STATE OF COLORADO

Bill Owens, Governor
Douglas H. Benevento, Executive Director

Dedicated to protecting and improving the health and environment of the people of Colorado

4300 Cherry Creek Dr. S.
Denver, Colorado 80246-1530
Phone (303) 692-2000
TDD Line (303) 691-7700
Located in Glendale, Colorado

Laboratory Services Division
8100 Lowry Blvd.
Denver, Colorado 80230-6928
(303) 692-3090

http://www.cdphe.state.co.us

Colorado Department
of Public Health
and Environment

April 20, 2005

Attention: David B. Nielsen, Director of Landfill Compliance
Clean Harbors Deer Trail, LLC
2500 West Lokern Road
PO Box 787
Buttonwillow, CA 93206

Re: Request for License-Concerns Regarding Assessment of Environmental Impacts and Assessment of Exposure to Workers

This letter is to request additional documentation to resolve issues and deficiencies identified with your January 31, 2005 license application to operate a low-level waste disposal facility in Colorado. The review of your application is ongoing and this list of issues/deficiencies is not comprehensive. The Department will provide additional requests for information as needed during the review process. Please provide appropriate documentation to resolve each of the following items.

1. RH 3.8.8 requires the applicant to submit an assessment of potential environmental impacts from the proposed activities at the facility. Please provide a detailed assessment of the radiological impacts to the environment and to the public from:
    a. accidents, incidents and spills at the facility;
    b. transportation of radioactive materials to the site; and
    c. from materials that may be dispersed into the environment during on-going operations.

2. Please provide supporting data and analysis for the selection of all model inputs to demonstrate that these adequately represent the characteristics at the site and the proposed activities. For example: RESRAD model runs need to include radionuclides such as K-40 and Th-232. The RESRAD inputs must accurately reflect site and meteorological conditions. Default values should not be used if site-specific data can be generated. For example, the stated average annual precipitation for the site is 16.65 inches (0.423 m). See Table 2-2. However, the RESRAD model input for precipitation is entered as 1 m/y. The models must not use inappropriate inputs such as "overhead irrigation of 0.2 m/y" on the waste impoundment. The modeling must also address the requirements of RH 14.8.1 and should include some boundary scenarios and calculations for radionuclide content in the materials.

3. Please provide the actual model inputs and calculations used for determining the dose to the nearby residents during operations, see Section 6, page 6-14.

Prepared by:_____ Reviewed by:_____ Reviewed by:_____ Mailed by:_____
Date:_____ Date:_____ Date:_____ Date Mailed:_____
Title: RFI dated April 21, 2005 regarding Assessment of Environmental Impacts and Worker Exposure
File: CHDT, ******, 3.2

4. Please provide a description of the current socioeconomic environment and a detailed description of the socioeconomic impacts associated with the disposal of radioactive materials.

5. Please provide additional analysis to adequately describe the site's geological and hydrogeological suitability for radioactive materials. Specifically, the application should provide a discussion of the physical and chemical attributes of the facility and disposed radionuclides, and how the two systems interact. The radionuclides are, for the most part, metals and their chemical behavior is well known. How is this facility geologically well suited for the containment of metals? How is this facility well suited hydrologically and geochemically for the containment of metals that are also radioactive? These questions can probably be answered with existing data.

6. Please provide additional analysis addressing the capability of the cap to mitigate radon emissions for the closure period. Will materials at the peak concentrations be located near the cap?

7. Please provide additional information demonstrating that surface water controls will be durable in the post-closure phase of 1000 years.

8. Please provide additional evaluation of impacts from 100-year and 500-year storm events. Are there ephemeral streams in the area that would be able to transport surface contamination in the event of a major storm?

9. RH 14.8.3 requires the applicant to submit analysis of the protection of individuals during operations. Section 6 and Attachment B of the application provide this analysis, but are incomplete. Please address the following comments in your response:

    a. The assessment does not adequately address what concentrations and volumes of radioactive materials containing free water or liquids would be accepted and treated at the site.
    b. Parts of the Section 6.1.1 do not appear to be consistent with recent submittals by Clean Harbors where they state that some wastes may be containerized (e.g., filter cakes, resins, scales). Please clarify this potential inconsistency with the RCRA requirements.
    c. There is no risk assessment for treatment of materials prior to placement.
    d. Does the claim that the material will generally be < 100 uR/h include radium progeny (i.e., Bismith-214) and include shielding from the containers? At what distance is the 100 uR/h correlation? Previous experience in UMTRA would indicate that tailings at 400 pCi/g Ra-226 (including progeny assuming about 20% emanation rate), gamma exposure rates (without shielding) can range up to 300 uR/h. We recognize that each mixture of materials will have its own characteristics. Modeling of worker exposures that are unshielded should use a more conservative gamma exposure rate for peak concentrations of Ra-226. Please provide revised or better-documented estimates of gamma exposure rates at peak concentrations.
    e. Please provide an evaluation of worker exposure to leachate during the operational phase.

f. Please provide supporting spreadsheets for section 6.1.3.
g. Please provide additional input parameters for Table 6.2, for example, shielding thickness for maintenance in transit. On the printout it is listed as 0.00625 inches, but it is not clear why this value was chosen.
h. Please reevaluate the breathing rate value used in the modeling for workers exposed to waste in the disposal cell. The default rate in RESRAD 6.22 is 8400 m3/yr. According to the reports in Appendix B, the breathing rate was lowered to 1960 m3/yr. Was the breathing rate normalized to 1,000 hrs? Since the activity at work can range from light to heavy, a more conservative value may be appropriate.
i. Please explain why different dimensions were used in the modeling for doses to individuals near transport container than were used in the modeling for truck drivers hauling waste.

Pursuant to RH 12.2.1 of the Regulations, the Department will consider an application abandoned if it does not receive a reply within forty-five (45) days to its most recent request for additional information. If you have any questions regarding your license or this letter, please contact Jennifer Opila of this Division at (303) 692-3403.

Steve Tarlton, Unit Leader
Radiation Management Unit
Hazardous Materials and Waste Management Division

Clean Harbors Deer Trail, LLC
108555 East Highway 36
Deer Trail, CO 80105
Telephone: (970) 386-2293
Facsimile: (970) 386-2262

May 24, 2005

Mr. Steve Tarlton, Unit Leader
Radiation Management Unit
Hazardous Materials and Waste Management Division
Colorado Department of Public Health and Environment
4300 Cherry Creek Drive South
Denver, CO 80246-1530

RE: Response to Concerns Regarding Assessment of Environmental Impacts and Assessment of Exposure to Workers, Clean Harbors Deer Trail, LLC, Radioactive Materials License Application, Docket Number 5873

Dear Mr. Tarlton:

I received you letter dated April 20, 2005, which contained comments on the Clean Harbors Deer Trail, LLC, *Radioactive Materials License Application*, dated January 2005. Enclosed is Clean Harbor's response to comments/questions regarding environmental impacts and assessment exposure to workers.

If you have any questions, please feel free to me at (661) 762-6200.

Sincerely,

David B. Nielsen, PE
Director of Landfill Compliance
Clean Harbors Environmental Services, Inc.

DBN:dbn

Enclosure: Response to Comments

RESPONSE TO COMMENTS ON CLEAN HARBORS DEER TRAIL, LLC, RADIOACTIVE MATERIALS LICENSE APPLICATION, DOCKET NUMBER 5873

Colorado Department of Public Health and Environment
Request for Information April 20, 2005

CDPHE Comment 1:

1. **RH 3.8.8 requires the applicant to submit an assessment of potential environmental impacts from the proposed activities at the facility. Please provide a detailed assessment of the radiological impacts to the environment and to the public from:**

Clean Harbors Responses:

a. **accidents, incidents and spills at the facility;** *The primary purpose of an accident analysis for nuclear facilities is to provide reasonable assurance that operations cannot potentially cause harm to workers or adversely affect public health and safety (SAIC 1998). Accident scenario analysis starts with an evaluation of site conditions and the development of a conceptual model within which accidents are identified. The most severe accidents involve energetic releases of radioactive material through such events as nuclear criticality, explosions, fires, or chemical reactions. Because of the relatively inert nature of most NORM/TENORM wastes, and because of waste form restrictions at the Deer Trail landfill imposed under RCRA (i.e., no explosive or flammable waste), these severe accidents are simply not possible.*

The next class of accidents involves mechanical initiators that could result in aerodynamic entrainment. This class can be defined for Deer Trail through such events as spills or other process upsets. The potential radiation doses that may result from these spill-related accidents at Deer Trail can be considered as an extension of the evaluations that have been conducted and reported in Section 6.0 of the license application.

For this analysis, workers onsite and nearby residents are assumed to be exposed from the complete spill and cleanup of a load of NORM/TENORM waste. Although this event could occur anywhere the truck is located, for purposes of analysis it is assumed to occur at the facility outside of a landfill cell on a haul road at the facility. The radiation exposure pathways would be the same as analyzed for chronic work conditions: external exposure to penetrating radiation, and inhalation of airborne material. The pathway analysis for this accident evaluation was conducted using RESRAD (Yu et al. 2001).

The quantity of waste involved was assumed to be one roll-off box full of NORM/TENORM waste. A standard container has dimensions of 1.8 x 2.4 x 6.5 m for a volume of about 28 m^3. It was assumed that the spill covers 56 m^2 to a depth of 0.5 m. Localized air concentrations were assumed to be 0.05 mg/m^3 (Kennedy and Strenge 1992), which is a factor of 5 higher than the chronic levels assumed for normal operations. This air concentration was modified to account for use of a full face masks, with a protection factor of 50. The resulting air concentration for workers was 0.001 mg/m^3. It was conservatively assumed that the exposure duration for the spill and cleanup would last for 10 hours using heavy equipment. Shielding provided by the equipment was considered by assuming a soil cover of 0.18 m.

The assumed radionuclide mixture is shown in Table 1.

Table 1. Revised Radionuclide Mixture Considered in the Deer Trail Dose Calculations

Radionuclide	***Waste Concentration (pCi/g)***
^{40}K	*300*
^{210}Pb	*400*
$^{226}Ra+D$	*400*
^{230}Th	*300*
$^{232}Th+D$	*50*
^{234}U	*300*
$^{238}U+D$	*300*

This radionuclide mixture includes the major decay chain members for $^{238}U+D$ and $^{232}Th+D$, plus ^{40}K. It is a conservative representation since an actual waste shipment would not likely contain this broad-spectrum mixture of NORM/TENORM radionuclides. Further, the total concentration is well in excess of the Deer Trail upper activity limit of 2,000 pCi/g when the activity of the decay chain members in equilibrium is included. For example, shipments containing higher concentrations of $^{232}Th+D$ than the mixture in Table 1 would likely have significantly less $^{226}Rn+D$. Since external exposure is the dominant pathway for both radionuclides for the scenarios considered in this analysis, given the use of full face masks to reduce the inhalation dose, the results would not change much with changing isotopic concentrations.

For workers, two separate RESRAD runs were required: one for inhalation (for an unshielded source), and one for external exposure (with 0.18 m of soil to account for shielding provided by the heavy equipment). The resulting doses for inhalation during accident recovery were trivial: 4.5×10^{-6} mrem. The resulting external doses were also quite small: 0.55 mrem. This result is consistent with the estimated operational radiation doses described in Section 6.3.1, page 6-9 of the license application. The RESRAD output is provided in Attachment 1 to this response.

For members of the public, the doses would be limited by the short duration of the event. Increasing the inhalation component of the above calculation to remove the inhalation protection afforded by face masks, the resulting doses are 2.25×10^{-4} mrem from inhalation and 0.55 mrem from external exposure, for a total dose of 0.55 mrem. It is noted that this dose would be a fraction of the doses estimated to a nearby resident during operations from wind blown waste. Doses to offsite residents are discussed in Section 6.3.1, page 6-14 of the license application. In summary, doses from accidental spills would be far less than 25 mrem/y, and more likely far less than 1 mrem/yr. A further elaboration of how the doses to offsite individuals were estimated is provided in response to Question 3, below.

The overall conclusion from this evaluation is that there is reasonable assurance that operations, including relevant accidents, will not potentially cause excessive radiation exposures to workers or adversely affect public health and safety.

b. **transportation of radioactive materials to the site;** *Doses during transportation of NORM/TENORM waste were developed in Section 6.1.3, page 6-5. The only potential exposure pathway is from penetrating radiation from the NORM/TENORM waste. Numerous previous studies have concluded that the individual who could be most exposed would be the truck driver, who would get far more dose than a member of the public residing along the transportation route. This conclusion is supported by the fact that the truck driver is in close proximity to the waste for a longer period than any other individual during transportation of waste, and is consistent with the TSD-Dose scenarios (Pfingston et*

al., 1998). For the bounding analysis, TSD Dose was used to estimate doses to the truck driver. The driver was conservatively assumed to haul waste 1,000 hours a year (with an empty truck the remaining 1,000 hours of a work year), plus 5 minutes each of loading, resting, and truck maintenance per hour of driving. The waste was assumed to contain 400 pCi/g of ^{226}Ra, plus progeny. The bounding truck driver dose was 48 mrem/y. The best-estimate analysis considered 500 hours of exposure, with 1 minute per hour driving each of loading, resting, and maintenance, at 20% of the maximum waste concentration defined by the waste acceptance criteria. The best-estimate dose was 3 mrem/yr. The majority of the dose was from ^{214}Bi in the ^{226}Ra decay series .

c. **from materials that may be dispersed into the environment during on-going operations;** *An analysis of the potential impacts of ongoing operations was provided in Section 6.3.1, page 6-14. A conservative analysis of the potential for doses to nearby residents during operation of the Deer Trail facility uses the screening models for release of radionuclides to the atmosphere provided by the National Council on Radiation Protection and Measurements (NCRP 1996) in Report No. 123 (NCRP 1996). The NCRP objective was to provide conservative models and methods to demonstrate compliance with environmental standards and to determine when additional site-specific data may be required in a refined analysis. However, using information from Report No. 123 for evaluation of offsite consequences at Deer Trail will assure a conservative assessment of the potential radiation doses from atmospheric releases. This analysis considers active releases over 30 years, with environmental accumulation over that period, and estimated exposures occurring in the last year of the release period. Under the RCRA Permit, Deer Trail must invoke measures to reduce or eliminate wind blown waste during periods of high wind. For this analysis, the active release was conservatively assumed to be blowing waste during periods when the waste is exposed to air (i.e., before the daily cover is in place). The bounding analysis assumes that the active release is continuous (i.e., 24 hours per day, 365 days per year) with an active air concentration of 0.01 mg/m^3 of air. The exposure pathways included from the NCRP screening model are inhalation and exposure to material deposited on the ground surface. The screening models are based on conservative atmospheric (i.e., neutral) conditions, a ground-level release (i.e., no plume rise), with transport over flat terrain. The receptor was assumed to be 1 km from the facility, much closer than the actual nearest resident, and the air concentration was conservatively assumed to be the same as in the landfill cell, corrected only for the time the wind blows toward the receptor. This is conservative since dispersion of the plume down wind is not considered. The resulting bounding doses were 19 mrem/yr from ^{238}U plus decay chain radionuclides (at a concentration of 2,000 pCi/g), and 6 mrem/yr from ^{226}Ra plus decay chain radionuclides (at a concentration of 400 pCi/g), for a total dose of 25 mrem/yr for both radionuclides and their associated decay chains. This is a conservative estimate since active releases were assumed to occur throughout the year, without considering periods when the waste is covered with clean soil. It is also conservative since it assumes maximum waste concentrations for both ^{238}U and ^{226}Ra plus decay chain radionuclides. The best-estimate individual radiation dose is found by accounting only for exposure of the waste for 2,000 hr/yr (rather than 8,760 hr/yr) and assuming waste concentrations are on average 20% of the maximum concentrations in the waste acceptance criteria. This annual average waste concentration would account for lower concentrations in average NORM/TENORM shipments compared to the maximum waste acceptance criteria concentration and non NORM/TENORM hazardous waste disposed under the RCRA permit. The best-estimate, yet still conservative, doses are about 1 mrem/yr. It is noted that since the effluents from the treatment building are sent through a HEPA filter system, they would be trivial compared to effluents caused by wind blown waste. Finally, if ^{232}Th+D and ^{40}K were added, the dose impacts from this scenario are not expected to be much different than those defined in this analysis since the dominant exposure pathway is external exposure (not inhalation). Additional details about the calculations supporting this analysis are provided in response to Question 3 below.*

2. Please provide supporting data and analysis for the selection of all model inputs to demonstrate that these adequately represent the characteristics at the site and the proposed activities. For example: RESRAD model runs need to include radionuclides such as K-40 and Th-232. The RESRAD inputs must accurately reflect site and meteorological conditions. Default values should not be used if site-specific data can be generated. For example, the stated average annual precipitation for the site is 16.65 inches (0.423 m). See Table 2-2. However, the RESRAD model input for precipitation is entered as 1 m/y. The models must not use inappropriate inputs such as "overhead irrigation of 0.2 m/y" on the waste impoundment. The modeling must also address the requirements of RH 14.8.1 and should include some boundary scenarios and calculations for radionuclide content in the materials.

The parameters selected as input to the RESRAD modeling are specific to each scenario considered. In many cases, selected pathways, such as the ground water pathway, were not selected. For example, the analysis of external exposure to in cell workers only had the external gamma and inhalation pathways activated. Thus parameters associated with the other, non-used pathways were left at the RESRAD default values since they were not used in the analysis. In fact, in some cases data must be entered for the calculation to proceed even though a pathway is suppressed in the analysis. For example, the RESRAD output for the in cell worker scenario shows 1 m/yr of rainfall and overhead irrigation at 0.2 m/y; however, these parameters were not used since the ground water pathway was not activated. Further, RESRAD does not include an offsite atmospheric transport pathway; thus, meteorological parameters are not generally used as input. The exceptions are the average annual wind speed and the humidity, used to estimate evaporation in the ground water assessment.

