3.84	24.13	27.50
Minumum	0	0	0
Maximum	32.2	203.4	235.6
Water			
Mean	1.65	1.92	2.99
Standard Deviation	2.47	4.53	6.70
Minumum	0.1	0	0
Maximum	19.6	34.5	45.1

1. $\sum U$ is the mean, standard deviation, and range calculated from $\sum_{i}^{n} U_i^{238} + U_i^{234}$.

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the amount that remains on the impact area. Based on these two estimates of the contaminated area, 1 x 10^6 m^2 was selected as the contaminated area at JPG.

Hunting or Occasional Use Scenario. The first scenario tested the use of the impact area for hunting or occasional recreational use. It is assumed that the site users will be in the impact area for no longer than one week per visit and visit the site four times a year. It is further assumed that all food and drinking water consumed by the users is brought in from off site and is uncontaminated above background levels. Hunters will take animals, in this case white tailed deer, raccoon, rabbit, or squirrel, and consume the edible portions in place of all or part of their normal variety of meat. The deer in the impact area were assumed to range within the impact area throughout their lives and consume all food and water from sources within the DU impact area. Thus, all food and water consumed by deer can be considered contaminated with DU. The animals hunted can be any other animals that occupy the site; but the data base on white tailed deer from JPG ERM data and the APG study were more extensive than for other animals.

In addition, the hunter or occasional visitor fishes in the streams on the site and consumes the catch at home. The total amount of fish taken and consumed is considered to replace 50% of the fish consumed yearly in the visitor's or hunter's household. The hunter or occasional visitor spends the nights in tents pitched on the ground, and transportation while on the impact area is strictly on foot. The hunter's or visitor's range during the visit is the impact area itself with little movement outside the area except when entering or leaving.

The RESRAD simulations were run for 1000 years from the time the site is hypothetically available for use. Total dose, or dose to humans from all sources, is shown in Figure 9. The dose throughout the simulation is small (maximum of 0.15 mrem/y) and is mainly due to dust inhalation and exposure to contaminated surface soil. Larger doses were estimated when the dust loading, or the dust concentration in the air, was increased by a factor of 10. Dust loading greater than 200 $\mu g/m^3$ could be imagined in heavily plowed areas or in extremely dusty environments, but it is not likely that such high dust loadings could be maintained for long periods. The JPG ERM data (Abbott *et al*, 1983) suggest an increase in airborne U during burning, but the increase is less than an order of magnitude over background. Therefore, the dose estimates from environments with high dust loadings are included mainly as illustration of the sensitivity of the model.

Since contaminated water is not consumed by the hunter or visitor, there is little contribution to the total dose from water-dependent pathways. Figure 10 shows the total dose from water-independent and water-dependent pathways. Figure 11 shows the total dose for the same scenario except that the soil concentration of DU was held at 35 pCi/g. The total dose increased significantly when the 35 pCi/g soil concentration was used, but is still only a fraction of the allowable annual dose to the general public of 100 mrem/y. The dust loading was varied as it was in Figure 9 to show the effects of extremely dusty conditions and on the sensitivity of the total dose to humans to this parameter.

Like the steady-state model above, RESRAD simulations can be subjected to sensitivity analysis, although the analysis is more limited than in the steady-state model. The sensitivity

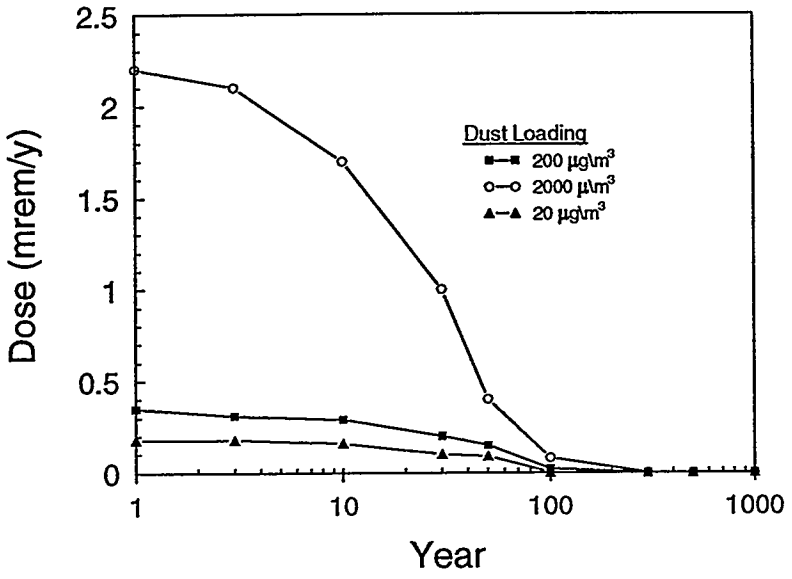

Figure 9. Dose calculated using RESRAD for all pathways in the hunting and occasional use scenario. Dust loading is the concentration of dust in the air and, therefore, related to the airborne DU concentration. Dust loading is one of the most sensitive parameters in the RESRAD simulations. Nominal dust loading is 200 µg/m^3 in each RESRAD simulation.

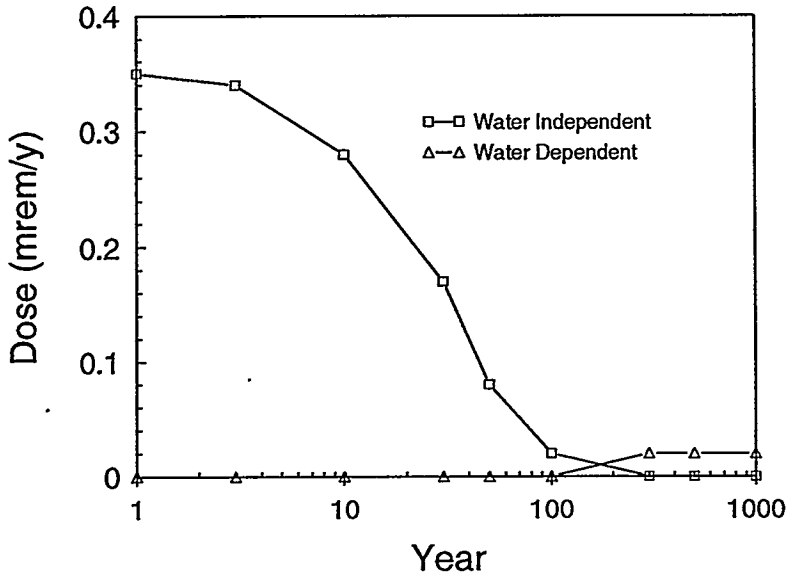

Figure 10. Water-dependent and water-independent contributions to the total dose from the hunting/occasional use scenario. Figure is based on nominal (200 µg/m^3) dust loading and average soil concentration. Water-dependent dose is low because drinking water was brought in and no on-site produce was consumed.

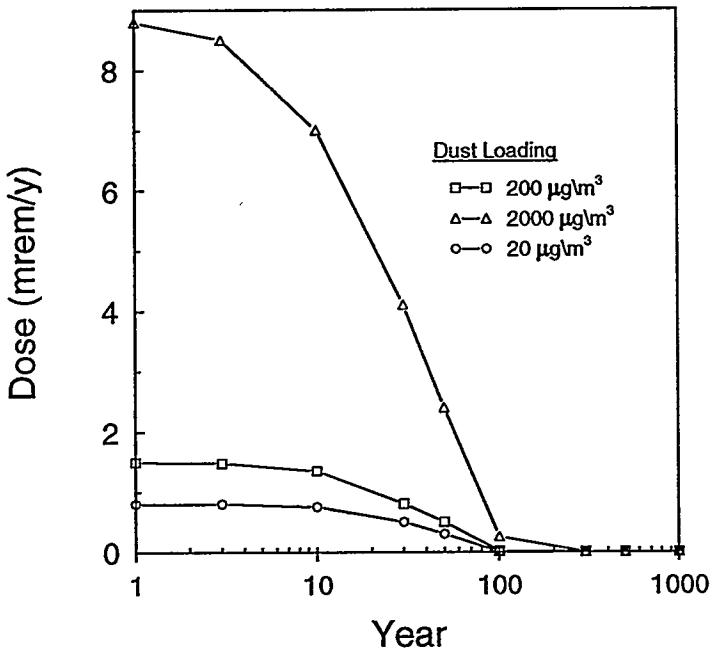

Figure 11. Total dose estimated using DU soil concentration of 35 pCi/g, water concentration of 1 pCi/l, and varying the dust loading. Graph illustrates the importance of actual soil and water DU concentrations in dose calculations.

analysis provision showed that the parameter of most importance in the hunting scenario is the mass loading, *i.e.*, dust concentration, of DU in the air. The value used in the simulations was the default value is 2×10^{-4} g/m^3 (200 μg/m^3). Different values are cited, the largest coming from agricultural fields that are plowed during mass loading measurements (Sehmel, 1980). The default value of 2×10^{-4} g/m^3 includes mechanical disturbance that could resuspend large quantities of contaminated soil in short periods of time and for short duration (Gilbert, *et al,* 1989). In addition, the default value is similar to the dust concentration reported in Cincinatti, Ohio, approximately 100 miles east of JPG. When the value was varied by one order of magnitude, the total dose increased significantly. However, 200 mg/m^3 is a dust concentration that is extremely high and found only in situations of severe mechanical disturbance to soils such as immediately behind a disc plower. The effects of changes in the mass loading coefficient are shown in Figure 9 using average soil concentrations and Figure 11 using maximum soil and water concentrations. Variation in other input parameters resulted in small changes in the total dose, and no changes of the same magnitude as for the mass loading coefficient were observed. There is little risk of death due to radiation-induced cancer or human detriment resulting from this scenario.