Tables 2 and 3 show a summary of the RESRAD input parameters and assumptions for the In Cell Worker Scenario and the Post Closure Residential scenario, respectively. The first information provided in these tables is a listing of the exposure pathways that are active, and those that are suppressed, followed by a summary of the parameters that are used. In most cases, the parameters are not site-specific in the sense that RESRAD default values or simple modifications are appropriate. These parameters include air concentrations, exposure durations, and annual diet information. Other parameters are more site-specific, for example, those describing the total waste area and depth of waste zone. Note that the In Cell Worker Scenario considers exposure to part of an active waste cell during disposal operations, while the Post Closure Residential Scenario considers the total of all waste in the cells.

Revised dose estimates for the In Cell Worker, modified to be consistent with the input parameters listed in Table 2, expanded to consider $^{238}U+D$ and $^{232}Th+D$, $^{226}Ra+D$, and ^{40}K in the radionuclide mixture, were performed and the RESRAD output is included in Attachment 2. The bounding case results for internal plus external exposure are 55 mrem/yr; a slight increase from the 48 mrem/yr reported in the license application caused by the addition of ^{40}K and $^{232}Th+D$ in the analysis. As described for the Worker Accident Scenario, the inhalation doses are quite small (a fraction of 1 mrem), because of the air concentration is modified to account for use of a full face masks, with a protection factor of 50. The best-estimate dose for this scenario assumes that the worker could be exposed 1,000 hours per year, with an annual average waste concentration 20% of the in the waste acceptance criteria. The best-estimate, yet still conservative, doses are about 11 mrem/yr using the increased radionuclide list.

Finally, revised dose estimates for the Post Closure Resident Scenario were conducted using the parameters shown in Table 3 and considering $^{238}U+D$ and $^{232}Th+D$, $^{226}Ra+D$, and ^{40}K in the radionuclide mixture. The RESRAD results are also shown in Attachment 2. The individual dose is estimated to be 0.0015 mrem/yr. The best-estimate evaluation for this scenario assumes that the nearby resident is not directly over the closed cell. In this case the doses are further reduced because of

shielding and extra distance to the source of radiation, and would approach zero. Note that the potential impacts of radon gas were not evaluated for this scenario, but are considered as part of the response to Question 6 below.

Table 2 Key RESRAD Parameters Used in the Analysis of the Doses to In-Cell Workers at Deer Trail

Pathways Considered	**User Selection**	
External Gamma	Active	In Cell Worker External and Inhalation Doses Only
Inhalation	Active	
Plant Ingestion	Suppressed	
Meat Ingestion	Suppressed	
Milk Ingestion	Suppressed	
Aquatic Foods	Suppressed	
Drinking Water	Suppressed	
Soil Ingestion	Suppressed	
Radon	Suppressed	
Find Peak Pathway Doses	Active	
Parameter	**Assigned Value**	**Source/Comment**
Area of Contaminated Zone	500 m^2	Calculation based on active cell area
Thickness of Contaminated Zone	1.5 m	Calculation based on daily operations prior to cover
Length Parallel to Aquifer Flow	Not Used	Ground Water Pathway Suppressed
Cover Depth – External	0.18 m	Soil depth to account for daily cover and equipment shielding
Cover Depth – Inhalation	0 m	Open for Air Entrainment
Density of Cover Material	1.5 g/cm^3	RESRAD Default
Times for Calculation	0, 1, yr	Evaluation of progeny in-growth
Inhalation Rate	1,916 m^3/yr	1,000 hours of Inhalation at RESRAD Default Rate
Mass Loading Factor	1E-5 g/m^3	NUREG/CR-5512 Value
Exposure Duration	1 years	Operational Lifetime
Indoor Shielding for Inhalation/External	Not Used	Not Used
Fraction of Total Year Spent Outdoors	0.114	1,000 h, Entered as a Fraction of a Total Year
Distribution Coefficients	Not Used	Ground Water Pathway Suppressed
Cover Erosion Rate	0 m/yr	Not Used
Contaminated Zone Erosion Rate	0 m/yr	Not Used
Contaminated Zone Total Porosity	0.4	Not Used
Contaminated Zone Effective Porosity	0.2	Not Used
Contaminated Zone Hydraulic Conductivity	10 m/yr	Not Used
Contaminated Zone b Parameter	5.3	Not Used
Contaminated Zone Density	1.5 g/cm^3	Not Used
Field Capacity	0.105	Not Used
Evaportranspiration Coefficient	0.5	Not Used
Precipitation	0.423 m/yr	Not Used
Overhead Irrigation	0 m/yr	Not Used
Runoff Coefficient	0.2	Not Used
Zone 1 –All Deeper Zones	**Zone 1**	
Thickness	Not Used	Not Used
Density	Not Used	Not Used
Total Porosity	Not Used	Not Used
Effective Porosity	Not Used	Not Used
Hydraulic Conductivity	Not Used	Not Used
Unsaturated Zone b Parameter	Not Used	Not Used
Unsaturated Zone Field Capacity	Not Used	Not Used

Table 3 Key RESRAD Parameters Used in the Post Closure Resident Scenario

Pathways Considered	**User Selection**	
External Gamma	Active	Resident Over Closed Cell
Inhalation	Active	
Plant Ingestion	Active	
Meat Ingestion	Active	
Milk Ingestion	Active	
Aquatic Foods	Suppressed	
Drinking Water	Suppressed	Separate Ground Water Evaluation – Separated in Time
Soil Ingestion	Active	
Radon	Suppressed	
Find Peak Pathway Doses	Active	
Parameter	**Assigned Value**	**Source/Comment**
Area of Contaminated Zone	330,000 m^2	Calculation based Landfill Cell Area at Closure
Thickness of Contaminated Zone	10 m	Calculation based on daily operations prior to cover
Length Parallel to Aquifer Flow	Not Used	Ground Water Pathway Suppressed
Cover Depth	1 m	Closure Cover Depth
Density of Cover Material	1.5 g/cm^3	RESRAD Default
Times for Calculation	0, 1, 100, 1,000, 10,000 yrs	Evaluation of progeny in-growth
Inhalation Rate	8,400 m^3/yr	6,560 hours of Inhalation at 1.2 m^3/h
Mass Loading Factor	1E-4 g/m^3	RESRAD Default
Exposure Duration	30 years	Operational Lifetime
Indoor Shielding for Inhalation	0.4	RESRAD Default
External Shielding	0.7	RESRAD Default
Time Spent Outdoors	2,190 h/yr	Entered as 25% of a Total Year
Time Spent Indoors	0.5	Entered as 50% of a Total Year
Distribution Coefficients	Not Used	Ground Water Pathway Suppressed
Cover Erosion Rate	0 m/yr	Near-Term Assumption
Contaminated Zone Erosion Rate	0 m/yr	Near-Term Assumption
Contaminated Zone Total Porosity	0.4	Not Used
Contaminated Zone Effective Porosity	0.2	Not Used
Contaminated Zone Hydraulic Conductivity	10 m/yr	Not Used
Contaminated Zone b Parameter	5.3	Not Used
Contaminated Zone Density	1.5 g/cm^3	Not Used
Field Capacity	0.105	Not Used
Evaportranspiration Coefficient	0.5	Not Used
Precipitation	0.423 m/yr	Not Used
Overhead Irrigation	0.2 m/yr	Not Used
Runoff Coefficient	0.2	Not Used
Diet – Plants, Meat, Milk, Soil	All Pathways	RESRAD Defaults
Unsaturated Zone	**Zone 1**	
Thickness	Not Used	Not Used
Density	Not Used	Not Used
Total Porosity	Not Used	Not Used
Effective Porosity	Not Used	Not Used
Hydraulic Conductivity	Not Used	Not Used
Unsaturated Zone b Parameter	Not Used	Not Used
Unsaturated Zone Field Capacity	Not Used	Not Used

3. Please provide the actual model inputs and calculations used for determining the dose to the nearby residents during operations, see Section 6, page 6-14.

These doses were calculated using the screening techniques provided by the NCRP in Report No. 123, Volumes I and II,- Screening Models for Releases of Radionuclides to Atmosphere, Surface Water, and Ground (NCRP 1996). The NCRP states that:

> Mathematical models for estimating exposures to members of the public from radionuclides released to the environment have become increasingly sophisticated. However, when applying these models to assess the potential impact of radionuclide releases, it is recommended that the simplest model that will adequately address the problem always be applied first (NCRP 1996, p. 1).

The objective of Report No. 123 is to provide a series of simple screening techniques that can be employed to demonstrate compliance with environmental standards. These screening techniques can be used by any facility releasing radionuclides to the environment. The basis for the screening techniques is conservative models and parameters. If compliance can be demonstrated using the conservative screening models, the NCRP states that more sophisticated modeling techniques are not necessary.

The screening techniques apply to intermittent or continuous releases of radionuclides to the environment during routine operations over a 30 year period, with exposure assumed to be during the last year of the operational period. The 30 year period allows for buildup of radionuclides in soil from atmospheric deposition. The techniques presented by the NCRP are a synthesis of many widely-used radiological assessment principles that have historically evolved in response to concerns about environmental impacts from releases of radioactive materials. Volume II of the report includes work sheets to allow the screening evaluation of potential doses to various locations downwind. The models described in Report No. 123 were used to develop "screening factors," which represent the sum of committed effective doses received from external radiation over an assumed time period, plus inhalation of radioactive particles and gases. The factors can also account for ingestion of locally grown foods, but since ingestion of an entire fruit and vegetable diet grown locally is inconsistent with local land use and practices (i.e., limitations on the availability of water), this pathway was not considered. However, for this revised analysis, ingestion of soil is included.

The NCRP states that the simplest screening technique is to assume that the atmospheric concentration at the receptor is equal to the atmospheric concentration at the release point, modified as follows:

$$C = fC_o$$

Where:

C = *average atmospheric concentration at receptor* (Bq/m^3)
f = *fraction of time the wind blows toward the receptor (dimensionless)*
C_o = *concentration at release point* (Bq/m^3)

For this bounding evaluation, the wind is conservatively assumed to blow toward the receptor 25% of the time, and the initial air concentration is assumed to be 0.01 mg/ m^3.

The screening models are based on conservative atmospheric (i.e., neutral) conditions, a ground-level release (i.e., no plume rise), with transport over flat terrain. The NCRP provides these screening factors and worksheets in units of Sv per Bq/m^3 for inhalation, external exposure from contaminated

ground, and soil ingestion. The screening factors for the radionuclides identified in Table 1 for NORM/TENORM analysis are shown in Table 4, with a conversion to units of mrem per pCi/m^3.

Table 4 NCRP Report No. 123 Atmospheric Screening Factors

	NCRP No. 123 Atmospheric Screening Factors (Sv per Bq/m^3)				
Radionuclide	**Inhalation**	**Ground**	**Soil Ingestion**	**Total**	**Converted to (mrem per pCi/m^3)**
^{238}U+D	2.6E-01	6.7E-03	2.9E-01	5.6E-01	2.1E+03
^{234}U+D	2.9E-01	1.9E-04	8.3E-03	3.0E-01	1.1E+03
^{232}Th+D	1.8E+00	3.6E-01	2.1E-01	2.4E+00	8.8E+03
^{230}Th+D	4.3E-01	2.6E-03	2.5E-02	4.6E-01	1.7E+03
^{226}Ra+D	1.7E-02	3.8E-01	1.8E-01	5.8E-01	2.1E+03
^{210}Pb	1.6E-02	4.6E-04	2.1E-01	2.3E-01	8.4E+02
^{40}K	2.7E-05	3.2E-02	1.6E-03	3.4E-02	1.2E+02

The bounding case dose to an individual offsite is estimated by multiplying the screening factor, times the average atmospheric air concentration at the receptor (0.01 mg/ m^3 times 0.25 to account for the time the wind blows toward the receptor times the waste concentration). A summary of the results is provided in Table 5.

Table 5 Estimated Bounding Offsite Doses Following 30 Years of NORM/TENORM Disposal at the Deer Trail Landfill

Radionuclide	**Converted Screening Factor (mrem per pCi/m^3)**	**Waste Concentration (pCi/g)**	**Estimated Dose (mrem/y)**
^{238}U+D	2.1E+03	3.0E+02	1.5E+00
^{234}U+D	1.1E+03	3.0E+02	8.3E-01
^{232}Th+D	8.8E+03	5.0E+01	1.1E+00
^{230}Th+D	1.7E+03	3.0E+02	1.3E+00
^{226}Ra+D	2.1E+03	4.0E+02	2.1E+00
^{210}Pb	8.4E+02	4.0E+02	8.4E-01
^{40}K	1.2E+02	3.0E+02	9.3E-02
		Total:	7.8E+00

As shown in Table 5, the bounding doses are about 8 mrem/y. For this scenario, the best-estimate individual radiation dose is found by accounting only for wind exposure of the waste for 2,000 hr/yr (rather than 8,760 hr/yr) and assuming waste concentrations are on average 20% of the maximum concentrations in the waste acceptance criteria. The best, yet still conservative, estimated doses are a fraction of 1 mrem/yr.

4. Please provide a description of the current socioeconomic environment and a detailed description of the socioeconomic impacts associated with the disposal of radioactive materials.

The socioeconomic environment was assessed and reported in the Browning-Ferris Industries, Inc. (BFI). 1982. Chemical Waste Treatment/Solidification & Disposal Facility Plan. Volume I – Technical Report. Highway 36 Land Development Company, Adams County, Colorado, Revised October 1982. This document can be found in the Clean Harbors Radioactive Materials License Application, Volume 3. Details of the assessment can be found in the following chapters;

- *Chapter 5 – Existing On-site and Off-site Conditions*
  - *5.8 – Environmental Inventory*
  - *5.8.3 – Land Use and Population*
  - *5.8.4 – Economic Activities*

- *Chapter 8 – Environmental Impact Assessment and Mitigating Measures*
  - *8.6.3 – Land Use and Population Impacts*
  - *8.6.4 – Impacts on Economic Activities*
  - *8.6.6 – Traffic and Transportation Impacts*

The facility is located in southeast corner of Adams County and is bordered on the east by Washington Count and on the south by Arapahoe County. The area remains unchanged since the assessments made in the previously mentioned report, thus the findings and conclusions remain valid today. Agriculture (ranching and farming) is the primary means of livelihood for the residents of the immediate (10 mile radius) area. The other industry located within the 10-mile study area is oil and gas exploration.

The BFI report indicates that in 1981 the total population within a 10-mile radius was 247 persons, there were 95 housing units and 79 households. This data was derived from a house-to-house survey conducted in 1981. A review of more recent population data from the EPA's Environmental Justice geographic Assessment Tool, which draws data from the year 2000 United States Bureau of Census, shows that the population within a 10 mile radius of the facility is 555 and that there are now 244 housing units and 214 households. The population density of the area is 1.77 per square mile.

There are no tourist destinations, Federal, State or County Parks, waterways or other recreational areas located in the vicinity of the facility.

A review of the Census of Agriculture data in 2002 published by the U.S. Department of Agriculture, National Agricultural Statistics Service shows that the market value of agricultural products sold, average per farm in Adams County has increased by 15% since the last census in 1997, while there was a 5% decrease in the same data for the State when including all counties.

A review of the data contained in the Adams County Assessor's Office Abstract of Assessments 2003 and 2004 shows that the value of property in Adams County increased by 4% from 2003 to 2004. During that same period the value of property in the School District in which the Clean Harbors facility is located increased by 13%.

A review of the latest available short duration traffic counts conducted by the State of Colorado Department of Transportation shows the peak hourly count to be 56, which is still well within the service range of 280 vehicles per hour that can be accommodated by US Highway 36. Thus, any increased truck traffic to Deer Trail would be well within the design limits of US Highway 36.

Successful operation of the Deer Trail facility generally provides an increased industrial employment and tax base for Adams County. The positive effects of employment and additional tax revenues within the county are difficult to quantify since they are directly related to the level of operation of the facility. However, in general terms, as operations increase to receive additional wastes (i.e., NORM/TENORM waste), employment and tax revenues will tend to increase.

In summary, there are no additional socioeconomic impacts associated with the disposal of NORM/TENORM waste at the Deer Trail facility than those addressed and reported in the initial assessment conducted during the RCRA hazardous waste permitting process.

References:

Browning-Ferris Industries, Inc. (BFI). 1982. Chemical Waste Treatment/Solidification & Disposal Facility Plan. Volume I – Technical Report. Highway 36 Land Development Company, Adams County, Colorado, Revised October 1982

United States Environmental Protection Agency, Enviromapper, Environmental Justice Geographic Assessment Tool, ***http://oaspub.epa.gov/envjust/***

United States Department of Agriculture, National Agricultural Statistics Service, Census of Agriculture, ***http://www.nass.usda.gov/census/***

Colorado Department of Transportation, Stats and Data, ***http://www.dot.state.co.us/***

Adams County Colorado, Elected Officials, Assessors Office, Abstract of Assessments, ***http://www.co.adams.co.us/elected_officials/assessor/abstract_current.html***

5. Please provide additional analysis to adequately describe the site's geological and hydrogeological suitability for radioactive materials. Specifically, the application should provide a discussion of the physical and chemical attributes of the facility and disposed radionuclides, and how the two systems interact. The radionuclides are, for the most part, metals and their chemical behavior is well known. How is this facility geologically well suited for the containment of metals? How is this facility well suited hydrologically and geochemically for the containment of metals that are also radioactive? These questions can probably be answered with existing data.

All waste disposed at Deer Trail, including NORM/TENORM waste, must meet the CHDT RCRA permit requirements as directed by U.S. Environmental Protection Agency regulations. This means that all waste will have similar chemical and physical properties so that there will be no synergistic effects of mixing NORM/TENORM waste with hazardous chemical waste. Treatment at CHDT is designed to render toxic metals insoluble. As discussed in the Safety Assessment provided in Section 6 of the application, and because of the site location, the engineered design of the disposal cells, and the low concentrations of NORM/TENORM waste to be disposed, we have shown that the performance objectives in 6 CCR 1007-1, Parts 14.18 through 14.21 will be met.

RH 14.18 specifies the general requirements for siting, operation, and closure of a land disposal facility. Clean Harbors believes that the Deer Trail facility is located, designed and operated to meet these requirements. The Colorado Geologic Survey (CGS), Department of Natural Resources, conducted an evaluation to find a suitable low-level radioactive disposal sites in Colorado. This evaluation was the initial step in a site selection process conducted by the Rocky Mountain Low-Level Radioactive Waste Compact. For its evaluation, the CGS used a comprehensive process to identify and select candidate areas and representative sites based on a detailed technical analysis of geologic, hydrologeologic, and geotechnical parameters important to radioactive waste disposal. The evaluation gave primary emphasis to natural mechanisms that would promote long-term isolation of the waste from man and the environment. It identified areas of Colorado that had stable geology, with thick layers of relatively impermeable shale containing little, if any, useable ground water. The CGS established a Geotechnical Rating Matrix system that considered various important geologic factors, assigned a ranking for each factor, and translated the ranking into a numeric score to provide a comparison among candidate sites. The matrix scores could range from a perfect score of 120 down to zero (a highly unsuitable site). According to this information, the general location of Deer Trail facility was in the Central Plains Candidate Area identified by the CGS, underlain with the Pierre Shale formation. The general location ranked with the highest of the scoring sites and the CGS indicated that it should be considered as having a very high potential for safe, long-term disposal of radioactive wastes (CGS 1986 – see Volume 3 of the Radioactive Materials License Application). The Deer Trail facility is located in this general area.

6. Please provide additional analysis addressing the capability of the cap to mitigate radon emissions for the closure period. Will materials at the peak concentrations be located near the cap?

Unlike regulations imposed for disposal of uranium mill tailings, radon emissions standards are not specifically included in the 6 CCR 1007-1, Part 14 licensing requirements for low-level radioactive waste. However, because radon emissions are an additional source of radiation exposure for workers and members of the public, to show compliance with the performance objectives of Part 14 a special analysis is provided in response to this question. In 40 CFR Part 61, Subpart B § 22, the U.S. Environmental Protection Agency (EPA) set emission standards to the ambient air for uranium mines not to exceed amounts that would cause any member of the public to receive doses in excess of 10 mrem/yr. For purposes of demonstrating compliance with Clean Air Act Standards for radionuclide emissions, the EPA provided the COMPLY-R computer software. This software evaluates the potential impacts downwind from a facility that has emissions of radionuclides to the atmosphere. Consistent with this requirement for estimating down wind impacts, a bounding evaluation was conducted of the potential effectiveness of the cover system as a radon barrier using the RESRAD computer program. This analysis is considered bounding since it accounts for the peak radon concentration without the benefit of down wind diffusion. It is also bounding since RCRA and an Environmental Covenant (under negotiation) would prohibit use of the land for residential purposes; thus, it is unlikely that anyone could spend a significant amount of time directly over the closed landfill. For this analysis, an individual was conservatively assumed to be located outdoors immediately over the closed landfill for half of a year. The exposure pathways included inhalation of radon and external exposure to penetrating radiation. The radionuclide mixture was assumed to be that defined in Table 1 in response to the first question above. The disposal cell cover design, which is applicable to each of the seven cells at Deer Trail, is a highly engineered design, consistent with RCRA closure requirements that incorporate multiple elements. The cover functions as an infiltration barrier, meeting the cover design requirement for permeability of less than or equal to 1×10^{-7} centimeter per second (cm/s). The key RESRAD parameters used in this analysis are shown in Table 6.

The RESRAD output for the Radon Inhalation scenario is provided in Attachment 3. The bounding case results indicate peak individual doses from radon of about 30 mrem/yr immediately after waste disposal. The best estimate evaluation would consider an average waste concentration of 20% of the values shown, resulting in about 6 mrem/yr individual doses.

It is noted that it is difficult to model the behavior of radon; however, this analysis is felt to be conservative since:

- *RCRA and the Environmental Covenant will prohibit occupancy of the site following closure,*
- *Peak waste concentrations for $^{226}Ra+D$ were assumed, with no attempt to account for the presence of non NORM/TENORM hazardous RCRA waste, and*
- *Down wind concentrations of radon gas would be orders of magnitude less than those immediately above the closed landfill through diffusion of the plume.*

Following the RESRAD analysis, consideration was given to the first five element of Criterion 6 in 6 CCR 1007-1, Part 18 for uranium and thorium waste processing and disposal:

- *The first criterion requires limitation of the radon releases to be less than 20 pCi per square meter per second. Using the RESRAD inhalation dose result for ^{222}Ra, the effective air concentration is estimated by dividing the reported inhalation dose by the inhalation dose*

conversion factor, to get the pCi inhaled in a year, then dividing this result by the amount of air inhaled in a year. This calculation is as follows:

$$[(30 \text{ mrem/yr})/(8.6E\text{-}3 \text{ mrem/pCi})] / (5{,}256 \text{ m}^3\text{per yr}) = 0.2 \text{ pCi/m}^3$$

Dividing this air concentration by the wind speed (i.e., 2 m/s) yields release rate as 0.66 pCi per square meter second. This result is less than the release rate criterion of 20 pCi per square meter second, and indicates that the release rate condition will likely be met.

- *Although the above calculations indicate that the release rate condition will likely be met, radon flux measurements consistent with EPA procedures can be made at the time of site closure to demonstrate the effectiveness of the disposal cap.*

- *If phased closure of specific cells is considered, release rates for each closed cell can be estimated consistent with EPA procedures.*

- *The results of such testing will be reported to the Department and maintained as part of the license termination documentation.*

- *Although the current RCRA closure plan considers four feet (not ten feet) of cover material, as stated above the adequacy of the cap can be evaluated using measurements of the radon release rates. CHDT has no current plans to prohibit disposal of NORM/TENORM waste immediately beneath the closure cap since the average radionuclide concentrations encountered when other RCRA waste is considered will likely be well below the peak NORM/TENORM waste acceptance criteria.*

Finally, because of out door waste disposal operations, there should be no excessive exposure of workers radon during disposal. As discussed in response to Question 9c below on operations of the treatment facility, because of the operation of the air handling equipment when NORM/TENORM is present, there should be no buildup of radon in the treatment facility; thus, there will be no worker protection issues for radon.

Table 6. Key RESRAD Parameters Used in the Post Closure Resident Radon Evaluation Scenario

Pathways Considered	**User Selection**	
External Gamma	Active	Outdoor Radon Exposures over the Landfill
Inhalation	Active	
Plant Ingestion	Suppressed	
Meat Ingestion	Suppressed	
Milk Ingestion	Suppressed	
Aquatic Foods	Suppressed	
Drinking Water	Suppressed	
Soil Ingestion	Suppressed	
Radon	Active	
Find Peak Pathway Doses	Active	
Parameter	**Assigned Value**	**Source/Comment**
Area of Contaminated Zone	330,000 m^2	Calculation based Landfill Cell Area at Closure
Thickness of Contaminated Zone	10 m	Calculation based on daily operations prior to cover
Length Parallel to Aquifer Flow	Not Used	Ground Water Pathway Suppressed
Cover Depth	1 m	Closure Cover depth
Density of Cover Material	1.5 g/cm^3	RESRAD Default
Times for Calculation	0, 1, 1,000 yr	Evaluation of progeny in-growth
Inhalation Rate	5,256 m^3/yr	4,380 hours of Inhalation at RESRAD Default Rate
Exposure Duration	1 yr	Annual Dose
Indoor Shielding for Inhalation/External	N/A	Not Used
Time Spent Outdoors	4,380	Entered as a Fraction of a Total Year (0.5)
Time Spent Indoors	0 h/yr	Entered as a Fraction of a Total Year (0)
Distribution Coefficients	N/A	Ground Water Pathway Suppressed
Cover Erosion Rate	0 m/yr	RCRA Closure Assumption
Contaminated Zone Erosion Rate	0 m/yr	RCRA Closure Assumption
Total porosity of the Cover Material	0.4	RESRAD Default
Total Porosity of Building Foundation	N/A	Not Used
Volumetric Water Content of Cover	0.05	RESRAD Default
Volumetric Water Content of Foundation	N/A	Not Used
Diffusion Coefficient for Radon in Waste	2E-6	RESRAD Default
Diffusion Coefficient for Radon in Cover	2E-6	RESRAD Default
Radon Vertical Mixing	2 m	RESRAD Default
Average Building Air Exchange	N/A	Not Used
Room Height	N/A	Not Used
Building Depth below Grade	N/A	Not Used
Evaportranspiration Coefficient	0.5	RESRAD Default
Precipitation	0.423 m/yr	Site Data
Average Annual Wind Speed	2 m/s	RESRAD Default
Humidity in Air	N/A	Not Used
Overhead Irrigation	0	Not Used
Runoff Coefficient	0.2	RESRAD Default

7. Please provide additional information demonstrating that surface water controls will be durable in the post-closure phase of 1000 years.

The Deer Trail runoff management system was designed to accommodation a probabilistic 24 hour, 1,000-year event storm, which is 8.2 inches of precipitation in 24 hours. In order to accommodate such incredibly high stormwater flows, the surface water controls had to be designed to be durable. The surface water control system design is contained in the RCRA Hazardous Waste Facility Permit, Permit Attachment LF-12, Runoff Management System plan, revised 6/95.

The surface water controls were designed according to the following general criteria:

- *The minimum land slope across a closed secure cell would be 3 percent to allow adequate drainage across the cell cap to minimize ponding of stormwater in surface depressions.*

- *The maximum land slope across a closed secure cell will be 5 percent to minimize the soil erosion potential and protect the integrity of the cell cap from gully erosion. Vegetation will be established on the cap during site closure.*

- *No drainage will be allowed to flow into open cells or across completed cell cap from upslope areas. Interceptor channels will collect this drainage, and convey it off site.*

- *The plan will use the natural existing site topography as much as possible.*

According to the Runoff Management Plan, all the channels have been or we be constructed according to the following criteria, which is also contained in Part VI, Condition F.8 of the hazardous waste facility permit:

- *Grass-lined, V-shaped channels with side slopes no steeper than 3H:1V for temporary channels and side slopes no steeper than 4H:1V for permanent channels.*

- *Maximum stormwater flow depth in all channels is limited to four feet.*

- *A minimum freeboard of 0.3 feet will be provided for all future channels within the disposal site area. Freeboard at the channel junctions and curved sections of the channel will be increased to allow for elevated flow conditions.*

- *The maximum flow velocity is 5 feet per second within vegetated stormwater drainage channels is allowed during a design storm peak flow event to reduce erosion potential in the channel. If velocities exceed 5 feet per second the channels will be lined with rip-rap or other suitable erosion protection.*

- *Erosion protection will be placed at all channel junctions requiring such protection.*

- *Erosion protection will be installed at the outlet of all culverts.*

- *Channels with side slopes 8H:1V or milder have been constructed with trapezoidal-shaped low-flow channels in their inverts, so as to concentrate low flows and prevent siltation.*

Durability of the surface water control system is based on controlling erosion in the appropriate channels. Erosion protection consists of a combination of controlling stormwater flow velocities and

the installation of riprap and vegetation in those areas susceptible to erosion. The Runoff Management Plan contains detailed specifications on the location of surface water control structures, sizes of the storm water channels, the type of vegetation, as well as the size and location of riprap. Attached is a copy of the Runoff Management System plan. Since surface water management system has been designed to accommodate surface water flows from an incredibly high probabilistic precipitation event, Clean Harbors believes the system will be durable for a 1,000 years.

8. Please provide additional evaluation of impacts from 100-year and 500-year storm events. Are there ephemeral streams in the area that would be able to transport surface contamination in the event of a major storm?

Part VI, Condition F.2 of the RCRA Hazardous Waste Facility Permit requires that the run-off management system be designed, constructed, operated and maintain to collect and control at the water volume resulting from a 24 hour, 1,000 year storm event which is defined as 8.2 inch of precipitation in a 24 hour period of time. To comply with this requirement, the storm water management system was designed to accommodate these probabilistic precipitation conditions. The results are contained in the RCRA Hazardous Waste Facility Permit, Permit Attachment LF-12, Runoff Management System plan, revised 6/95. Since the stormwater management system is designed for a 1,000-year event storm, which is greater than a 100-year or 500-year event storm, Clean Harbors does not anticipate any impact to the stormwater management system from a 100-year or 500-year storm event.

There are two ephemeral drainage channels at the facility. They are Wetzel and Beaver Creek. Stormwater cannot enter the Wetzel Creek tributary area due to the presence of a small knoll on the west flank of the facility. Thus, water would have to flow uphill in order to enter Wetzel Creek. However, the site topography is such the natural drainage flow is towards Beaver Creek. The surface water management plan was designed to control three (3) types of surface water. Stormwater from uncontaminated areas, stormwater from potentially contaminated areas, and storm water from contaminated areas.

Areas producing uncontaminated stormwater include:

- *Undeveloped areas and developed areas not used for the storage, treatment or disposal of wastes.*
- *After development, areas of the site that have been closed in accordance with the closure plan. Ultimately, the entire site will meet this criterion.*

Areas producing potentially contaminated stormwater include:

- *All on-site roadways past the sampling station over which waste materials are transported.*
- *Processing areas.*
- *Partially closed cell areas.*
- *Cell areas not containing waste or segregated by a divider berm.*
- *All equipment storage and parking areas for vehicles carrying waste or vehicles which have not been decontaminated after handling waste.*

Areas producing contaminated stormwater include:

- *The secure landfill cells in which waste is placed.*
- *Sumps receiving or containing materials resulting from waste spills or equipment washings.*
- *Any leachate collected from the secure cell leachate collection system(s).*

Uncontaminated stormwater or stormwater from areas of the facility that are not contaminated is intercepted by a series of drainage channels and diverted to an uncontaminated stormwater detention pond. Potentially contaminated runoff is directed to lift stations and/or to the potentially contaminated stormwater retention basin. Contaminated stormwater is removed from the landfill and pumped to a series of tanks for treatment. Please refer to the plan for specific details.

The storm water management system is designed to control contaminated or potentially contaminated stormwater on the facility from a very large probabilistic storm event. As such, Clean Harbors does not believe that contaminated surface water from a major storm event could be transported to Wetzel or Beaver Creek.

9. RH 14.8.3 requires the applicant to submit analysis of the protection of individuals during operations. Section 6 and Attachment B of the application provide this analysis, but are incomplete. Please address the following comments in your response:

a. The assessment does not adequately address what concentrations and volumes of radioactive materials containing free water or liquids would be accepted and treated at the site.

For purposes of determining compliance with the Deer Trail waste acceptance criteria, any free liquids in the NORM/TENORM waste, such as potentially encountered in drinking water residuals, will be considered to have a density of 1 g/mL. That is, the limits for liquids will be interpreted as 2,000 pCi/mL NORM/TENORM and 400 pCi/g ^{226}Ra. It is not possible to accurately estimate the volumes of NORM/TENORM waste containing liquids that may require treatment since this will depend on market conditions. However, for purposes of estimating operational doses during treatment for part c of this question, it is assumed that such treatment would last for 500 hr/yr, or about 25% of an operational year.

b. Parts of the Section 6.1.1 do not appear to be consistent with recent submittals by Clean Harbors where they state that some wastes may be containerized (e.g., filter cakes, resins, scales). Please clarify this potential inconsistency with the RCRA requirements.

The Deer Trail RCRA permit is for disposal of bulk, not containerized, waste. In the past, containerized shipments were rare and the waste was typically treated in the treatment building and disposed as bulk waste (i.e., removed from the containers). However, in the case of drinking water residuals, it is anticipated that much of the waste will be received in some form of container. This waste will be sent to the treatment facility and mixed with solidifying agents prior to disposal as bulk waste in a similar manner as containerized hazardous waste. The basic operating conditions for waste treatment in the treatment building will be included in a Standard Operating Procedure on Waste Treatment, to be provided in a separate submittal.

c. There is no risk assessment for treatment of materials prior to placement.

Clean Harbors has well-established processes and standard operating procedures to treat chemically hazardous wastes. It is anticipated that these processes and procedures will also apply to NORM/TENORM waste, as appropriate, because of the requirement that all waste must meet the CHDT RCRA Permit requirements. No additional treatment processes or procedures are anticipated. NORM and/or TENORM waste will go directly to the landfill for disposal or may have to be treated for chemical hazards if required by the RCRA regulations. It is recognized that there potentially are wastes that could be chemically hazardous as defined by RCRA, and also contain some level of NORM/TENORM radionuclides, which would require treatment. An example is a wastewater treatment sludge that is RCRA hazardous for arsenic, which also contains NORM or TENORM radionuclides. Depending on the concentrations of arsenic, the waste could go directly to the landfill or may have to be treated as defined in the RCRA regulations. In this example, the waste would be treated for arsenic, with no special treatment of NORM/TENORM in the waste. CHDT utilizes a wide variety of industry standard treatment formula for different types of waste. Specific treatment formulas and mixed designs for each waste batch are assigned by general manager or designee.