Resident Farming Scenario #1. The first resident farming scenario tested includes a family or families living on the impact area full time and producing all meat and vegetables from fields in the contaminated area. Livestock fodder is produced on-site and all irrigation for plants and drinking water for animals is pumped from the aquifer that contains small amounts of DU. The family, however, obtains their drinking water from an uncontaminated source off-site such as the City of Madison, Indiana. Figure 12 shows the results of the resident farming scenario with supplied drinking water.

The total dose for this scenario is again dominated by the dose from inhaled dust and partly by irradiation from contaminated soil early in the simulation. After about year 30 the contribution from the meat and produce grown on the farm contributes significantly. The total

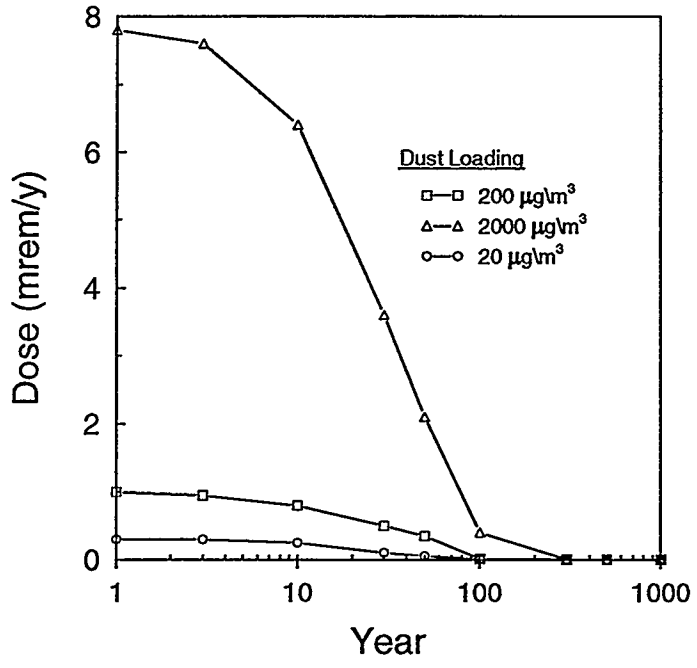

Figure 12. Total dose from farming scenario #1 using average soil concentration. Dust loading is the most sensitive parameter, and the range is the same as in previous figures. Dose to humans is significantly greater than hunting scenario due to longer times on the site and consumption of more produce from the site.

dose, however, is low, about 1.3 mrem/y, well below the 100 mrem/y exposure limit for the general public.

Figure 13 shows the doses due to water-dependent and water-independent pathways. Sensitivity analyses of this scenario indicate that the mass loading is again an important variable, especially early in the simulation (Figure 12). The analyses also showed that the amount of irrigation water applied influenced the total dose, but there was little increased dose from increased water consumption by livestock. Variation in the distribution coefficients in the contaminated zone soils and in the aquifer also had little effect. The water-independent pathways contributed about the same proportion of the total dose as in the hunting scenario, but the water-dependent pathways showed a much different pattern (Figures 13 and 14). Inhalation of DU and surface exposure were the largest contriubtors to humans dose; consumption of plants, milke, and meat were significant but small contributors.

The total dose increased significantly when soil and water DU concentrations were 35 pCi/g (Figure 15). The nominal case (2×10^{-4} g/m^3) showed about 8 mrem/y total dose, and about 34 mrem/y when the mass loading increased by an order of magnitude (Figure 15). Mass loadings of 2×10^{-3} g/m^3 are much greater than the average loading to which the residents would be exposed, but this value illustrates that the 100 mrem/y limit can be approached under unreasonably concentrations of dust. The water-independent and water-dependent pathways contributed about the same proportions to the total dose for the average soil and water DU concentration as they did in the hunting scenario above (Figure 16).

Resident Farming Scenario #2. The second farming scenario is the same as Farming Scenario #1 but also includes use of well water from the site as the drinking water supply for the resident family. As expected, the total dose to humans under this scenario is significantly higher than in the previous farming scenario (Figure 17). Doses from all pathways exceed 100 mrem/y between year 10 and year 100 when average DU soil concentration and 1 pCi/l are used for part of the simulation period. Figure 18 shows that drinking water consumption dominates both the dose from water dependent pathways and the total dose. The largest dose from water

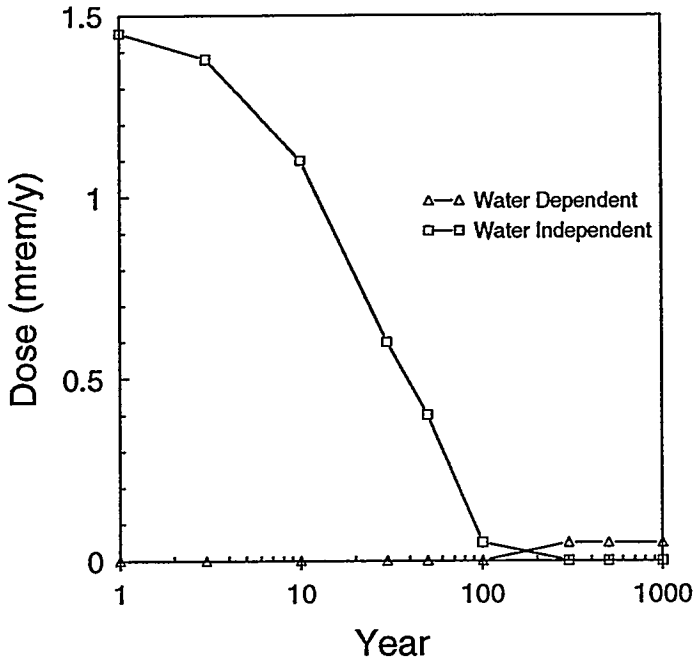

Figure 13. Water-dependent and water-independent contributions to total dose, farming scenario #1 and average soil concentration. Dose from water dependent sources is due to consumption of produce, meat, and fish. Dose from water independent pathway is from dust inhalation and irradiation from contaminated soil. Figure based on nominal (200 $\mu g/m^3$) dust loading.

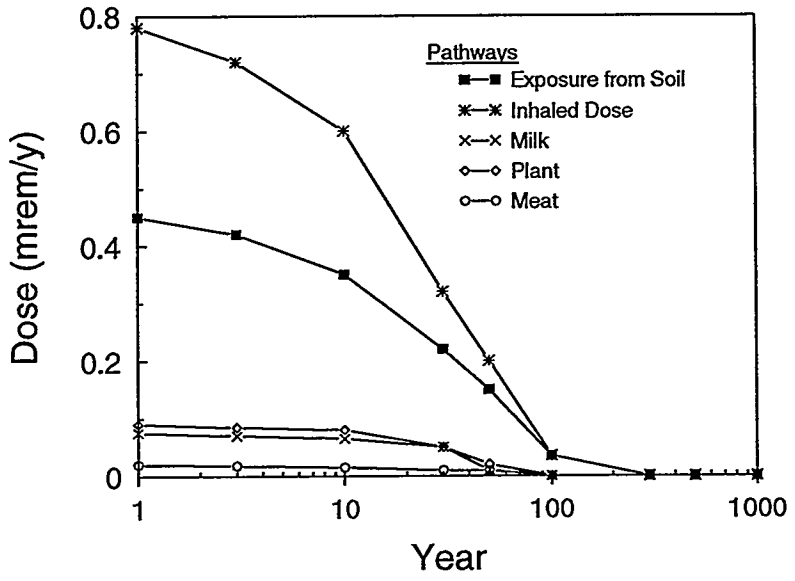

Figure 14. Dose from water-dependent pathways, farming scenario #1, average soil concentration. Nominal (200 $\mu g/m^3$) dust loading used for this figure.

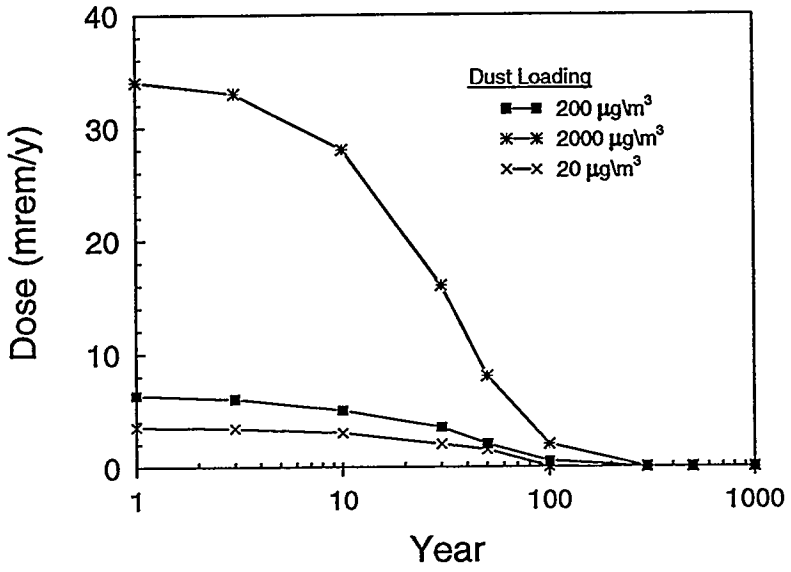

Figure 15. Total dose, farming scenario #1, assuming 35 pCi/g soil and water concentrations of 1 pCi/l DU across the site.

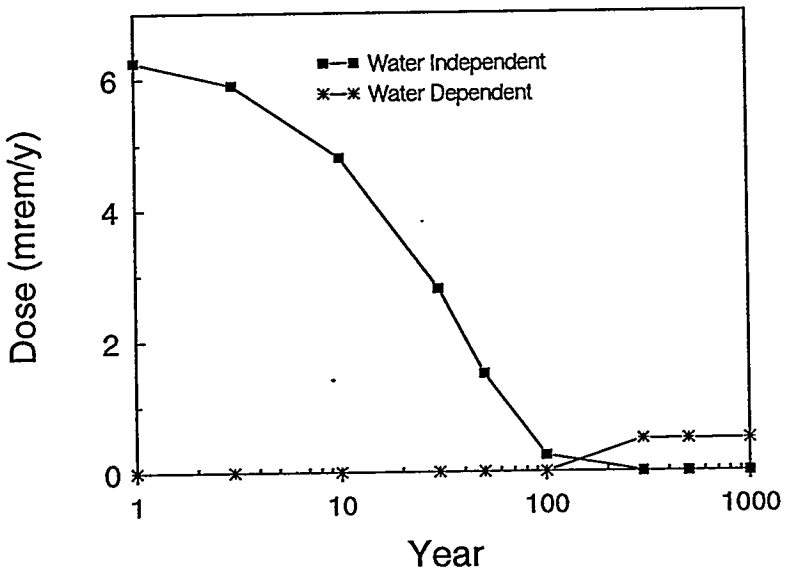

Figure 16. Water dependent and water independent contributions to total dose farming scenario #1. Soil concentration of 35 pCi/g and water concentration of 1 pCi/l were assumed throughout the site as in Figure 15. Nominal dust loading used for this graph.

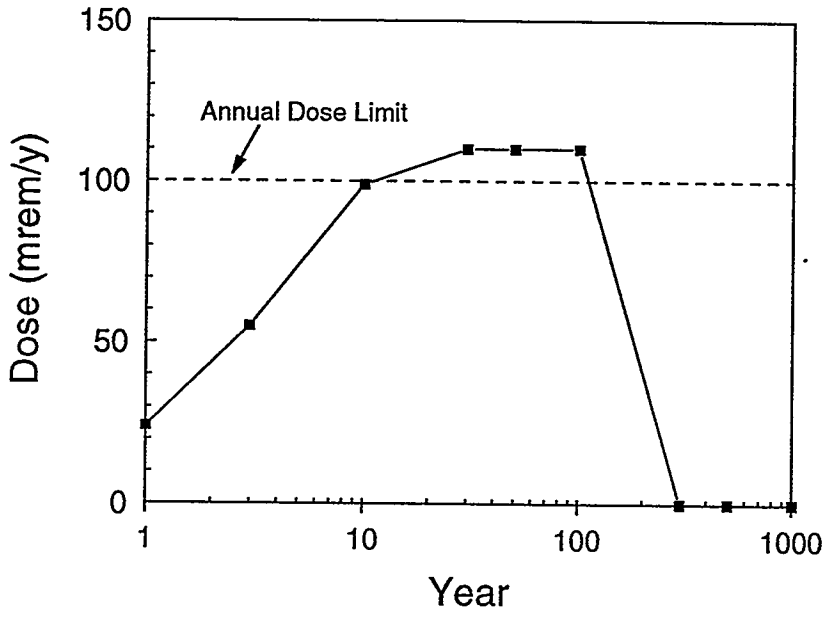

Figure 17. Total dose, farming scenario #2, average soil concentration and 1 pCi/l in water. Dust loading range same as in previous figures.

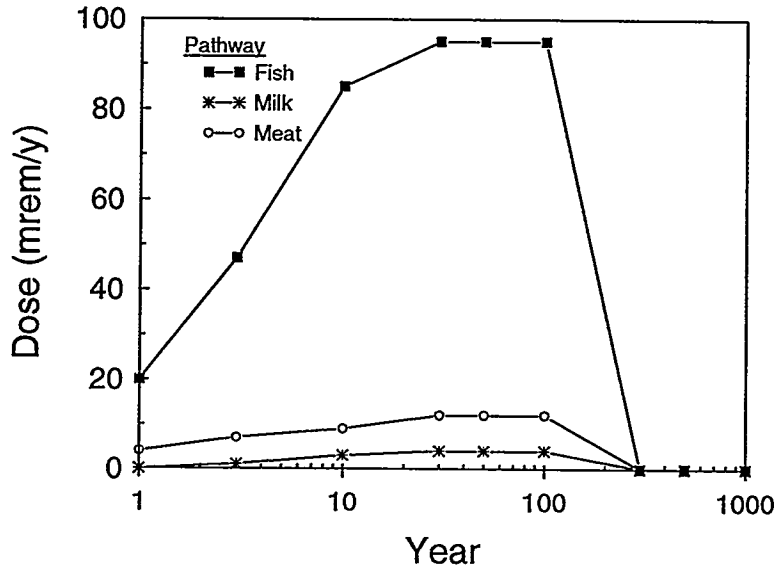

Figure 18. Water dependent contributions to total dose, farming scenario #2, average soil concentration and 1 pCi/l in water. Nominal (200 $\mu g/m^3$) dust loading used for this figure. Total dose dominated by the contributions from fish concumption and drinking water. Compare to Figure 14.

independent pathways was from inhaled DU, but the total contribution was less than 1 % of the total dose (Figure 19).

Increasing the soil concentration to 35 pCi/g and keeping the water concentration at 1 pCi/l resulted in total dose to the site resident well in excess of 100 mrem/y (Figure 20). The dose from water dependent pathways and the total dose were dominated again by the consumption of drinking water with minor contribution from inhalation of DU. Figure 21 shows the importance of drinking water consumption on the total dose, and Figure 22 shows the relative contriubutions of water-dependent and water-independent pathways. The total dose exceeds 100 mrem/y from year 1 through year 100 because of the increased transport of DU through the system.

Doses to Humans Estimated from Models

The models discussed in the previous sections provide estimates of DU concentration in different ecological compartments, or in the case of RESRAD, provide dose estimates from different pathways. Since the models define the pathways and methods used to calculate DU concentrations, different values of the doses were obtained from different models. The steady-state model generates doses that remain constant through time since time-dependent values are not used in the model. Doses calculated from the steady-state model are therefore conservative because they do not show the effects of DU source-term depletion with time. Doses calculated from RESRAD, on the other hand, show important temporal effects that the steady-state model cannot show. For example, Figures 17 and 20 show increasing dose through the first 10 to 20 years, a maximum in the dose for the next 200 years, then a sharp decrease due to DU source-term depletion or flushing the DU out of the system.

The doses for the steady-state model were calculated by converting the expected C_i values to dose rates using Equation 7:

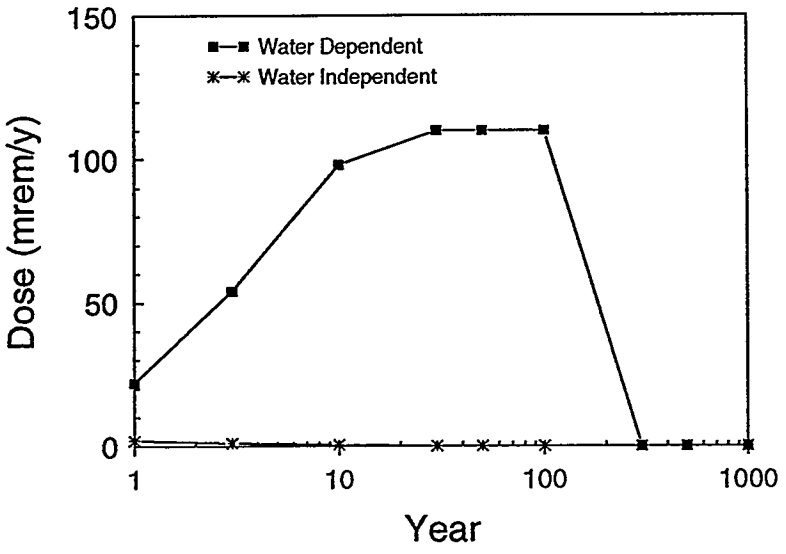

Figure 19. Water dependent and water independent contributions to total dose, farming scenario #2, average soil concentration and 1 pCi/l in water. Nominal (200 $\mu g/m^3$) dust loading used.