CHDT performs waste treatment operation in a totally enclosed building equipped with an air handling and HEPA filter system. The basic operating conditions for waste treatment in the treatment building will be included in a Standard Operating Procedure on Waste Treatment, to be provided in a separate

submittal. Treatment takes place in one of the treatment basins. There are nine treatment basins at CHDT and six of these are normally used for treatment. These basins are 150 cubic yard in capacity, and are constructed of a ¾ inch thick steel shell inside a concrete vault. Mixing is done with a tracked excavator (track-hoe). The simplest form of treatment is solidification. In this treatment, liquid or semisolid waste is dumped from a truck or container into the treatment basin. A pozzolanic solidifying reagent is added to the waste in the quantity determined by the CHDT laboratory. The waste, and reagent is mixed with the track-hoe until it is a solid. A sample is taken to the lab for testing to confirm that it meets treatment requirements. The solidified waste is then taken via site haul trucks to the landfill and disposed of. The pozzolanic reagents used at CHDT include cement kiln dust, fly ash, and cement. These reagents act not just as sorbants, but actually chemically combine with the water in waste materials rendering them stable. In addition, the treatment process greatly decreases the solubility of all toxic elements. In the case of RCRA waste treatment, other additives are used in addition to the pozzolanic reagents in order to stabilize certain elements. These additives include phosphates, sulfides, and iron compounds. As with other work under the RCRA permit, Clean Harbors requires the use of standard PPE during all operations in the landfill or treatment building. This standard PPE includes full-face air purifying respirators with combination cartridges, which protect against organic vapors, acid gases, and particulates including radionuclides. Disposable coveralls, gloves, and foot protection are also required. This PPE is worn at all times in the landfill and treatment building whether or not radionuclides are present. All Deer Trail personnel working in the landfill or the treatment building will be trained in procedures for radiation protection. Clean Harbors will also monitor dose rates to its workers and contamination levels within the facility according to the provisions of the Radiation Protection Plan. NORM/TENORM treatment will only occur when the air handling equipment is operational, thus ensuring that there will be no buildup of radon gas in the treatment building.

The frequency of waste treatment is dependent on the type of waste and the ability to meet the Deer Trail Waste Acceptance Criteria under RCRA. For NORM/TENORM waste, the most likely waste form requiring treatment is drinking water purification residuals, where there may be a liquid (water) or chemical content that requires treatment and/or stabilization. A bounding estimate would consider workers exposed for 500 hours per year (12.5 weeks) to an external exposure rate of 100 µR/hr, for a worker dose of about 50 mrem/y. This is a bounding estimate since it does not account for shielding associated with the process equipment, since it assumes concentrations in the waste requiring treatment that would produce an exposure rate of 100 µR/hr, and since the waste will likely not require 500 hours on an annual basis. A best estimate for worker doses in the treatment building would be based on an average 20% of the waste concentration, for 200 hours per year, or about 4 mrem/y.

As defined in the Deer Trail Radiation Protection Plan, when special conditions are encountered, such as treatment of NORM/TENORM waste prior to disposal, exposure rates, contamination levels, and potential exposure conditions shall be determined in advance of performing the activity using the CHDT Standard Operating Procedure on Routine NORM/TENORM Radiation Surveys. The Deer Trail RSO shall evaluate the survey data and evaluate which controls will be required for a specific task. For example, the NORM/TENORM concentrations and dose rates associated with NORM/TENORM waste treatment will be evaluated and appropriate controls developed. The goal will be to maintain dose rates during NORM/TENORM waste treatment to less than 100 µR/hr and maintain worker exposures ALARA.

d. Does the claim that the material will generally be < 100 uR/h include radium progeny (i.e., Bismith-214) and include shielding from the containers? At what distance is the 100 uR/h correlation? Previous experience in UMTRA would indicate that tailings at 400 pCi/g Ra-226 (including progeny assuming about 20% emanation rate), gamma exposure rates (without shielding) can range up to 300 uR/h. We recognize that each

mixture of materials will have its own characteristics. Modeling of worker exposures that are unshielded should use a more conservative gamma exposure rate for peak concentrations of Ra-226. Please provide revised or better-documented estimates of gamma exposure rates at peak concentrations.

Yes, the analysis accounted for the decay chain associated with ^{226}Ra, including ^{214}Bi in equilibrium. Key to any modeling estimate of external exposure are the assumptions about source geometry and shielding. For example, the ratio of external dose coefficients provided by the U.S. Environmental Protection Agency in Federal Guidance Report No. 12 (EPA 1993) for ^{214}Bi for soil contamination with an infinite depth and area, to soil contamination 1 cm in depth over an infinite area, is almost a factor of 6; twice the variation cited in the question above. In addition, the EPA dose conversion factors are in general agreement with the 300 µR/hr estimate cited for UMTRA uranium mill tailings, at 400 pCi/g of ^{226}Ra plus progeny, for the infinite depth source. Such a large source would be expected at a uranium mill tailings facility. However, at the Deer Trail facility the geometry and shielding factors will be quite different. First, the daily cover of soil will provide some effective shielding, thus reducing the dose rates. Second, not all of the waste received will be NORM/TENORM waste, providing additional shielding. Taking these factors into account, it is reasonable to expect dose rates somewhat less than would be experienced at a uranium mill tailings facility.

As stated in Section 6.1.3, page 6-13, dose rates were estimated using a conservative assumption that they could be 1 m from a truck or container of waste. External exposure to penetrating radiation (photons and x rays) from the waste was modeled using the MicroShield® computer code (Grove Engineering 1998). The industry-accepted MicroShield® code estimates radiation doses for various source/shield/receptor geometries. The analysis was conducted for ^{226}Ra and four shorter-lived, photon-emitting progeny: ^{214}Pb, ^{210}Pb, ^{214}Bi, and ^{210}Bi. For this analysis, the waste truck or container is assumed to have dimensions of 2.2 × 5.6 × 1 m (7.2 × 18.4 × 3.3 ft), consistent with typical waste boxes used at Deer Trail. The analysis considered 0.32 cm (0.125 in.) of steel shielding to account for the side of the truck or waste container. The waste density was set at 1.4 g/cm^3, or the approximate density of soil. Experience shows that many types of waste have densities in excess of 2.0 g/cm^3, which would lower the exposure rates because of increased self shielding. As shown in Attachment B of the license application, the modeling results are 2.76×10^{-4} mR/hr (or 0.276 µR/hr) per pCi/g of ^{226}Ra plus its progeny in the waste. At a waste concentration of 400 pCi/g of ^{226}Ra plus its progeny in the waste, this gives about 110 µR/hr. Again, the bounding estimate indicated worker doses from 500 hr of exposure in a year to be about 55 mrem. The best estimate indicated 200 hr/yr of exposure, to waste at 20% of the waste acceptance criteria, with a resulting dose of 4.4 mrem/yr.

Finally, through the personnel and area monitoring and gate monitoring operating procedures defined in the Deer Trail Radiation Protection Program will effectively monitor doses and exposure rates. Employee doses, both internal and external, shall be evaluated on a quarterly basis and workers shall be re-assigned to different duties if their quarterly radiation doses equal or exceed 5 mrem in any two consecutive quarters. If it is determined from worker dosimetry results that selected worker doses could exceed 25 mrem/yr, an assessment shall be conducted of the potential for other man-made exposures for those workers to ensure that maximum individual doses from man-made sources shall not exceed 100 mrem/yr. This assessment shall consider real workers at Deer Trail, not hypothetical members of the public. Additional workplace controls or limitations may be imposed to maintain worker doses ALARA. Finally, the gate monitor will be set to 100 µR/hr above background, thus identifying any waste shipments that would exceed the defined operational conditions.

e. Please provide an evaluation of worker exposure to leachate during the operational phase.

The frequency of leachate processing is dependent on the amount of precipitation entering the landfill and is at best an episodic event. A bounding estimate would consider workers exposed for 500 hours per year to an external exposure rate of 100 µR/hr, for a worker dose of about 50 mrem/yr. This is a bounding estimate since it does not account for shielding associated with the process equipment, and since it assumes concentrations in the leachate that would produce an exposure rate of 100 µR/hr. As described in response to previous questions on the license application, CHDT believes that radionuclide concentrations in the leachate at Deer Trail will be very low and that the dose rates will not approach 100 µR/hr. There are several reasons for this. First, total radionuclide concentration in raw waste must not exceed 2,000 pCi/g. Second, only a portion of the all waste in the landfill cell will be NORM/TENORM waste. This strictly limits the potential radiation hazard. Based on past experience at a another Clean Harbors landfill that receives similar concentrations of NORM/ TENORM waste, the expectation is that most NORM/TENORM radionuclides will be insoluble, and that the leachate concentration will always be at least two or three orders of magnitude lower in concentration than the raw waste. For example, wastes such as Denver Radium consist of asphalt and road base which strictly limits its solubility as the radionuclides are encapsulated in the asphalt. Wastes that are treated at CHDT will have low solubility as well. CHDT treatment is designed to render toxic metals insoluble. This is accomplished through raising the pH to a very alkaline level where metal solubilities are low, encapsulating the waste in pozzolanic (cement-like) materials, and through the addition of chemicals to form insoluble salts. When the low solubility of the waste is considered with diffusion and dispersion in the leachate, potential radionuclide concentration in the leachate should be at or near background. This means that a best estimate of the potential worker doses is that they would not be distinguishable from background.

Finally, as described in the Deer Trail NORM/TENORM Radiation Protection Plan, the provisions of 6 CCR 1007-1, § 4.11 require licensees to authorize an adult worker to receive doses in addition to and accounted for separately from the doses received under the limits under specified conditions. These provisions relate to the occupational dose limits of 5 rem/yr plus ALARA. However, because public radiation dose limits shall be imposed on Deer Trail workers, and because of the limited concentrations of NORM/TENORM waste to be treated and disposed under the license, it is highly unlikely that exposure situations will arise that could require imposition of these provisions. When special conditions are encountered, such as leachate treatment, routine maintenance of equipment potentially contaminated with NORM/TENORM, or other activities, exposure rates, contamination levels, and potential exposure conditions shall be determined in advance of performing the activity using the CHDT Standard Operating Procedure on Routine NORM/TENORM Radiation Surveys. The Deer Trail RSO shall evaluate the survey data and determine which controls will be required for a specific task. For example, the NORM/TENORM concentrations and dose rates associated with leachate from the disposal cells shall be determined and appropriate controls developed prior to leachate processing. The goal will be to maintain dose rates during leachate processing to less than 100 µR/hr and maintain worker exposures ALARA.

f. Please provide supporting spreadsheets for section 6.1.3.

The spreadsheet calculations discussed in Section 6.1.3 were for scenarios involving the TDS-Dose computer program. For TSD-Dose, it was necessary to input a unit concentration per shipment (i.e., 1 Ci of ^{226}Ra plus decay chain progeny and 1 Ci of ^{238}U plus decay chain progeny) and a unit drive time (i.e., 1 hour), then modify the results to account for the actual waste concentration and hours of driving per year. In fact, it is not necessary to use a spreadsheet for these calculations. These simple calculations were reviewed, and the calculations and results are described in the following paragraphs:

- *Truck Drivers Hauling Waste: As shown on page B-30 of the license application, the resulting dose factor per each hour of driving (plus 5 minutes each of loading, resting, and truck*

maintenance) is 6 mrem/hr, and is dominated by external exposure from ^{226}Ra plus decay chain progeny. Each box has dimensions 6.5 x 2.44 x 28.2 m, for a volume of about 28 m^3. With a density of 1.4 x 10^6 g/ m^3, the mass of waste is 3.9 x 10^7 g per truck. Each truck has a total of 2 Ci (or 2 x 10^{12} pCi) of total activity (radium plus uranium). Thus the concentration in the truck is (2 x 10^{12} pCi) per 3.9 x 10^7 g, or about 5.1 x 10^4 pCi/g. Solving for the mrem/hr per pCi/g:

(6 mrem/hr)/ (5.1 x 10^4 pCi/g) = 1.2 x 10^{-4} mrem/hr per pCi/g

Since each shipment has an assumed maximum value of 400 pCi/g of ^{226}Ra plus decay chain progeny, truck driver dose is about 4.8 x 10^{-2} mrem/hr of driving. For the bounding case, assuming 1,000 hours per year of driving (with an empty truck the remaining 1,000 hours), the truck driver dose is estimated to be about 48 mrem/yr. The derivation of the best-estimate radiation doses for this scenario consider that the truck driver is exposed for 500 hours per year, at an average waste concentration 20% of the maximum concentration defined by the waste acceptance criteria, with a resulting dose of about 5 mrem/yr. If the duration of loading, resting, and truck maintenance drops from 5 minutes per hour of driving to 1 minute per hour of driving, this dose would be further reduced, to about 3 mrem/yr. It is noted that this analysis considers the truck driver is a worker under the Deer Trail license; however, this may not be the case in all situations. It may be more likely that the licensed NORM/TENORM waste will be shipped under the waste generator's license, or brokered to another company for transportation under their license. For coverage under an outside license, truck driver dose compliance would be with the 5 rem/yr plus ALARA operational dose limit.

- *<u>Deer Trail Landfill Workers – Waste Receipt and Sampling</u>: For the waste receipt and sampling scenario, the TSD-Dose default times and exposure geometries are those associated with drums, not bulk waste. For example, the code asks the user to input the sampling time per drum, for a total time of as long as 5 hours per truck to sample the waste. For bulk waste, composite samples are collected for each shipment, with a total exposure duration of between 10 to 15 minutes per truckload. TSD-Dose assumes 80 drums per truck; therefore, the sampling time per drum needs to be 0.19 minutes to arrive at 15 minutes per shipment sampling time for the bulk load. Consistent with the truck driver scenario, unit concentration dose conversion factors were developed for this scenario using TSD-Dose, assuming 1 Ci per roll-off box of ^{226}Ra plus decay chain progeny and 1 Ci of ^{238}U plus decay chain progeny, which equates to an average waste concentration of 5.1 × 10^4 pCi/g. From page B-32 of the license application, the resulting unit concentration dose conversion factor, at this unit waste concentration, is 3.9 mrem. This dose is dominated by the external exposure pathway and ^{226}Ra plus decay chain progeny, with a small additional contribution from inhalation. As for the previous truck driver scenario, solving for the mrem per shipment per pCi/g of waste:*

  (3.9 mrem/shipment)/ (5.1 × 10^4 pCi/g) = 7.7 x 10^{-5} mrem/shipment per pCi/g

  For the bounding estimate, at full capacity the Deer Trail facility could handle an estimated 2,500 shipments per year. If 2,000 of these shipments were assumed to be NORM/TENORM waste, and if a single worker were exposed to all shipments, the annual unit concentration dose conversion factor would be 0.154 mrem/yr per pCi/g. The estimated bounding radiation dose for a ^{226}Ra plus decay chain progeny concentration of 400 pCi/g is about 62 mrem/yr. Again, the bounding value is a conservative overestimate because not all of the waste received in a year at the Deer Trail facility would be NORM/TENORM waste at the maximum average concentration, and because one worker might not be exposed to all shipments. Derivation of the best-estimate radiation doses for this scenario considered that a worker could be exposed at

most to about 1,000 shipments, and that the average annual waste concentration would be 20% of the waste acceptance criteria upper limit, with a resulting dose of about 6.2 mrem/yr.

g. Please provide additional input parameters for Table 6.2, for example, shielding thickness for maintenance in transit. On the printout it is listed as 0.00625 inches, but it is not clear why this value was chosen.

The value from the output indicates 6.25E-2 (or 0.0625 inches), which is 1/16th of an inch of steel. This was consistent with the thickness of a steel drum, but it was used as a conservative representation of the side of a truck bed. In all likelihood, the steel would be 1/8th of an inch, or greater, which would reduce the estimated doses because of increased shielding. Revisions to Table 6.2 are:

Table 6.2. TSD-Dose Input Parameters for the Truck Driver and Receipt/Sampling Scenarios.

Parameter/Scenario	Value	Comment
Truck Driver Scenario		
Roll-off Box Dimensions	1.8 × 2.4 × 6.5 m (5'10" × 8' × 21'3")	Dimensions of a standard 19 m^3 (25 yd^3) roll-off box.
Waste Density	1.4 g/cm^3	Solid bulk waste density.
Load Bulk Waste Duration	0.082 hr (5 minutes)	Average time to load roll-off box with driver present.
Driver Distance During Loading	1.5 m (5')	Average driver proximity to roll-off box.
Driver Shielding During Loading	0.32 cm (1/8")	Assumed 12-gauge steel roll-off box.
Normalized Drive Time	1 h	To produce unit duration dose factors
Driver Distance From Waste	2.1 m (7')	From cab to roll-off box.
Driver Shielding	0.63 cm (1/4")	Combined roll-off box and cab.
Driver Rest Duration	5 minutes	Assumed 5 minutes of rest per hour of driving.
Driver Rest Location	0.61 m (2')	Assumed close proximity to roll-off box.
Driver Rest Shielding	0.32 cm (1/8")	Assumed 12-gauge steel roll-off box.
Driver – Maintenance Duration	5 minutes	Assumed 5 minutes maintenance per hour of driving.
Driver – Maintenance Location	0.91 m (3')	Assumed close proximity to waste.
Driver Maintenance Shielding	0.0625 cm (1/16")	Assumed waste drum thickness.
Receipt/Sampling Scenario		
Weigh Truck: Average Distance	3.6 m(12')	The worker is in the weigh station to record readings.
Weigh Truck: Duration	10 minutes	Estimated time to inspect the manifest and record the weight.
Inspect/Sample Waste: Average Distance	0.3 m(12")	Sampling near contact with the waste roll-off box.
Inspect/Sample Waste: Time per Drum	11.4 seconds	Assigned duration per drum to equal a total of 15 minutes per truck (80 drums).
Airborne Dust Concentration	10 mg/m^3	TSD-Dose default value.
Respiratory Protection Factor	1	No credit for the protection provided by dust masks.

h. Please reevaluate the breathing rate value used in the modeling for workers exposed to waste in the disposal cell. The default rate in RESRAD 6.22 is 8400 m3/yr. According to the reports in Appendix B, the breathing rate was lowered to 1960 m3/yr. Was the breathing rate normalized to 1,000 hrs? Since the activity at work can range from light to heavy, a more conservative value may be appropriate.