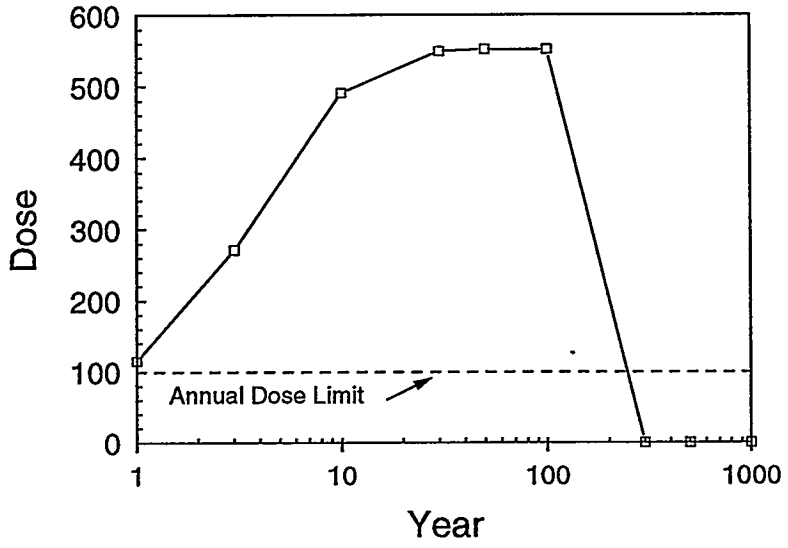

Figure 20. Total dose assuming soil concentration of 35 pCi/g and water concentration of 1 pCi/l across the site, farming scenario #2. Nominal dust loading used for this graph.

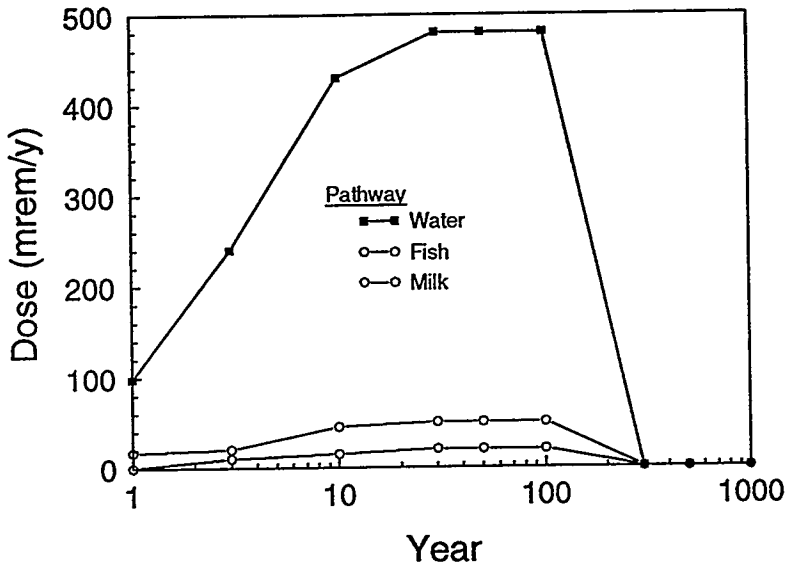

Figure 21. Contributions from water-dependent pathways to total dose based on soil concentration of 35 pCi/g and water concentration of 1 pCi/l. Dose is dominated by fish and water consumption with relatively small contributions from different pathways.

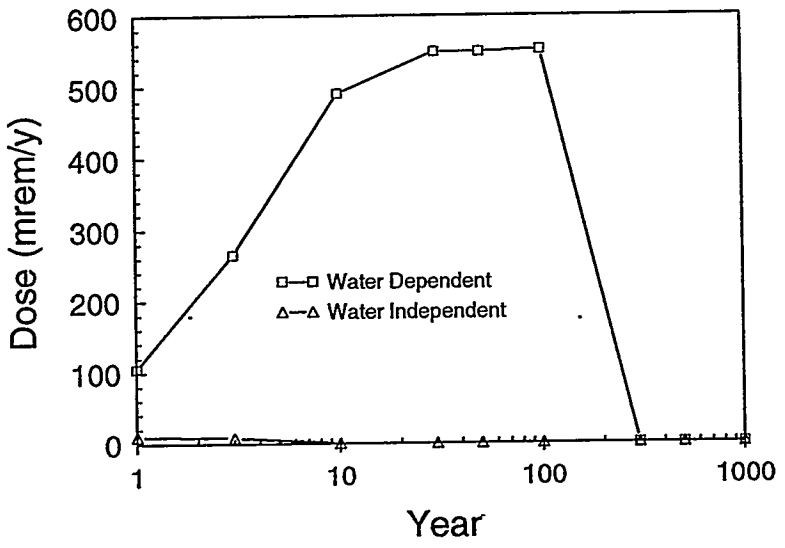

Figure 22. Water-dependent and water-independent contributions to total dose assuming soil concentration of 35 pCi/g and water concentration of 1 pCi/l, farming scenario #2. The large contribution from the water dependent pathway is due to consumption of fish and drinking water at the site and DU transfer to produce, meat, and milk.

$$E = \frac{(C_i Q_m f_a) * DCF * w_t}{1000} \quad (7)$$

where E is the effective annual dose (mrem/y), C_i is defined in Equation 1, Q_m is the quantity of meat consumed yearly, f_a is the fraction of DU absorbed into the body (*i.e.*, the DU that is not initially excreted), DCF is the dose conversion factor (DOE, 1988), w_t is the appropriate tissue weighting factor (ICRP, 1990), and 1000 is a units conversion factor. Table 4 shows the values for DCF and w_t used for the conversions. The effective dose was calculated for exposure of different tissue to DU, and the CEDE was used so that doses from the Steady-Sate model could be compared with doses calculated from the RESRAD model. Since the CEDE is a measure of the effective dose equivalent to all organs, the w_t is 1. The radiological doses were calculated with the values of C_i in the steady-state model, thus the estimated doses were subjected to the same sensitivity and uncertainty analyses as C_i. The mean, median, mode, and standard deviations of the effective doses are given in Table 5.

Annual effective dose calculations using the steady-state model are low for exposure of kidney (1.85×10^{-3} mrem/y), bone surface (0.92×10^{-3} mrem/y), and GI tract (7.0×10^{-2} mrem/y), as well as for the cumulative effective dose equivalent (CEDE, 0.62 mrem/y). The low doses reflect the small amounts of DU transferred through different pathways considered in the model. Table 5 lists the mean, median, mode, and standard deviations of the doses estimated with the steady-state model.

Comparison of the CEDE values from the steady-state model in Table 5 with the dose rates calculated for the hunting scenario with RESRAD show similar trends but clearly different values. Tables 5 and 6 from the steady-state model and RESRAD model, respectively, show clear differences between the two types of models. Figures 9 and 10 show the dose rate over time from all components in the model, thus, the values shown in the figures do not agree with the values in Table 6. However, when only the dose from meat consumption in the RESRAD results are used for the comparison the two sets of calculations are in much better agreement.

Table 4. Dose conversion factors for ^{238}U and ^{235}U (DCF_U, rem/Ci) and tissue weighting factors (w_t) used for calculating human doses and detriment due to radiation.

	Kidney	Bone Surface	GI Tract	CEDE
DCF_U[1]	1.5	3.7	0.05	0.23
w_t[2]	0.05	0.01	0.05	1.0

[1] Source: DOE, 1988.
[2] Source: ICRP, 1990.

Table 5. Estimated human dose from consumption of deer tissue, steady-state model. Doses for all but CEDE include appropriate tissue weighting factor (ICRP, 1990).

	Dose (in 10^{-3} mrem/y)			
Human Tissue	Mean	Median	Mode	Standard Deviation
Kidney	1.85	1.04	.03	2.36
Bone Surface	0.92	0.51	0.017	1.2
GI Tract	0.07	0.04	0.008	0.13
CEDE[1]	0.62	0.36	0.083	0.75

[1] CEDE is the cumulative effective dose equivalent, or the summation of the effective doses to all tissues.

The largest RESRAD dose is about 0.36 mrem/y from consumption of deer meat, whereas the steady-state model is 0.62 mrem/y. The RESRAD dose, moreover, falls within the standard deviation of the steady-state model result. The RESRAD calculations for the hunting scenario also show that the contribution to the total human dose from meat consumption is the largest contribution from food products (Figure 23), and that there is a significant contribution to dose from the dust inhaled by humans and from contaminated soil (Figure 24). The trend in the steady-state model as well as the meat consumption portion of the RESRAD model support the conclusion that little DU is transferred to humans by the deer consumption pathway.

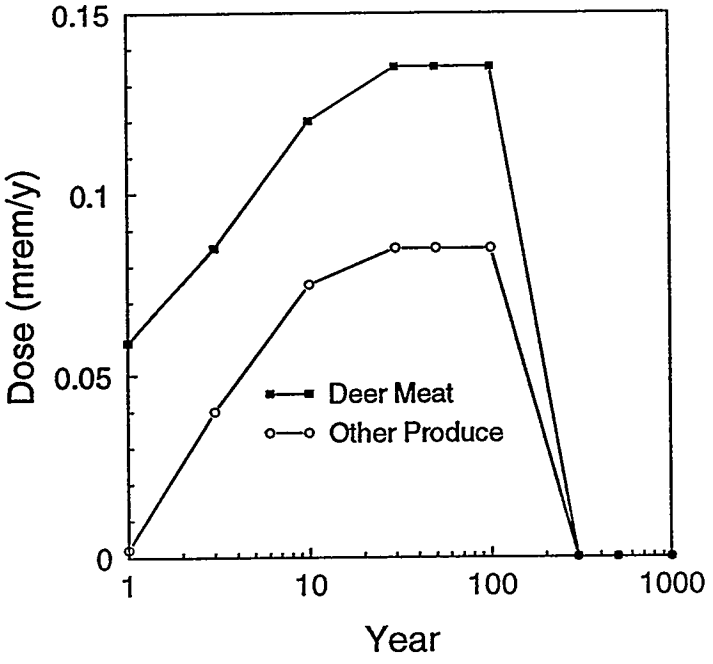

Figure 23. Contribution of deer meat and all other produce to human dose for the hunting scenario. Graph based on nominal (200 μg/m^3) dust loading and average soil concentrations.

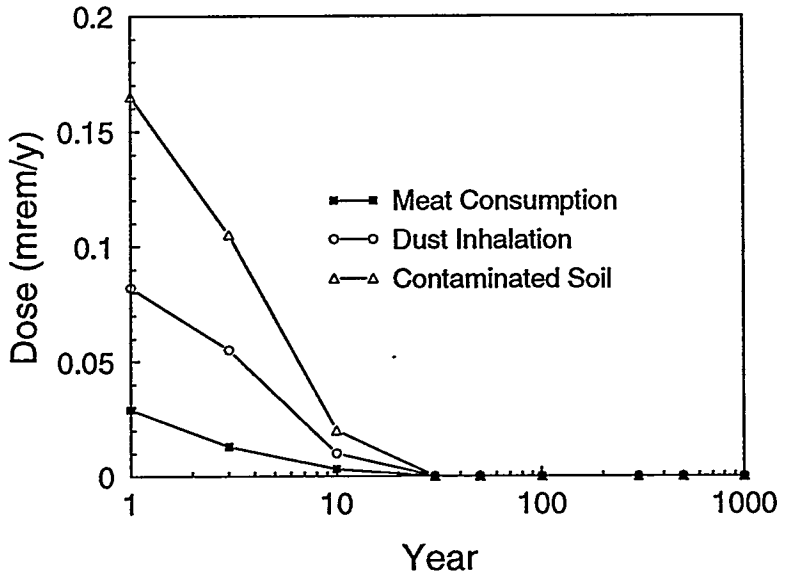

Figure 24. Contributions to human dose from exposure to contaminated soil, direct inhalation, and consumption of deer meat. Graph based on nominal (200 μg/m^3) dust loading and average soil concentrations.

Table 6. Annual doses (mrem/y) from all pathways calculated from RESRAD model scenarios. Annual dose is based on CEDE and is shown for each year of the simulations. Doses for average and 35pCi/g soil and water concentrations given.

Hunting Scenario										
Year	0	1	3	10	30	50	100	300	500	1000
Dose (mrem, Ave.)	0.36	0.35	0.33	0.28	0.16	0.09	0.02	5.6×10^{-3}	6.0×10^{-3}	6.3×10^{-3}
Dose (mrem, 35 pCi/g)	1.6	1.5	1.4	1.2	0.7	0.4	0.07	0.02	0.02	0.02
Farming Scenario #1										
Year	0	1	3	10	30	50	100	300	500	1000
Dose (mrem, Ave.)	1.48	1.44	1.37	1.14	0.66	0.37	0.07	0.05	0.05	0.06
Dose (mrem, 35 pCi/g.)	6.43	6.27	5.94	4.94	2.87	1.63	0.32	0.21	0.22	0.23
Farming Scenario #2										
Year	0	1	3	10	30	50	100	300	500	1000
Dose (mrem, Ave.)	1.63	23.3	54.6	98.7	110.1	110.1	110.7	0.096	0.1	0.1
Dose (mrem, 35 pCi/g.)	6.6	115	271	490	548	549	551	0.05	0.05	0.06

Estimated Risk Calculated from Doses

The estimated detriments to humans from the above dose rates were calculated using the ICRP guidelines (ICRP, 1990). Detriments, for the purpose of converting the doses estimated using the above models, are the sum of radiation-induced fatal cancers, non-fatal cancers, and severe hereditary effects in humans.

Table 7 shows the estimated detriments to humans based on the results of the steady-state model. The total detriment to humans, including radiation workers or the general population, is between 3.5×10^{-7} detriments per year and 4.5×10^{-7} detriments per year based on the cumulative effective does equivalent (CEDE) of Table 4. Detriment due to doses to other tissues are of the same magnitude as calculated using the CEDE. Table 8 shows the estimated detriments to adult radiation workers and the whole population from the doses calculated in the RESRAD simulations. Farming scenario #2 generates the highest human health risks, as expected, because of the highest ingestion of and exposure to contaminated soils, food, and water; the hunting scenario generates the lowest risk because of minimal ingestion and exposure.

Doses used for Table 8 include average and maximum soil and water DU concentrations but show only default dust loading simulations (200 μg/L).

Simulations run with average soil and water concentrations show expected annual detriment of the same magnitude as the results from the steady-state model until about year 300, then significantly lower dose and detriments per year thereafter. Farming scenario simulations at maximum soil and water concentrations show annual detriments in the 10^{-5} range. These results suggest the importance of using accurate soil and water concentrations and the importance of using reasonable dust loadings (*i.e.*, much less than 2000 $\mu g/m^3$) in order to provide a better upper bound on the soil and water concentrations used in the simulations. RESRAD and the steady-state model assume that the values of soil and water concentrations are uniform across the area of contamination. The environmental data show that DU concentrations in soil and water vary considerably as do DU concentrations in most of the parameters monitored. The doses and detriments calculated for the highest soil and water concentrations are conservative in that they assume soil and water DU concentrations for the entire impact area that are higher than have been documented by the environmental data.

Table 7. Conversion of annual doses to annual detriments in adult workers and the whole population from the steady-state model. Detriments are tabulated below as 10^{-7} detriments per year, and are a sum of fatal cancers, non-fatal cancers, and severe hereditary effects. Conversion based on 1 x 10^{-2} detriments/Sv or 1 x 10^{-7} detriments/mrem (ICRP, 1990).

Adult Workers

		---------- 10^{-7} Detriments/year ----------			
Tissue	Dose Rate (mrem/y)	Fatal Cancer	Non-Fatal Cancer	Hereditary Effects	Total
Kidney	1.85 x 10^{-3}	7.4	1.5	1.5	10.0
Bone Surface	0.92 x 10^{-3}	3.7	0.7	0.7	5.2
GI Tract	0.07 x 10^{-3}	0.3	0.06	0.06	0.4
CEDE	0.62 x 10^{-3}	2.5	0.5	0.5	3.5

Whole Population

		---------- 10^{-7} Detriments/year ----------			
Tissue	Dose Rate (mrem/y)	Fatal Cancer	Non-Fatal Cancer	Hereditary Effects	Total
Kidney	1.85 x 10^{-3}	9.3	1.9	2.4	14.0
Bone Surface	0.92 x 10^{-3}	4.6	0.9	0.1	6.7
GI Tract	0.07 x 10^{-3}	0.4	7.0	0.1	0.5
CEDE	0.62 x 10^{-3}	3.1	0.6	0.8	4.5

Table 8. Excess cancer risks based on doses in Table 6. Excess cancers are tabulated as 10^{-5} or 10^{-6} cancers per year from all pathways. Exposed individual is the site user or site resident.

Year	0	1	3	10	30	50	100	300	500	1000
Hunting Scenario, Average Concentrations (x 10^{-6})										
Site User	3.4	3.4	3.2	2.6	1.5	0.85	0.16	0.02	0.02	0.02
Hunting Scenario, 35 pCi/g Soil Concentration (x 10^{-5})										
Site User	1.6	1.6	1.5	1.2	0.7	0.4	0.08	0.001	0.001	0.001
Farming Scenario #1, Average Concentrations (x 10^{-5})										
Site Resident	1.4	1.3	1.3	1.1	0.6	0.4	0.06	0.02	0.02	0.17
Farming Scenario #1, 35 pCi/g Soil Concentration (x 10^{-5})										
Site Resident	6.4	9.3	13.4	19.2	20.7	20.7	20.8	.001	.002	.002
Farming Scenario #2, Average Concentrations (x 10^{-5})										
Site Resident	1.4	8.5	18.8	33.3	37.0	37.0	37.2	.02	.02	.03
Farming Scenario #2, 35 pCi/g Soil Concentration (x 10^{-5})										
Site Resident	6.4	41.9	93.2	165.9	184.3	185.0	185.0	0.01	0.01	0.01

CONCLUSIONS

Models of the terrestrial ecosystem at JPG have been developed and show that human uptake of DU through different pathways is possible. The models also suggest that the doses to humans are small except in the case of extremely high and unrealistic DU concentrations in soils and waters. Sensitivity analyses of the models indicate that DU concentrations in soils, waters, and in or on plants are important to environmental transport of DU. In addition, the sensitivity analysis showed that the area of contamination, the biomass of plants consumed by animals, and the rate at which DU is washed off the plants surfaces are also of importance. Finally, the concentration of dust in the air and, therefore, the amount of airborne DU, play an important role when humans live on the site and/or use the land as a farm.