As described in response to the second question of this RFI, the in cell worker scenario was revised to reflect consistent input parameter selections and to add additional radionuclides. The inhalation rate was set to 1,916 m^3 per year, with an exposure duration of 1,000 hours per year. This equates to a breathing rate of 1.9 m^3 per hour, which represents heavy activity. By comparison, light activity over this duration would equate to 1,200 m^3 per year, at a breathing rate of 1.2 m^3 per hour.

i. Please explain why different dimensions were used in the modeling for doses to individuals near transport container than were used in the modeling for truck drivers hauling waste.

It is recognized that waste may arrive in different configurations either depending on the type of truck used, or the use and size of roll off boxes. The TSD-Dose software allows two truck configurations; a large truck, and a small truck. The large truck configuration, with a large roll off box, was selected for the TSD-Dose analyses The dimensions of this box were 1.8 x 2.4 x 6.5 m, for a volume of about 28 m^3. For contrast, the MicroShield® computer runs were performed using the dimensions of a smaller standard roll off box, frequently used for hazardous waste at the Deer Trail landfill, with dimensions 1 x 2.2 x 5.6 m, for a volume of about 12 m^3.

REFERENCES

6 CCR 1007-1, Radiation Control, Part 14: *Licensing Requirements for Land Disposal of Low-Level Radioactive Waste.*

6 CCR 1007-1, Radiation Control, Part 18: *Licensing Requirements for Uranium and Thorium Processing.*

Kennedy and Strenge. 1992. *Residual Radioactive Contamination from Decommissioning – Technical Basis for Translating Contamination Levels to Annual Total Effective Dose Equivalent.* NUREG/CR-5512, Vol. 1. Prepared by Pacific Northwest National Laboratory for the U.S. Nuclear Regulatory Commission, Washington, D.C.

National Council on Radiation Protection and Measurements (NCRP). 1996. *Screening Models for Releases of Radionuclides to Atmosphere, Surface Water, and Ground.* NCRP Report No. 123, Volumes I and II. Bethesda, Maryland.

Pfingston, M.., J. Arnish, D. LePoire, and S.-Y. Chen. 1998. *TSD-Dose: A Radiological Dose Assessment Model for Treatment, Storage, and Disposal Facilities.* ANL/EAD/LD-4 (Rev. 1), Argonne National Laboratory, Argonne, Illinois.

Science Applications International Corporation (SAIC). 1998. *Nuclear Fuel Cycle Facility Accident Handbook*. NUREG/CR-6410. Prepared for the U.S. Nuclear Regulatory Commission, Washington, D.C.

Yu, C., A. J. Zielen, J. J. Cheng, D. J. LePoire, E. Gnanapragasam, S. Kamboj, J. Arnish, A Wallo, III, W. A. Williams, and H. Peterson. 2001. *User's Manual for RESRAD Version 6*. ANL/EAD-4, Argonne National Laboratory, Argonne, Illinois.

Title 40 CFR Part 61, Subpart B, *National Emission Standards for Radon Emissions From Underground Uranium Mines*. Federal Register Vol. 54, No. 240, pp. 51654-51715, December 15, 1989.

RESPONSE TO COMMENTS ON CLEAN HARBORS DEER TRAIL, LLC, RADIOACTIVE MATERIALS LICENSE APPLICATION, DOCKET NUMBER 5873

Colorado Department of Public Health and Environment
Request for Information April 20, 2005

ATTACHMENT 1: RESRAD Output for Analysis of the Accidental Spill

Inhalation
External

Summary : Deer Trail - Worker Accident Analysis - Inhalation
File : Deer Trail - Worker Accident - Inhalation.RAD

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Summary : Deer Trail - Worker Accident Analysis - Inhalation
File : Deer Trail - Worker Accident - Inhalation.RAD

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

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	K-40	1.240E-05	1.240E-05	DCF2(1)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(2)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(3)
B-1	Ra-228+D	5.080E-03	5.080E-03	DCF2(4)
B-1	Th-228+D	3.450E-01	3.450E-01	DCF2(5)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(6)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(7)
B-1	U-234	1.320E-01	1.320E-01	DCF2(8)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(9)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	K-40	1.860E-05	1.860E-05	DCF3(1)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(2)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(3)
D-1	Ra-228+D	1.440E-03	1.440E-03	DCF3(4)
D-1	Th-228+D	8.080E-04	8.080E-04	DCF3(5)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(6)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(7)
D-1	U-234	2.830E-04	2.830E-04	DCF3(8)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(9)
D-34	Food transfer factors:			
D-34	K-40 , plant/soil concentration ratio, dimensionless	3.000E-01	3.000E-01	RTF(1,1)
D-34	K-40 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-02	2.000E-02	RTF(1,2)
D-34	K-40 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	7.000E-03	7.000E-03	RTF(1,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(2,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(2,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(3,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(3,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(3,3)
D-34				
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
D-34				
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(5,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(5,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(5,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(6,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(6,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(6,3)
D-34				
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(7,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(7,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(7,3)

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

Menu	Parameter	Current Value	Default	Parameter Name
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(8,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(8,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(8,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(9,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(9,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(9,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	K-40 , fish	1.000E+03	1.000E+03	BIOFAC(1,1)
D-5	K-40 , crustacea and mollusks	2.000E+02	2.000E+02	BIOFAC(1,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(2,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(2,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(3,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(3,2)
D-5				
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(4,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(4,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(5,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(5,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(6,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(6,2)
D-5				
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(7,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(7,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(8,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(8,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(9,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(9,2)

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)	5.600E+01	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	5.000E-01	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	not used	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	2.500E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	not used	3.000E+00	---	T(3)
R011	Times for calculations (yr)	not used	1.000E+01	---	T(4)
R011	Times for calculations (yr)	not used	3.000E+01	---	T(5)
R011	Times for calculations (yr)	not used	1.000E+02	---	T(6)
R011	Times for calculations (yr)	not used	3.000E+02	---	T(7)
R011	Times for calculations (yr)	not used	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): K-40	3.000E+02	0.000E+00	---	S1(1)
R012	Initial principal radionuclide (pCi/g): Pb-210	4.000E+02	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Ra-226	4.000E+02	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): Th-230	3.000E+02	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Th-232	5.000E+01	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): U-234	3.000E+02	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): U-238	3.000E+02	0.000E+00	---	S1(9)
R012	Concentration in groundwater (pCi/L): K-40	not used	0.000E+00	---	W1(1)
R012	Concentration in groundwater (pCi/L): Pb-210	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Ra-226	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): Th-230	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(9)
R013	Cover depth (m)	1.800E-01	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)	0.000E+00	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)	0.000E+00	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	4.000E-01	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	5.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	not used	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	not used	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	not used	1.500E+00	---	DENSAQ

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R014	Saturated zone total porosity	not used	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	not used	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	not used	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	not used	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	not used	2.000E-02	---	HGWT
R014	Saturated zone b parameter	not used	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	not used	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	not used	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	not used	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	not used	1	---	NS
R015	Unsat. zone 1, thickness (m)	not used	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	not used	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	not used	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	not used	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	not used	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	not used	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	not used	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for K-40				
R016	Contaminated zone (cm**3/g)	5.500E+00	5.500E+00	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.500E+00	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	not used	5.500E+00	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.343E-02	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+02	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	not used	1.000E+02	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.331E-03	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.900E-03	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.222E-06	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)

Site-Specific Parameter Summary (continued)

Menu Name	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.222E-06	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.657E-03	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(9,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.657E-03	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.900E-03	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for daughter Th-228				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.222E-06	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R017	Inhalation rate (m**3/yr)	1.500E+01	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-05	1.000E-04	---	MLINH
R017	Exposure duration	1.000E+00	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	not used	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	0.000E+00	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	1.140E-03	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	not used	1.000E+00	>0 shows circular AREA.	FS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	not used	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	not used	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	not used	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	not used	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (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
C14	DCF correction factor for gaseous forms of C14	not used	8.894E+01	---	CO2F
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	KYMAX

Summary of Pathway Selections

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

Summary : Deer Trail - Worker Accident Analysis - Inhalation
File : Deer Trail - Worker Accident - Inhalation.RAD

Contaminated Zone Dimensions			Initial Soil Concentrations, pCi/g	
Area:	56.00	square meters	K-40	3.000E+02
Thickness:	0.50	meters	Pb-210	4.000E+02
Cover Depth:	0.18	meters	Ra-226	4.000E+02
			Th-230	3.000E+02
			Th-232	5.000E+01
			U-234	3.000E+02
			U-238	3.000E+02

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

t (years):	0.000E+00	1.000E+00
TDOSE(t):	0.000E+00	0.000E+00
M(t):	0.000E+00	0.000E+00

Maximum TDOSE(t): 0.000E+00 mrem/yr at t = 0.000E+00 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

*Sum of all water independent and dependent pathways.

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

Parent (i)	Product (j)	Branch Fraction*	DSR(j,t) (mrem/yr)/(pCi/g) t= 0.000E+00	1.000E+00
K-40	K-40	1.000E+00	0.000E+00	0.000E+00
0Pb-210	Pb-210	1.000E+00	0.000E+00	0.000E+00
0Ra-226	Ra-226	1.000E+00	0.000E+00	0.000E+00
Ra-226	Pb-210	1.000E+00	0.000E+00	0.000E+00
Ra-226	äDSR(j)		0.000E+00	0.000E+00
0Th-230	Th-230	1.000E+00	0.000E+00	0.000E+00
Th-230	Ra-226	1.000E+00	0.000E+00	0.000E+00
Th-230	Pb-210	1.000E+00	0.000E+00	0.000E+00
Th-230	äDSR(j)		0.000E+00	0.000E+00
0Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00
Th-232	Ra-228	1.000E+00	0.000E+00	0.000E+00
Th-232	Th-228	1.000E+00	0.000E+00	0.000E+00
Th-232	äDSR(j)		0.000E+00	0.000E+00
0U-234	U-234	1.000E+00	0.000E+00	0.000E+00
U-234	Th-230	1.000E+00	0.000E+00	0.000E+00
U-234	Ra-226	1.000E+00	0.000E+00	0.000E+00
U-234	Pb-210	1.000E+00	0.000E+00	0.000E+00
U-234	äDSR(j)		0.000E+00	0.000E+00
0U-238	U-238	1.000E+00	0.000E+00	0.000E+00
U-238	U-234	1.000E+00	0.000E+00	0.000E+00
U-238	Th-230	1.000E+00	0.000E+00	0.000E+00
U-238	Ra-226	1.000E+00	0.000E+00	0.000E+00
U-238	Pb-210	1.000E+00	0.000E+00	0.000E+00
U-238	äDSR(j)		0.000E+00	0.000E+00

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

Summary : Deer Trail - Worker Accident Analysis - Inhalation
File : Deer Trail - Worker Accident - Inhalation.RAD

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 2.500E+01 mrem/yr

0Nuclide (i)	t= 0.000E+00	1.000E+00
K-40	*6.986E+06	*6.986E+06
Pb-210	*7.631E+13	*7.631E+13
Ra-226	*9.882E+11	*9.882E+11
Th-230	*2.018E+10	*2.018E+10
Th-232	*1.096E+05	*1.096E+05
U-234	*6.245E+09	*6.245E+09
U-238	*3.360E+05	*3.360E+05

*At specific activity limit

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

0Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
K-40	3.000E+02	0.000E+00	0.000E+00	*6.986E+06	0.000E+00	*6.986E+06
Pb-210	4.000E+02	0.000E+00	0.000E+00	*7.631E+13	0.000E+00	*7.631E+13
Ra-226	4.000E+02	0.000E+00	0.000E+00	*9.882E+11	0.000E+00	*9.882E+11
Th-230	3.000E+02	0.000E+00	0.000E+00	*2.018E+10	0.000E+00	*2.018E+10
Th-232	5.000E+01	0.000E+00	0.000E+00	*1.096E+05	0.000E+00	*1.096E+05
U-234	3.000E+02	0.000E+00	0.000E+00	*6.245E+09	0.000E+00	*6.245E+09
U-238	3.000E+02	0.000E+00	0.000E+00	*3.360E+05	0.000E+00	*3.360E+05

*At specific activity limit

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

0Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00
K-40	K-40	1.000E+00	0.000E+00	0.000E+00
0Pb-210	Pb-210	1.000E+00	0.000E+00	0.000E+00
Pb-210	Ra-226	1.000E+00	0.000E+00	0.000E+00
Pb-210	Th-230	1.000E+00	0.000E+00	0.000E+00
Pb-210	U-234	1.000E+00	0.000E+00	0.000E+00
Pb-210	U-238	1.000E+00	0.000E+00	0.000E+00
Pb-210	äDOSE(j)		0.000E+00	0.000E+00
0Ra-226	Ra-226	1.000E+00	0.000E+00	0.000E+00
Ra-226	Th-230	1.000E+00	0.000E+00	0.000E+00
Ra-226	U-234	1.000E+00	0.000E+00	0.000E+00
Ra-226	U-238	1.000E+00	0.000E+00	0.000E+00
Ra-226	äDOSE(j)		0.000E+00	0.000E+00
0Th-230	Th-230	1.000E+00	0.000E+00	0.000E+00
Th-230	U-234	1.000E+00	0.000E+00	0.000E+00
Th-230	U-238	1.000E+00	0.000E+00	0.000E+00
Th-230	äDOSE(j)		0.000E+00	0.000E+00
0Th-232	Th-232	1.000E+00	0.000E+00	0.000E+00
0Ra-228	Th-232	1.000E+00	0.000E+00	0.000E+00
0Th-228	Th-232	1.000E+00	0.000E+00	0.000E+00
0U-234	U-234	1.000E+00	0.000E+00	0.000E+00
U-234	U-238	1.000E+00	0.000E+00	0.000E+00
U-234	äDOSE(j)		0.000E+00	0.000E+00
0U-238	U-238	1.000E+00	0.000E+00	0.000E+00

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

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00
K-40	K-40	1.000E+00	3.000E+02	2.931E+02
Pb-210	Pb-210	1.000E+00	4.000E+02	3.872E+02
Pb-210	Ra-226	1.000E+00	0.000E+00	1.222E+01
Pb-210	Th-230	1.000E+00	0.000E+00	1.997E-03
Pb-210	U-234	1.000E+00	0.000E+00	6.004E-09
Pb-210	U-238	1.000E+00	0.000E+00	4.261E-15
Pb-210	äS(j):		4.000E+02	3.995E+02
Ra-226	Ra-226	1.000E+00	4.000E+02	3.991E+02
Ra-226	Th-230	1.000E+00	0.000E+00	1.298E-01
Ra-226	U-234	1.000E+00	0.000E+00	5.840E-07
Ra-226	U-238	1.000E+00	0.000E+00	5.517E-13
Ra-226	äS(j):		4.000E+02	3.992E+02
Th-230	Th-230	1.000E+00	3.000E+02	3.000E+02
Th-230	U-234	1.000E+00	0.000E+00	2.697E-03
Th-230	U-238	1.000E+00	0.000E+00	3.821E-09
Th-230	äS(j):		3.000E+02	3.000E+02
Th-232	Th-232	1.000E+00	5.000E+01	5.000E+01
Ra-228	Th-232	1.000E+00	0.000E+00	5.673E+00
Th-228	Th-232	1.000E+00	0.000E+00	9.316E-01
U-234	U-234	1.000E+00	3.000E+02	2.992E+02
U-234	U-238	1.000E+00	0.000E+00	8.482E-04
U-234	äS(j):		3.000E+02	2.992E+02
U-238	U-238	1.000E+00	3.000E+02	2.992E+02

BRF(i) is the branch fraction of the parent nuclide.
RESCALC.EXE execution time = 1.14 seconds

Summary : Deer Trail - Worker Accident Analysis
File : Deer Trail - Worker Accident.RAD

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

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

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	K-40	1.240E-05	1.240E-05	DCF2(1)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(2)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(3)
B-1	Ra-228+D	5.080E-03	5.080E-03	DCF2(4)
B-1	Th-228+D	3.450E-01	3.450E-01	DCF2(5)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(6)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(7)
B-1	U-234	1.320E-01	1.320E-01	DCF2(8)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(9)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	K-40	1.860E-05	1.860E-05	DCF3(1)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(2)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(3)
D-1	Ra-228+D	1.440E-03	1.440E-03	DCF3(4)
D-1	Th-228+D	8.080E-04	8.080E-04	DCF3(5)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(6)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(7)
D-1	U-234	2.830E-04	2.830E-04	DCF3(8)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(9)
D-34	Food transfer factors:			
D-34	K-40 , plant/soil concentration ratio, dimensionless	3.000E-01	3.000E-01	RTF(1,1)
D-34	K-40 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-02	2.000E-02	RTF(1,2)
D-34	K-40 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	7.000E-03	7.000E-03	RTF(1,3)
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(2,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(2,3)
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(3,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(3,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(3,3)
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(5,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(5,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(5,3)
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(6,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(6,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(6,3)
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(7,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(7,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(7,3)

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

Menu	Parameter	Current Value	Default	Parameter Name
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(8,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(8,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(8,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(9,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(9,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(9,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	K-40 , fish	1.000E+03	1.000E+03	BIOFAC(1,1)
D-5	K-40 , crustacea and mollusks	2.000E+02	2.000E+02	BIOFAC(1,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(2,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(2,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(3,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(3,2)
D-5				
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(4,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(4,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(5,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(5,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(6,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(6,2)
D-5				
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(7,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(7,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(8,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(8,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(9,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(9,2)