Doses to humans estimated from the RESRAD model indicate that the 100 mrem/year exposure limit is exceeded only when the impact area is farmed and all drinking water is obtained from the shallow aquifer on site (*i.e.*, farming scenario #2). DU in drinking water dominated the dose estimates when the exposure limits were exceeded. In the hunting scenario and farming scenario #1, the RESRAD model showed that the DU concentration in the air and, therefore, on the surface of vegetation, played the important role in doses to humans. Significant uncertainty in the dose estimates can be reduced by measuring DU concentrations in water, dust, and soil and the temporal or spatial variability in each measurement. Figures 9, 11, 12, and 15 show the amount of variation in estimated doses due to uncertainty in the dust loading values used in the RESRAD simulations.

Removal of DU fragments on the surface of soils in the impact area would reduce the total amount of DU available for transport through the various environmental pathways. However, subsurface recovery of DU would result in increased airborne DU concentrations, damage to the ecosystem at JPG as a result of damage to soils, and could increase erosion of DU-containing soil and thereby increase the water concentration of DU. A risk-based approach to specific remediation activities is suggested so that the reduction in risk due to a particular land-use scenarios can be evaluated before it is implemented.

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APPENDIX A

PARAMETER VALUES AND DISTRIBUTIONS FOR THE STEADY-STATE MODEL

Parameters for Steady State Model

BCF, soil to plants, B_1

Uniform distribution with parameters:

Minimum	2.90E-04	(unitless)
Maximum	2.50E-03	

Selected range is from 2.90E-4 to 2.50E-3
Mean value in simulation was 1.39E-3

Plant Density, P

Triangular distribution with parameters:

Minimum	150.00	(kg/m^2)
Likeliest	240.00	
Maximum	300.00	

Selected range is from 150.00 to 300.00
Mean value in simulation was 230.03

Build-up time, years, tb

Uniform distribution with parameters:

Minimum	5.00	(years)
Maximum	20.00	

Selected range is from 5.00 to 20.00
Mean value in simulation was 12.51

Groundwater flow velocity Vw

Uniform distribution with parameters:

Minimum	2.00	(cm/day)
Maximum	25.00	

Selected range is from 2.00 to 25.00
Mean value in simulation was 13.56

Rooting zone depth, ds

Uniform distribution with parameters:

Minimum	10.00	(cm)
Maximum	40.00	

Selected range is from 10.00 to 40.00
Mean value in simulation was 25.08

Soil bulk density, rho

Normal distribution with parameters:

Mean	1.50	(g/cm^3)
Standard Dev.	0.15	

Selected range is from -Infinity to +Infinity
Mean value in simulation was 1.50

Soil Moisture, theta

Uniform distribution with parameters:

Minimum	0.25	(cm/cm)
Maximum	0.45	

Selected range is from 0.25 to 0.45
Mean value in simulation was 0.35

Distribution coefficient, Kdi

Uniform distribution with parameters:

Minimum	10.00	(ml/g)
Maximum	300.00	

Selected range is from 10.00 to 300.00
Mean value in simulation was 154.97

Soil Surface Conc., Cs

Uniform distribution with parameters:

Minimum	10.00	(pCi/g)
Maximum	100.00	

Selected range is from 10.00 to 100.00
Mean value in simulation was 54.96

Soil Ingestion Rate, g/day, Qs

Uniform distribution with parameters:

Minimum	30.00	(g/day)
Maximum	60.00	

Selected range is from 30.00 to 60.00
Mean value in simulation was 44.95

Fraction of water from contaminated source, fw

Uniform distribution with parameters:

Minimum	1.00E-01	(unitless)
Maximum	1.00E+00	

Selected range is from 1.00E-1 to 1.00E+0
Mean value in simulation was 5.49E-1

Water Consumption, Qw

Uniform distribution with parameters:

Minimum	2.00E+01	(l/day)
Maximum	6.00E+01	

Selected range is from 2.00E+1 to 6.00E+1
Mean value in simulation was 4.01E+1

Water Concentration, Cw

Lognormal distribution with parameters:

Mean	3.00E+00	(pCi/l)
Standard Dev.	5.00E+00	

Selected range is from 0.00E+0 to +Infinity
Mean value in simulation was 2.88E+0

Frequency on pasture, fp

Uniform distribution with parameters:

Minimum	0.00	(unitless)
Maximum	1.00	

Selected range is from 0.00 to 1.00
Mean value in simulation was 0.50

Fraction of food that is contaminated, fs

Uniform distribution with parameters:

Minimum	0.00	(unitless)
Maximum	1.00	

Selected range is from 0.00 to 1.00
Mean value in simulation was 0.50

Fraction of Impact Area in Resuspension

Uniform distribution with parameters:

Minimum	0.01	(unitless)
Maximum	0.10	

Selected range is from 0.01 to 0.10
Mean value in simulation was 0.06
Fraction was 1.0 when entire impact area used

Fraction of Area in Resuspension

Uniform distribution with parameters:

Minimum	0.01	(unitless)
Maximum	0.10	

Selected range is from 0.01 to 0.10
Mean value in simulation was 0.05

Interception fraction, fr

Uniform distribution with parameters:

Minimum	0.00	(unitless)
Maximum	1.00	

Selected range is from 0.00 to 1.00
Mean value in simulation was 0.50

Translocation factor, Tv

Uniform distribution with parameters:

Minimum	0.00	(unitless)
Maximum	1.00	

Selected range is from 0.00 to 1.00
Mean value in simulation was 0.50

Biomass at Harvest, Yv

Triangular distribution with parameters:

Minimum	0.20	(kg/m^2)
Likeliest	2.00	
Maximum	2.20	

Selected range is from 0.20 to 2.20
Mean value in simulation was 1.46

Weathering time, tw

Normal distribution with parameters:

Mean	14.00	(day)
Standard Dev.	4.00	

Selected range is from -Infinity to +Infinity
Mean value in simulation was 14.00

Time of Crop exposure, te

Normal distribution with parameters:

Mean	60.00	(day)
Standard Dev.	10.00	

Selected range is from -Infinity to +Infinity
Mean value in simulation was 59.89

APPENDIX B

PARAMETER VALUES FOR

RESRAD CALCULATIONS

Input Data for hunting scenario, average soil concentrations.

Residual Radioactivity Program, Version 5.00 04/04/94 20:52 Page 4
Summary : JPG Hunting scenario, average soil conc. File: HUNT.DAT

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.000E+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)	1.500E+03	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.000E+02	3.000E+01	---	BRLD
R011	Time since placement of material (yr)	1.500E+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)	5.000E+01	1.000E+02	---	T(6)
R011	Times for calculations (yr)	1.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	3.000E+02	1.000E+03	---	T(8)
R011	Times for calculations (yr)	5.000E+02	3.000E+03	---	T(9)
R011	Times for calculations (yr)	1.000E+03	1.000E+04	---	T(10)
R012	Initial principal radionuclide (pCi/g): U-234	1.610E+00	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): U-238	6.990E+00	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)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone effective porosity	3.000E-01	2.000E-01	---	EPCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	6.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	4.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	3.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Individual's use of groundwater (m**3/yr)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	1	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)	1.500E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	5.000E+01	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.125E-02	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	---	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	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.125E-02	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(5)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.065E-02	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(1)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.519E-02	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(2)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.778E-05	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	---	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, external gamma	1.000E+00	1.000E+00	---	FS1

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Fractions of annular areas within AREA:				
R017	Outer annular radius (m) = ∝(1/Đ)	not used	1.000E+00	---	FRACA(1)
R017	Outer annular radius (m) = ∝(10/Đ)	not used	1.000E+00	---	FRACA(2)
R017	Outer annular radius (m) = ∝(20/Đ)	not used	1.000E+00	---	FRACA(3)
R017	Outer annular radius (m) = ∝(50/Đ)	not used	1.000E+00	---	FRACA(4)
R017	Outer annular radius (m) = ∝(100/Đ)	not used	1.000E+00	---	FRACA(5)
R017	Outer annular radius (m) = ∝(200/Đ)	not used	1.000E+00	---	FRACA(6)
R017	Outer annular radius (m) = ∝(500/Đ)	not used	1.000E+00	---	FRACA(7)
R017	Outer annular radius (m) = ∝(1000/Đ)	not used	1.000E+00	---	FRACA(8)
R017	Outer annular radius (m) = ∝(5000/Đ)	not used	1.000E+00	---	FRACA(9)
R017	Outer annular radius (m) = ∝(1.E+04/Đ)	not used	1.000E+00	---	FRACA(10)
R017	Outer annular radius (m) = ∝(1.E+05/Đ)	not used	0.000E+00	---	FRACA(11)
R017	Outer annular radius (m) = ∝(1.E+06/Đ)	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	0.000E+00	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	0.000E+00	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	9.200E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	5.400E+00	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	0.000E+00	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	0.000E+00	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	0.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	1.000E+00	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	1.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT
R018	Contamination fraction of meat	-1	-1	0.100E+01	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	4.000E+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)	5.500E+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-03	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	0.000E+00	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	0.000E+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

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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
R021	Thickness of building foundation (m)	1.500E-01	1.500E-01	---	FLOOR
R021	Bulk density of building foundation (g/cm**3)	2.400E+00	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	1.000E-01	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	3.000E-02	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	3.000E-07	3.000E-07	---	DIFFL
R021	in contaminated zone soil	2.000E-06	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	2.000E+00	2.000E+00	---	HMIX
R021	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R021	Average building air exchange rate (1/hr)	5.000E-01	5.000E-01	---	REXG
R021	Height of the building (room) (m)	2.500E+00	2.500E+00	---	HRM
R021	Building interior area factor	0.000E+00	0.000E+00	code computed (time dependent)	FAI
R021	Building depth below ground surface (m)	1.000E+00	1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	2.500E-01	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	active
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	active

Input data for hunting scenario, 35 pCi/g soil concentration.

Residual Radioactivity Program, Version 5.00 04/04/94 10:14 Page 6
Summary : JPG Hunting scenario, 35 pCi/g File: HUNT35.DAT

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.000E+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)	1.500E+03	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.000E+02	3.000E+01	---	BRLD
R011	Time since placement of material (yr)	1.500E+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)	5.000E+01	1.000E+02	---	T(6)
R011	Times for calculations (yr)	1.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	3.000E+02	1.000E+03	---	T(8)
R011	Times for calculations (yr)	5.000E+02	3.000E+03	---	T(9)
R011	Times for calculations (yr)	1.000E+03	1.000E+04	---	T(10)
R012	Initial principal radionuclide (pCi/g): U-234	1.600E-03	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): U-235	7.000E-02	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): U-238	3.489E+01	0.000E+00	---	S1(8)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(8)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone effective porosity	3.000E-01	2.000E-01	---	EPCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	6.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	4.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	3.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Individual's use of groundwater (m**3/yr)	not used	2.500E+02	---	UW

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	1.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	5.000E+01	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.125E-02	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(6)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.125E-02	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(7)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.125E-02	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(8)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.280E-02	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(1)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.125E-02	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(2)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.065E-02	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(3)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.519E-02	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(4)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.778E-05	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(5)
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, external gamma	1.000E+00	1.000E+00	---	FS1
R017	Fractions of annular areas within AREA:				
R017	Outer annular radius (m) = ∝(1/Đ)	not used	1.000E+00	---	FRACA(1)
R017	Outer annular radius (m) = ∝(10/Đ)	not used	1.000E+00	---	FRACA(2)
R017	Outer annular radius (m) = ∝(20/Đ)	not used	1.000E+00	---	FRACA(3)
R017	Outer annular radius (m) = ∝(50/Đ)	not used	1.000E+00	---	FRACA(4)
R017	Outer annular radius (m) = ∝(100/Đ)	not used	1.000E+00	---	FRACA(5)
R017	Outer annular radius (m) = ∝(200/Đ)	not used	1.000E+00	---	FRACA(6)
R017	Outer annular radius (m) = ∝(500/Đ)	not used	1.000E+00	---	FRACA(7)
R017	Outer annular radius (m) = ∝(1000/Đ)	not used	1.000E+00	---	FRACA(8)
R017	Outer annular radius (m) = ∝(5000/Đ)	not used	1.000E+00	---	FRACA(9)
R017	Outer annular radius (m) = ∝(1.E+04/Đ)	not used	1.000E+00	---	FRACA(10)
R017	Outer annular radius (m) = ∝(1.E+05/Đ)	not used	0.000E+00	---	FRACA(11)
R017	Outer annular radius (m) = ∝(1.E+06/Đ)	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	0.000E+00	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	0.000E+00	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	9.200E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	5.400E+00	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	0.000E+00	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	0.000E+00	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	0.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	1.000E+00	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	1.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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)	4.000E+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)	5.500E+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-03	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	0.000E+00	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	0.000E+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
R021	Thickness of building foundation (m)	1.500E-01	1.500E-01	---	FLOOR
R021	Bulk density of building foundation (g/cm**3)	2.400E+00	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	1.000E-01	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	3.000E-02	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	3.000E-07	3.000E-07	---	DIFFL
R021	in contaminated zone soil	2.000E-06	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	2.000E+00	2.000E+00	---	HMIX
R021	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R021	Average building air exchange rate (1/hr)	5.000E-01	5.000E-01	---	REXG
R021	Height of the building (room) (m)	2.500E+00	2.500E+00	---	HRM
R021	Building interior area factor	0.000E+00	0.000E+00	code computed (time dependent)	FAI
R021	Building depth below ground surface (m)	1.000E+00	1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	2.500E-01	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)

Input data for farming scenario #1 (off-site drinking water), average soil concentration.

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Summary : Farming scenario #1 (no drinking water), Average Concentration
File : FARM1.DAT

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.000E+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)	1.500E+03	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.000E+02	3.000E+01	---	BRLD
R011	Time since placement of material (yr)	1.500E+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)	5.000E+01	1.000E+02	---	T(6)
R011	Times for calculations (yr)	1.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	3.000E+02	1.000E+03	---	T(8)
R011	Times for calculations (yr)	5.000E+02	3.000E+03	---	T(9)
R011	Times for calculations (yr)	1.000E+03	1.000E+04	---	T(10)
R012	Initial principal radionuclide (pCi/g): U-234	1.610E+00	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): U-238	6.990E+00	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)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone effective porosity	3.000E-01	2.000E-01	---	EPCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	6.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	4.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	3.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Individual's use of groundwater (m**3/yr)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	1	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)	1.500E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	5.000E+01	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.125E-02	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	---	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	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.125E-02	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(5)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.065E-02	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(1)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.519E-02	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(2)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.778E-05	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	---	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)	2.500E-01	2.500E-01	---	FOTD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Shape factor, external gamma	1.000E+00	1.000E+00	---	FS1
R017	Fractions of annular areas within AREA:				
R017	Outer annular radius (m) = ∞(1/Đ)	not used	1.000E+00	---	FRACA(1)
R017	Outer annular radius (m) = ∞(10/Đ)	not used	1.000E+00	---	FRACA(2)
R017	Outer annular radius (m) = ∞(20/Đ)	not used	1.000E+00	---	FRACA(3)
R017	Outer annular radius (m) = ∞(50/Đ)	not used	1.000E+00	---	FRACA(4)
R017	Outer annular radius (m) = ∞(100/Đ)	not used	1.000E+00	---	FRACA(5)
R017	Outer annular radius (m) = ∞(200/Đ)	not used	1.000E+00	---	FRACA(6)
R017	Outer annular radius (m) = ∞(500/Đ)	not used	1.000E+00	---	FRACA(7)
R017	Outer annular radius (m) = ∞(1000/Đ)	not used	1.000E+00	---	FRACA(8)
R017	Outer annular radius (m) = ∞(5000/Đ)	not used	1.000E+00	---	FRACA(9)
R017	Outer annular radius (m) = ∞(1.E+04/Đ)	not used	1.000E+00	---	FRACA(10)
R017	Outer annular radius (m) = ∞(1.E+05/Đ)	not used	0.000E+00	---	FRACA(11)
R017	Outer annular radius (m) = ∞(1.E+06/Đ)	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)	9.200E+01	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	9.200E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	5.400E+00	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	0.000E+00	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	0.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	1.000E+00	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT
R018	Contamination fraction of meat	-1	-1	0.100E+01	FMEAT
R018	Contamination fraction of milk	-1	-1	0.100E+01	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.500E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	1.000E-03	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	1.000E+00	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

Site-Specific Parameter Summary (continued)

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

Summary of Pathway Selections

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

Input data for farming scenario #1 (off-site drinking water), 35 pCi/g soil concentration.

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Summary : Farming scenario #1 (no drinking water), 35 pCi/g File: FARM35.DAT

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.000E+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)	1.500E+03	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.000E+02	3.000E+01	---	BRLD
R011	Time since placement of material (yr)	1.500E+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)	5.000E+01	1.000E+02	---	T(6)
R011	Times for calculations (yr)	1.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	3.000E+02	1.000E+03	---	T(8)
R011	Times for calculations (yr)	5.000E+02	3.000E+03	---	T(9)
R011	Times for calculations (yr)	1.000E+03	1.000E+04	---	T(10)
R012	Initial principal radionuclide (pCi/g): U-234	1.600E-03	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): U-235	7.000E-02	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): U-238	3.489E+01	0.000E+00	---	S1(8)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(8)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone effective porosity	3.000E-01	2.000E-01	---	EPCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	6.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	4.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	3.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Individual's use of groundwater (m**3/yr)	not used	2.500E+02	---	UW