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)	5.600E+01	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	5.000E-01	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	not used	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	2.500E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	1.000E+03	3.000E+00	---	T(3)
R011	Times for calculations (yr)	not used	1.000E+01	---	T(4)
R011	Times for calculations (yr)	not used	3.000E+01	---	T(5)
R011	Times for calculations (yr)	not used	1.000E+02	---	T(6)
R011	Times for calculations (yr)	not used	3.000E+02	---	T(7)
R011	Times for calculations (yr)	not used	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): K-40	3.000E+02	0.000E+00	---	S1(1)
R012	Initial principal radionuclide (pCi/g): Pb-210	4.000E+02	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Ra-226	4.000E+02	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): Th-230	3.000E+02	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Th-232	5.000E+01	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): U-234	3.000E+02	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): U-238	3.000E+02	0.000E+00	---	S1(9)
R012	Concentration in groundwater (pCi/L): K-40	not used	0.000E+00	---	W1(1)
R012	Concentration in groundwater (pCi/L): Pb-210	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Ra-226	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): Th-230	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(9)
R013	Cover depth (m)	1.800E-01	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	1.500E+00	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	0.000E+00	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)	0.000E+00	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	4.000E-01	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	5.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	not used	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	not used	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	not used	1.500E+00	---	DENSAQ

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R014	Saturated zone total porosity	not used	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	not used	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	not used	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	not used	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	not used	2.000E-02	---	HGWT
R014	Saturated zone b parameter	not used	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	not used	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	not used	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	not used	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	not used	1	---	NS
R015	Unsat. zone 1, thickness (m)	not used	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	not used	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	not used	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	not used	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	not used	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	not used	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	not used	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for K-40				
R016	Contaminated zone (cm**3/g)	5.500E+00	5.500E+00	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.500E+00	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	not used	5.500E+00	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.343E-02	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+02	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	not used	1.000E+02	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.331E-03	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.900E-03	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.222E-06	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.222E-06	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.657E-03	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(9,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.657E-03	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.900E-03	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for daughter Th-228				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.222E-06	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R017	Inhalation rate (m**3/yr)	1.500E+01	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-05	1.000E-04	---	MLINH
R017	Exposure duration	1.000E+00	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	0.000E+00	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	1.140E-03	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	not used	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	not used	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	not used	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	not used	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (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
C14	DCF correction factor for gaseous forms of C14	not used	8.894E+01	---	CO2F
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	KYMAX

Summary of Pathway Selections

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

Summary : Deer Trail - Worker Accident Analysis
File : Deer Trail - Worker Accident.RAD

Contaminated Zone Dimensions

Area:	56.00	square meters
Thickness:	0.50	meters
Cover Depth:	0.18	meters

Initial Soil Concentrations, pCi/g

K-40	3.000E+02
Pb-210	4.000E+02
Ra-226	4.000E+02
Th-230	3.000E+02
Th-232	5.000E+01
U-234	3.000E+02
U-238	3.000E+02

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

t (years):	0.000E+00	1.000E+00	1.000E+03
TDOSE(t):	5.461E-01	5.496E-01	2.091E-01
M(t):	2.184E-02	2.198E-02	8.365E-03

Maximum TDOSE(t): 5.964E-01 mrem/yr at t = 18.46 ñ 0.04 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.846E+01 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	2.632E-02	0.0441	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	1.004E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	4.785E-01	0.8024	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	3.016E-03	0.0051	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	8.495E-02	0.1425	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	7.571E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	3.545E-03	0.0059	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	5.964E-01	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.846E+01 years

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	Water Dependent Pathways													
Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.632E-02	0.0441
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.004E-05	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.785E-01	0.8024
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.016E-03	0.0051
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.495E-02	0.1425
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.571E-07	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.545E-03	0.0059
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.964E-01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	4.056E-02	0.0743	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	1.825E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	4.996E-01	0.9148	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	8.348E-05	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	2.149E-03	0.0039	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	5.275E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	3.723E-03	0.0068	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	5.461E-01	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Dependent Pathways

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.056E-02	0.0743
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.825E-05	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.996E-01	0.9148
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.348E-05	0.0002
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.149E-03	0.0039
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.275E-07	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.723E-03	0.0068
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.461E-01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	3.962E-02	0.0721	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	1.767E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	4.984E-01	0.9068	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	2.456E-04	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	7.607E-03	0.0138	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	5.275E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	3.713E-03	0.0068	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	5.496E-01	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.962E-02	0.0721
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.767E-05	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.984E-01	0.9068
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.456E-04	0.0004
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.607E-03	0.0138
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.275E-07	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.713E-03	0.0068
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.496E-01	1.0000

*Sum of all water independent and dependent pathways.

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

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	2.701E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	1.529E-19	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	4.847E-02	0.2318	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	6.244E-02	0.2985	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	9.780E-02	0.4676	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	1.666E-04	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	2.614E-04	0.0013	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	2.091E-01	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

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

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.701E-12	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.529E-19	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.847E-02	0.2318
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.244E-02	0.2985
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.780E-02	0.4676
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.666E-04	0.0008
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.614E-04	0.0013
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.091E-01	1.0000

*Sum of all water independent and dependent pathways.

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

0Parent (i)	Product (j)	Branch Fraction*	t= DSR(j,t) 0.000E+00	(mrem/yr)/(pCi/g) 1.000E+00	1.000E+03
K-40	K-40	1.000E+00	1.352E-04	1.321E-04	9.002E-15
Pb-210	Pb-210	1.000E+00	4.564E-08	4.418E-08	3.822E-22
Ra-226	Ra-226	1.000E+00	1.249E-03	1.246E-03	1.212E-04
Ra-226	Pb-210	1.000E+00	7.125E-10	2.105E-09	4.644E-09
Ra-226	äDSR(j)		1.249E-03	1.246E-03	1.212E-04
Th-230	Th-230	1.000E+00	7.637E-09	7.637E-09	7.552E-09
Th-230	Ra-226	1.000E+00	2.706E-07	8.110E-07	2.081E-04
Th-230	Pb-210	1.000E+00	1.032E-13	7.152E-13	7.343E-09
Th-230	äDSR(j)		2.783E-07	8.187E-07	2.081E-04
Th-232	Th-232	1.000E+00	1.762E-09	1.762E-09	1.758E-09
Th-232	Ra-228	1.000E+00	3.390E-05	9.643E-05	5.752E-04
Th-232	Th-228	1.000E+00	9.083E-06	5.570E-05	1.381E-03
Th-232	äDSR(j)		4.298E-05	1.521E-04	1.956E-03
U-234	U-234	1.000E+00	1.757E-09	1.753E-09	1.230E-10
U-234	Th-230	1.000E+00	3.435E-14	1.029E-13	2.386E-11
U-234	Ra-226	1.000E+00	8.117E-13	5.674E-12	5.551E-07
U-234	Pb-210	1.000E+00	2.325E-19	3.460E-18	1.929E-11
U-234	äDSR(j)		1.758E-09	1.758E-09	5.553E-07
U-238	U-238	1.000E+00	1.241E-05	1.238E-05	8.710E-07
U-238	U-234	1.000E+00	2.490E-15	7.452E-15	3.494E-13
U-238	Th-230	1.000E+00	3.244E-20	2.267E-19	2.041E-14
U-238	Ra-226	1.000E+00	5.751E-19	8.612E-18	3.902E-10
U-238	Pb-210	1.000E+00	1.320E-25	4.062E-24	1.328E-14
U-238	äDSR(j)		1.241E-05	1.238E-05	8.714E-07

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

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 2.500E+01 mrem/yr

Nuclide (i)	t= 0.000E+00	1.000E+00	1.000E+03
K-40	1.849E+05	1.893E+05	*6.986E+06
Pb-210	5.478E+08	5.659E+08	*7.631E+13
Ra-226	2.002E+04	2.006E+04	2.063E+05
Th-230	8.984E+07	3.054E+07	1.201E+05
Th-232	*1.096E+05	*1.096E+05	1.278E+04
U-234	*6.245E+09	*6.245E+09	4.502E+07
U-238	*3.360E+05	*3.360E+05	*3.360E+05

*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 18.46 ñ 0.04 years

Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
K-40	3.000E+02	0.000E+00	1.352E-04	1.849E+05	8.773E-05	2.850E+05
Pb-210	4.000E+02	0.000E+00	4.564E-08	5.478E+08	2.509E-08	9.965E+08
Ra-226	4.000E+02	0.000E+00	1.249E-03	2.002E+04	1.196E-03	2.090E+04
Th-230	3.000E+02	1.000E+03	2.081E-04	1.201E+05	1.005E-05	2.487E+06
Th-232	5.000E+01	91.8 ñ 0.2	1.960E-03	1.276E+04	1.699E-03	1.471E+04
U-234	3.000E+02	1.000E+03	5.553E-07	4.502E+07	2.524E-09	*6.245E+09
U-238	3.000E+02	0.000E+00	1.241E-05	*3.360E+05	1.182E-05	*3.360E+05

*At specific activity limit

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

Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	1.000E+03
K-40	K-40	1.000E+00	4.056E-02	3.962E-02	2.701E-12
Pb-210	Pb-210	1.000E+00	1.825E-05	1.767E-05	1.529E-19
Pb-210	Ra-226	1.000E+00	2.850E-07	8.420E-07	1.858E-06
Pb-210	Th-230	1.000E+00	3.096E-11	2.146E-10	2.203E-06
Pb-210	U-234	1.000E+00	6.975E-17	1.038E-15	5.787E-09
Pb-210	U-238	1.000E+00	3.959E-23	1.219E-21	3.985E-12
Pb-210	äDOSE(j)		1.854E-05	1.851E-05	4.066E-06
Ra-226	Ra-226	1.000E+00	4.996E-01	4.984E-01	4.847E-02
Ra-226	Th-230	1.000E+00	8.119E-05	2.433E-04	6.243E-02
Ra-226	U-234	1.000E+00	2.435E-10	1.702E-09	1.665E-04
Ra-226	U-238	1.000E+00	1.725E-16	2.584E-15	1.171E-07
Ra-226	äDOSE(j)		4.996E-01	4.986E-01	1.111E-01
Th-230	Th-230	1.000E+00	2.291E-06	2.291E-06	2.266E-06
Th-230	U-234	1.000E+00	1.030E-11	3.087E-11	7.157E-09
Th-230	U-238	1.000E+00	9.732E-18	6.802E-17	6.122E-12
Th-230	äDOSE(j)		2.291E-06	2.291E-06	2.273E-06
Th-232	Th-232	1.000E+00	8.808E-08	8.808E-08	8.788E-08
Ra-228	Th-232	1.000E+00	1.695E-03	4.822E-03	2.876E-02
Th-228	Th-232	1.000E+00	4.542E-04	2.785E-03	6.903E-02
U-234	U-234	1.000E+00	5.272E-07	5.258E-07	3.690E-08
U-234	U-238	1.000E+00	7.470E-13	2.236E-12	1.048E-10
U-234	äDOSE(j)		5.272E-07	5.258E-07	3.700E-08
U-238	U-238	1.000E+00	3.723E-03	3.713E-03	2.613E-04

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

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	1.000E+03
K-40	K-40	1.000E+00	3.000E+02	2.931E+02	1.997E-08
Pb-210	Pb-210	1.000E+00	4.000E+02	3.872E+02	3.350E-12
Pb-210	Ra-226	1.000E+00	0.000E+00	1.222E+01	4.010E+01
Pb-210	Th-230	1.000E+00	0.000E+00	1.997E-03	4.749E+01
Pb-210	U-234	1.000E+00	0.000E+00	6.004E-09	1.247E-01
Pb-210	U-238	1.000E+00	0.000E+00	4.261E-15	8.586E-05
Pb-210	äS(j):		4.000E+02	3.995E+02	8.772E+01
Ra-226	Ra-226	1.000E+00	4.000E+02	3.991E+02	3.881E+01
Ra-226	Th-230	1.000E+00	0.000E+00	1.298E-01	4.992E+01
Ra-226	U-234	1.000E+00	0.000E+00	5.840E-07	1.331E-01
Ra-226	U-238	1.000E+00	0.000E+00	5.517E-13	9.357E-05
Ra-226	äS(j):		4.000E+02	3.992E+02	8.887E+01
Th-230	Th-230	1.000E+00	3.000E+02	3.000E+02	2.967E+02
Th-230	U-234	1.000E+00	0.000E+00	2.697E-03	9.370E-01
Th-230	U-238	1.000E+00	0.000E+00	3.821E-09	8.013E-04
Th-230	äS(j):		3.000E+02	3.000E+02	2.976E+02
Th-232	Th-232	1.000E+00	5.000E+01	5.000E+01	4.989E+01
Ra-228	Th-232	1.000E+00	0.000E+00	5.673E+00	4.912E+01
Th-228	Th-232	1.000E+00	0.000E+00	9.316E-01	4.912E+01
U-234	U-234	1.000E+00	3.000E+02	2.992E+02	2.100E+01
U-234	U-238	1.000E+00	0.000E+00	8.482E-04	5.961E-02
U-234	äS(j):		3.000E+02	2.992E+02	2.106E+01
U-238	U-238	1.000E+00	3.000E+02	2.992E+02	2.106E+01

BRF(i) is the branch fraction of the parent nuclide.
0RESCALC.EXE execution time = 1.32 seconds

RESPONSE TO COMMENTS ON CLEAN HARBORS DEER TRAIL, LLC, RADIOACTIVE MATERIALS LICENSE APPLICATION, DOCKET NUMBER 5873

Colorado Department of Public Health and Environment
Request for Information April 20, 2005

ATTACHMENT 2: RESRAD Output for the Revised In-Cell Worker Analysis

Separate Output for
Inhalation
External

RESRAD Output for the Revised Post Closure Resident Analysis

Summary : Deer Trail - In Cell Worker - Inhalation
File : Deer Trail - In Cell Worker - Inhalation.RAD

Table of Contents
Part I: Mixture Sums and Single Radionuclide Guidelines

Summary : Deer Trail - In Cell Worker - Inhalation
File : Deer Trail - In Cell Worker - Inhalation.RAD

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

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	K-40	1.240E-05	1.240E-05	DCF2(1)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(2)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(3)
B-1	Ra-228+D	5.080E-03	5.080E-03	DCF2(4)
B-1	Th-228+D	3.450E-01	3.450E-01	DCF2(5)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(6)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(7)
B-1	U-234	1.320E-01	1.320E-01	DCF2(8)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(9)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	K-40	1.860E-05	1.860E-05	DCF3(1)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(2)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(3)
D-1	Ra-228+D	1.440E-03	1.440E-03	DCF3(4)
D-1	Th-228+D	8.080E-04	8.080E-04	DCF3(5)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(6)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(7)
D-1	U-234	2.830E-04	2.830E-04	DCF3(8)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(9)
D-34	Food transfer factors:			
D-34	K-40 , plant/soil concentration ratio, dimensionless	3.000E-01	3.000E-01	RTF(1,1)
D-34	K-40 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-02	2.000E-02	RTF(1,2)
D-34	K-40 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	7.000E-03	7.000E-03	RTF(1,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(2,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(2,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(3,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(3,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(3,3)
D-34				
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
D-34				
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(5,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(5,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(5,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(6,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(6,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(6,3)
D-34				
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(7,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(7,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(7,3)

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

Menu	Parameter	Current Value	Default	Parameter Name
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(8,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(8,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(8,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(9,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(9,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(9,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	K-40 , fish	1.000E+03	1.000E+03	BIOFAC(1,1)
D-5	K-40 , crustacea and mollusks	2.000E+02	2.000E+02	BIOFAC(1,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(2,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(2,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(3,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(3,2)
D-5				
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(4,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(4,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(5,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(5,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(6,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(6,2)
D-5				
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(7,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(7,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(8,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(8,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(9,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(9,2)

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)	5.000E+02	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	1.500E+00	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	not used	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	2.500E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	not used	3.000E+00	---	T(3)
R011	Times for calculations (yr)	not used	1.000E+01	---	T(4)
R011	Times for calculations (yr)	not used	3.000E+01	---	T(5)
R011	Times for calculations (yr)	not used	1.000E+02	---	T(6)
R011	Times for calculations (yr)	not used	3.000E+02	---	T(7)
R011	Times for calculations (yr)	not used	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): K-40	3.000E+02	0.000E+00	---	S1(1)
R012	Initial principal radionuclide (pCi/g): Pb-210	4.000E+02	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Ra-226	4.000E+02	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): Th-230	3.000E+02	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Th-232	5.000E+01	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): U-234	3.000E+02	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): U-238	3.000E+02	0.000E+00	---	S1(9)
R012	Concentration in groundwater (pCi/L): K-40	not used	0.000E+00	---	W1(1)
R012	Concentration in groundwater (pCi/L): Pb-210	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Ra-226	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): Th-230	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(9)
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)	0.000E+00	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	4.230E-01	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	5.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	not used	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	not used	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	not used	1.500E+00	---	DENSAQ

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R014	Saturated zone total porosity	not used	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	not used	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	not used	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	not used	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	not used	2.000E-02	---	HGWT
R014	Saturated zone b parameter	not used	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	not used	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	not used	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	not used	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	not used	1	---	NS
R015	Unsat. zone 1, thickness (m)	not used	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	not used	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	not used	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	not used	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	not used	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	not used	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	not used	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for K-40				
R016	Contaminated zone (cm**3/g)	5.500E+00	5.500E+00	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.500E+00	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	not used	5.500E+00	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.259E-03	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+02	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	not used	1.000E+02	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.691E-04	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.696E-04	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.833E-07	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.833E-07	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.364E-04	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(9,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.364E-04	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.696E-04	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for daughter Th-228				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.833E-07	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R017	Inhalation rate (m**3/yr)	1.916E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-05	1.000E-04	---	MLINH
R017	Exposure duration	1.000E+00	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	not used	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	0.000E+00	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	1.140E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	not used	1.000E+00	>0 shows circular AREA.	FS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	not used	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	not used	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	not used	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	not used	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (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
C14	DCF correction factor for gaseous forms of C14	not used	8.894E+01	---	CO2F
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	KYMAX

Summary of Pathway Selections

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

Summary : Deer Trail - In Cell Worker - Inhalation
File : Deer Trail - In Cell Worker - Inhalation.RAD

Contaminated Zone Dimensions		Initial Soil Concentrations, pCi/g	
Area:	500.00 square meters	K-40	3.000E+02
Thickness:	1.50 meters	Pb-210	4.000E+02
Cover Depth:	0.00 meters	Ra-226	4.000E+02
		Th-230	3.000E+02
		Th-232	5.000E+01
		U-234	3.000E+02
		U-238	3.000E+02

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

t (years):	0.000E+00	1.000E+00
TDOSE(t):	7.246E-02	7.260E-02
M(t):	2.898E-03	2.904E-03

Maximum TDOSE(t): 7.260E-02 mrem/yr at t = 1.000E+00 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	0.000E+00	0.0000	1.003E-06	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	0.000E+00	0.0000	2.473E-03	0.0341	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	0.000E+00	0.0000	9.695E-04	0.0134	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	0.000E+00	0.0000	2.648E-02	0.3655	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	2.224E-02	0.3069	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	1.072E-02	0.1479	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	9.581E-03	0.1322	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	7.246E-02	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.003E-06	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.473E-03	0.0341
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.695E-04	0.0134
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.648E-02	0.3655
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.224E-02	0.3069
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.072E-02	0.1479
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.581E-03	0.1322
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.246E-02	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	0.000E+00	0.0000	9.948E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	0.000E+00	0.0000	2.397E-03	0.0330	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	0.000E+00	0.0000	1.044E-03	0.0144	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	0.000E+00	0.0000	2.648E-02	0.3647	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	0.000E+00	0.0000	2.240E-02	0.3085	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	0.000E+00	0.0000	1.071E-02	0.1475	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	0.000E+00	0.0000	9.572E-03	0.1318	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	0.000E+00	0.0000	7.260E-02	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.948E-07	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.397E-03	0.0330
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.044E-03	0.0144
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.648E-02	0.3647
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.240E-02	0.3085
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.071E-02	0.1475
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.572E-03	0.1318
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.260E-02	1.0000

*Sum of all water independent and dependent pathways.