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	1.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	5.000E+01	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.125E-02	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(6)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.125E-02	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(7)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.125E-02	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(8)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.280E-02	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(1)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.125E-02	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(2)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.065E-02	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(3)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.519E-02	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(4)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.778E-05	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(5)
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)	2.500E-01	2.500E-01	---	FOTD
R017	Shape factor, external gamma	1.000E+00	1.000E+00	---	FS1
R017	Fractions of annular areas within AREA:				
R017	Outer annular radius (m) = ∝(1/Đ)	not used	1.000E+00	---	FRACA(1)
R017	Outer annular radius (m) = ∝(10/Đ)	not used	1.000E+00	---	FRACA(2)
R017	Outer annular radius (m) = ∝(20/Đ)	not used	1.000E+00	---	FRACA(3)
R017	Outer annular radius (m) = ∝(50/Đ)	not used	1.000E+00	---	FRACA(4)
R017	Outer annular radius (m) = ∝(100/Đ)	not used	1.000E+00	---	FRACA(5)
R017	Outer annular radius (m) = ∝(200/Đ)	not used	1.000E+00	---	FRACA(6)
R017	Outer annular radius (m) = ∝(500/Đ)	not used	1.000E+00	---	FRACA(7)
R017	Outer annular radius (m) = ∝(1000/Đ)	not used	1.000E+00	---	FRACA(8)
R017	Outer annular radius (m) = ∝(5000/Đ)	not used	1.000E+00	---	FRACA(9)
R017	Outer annular radius (m) = ∝(1.E+04/Đ)	not used	1.000E+00	---	FRACA(10)
R017	Outer annular radius (m) = ∝(1.E+05/Đ)	not used	0.000E+00	---	FRACA(11)
R017	Outer annular radius (m) = ∝(1.E+06/Đ)	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)	9.200E+01	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	9.200E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	5.400E+00	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	0.000E+00	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	0.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	1.000E+00	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R018	Contamination fraction of meat	-1	-1	0.100E+01	FMEAT
R018	Contamination fraction of milk	-1	-1	0.100E+01	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.500E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	1.000E-03	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	1.000E+00	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
R021	Thickness of building foundation (m)	1.500E-01	1.500E-01	---	FLOOR
R021	Bulk density of building foundation (g/cm**3)	2.400E+00	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	1.000E-01	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	3.000E-02	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	3.000E-07	3.000E-07	---	DIFFL
R021	in contaminated zone soil	2.000E-06	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	2.000E+00	2.000E+00	---	HMIX
R021	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R021	Average building air exchange rate (1/hr)	5.000E-01	5.000E-01	---	REXG
R021	Height of the building (room) (m)	2.500E+00	2.500E+00	---	HRM
R021	Building interior area factor	0.000E+00	0.000E+00	code computed (time dependent)	FAI
R021	Building depth below ground surface (m)	1.000E+00	1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	2.500E-01	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)

Input data for farming scenario #2 (on-site drinking water), average soil concentration and 1 pCi/l water concentration.

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Summary : Farming scenario #2 (On-Site Drinking Water), Average Concentration
File : FARM2.DAT

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.000E+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)	1.500E+03	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.000E+02	3.000E+01	---	BRLD
R011	Time since placement of material (yr)	1.500E+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)	5.000E+01	1.000E+02	---	T(6)
R011	Times for calculations (yr)	1.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	3.000E+02	1.000E+03	---	T(8)
R011	Times for calculations (yr)	5.000E+02	3.000E+03	---	T(9)
R011	Times for calculations (yr)	1.000E+03	1.000E+04	---	T(10)
R012	Initial principal radionuclide (pCi/g): U-234	1.610E+00	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): U-238	6.990E+00	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	1.000E+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)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone effective porosity	3.000E-01	2.000E-01	---	EPCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	6.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	4.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	3.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Individual's use of groundwater (m**3/yr)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	1	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)	1.500E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	5.000E+01	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.125E-02	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(4)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	4.618E+00	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	4.618E+00	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	4.618E+00	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.213E-01	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(5)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.065E-02	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(1)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.519E-02	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(2)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.778E-05	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	---	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)	2.500E-01	2.500E-01	---	FOTD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Shape factor, external gamma	1.000E+00	1.000E+00	---	FS1
R017	Fractions of annular areas within AREA:				
R017	Outer annular radius (m) = ≤(1/Ð)	not used	1.000E+00	---	FRACA(1)
R017	Outer annular radius (m) = ≤(10/Ð)	not used	1.000E+00	---	FRACA(2)
R017	Outer annular radius (m) = ≤(20/Ð)	not used	1.000E+00	---	FRACA(3)
R017	Outer annular radius (m) = ≤(50/Ð)	not used	1.000E+00	---	FRACA(4)
R017	Outer annular radius (m) = ≤(100/Ð)	not used	1.000E+00	---	FRACA(5)
R017	Outer annular radius (m) = ≤(200/Ð)	not used	1.000E+00	---	FRACA(6)
R017	Outer annular radius (m) = ≤(500/Ð)	not used	1.000E+00	---	FRACA(7)
R017	Outer annular radius (m) = ≤(1000/Ð)	not used	1.000E+00	---	FRACA(8)
R017	Outer annular radius (m) = ≤(5000/Ð)	not used	1.000E+00	---	FRACA(9)
R017	Outer annular radius (m) = ≤(1.E+04/Ð)	not used	1.000E+00	---	FRACA(10)
R017	Outer annular radius (m) = ≤(1.E+05/Ð)	not used	0.000E+00	---	FRACA(11)
R017	Outer annular radius (m) = ≤(1.E+06/Ð)	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)	9.200E+01	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	9.200E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	5.400E+00	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	5.100E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	1.000E+00	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT
R018	Contamination fraction of meat	-1	-1	0.100E+01	FMEAT
R018	Contamination fraction of milk	-1	-1	0.100E+01	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.500E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	1.000E-03	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	1.000E+00	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

Site-Specific Parameter Summary (continued)

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

Summary of Pathway Selections

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

Input data for farming scenario #2 (on-site drinking water), 35 pCi/g soil concentration and 1 pCi/l water concentration.

Residual Radioactivity Program, Version 5.00 04/24/94 17:37 Page 6
Summary : Farming scenario #2 (On-Site Drinking Water), 35 pCi/g
File : FARM235.DAT

Site-Specific Parameter Summary

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.000E+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)	1.500E+03	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.000E+02	3.000E+01	---	BRLD
R011	Time since placement of material (yr)	1.500E+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)	5.000E+01	1.000E+02	---	T(6)
R011	Times for calculations (yr)	1.000E+02	3.000E+02	---	T(7)
R011	Times for calculations (yr)	3.000E+02	1.000E+03	---	T(8)
R011	Times for calculations (yr)	5.000E+02	3.000E+03	---	T(9)
R011	Times for calculations (yr)	1.000E+03	1.000E+04	---	T(10)
R012	Initial principal radionuclide (pCi/g): U-234	1.600E-03	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): U-235	7.000E-02	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): U-238	3.489E+01	0.000E+00	---	S1(8)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): U-235	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): U-238	1.000E+00	0.000E+00	---	W1(8)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone effective porosity	3.000E-01	2.000E-01	---	EPCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	6.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.000E+00	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	4.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.500E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	3.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Individual's use of groundwater (m**3/yr)	not used	2.500E+02	---	UW

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	1.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	5.000E+01	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.125E-02	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(6)
R016	Distribution coefficients for U-235				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.125E-02	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(7)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	4.620E+00	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	4.620E+00	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	4.620E+00	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.212E-01	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(8)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.280E-02	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(1)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.125E-02	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(2)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.065E-02	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(3)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.519E-02	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(4)
R016	Distribution coefficients for daughter Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.778E-05	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	---	SOLUBK(5)
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)	2.500E-01	2.500E-01	---	FOTD
R017	Shape factor, external gamma	1.000E+00	1.000E+00	---	FS1
R017	Fractions of annular areas within AREA:				
R017	Outer annular radius (m) = ∝(1/Đ)	not used	1.000E+00	---	FRACA(1)
R017	Outer annular radius (m) = ∝(10/Đ)	not used	1.000E+00	---	FRACA(2)
R017	Outer annular radius (m) = ∝(20/Đ)	not used	1.000E+00	---	FRACA(3)
R017	Outer annular radius (m) = ∝(50/Đ)	not used	1.000E+00	---	FRACA(4)
R017	Outer annular radius (m) = ∝(100/Đ)	not used	1.000E+00	---	FRACA(5)
R017	Outer annular radius (m) = ∝(200/Đ)	not used	1.000E+00	---	FRACA(6)
R017	Outer annular radius (m) = ∝(500/Đ)	not used	1.000E+00	---	FRACA(7)
R017	Outer annular radius (m) = ∝(1000/Đ)	not used	1.000E+00	---	FRACA(8)
R017	Outer annular radius (m) = ∝(5000/Đ)	not used	1.000E+00	---	FRACA(9)
R017	Outer annular radius (m) = ∝(1.E+04/Đ)	not used	1.000E+00	---	FRACA(10)
R017	Outer annular radius (m) = ∝(1.E+05/Đ)	not used	0.000E+00	---	FRACA(11)
R017	Outer annular radius (m) = ∝(1.E+06/Đ)	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)	9.200E+01	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	9.200E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	5.400E+00	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	5.100E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	1.000E+00	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
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	-1	-1	0.100E+01	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.500E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	1.000E-03	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	1.000E+00	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
R021	Thickness of building foundation (m)	1.500E-01	1.500E-01	---	FLOOR
R021	Bulk density of building foundation (g/cm**3)	2.400E+00	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	1.000E-01	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	3.000E-02	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	3.000E-07	3.000E-07	---	DIFFL
R021	in contaminated zone soil	2.000E-06	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	2.000E+00	2.000E+00	---	HMIX
R021	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R021	Average building air exchange rate (1/hr)	5.000E-01	5.000E-01	---	REXG
R021	Height of the building (room) (m)	2.500E+00	2.500E+00	---	HRM
R021	Building interior area factor	0.000E+00	0.000E+00	code computed (time dependent)	FAI
R021	Building depth below ground surface (m)	1.000E+00	1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	2.500E-01	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)