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

Parent (i)	Product (j)	Branch Fraction*	DSR(j,t) (mrem/yr)/(pCi/g) t= 0.000E+00	1.000E+00
K-40	K-40	1.000E+00	3.344E-09	3.316E-09
0Pb-210	Pb-210	1.000E+00	6.184E-06	5.992E-06
0Ra-226	Ra-226	1.000E+00	2.327E-06	2.325E-06
Ra-226	Pb-210	1.000E+00	9.657E-08	2.856E-07
Ra-226	äDSR(j)		2.424E-06	2.610E-06
0Th-230	Th-230	1.000E+00	8.827E-05	8.827E-05
Th-230	Ra-226	1.000E+00	5.042E-10	1.512E-09
Th-230	Pb-210	1.000E+00	1.398E-11	9.698E-11
Th-230	äDSR(j)		8.827E-05	8.827E-05
0Th-232	Th-232	1.000E+00	4.441E-04	4.441E-04
Th-232	Ra-228	1.000E+00	7.965E-08	2.267E-07
Th-232	Th-228	1.000E+00	6.039E-07	3.704E-06
Th-232	äDSR(j)		4.447E-04	4.480E-04
0U-234	U-234	1.000E+00	3.572E-05	3.569E-05
U-234	Th-230	1.000E+00	3.972E-10	1.191E-09
U-234	Ra-226	1.000E+00	1.513E-15	1.058E-14
U-234	Pb-210	1.000E+00	3.151E-17	4.694E-16
U-234	äDSR(j)		3.572E-05	3.569E-05
0U-238	U-238	1.000E+00	3.194E-05	3.191E-05
U-238	U-234	1.000E+00	5.063E-11	1.518E-10
U-238	Th-230	1.000E+00	3.753E-16	2.625E-15
U-238	Ra-226	1.000E+00	1.072E-21	1.607E-20
U-238	Pb-210	1.000E+00	1.789E-23	5.512E-22
U-238	äDSR(j)		3.194E-05	3.191E-05

í

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

Summary : Deer Trail - In Cell Worker - Inhalation
File : Deer Trail - In Cell Worker - Inhalation.RAD

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 2.500E+01 mrem/yr

0Nuclide (i)	t= 0.000E+00	1.000E+00
K-40	*6.986E+06	*6.986E+06
Pb-210	4.043E+06	4.172E+06
Ra-226	1.031E+07	9.577E+06
Th-230	2.832E+05	2.832E+05
Th-232	5.621E+04	5.581E+04
U-234	6.998E+05	7.004E+05
U-238	*3.360E+05	*3.360E+05

*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 1.000E+00 years

0Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
K-40	3.000E+02	0.000E+00	3.344E-09	*6.986E+06	3.316E-09	*6.986E+06
Pb-210	4.000E+02	0.000E+00	6.184E-06	4.043E+06	5.992E-06	4.172E+06
Ra-226	4.000E+02	1.000E+00	2.610E-06	9.577E+06	2.610E-06	9.577E+06
Th-230	3.000E+02	1.000E+00	8.827E-05	2.832E+05	8.827E-05	2.832E+05
Th-232	5.000E+01	1.000E+00	4.480E-04	5.581E+04	4.480E-04	5.581E+04
U-234	3.000E+02	0.000E+00	3.572E-05	6.998E+05	3.569E-05	7.004E+05
U-238	3.000E+02	0.000E+00	3.194E-05	*3.360E+05	3.191E-05	*3.360E+05

*At specific activity limit

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

Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00
K-40	K-40	1.000E+00	1.003E-06	9.948E-07
Pb-210	Pb-210	1.000E+00	2.473E-03	2.397E-03
Pb-210	Ra-226	1.000E+00	3.863E-05	1.142E-04
Pb-210	Th-230	1.000E+00	4.195E-09	2.909E-08
Pb-210	U-234	1.000E+00	9.454E-15	1.408E-13
Pb-210	U-238	1.000E+00	5.367E-21	1.654E-19
Pb-210	äDOSE(j)		2.512E-03	2.511E-03
Ra-226	Ra-226	1.000E+00	9.309E-04	9.299E-04
Ra-226	Th-230	1.000E+00	1.513E-07	4.536E-07
Ra-226	U-234	1.000E+00	4.538E-13	3.175E-12
Ra-226	U-238	1.000E+00	3.216E-19	4.821E-18
Ra-226	äDOSE(j)		9.311E-04	9.303E-04
Th-230	Th-230	1.000E+00	2.648E-02	2.648E-02
Th-230	U-234	1.000E+00	1.192E-07	3.573E-07
Th-230	U-238	1.000E+00	1.126E-13	7.876E-13
Th-230	äDOSE(j)		2.648E-02	2.648E-02
Th-232	Th-232	1.000E+00	2.220E-02	2.220E-02
Ra-228	Th-232	1.000E+00	3.983E-06	1.134E-05
Th-228	Th-232	1.000E+00	3.019E-05	1.852E-04
U-234	U-234	1.000E+00	1.072E-02	1.071E-02
U-234	U-238	1.000E+00	1.519E-08	4.553E-08
U-234	äDOSE(j)		1.072E-02	1.071E-02
U-238	U-238	1.000E+00	9.581E-03	9.572E-03

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

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00
Ä				
K-40	K-40	1.000E+00	3.000E+02	2.975E+02
Pb-210	Pb-210	1.000E+00	4.000E+02	3.876E+02
Pb-210	Ra-226	1.000E+00	0.000E+00	1.223E+01
Pb-210	Th-230	1.000E+00	0.000E+00	1.998E-03
Pb-210	U-234	1.000E+00	0.000E+00	6.010E-09
Pb-210	U-238	1.000E+00	0.000E+00	4.266E-15
Pb-210	äS(j):		4.000E+02	3.998E+02
Ra-226	Ra-226	1.000E+00	4.000E+02	3.996E+02
Ra-226	Th-230	1.000E+00	0.000E+00	1.299E-01
Ra-226	U-234	1.000E+00	0.000E+00	5.846E-07
Ra-226	U-238	1.000E+00	0.000E+00	5.524E-13
Ra-226	äS(j):		4.000E+02	3.997E+02
Th-230	Th-230	1.000E+00	3.000E+02	3.000E+02
Th-230	U-234	1.000E+00	0.000E+00	2.699E-03
Th-230	U-238	1.000E+00	0.000E+00	3.826E-09
Th-230	äS(j):		3.000E+02	3.000E+02
Th-232	Th-232	1.000E+00	5.000E+01	5.000E+01
Ra-228	Th-232	1.000E+00	0.000E+00	5.676E+00
Th-228	Th-232	1.000E+00	0.000E+00	9.320E-01
U-234	U-234	1.000E+00	3.000E+02	2.997E+02
U-234	U-238	1.000E+00	0.000E+00	8.497E-04
U-234	äS(j):		3.000E+02	2.997E+02
U-238	U-238	1.000E+00	3.000E+02	2.997E+02

BRF(i) is the branch fraction of the parent nuclide.
RESCALC.EXE execution time = 1.02 seconds

Summary : Deer Trail - In Cell Worker - External
File : Deer Trail - In Cell Worker - External.RAD

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Summary : Deer Trail - In Cell Worker - External
File : Deer Trail - In Cell Worker - External.RAD

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

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	K-40	1.240E-05	1.240E-05	DCF2(1)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(2)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(3)
B-1	Ra-228+D	5.080E-03	5.080E-03	DCF2(4)
B-1	Th-228+D	3.450E-01	3.450E-01	DCF2(5)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(6)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(7)
B-1	U-234	1.320E-01	1.320E-01	DCF2(8)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(9)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	K-40	1.860E-05	1.860E-05	DCF3(1)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(2)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(3)
D-1	Ra-228+D	1.440E-03	1.440E-03	DCF3(4)
D-1	Th-228+D	8.080E-04	8.080E-04	DCF3(5)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(6)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(7)
D-1	U-234	2.830E-04	2.830E-04	DCF3(8)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(9)
D-34	Food transfer factors:			
D-34	K-40 , plant/soil concentration ratio, dimensionless	3.000E-01	3.000E-01	RTF(1,1)
D-34	K-40 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-02	2.000E-02	RTF(1,2)
D-34	K-40 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	7.000E-03	7.000E-03	RTF(1,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(2,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(2,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(3,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(3,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(3,3)
D-34				
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
D-34				
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(5,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(5,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(5,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(6,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(6,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(6,3)
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(7,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(7,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(7,3)

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

Menu	Parameter	Current Value	Default	Parameter Name
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(8,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(8,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(8,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(9,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(9,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(9,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	K-40 , fish	1.000E+03	1.000E+03	BIOFAC(1,1)
D-5	K-40 , crustacea and mollusks	2.000E+02	2.000E+02	BIOFAC(1,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(2,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(2,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(3,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(3,2)
D-5				
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(4,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(4,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(5,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(5,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(6,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(6,2)
D-5				
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(7,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(7,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(8,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(8,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(9,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(9,2)

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)	5.000E+02	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	1.500E+00	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	not used	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	2.500E+01	2.500E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	not used	3.000E+00	---	T(3)
R011	Times for calculations (yr)	not used	1.000E+01	---	T(4)
R011	Times for calculations (yr)	not used	3.000E+01	---	T(5)
R011	Times for calculations (yr)	not used	1.000E+02	---	T(6)
R011	Times for calculations (yr)	not used	3.000E+02	---	T(7)
R011	Times for calculations (yr)	not used	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): K-40	3.000E+02	0.000E+00	---	S1(1)
R012	Initial principal radionuclide (pCi/g): Pb-210	4.000E+02	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Ra-226	4.000E+02	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): Th-230	3.000E+02	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Th-232	5.000E+01	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): U-234	3.000E+02	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): U-238	3.000E+02	0.000E+00	---	S1(9)
R012	Concentration in groundwater (pCi/L): K-40	not used	0.000E+00	---	W1(1)
R012	Concentration in groundwater (pCi/L): Pb-210	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Ra-226	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): Th-230	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(9)
R013	Cover depth (m)	1.800E-01	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	1.500E+00	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	0.000E+00	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)	0.000E+00	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	4.230E-01	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	5.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	not used	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	not used	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	not used	1.500E+00	---	DENSAQ

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R014	Saturated zone total porosity	not used	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	not used	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	not used	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	not used	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	not used	2.000E-02	---	HGWT
R014	Saturated zone b parameter	not used	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	not used	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	not used	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	not used	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	not used	2.500E+02	---	UW
R015	Number of unsaturated zone strata	not used	1	---	NS
R015	Unsat. zone 1, thickness (m)	not used	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	not used	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	not used	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	not used	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	not used	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	not used	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	not used	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for K-40				
R016	Contaminated zone (cm**3/g)	5.500E+00	5.500E+00	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.500E+00	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	not used	5.500E+00	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.259E-03	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	not used	1.000E+02	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	not used	1.000E+02	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.691E-04	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.696E-04	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.833E-07	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.833E-07	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for U-234				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.364E-04	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	not used	5.000E+01	---	DCNUCU(9,1)
R016	Saturated zone (cm**3/g)	not used	5.000E+01	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.364E-04	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	not used	7.000E+01	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	not used	7.000E+01	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.696E-04	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for daughter Th-228				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	not used	6.000E+04	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	not used	6.000E+04	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.833E-07	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R017	Inhalation rate (m**3/yr)	not used	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	not used	1.000E-04	---	MLINH
R017	Exposure duration	1.000E+00	3.000E+01	---	ED
R017	Shielding factor, inhalation	not used	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	0.000E+00	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	1.140E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	not used	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	not used	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	not used	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	not used	1.500E-01	---	DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	not used	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (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
C14	DCF correction factor for gaseous forms of C14	not used	8.894E+01	---	CO2F
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	KYMAX

Summary of Pathway Selections

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

Summary : Deer Trail - In Cell Worker - External
File : Deer Trail - In Cell Worker - External.RAD

Contaminated Zone Dimensions			Initial Soil Concentrations, pCi/g	
Area:	500.00	square meters	K-40	3.000E+02
Thickness:	1.50	meters	Pb-210	4.000E+02
Cover Depth:	0.18	meters	Ra-226	4.000E+02
			Th-230	3.000E+02
			Th-232	5.000E+01
			U-234	3.000E+02
			U-238	3.000E+02

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

t (years):	0.000E+00	1.000E+00
TDOSE(t):	5.503E+01	5.551E+01
M(t):	2.201E+00	2.220E+00

Maximum TDOSE(t): 5.551E+01 mrem/yr at t = 1.000E+00 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	4.106E+00	0.0746	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	1.828E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	5.032E+01	0.9145	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	8.406E-03	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	2.161E-01	0.0039	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	5.279E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	3.733E-01	0.0068	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	5.503E+01	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.106E+00	0.0746
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.828E-03	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.032E+01	0.9145
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	8.406E-03	0.0002
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.161E-01	0.0039
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.279E-05	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.733E-01	0.0068
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.503E+01	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	4.073E+00	0.0734	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	1.771E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	5.027E+01	0.9056	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	2.475E-02	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	7.664E-01	0.0138	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	5.289E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	3.729E-01	0.0067	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	5.551E+01	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.073E+00	0.0734
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.771E-03	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.027E+01	0.9056
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.475E-02	0.0004
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.664E-01	0.0138
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.289E-05	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.729E-01	0.0067
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.551E+01	1.0000

*Sum of all water independent and dependent pathways.

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

0Parent (i)	Product (j)	Branch Fraction*	DSR(j,t) (mrem/yr)/(pCi/g) t= 0.000E+00	1.000E+00
K-40	K-40	1.000E+00	1.369E-02	1.358E-02
0Pb-210	Pb-210	1.000E+00	4.569E-06	4.427E-06
0Ra-226	Ra-226	1.000E+00	1.258E-01	1.257E-01
Ra-226	Pb-210	1.000E+00	7.136E-08	2.110E-07
Ra-226	äDSR(j)		1.258E-01	1.257E-01
0Th-230	Th-230	1.000E+00	7.637E-07	7.637E-07
Th-230	Ra-226	1.000E+00	2.726E-05	8.173E-05
Th-230	Pb-210	1.000E+00	1.033E-11	7.166E-11
Th-230	äDSR(j)		2.802E-05	8.249E-05
0Th-232	Th-232	1.000E+00	1.762E-07	1.762E-07
Th-232	Ra-228	1.000E+00	3.401E-03	9.679E-03
Th-232	Th-228	1.000E+00	9.207E-04	5.648E-03
Th-232	äDSR(j)		4.322E-03	1.533E-02
0U-234	U-234	1.000E+00	1.759E-07	1.757E-07
U-234	Th-230	1.000E+00	3.436E-12	1.031E-11
U-234	Ra-226	1.000E+00	8.177E-11	5.721E-10
U-234	Pb-210	1.000E+00	2.329E-17	3.468E-16
U-234	äDSR(j)		1.760E-07	1.763E-07
0U-238	U-238	1.000E+00	1.244E-03	1.243E-03
U-238	U-234	1.000E+00	2.493E-13	7.472E-13
U-238	Th-230	1.000E+00	3.247E-18	2.272E-17
U-238	Ra-226	1.000E+00	5.795E-17	8.687E-16
U-238	Pb-210	1.000E+00	1.322E-23	4.073E-22
U-238	äDSR(j)		1.244E-03	1.243E-03

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

Summary : Deer Trail - In Cell Worker - External
File : Deer Trail - In Cell Worker - External.RAD

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 2.500E+01 mrem/yr

0Nuclide (i)	t= 0.000E+00	1.000E+00
K-40	1.826E+03	1.842E+03
Pb-210	5.471E+06	5.647E+06
Ra-226	1.987E+02	1.989E+02
Th-230	8.922E+05	3.031E+05
Th-232	5.785E+03	1.631E+03
U-234	1.421E+08	1.418E+08
U-238	2.009E+04	2.011E+04

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 1.000E+00 years

0Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
K-40	3.000E+02	0.000E+00	1.369E-02	1.826E+03	1.358E-02	1.842E+03
Pb-210	4.000E+02	0.000E+00	4.569E-06	5.471E+06	4.427E-06	5.647E+06
Ra-226	4.000E+02	0.000E+00	1.258E-01	1.987E+02	1.257E-01	1.989E+02
Th-230	3.000E+02	1.000E+00	8.249E-05	3.031E+05	8.249E-05	3.031E+05
Th-232	5.000E+01	1.000E+00	1.533E-02	1.631E+03	1.533E-02	1.631E+03
U-234	3.000E+02	1.000E+00	1.763E-07	1.418E+08	1.763E-07	1.418E+08
U-238	3.000E+02	0.000E+00	1.244E-03	2.009E+04	1.243E-03	2.011E+04

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

0Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00
K-40	K-40	1.000E+00	4.106E+00	4.073E+00
0Pb-210	Pb-210	1.000E+00	1.828E-03	1.771E-03
Pb-210	Ra-226	1.000E+00	2.854E-05	8.440E-05
Pb-210	Th-230	1.000E+00	3.100E-09	2.150E-08
Pb-210	U-234	1.000E+00	6.986E-15	1.040E-13
Pb-210	U-238	1.000E+00	3.965E-21	1.222E-19
Pb-210	äDOSE(j)		1.856E-03	1.855E-03
0Ra-226	Ra-226	1.000E+00	5.032E+01	5.027E+01
Ra-226	Th-230	1.000E+00	8.177E-03	2.452E-02
Ra-226	U-234	1.000E+00	2.453E-08	1.716E-07
Ra-226	U-238	1.000E+00	1.739E-14	2.606E-13
Ra-226	äDOSE(j)		5.033E+01	5.029E+01
0Th-230	Th-230	1.000E+00	2.291E-04	2.291E-04
Th-230	U-234	1.000E+00	1.031E-09	3.092E-09
Th-230	U-238	1.000E+00	9.741E-16	6.815E-15
Th-230	äDOSE(j)		2.291E-04	2.291E-04
0Th-232	Th-232	1.000E+00	8.808E-06	8.808E-06
0Ra-228	Th-232	1.000E+00	1.700E-01	4.839E-01
0Th-228	Th-232	1.000E+00	4.604E-02	2.824E-01
0U-234	U-234	1.000E+00	5.277E-05	5.272E-05
U-234	U-238	1.000E+00	7.478E-11	2.242E-10
U-234	äDOSE(j)		5.277E-05	5.272E-05
0U-238	U-238	1.000E+00	3.733E-01	3.729E-01

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

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00
K-40	K-40	1.000E+00	3.000E+02	2.975E+02
Pb-210	Pb-210	1.000E+00	4.000E+02	3.876E+02
Pb-210	Ra-226	1.000E+00	0.000E+00	1.223E+01
Pb-210	Th-230	1.000E+00	0.000E+00	1.998E-03
Pb-210	U-234	1.000E+00	0.000E+00	6.010E-09
Pb-210	U-238	1.000E+00	0.000E+00	4.266E-15
Pb-210	äS(j):		4.000E+02	3.998E+02
Ra-226	Ra-226	1.000E+00	4.000E+02	3.996E+02
Ra-226	Th-230	1.000E+00	0.000E+00	1.299E-01
Ra-226	U-234	1.000E+00	0.000E+00	5.846E-07
Ra-226	U-238	1.000E+00	0.000E+00	5.524E-13
Ra-226	äS(j):		4.000E+02	3.997E+02
Th-230	Th-230	1.000E+00	3.000E+02	3.000E+02
Th-230	U-234	1.000E+00	0.000E+00	2.699E-03
Th-230	U-238	1.000E+00	0.000E+00	3.826E-09
Th-230	äS(j):		3.000E+02	3.000E+02
Th-232	Th-232	1.000E+00	5.000E+01	5.000E+01
Ra-228	Th-232	1.000E+00	0.000E+00	5.676E+00
Th-228	Th-232	1.000E+00	0.000E+00	9.320E-01
U-234	U-234	1.000E+00	3.000E+02	2.997E+02
U-234	U-238	1.000E+00	0.000E+00	8.497E-04
U-234	äS(j):		3.000E+02	2.997E+02
U-238	U-238	1.000E+00	3.000E+02	2.997E+02

BRF(i) is the branch fraction of the parent nuclide.
RESCALC.EXE execution time = 1.10 seconds

Summary : Denver Radium Case - Post Closure Resident
File : Post Closure Resident.RAD

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Summary : Denver Radium Case - Post Closure Resident
File : Post Closure Resident.RAD

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

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	K-40	1.240E-05	1.240E-05	DCF2(1)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(2)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(3)
B-1	Ra-228+D	5.080E-03	5.080E-03	DCF2(4)
B-1	Th-228+D	3.450E-01	3.450E-01	DCF2(5)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(6)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(7)
B-1	U-234	1.320E-01	1.320E-01	DCF2(8)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(9)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	K-40	1.860E-05	1.860E-05	DCF3(1)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(2)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(3)
D-1	Ra-228+D	1.440E-03	1.440E-03	DCF3(4)
D-1	Th-228+D	8.080E-04	8.080E-04	DCF3(5)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(6)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(7)
D-1	U-234	2.830E-04	2.830E-04	DCF3(8)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(9)
D-34	Food transfer factors:			
D-34	K-40 , plant/soil concentration ratio, dimensionless	3.000E-01	3.000E-01	RTF(1,1)
D-34	K-40 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-02	2.000E-02	RTF(1,2)
D-34	K-40 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	7.000E-03	7.000E-03	RTF(1,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(2,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(2,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(3,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(3,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(3,3)
D-34				
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
D-34				
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(5,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(5,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(5,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(6,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(6,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(6,3)
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(7,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(7,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(7,3)

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

Menu	Parameter	Current Value	Default	Parameter Name
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(8,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(8,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(8,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(9,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(9,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(9,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	K-40 , fish	1.000E+03	1.000E+03	BIOFAC(1,1)
D-5	K-40 , crustacea and mollusks	2.000E+02	2.000E+02	BIOFAC(1,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(2,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(2,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(3,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(3,2)
D-5				
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(4,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(4,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(5,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(5,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(6,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(6,2)
D-5				
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(7,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(7,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(8,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(8,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(9,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(9,2)

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)	3.300E+05	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	1.000E+01	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	1.000E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.000E+02	2.500E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+02	1.000E+00	---	T(2)
R011	Times for calculations (yr)	5.000E+02	3.000E+00	---	T(3)
R011	Times for calculations (yr)	1.000E+03	1.000E+01	---	T(4)
R011	Times for calculations (yr)	1.000E+04	3.000E+01	---	T(5)
R011	Times for calculations (yr)	not used	1.000E+02	---	T(6)
R011	Times for calculations (yr)	not used	3.000E+02	---	T(7)
R011	Times for calculations (yr)	not used	1.000E+03	---	T(8)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): K-40	3.000E+02	0.000E+00	---	S1(1)
R012	Initial principal radionuclide (pCi/g): Pb-210	4.000E+02	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Ra-226	4.000E+02	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): Th-230	3.000E+02	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Th-232	5.000E+01	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g): U-234	3.000E+02	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): U-238	3.000E+02	0.000E+00	---	S1(9)
R012	Concentration in groundwater (pCi/L): K-40	not used	0.000E+00	---	W1(1)
R012	Concentration in groundwater (pCi/L): Pb-210	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Ra-226	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): Th-230	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Th-232	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L): U-234	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): U-238	not used	0.000E+00	---	W1(9)
R013	Cover depth (m)	1.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	1.500E+00	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	0.000E+00	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)	0.000E+00	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	5.300E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	2.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	4.230E-01	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	0.000E+00	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+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

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	4.000E+03	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	2.000E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for K-40				
R016	Contaminated zone (cm**3/g)	5.500E+00	5.500E+00	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	5.500E+00	5.500E+00	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	5.500E+00	5.500E+00	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.980E-03	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.126E-04	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.607E-04	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.880E-07	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.880E-07	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for U-234				
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	2.247E-04	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(9,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.247E-04	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for daughter Ra-228				
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	1.607E-04	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for daughter Th-228				
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	1.880E-07	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R017	Inhalation rate (m**3/yr)	8.400E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	7.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	5.000E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	2.500E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	1.600E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	1.400E+01	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	9.200E+01	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	6.300E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	3.650E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	not used	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	not used	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT
R018	Contamination fraction of meat	-1	-1	0.100E+01	FMEAT
R018	Contamination fraction of milk	-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)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	not used	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	1.100E+00	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	8.000E-02	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	1.000E+00	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	2.000E+01	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
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
C14	DCF correction factor for gaseous forms of C14	not used	8.894E+01	---	CO2F
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	KYMAX

Summary of Pathway Selections

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

Summary : Denver Radium Case - Post Closure Resident
File : Post Closure Resident.RAD

Contaminated Zone Dimensions

Area: 330000.00 square meters
Thickness: 10.00 meters
Cover Depth: 1.00 meters

Initial Soil Concentrations, pCi/g

K-40	3.000E+02
Pb-210	4.000E+02
Ra-226	4.000E+02
Th-230	3.000E+02
Th-232	5.000E+01
U-234	3.000E+02
U-238	3.000E+02

Total Dose TDOSE(t), mrem/yr
Basic Radiation Dose Limit = 1.000E+02 mrem/yr
Total Mixture Sum M(t) = Fraction of Basic Dose Limit Received at Time (t)

t (years):	0.000E+00	1.000E+02	5.000E+02	1.000E+03	1.000E+04
TDOSE(t):	1.150E-02	1.490E-02	1.326E-02	1.203E-02	9.120E-03
M(t):	1.150E-04	1.490E-04	1.326E-04	1.203E-04	9.120E-05

Maximum TDOSE(t): 1.518E-02 mrem/yr at t = 39.53 ñ 0.08 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.953E+01 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	1.545E-03	0.1018	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	1.257E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	9.533E-03	0.6281	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	1.255E-04	0.0083	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	3.950E-03	0.2602	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	2.263E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	2.401E-05	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.518E-02	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 3.953E+01 years

	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
Radio-Nuclide	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
Nuclide														
K-40	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.545E-03	0.1018
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.257E-12	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.533E-03	0.6281
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.255E-04	0.0083
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.950E-03	0.2602
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.263E-08	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.401E-05	0.0016
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.518E-02	1.0000

*Sum of all water independent and dependent pathways.

Water Dependent Pathways

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	1.671E-03	0.1453	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	4.316E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	9.759E-03	0.8488	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	1.586E-06	0.0001	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	4.171E-05	0.0036	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	4.770E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	2.423E-05	0.0021	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.150E-02	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.671E-03	0.1453
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.316E-12	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.759E-03	0.8488
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.586E-06	0.0001
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.171E-05	0.0036
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.770E-12	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.423E-05	0.0021
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.150E-02	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	1.370E-03	0.0920	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	1.907E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	9.196E-03	0.6174	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	3.093E-04	0.0208	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	3.996E-03	0.2683	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	1.402E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	2.369E-05	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.490E-02	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+02 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.370E-03	0.0920
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.907E-13	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.196E-03	0.6174
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.093E-04	0.0208
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.996E-03	0.2683
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.402E-07	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.369E-05	0.0016
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.490E-02	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 5.000E+02 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	6.208E-04	0.0468	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	7.262E-19	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	7.252E-03	0.5468	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	1.370E-03	0.1033	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	3.996E-03	0.3013	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	3.119E-06	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	2.165E-05	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.326E-02	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 5.000E+02 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	6.208E-04	0.0468
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.262E-19	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.252E-03	0.5468
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.370E-03	0.1033
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.996E-03	0.3013
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.119E-06	0.0002
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.165E-05	0.0016
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.326E-02	1.0000

*Sum of all water independent and dependent pathways.

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

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	2.307E-04	0.0192	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	1.222E-25	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	5.389E-03	0.4481	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	2.381E-03	0.1980	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	3.995E-03	0.3322	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	1.091E-05	0.0009	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	1.936E-05	0.0016	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	1.203E-02	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

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

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.307E-04	0.0192
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.222E-25	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.389E-03	0.4481
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.381E-03	0.1980
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.995E-03	0.3322
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.091E-05	0.0009
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.936E-05	0.0016
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.203E-02	1.0000

*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+04 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	4.214E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	2.571E-05	0.0028	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	4.934E-03	0.5410	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	3.989E-03	0.4373	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	1.677E-04	0.0184	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	3.984E-06	0.0004	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	9.120E-03	1.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+04 years
Water Dependent Pathways

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.214E-12	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.571E-05	0.0028
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.934E-03	0.5410
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.989E-03	0.4373
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.677E-04	0.0184
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.984E-06	0.0004
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.120E-03	1.0000

*Sum of all water independent and dependent pathways.

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

0Parent (i)	Product (j)	Branch Fraction*	t= 0.000E+00	1.000E+02	5.000E+02	1.000E+03	1.000E+04
			DSR(j,t)	(mrem/yr)/(pCi/g)			
K-40	K-40	1.000E+00	5.568E-06	4.568E-06	2.069E-06	7.690E-07	1.405E-14
0Pb-210	Pb-210	1.000E+00	1.079E-14	4.766E-16	1.815E-21	3.055E-28	0.000E+00
0Ra-226	Ra-226	1.000E+00	2.440E-05	2.299E-05	1.813E-05	1.347E-05	6.428E-08
Ra-226	Pb-210	1.000E+00	1.685E-16	1.000E-14	8.268E-15	6.144E-15	2.931E-17
Ra-226	äDSR(j)		2.440E-05	2.299E-05	1.813E-05	1.347E-05	6.428E-08
0Th-230	Th-230	1.000E+00	4.121E-16	4.117E-16	4.102E-16	4.083E-16	3.759E-16
Th-230	Ra-226	1.000E+00	5.285E-09	1.031E-06	4.567E-06	7.935E-06	1.645E-05
Th-230	Pb-210	1.000E+00	2.440E-20	3.225E-16	1.929E-15	3.466E-15	7.360E-15
Th-230	äDSR(j)		5.285E-09	1.031E-06	4.567E-06	7.935E-06	1.645E-05
0Th-232	Th-232	1.000E+00	7.181E-18	7.180E-18	7.180E-18	7.179E-18	7.167E-18
Th-232	Ra-228	1.000E+00	3.565E-07	6.147E-06	6.146E-06	6.146E-06	6.136E-06
Th-232	Th-228	1.000E+00	4.776E-07	7.377E-05	7.377E-05	7.376E-05	7.364E-05
Th-232	äDSR(j)		8.341E-07	7.992E-05	7.991E-05	7.991E-05	7.977E-05
0U-234	U-234	1.000E+00	4.013E-17	3.923E-17	3.582E-17	3.196E-17	4.124E-18
U-234	Th-230	1.000E+00	1.855E-21	3.684E-19	1.751E-18	3.303E-18	1.375E-17
U-234	Ra-226	1.000E+00	1.586E-14	4.675E-10	1.040E-08	3.637E-08	5.589E-07
U-234	Pb-210	1.000E+00	5.499E-26	1.170E-19	4.125E-18	1.538E-17	2.498E-16
U-234	äDSR(j)		1.590E-14	4.675E-10	1.040E-08	3.637E-08	5.589E-07
0U-238	U-238	1.000E+00	8.076E-08	7.896E-08	7.218E-08	6.451E-08	8.536E-09
U-238	U-234	1.000E+00	5.688E-23	1.118E-20	5.086E-20	9.079E-20	1.186E-19
U-238	Th-230	1.000E+00	1.753E-27	5.230E-23	1.220E-21	4.519E-21	1.300E-19
U-238	Ra-226	1.000E+00	1.124E-20	4.446E-14	4.946E-12	3.474E-11	4.745E-09
U-238	Pb-210	1.000E+00	3.122E-32	9.328E-24	1.851E-21	1.425E-20	2.115E-18
U-238	äDSR(j)		8.076E-08	7.896E-08	7.218E-08	6.454E-08	1.328E-08

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

Summary : Denver Radium Case - Post Closure Resident
File : Post Closure Resident.RAD

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 1.000E+02 mrem/yr

0Nuclide (i)	t= 0.000E+00	1.000E+02	5.000E+02	1.000E+03	1.000E+04
K-40	*6.986E+06	*6.986E+06	*6.986E+06	*6.986E+06	*6.986E+06
Pb-210	*7.631E+13	*7.631E+13	*7.631E+13	*7.631E+13	*7.631E+13
Ra-226	4.099E+06	4.349E+06	5.516E+06	7.423E+06	1.556E+09
Th-230	1.892E+10	9.699E+07	2.190E+07	1.260E+07	6.080E+06
Th-232	*1.096E+05	*1.096E+05	*1.096E+05	*1.096E+05	*1.096E+05
U-234	*6.245E+09	*6.245E+09	*6.245E+09	2.749E+09	1.789E+08
U-238	*3.360E+05	*3.360E+05	*3.360E+05	*3.360E+05	*3.360E+05

*At specific activity limit

Summed Dose/Source Ratios DSR(i,t) in (mrem/yr)/(pCi/g)
and Single Radionuclide Soil Guidelines G(i,t) in pCi/g
at tmin = time of minimum single radionuclide soil guideline
and at tmax = time of maximum total dose = 39.53 ñ 0.08 years

0Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
K-40	3.000E+02	0.000E+00	5.568E-06	*6.986E+06	5.149E-06	*6.986E+06
Pb-210	4.000E+02	0.000E+00	1.079E-14	*7.631E+13	3.143E-15	*7.631E+13
Ra-226	4.000E+02	0.000E+00	2.440E-05	4.099E+06	2.383E-05	4.196E+06
Th-230	3.000E+02	7133 ñ *	1.667E-05	5.998E+06	4.182E-07	2.391E+08
Th-232	5.000E+01	116.6 ñ 0.2	7.992E-05	*1.096E+05	7.899E-05	*1.096E+05
U-234	3.000E+02	1.000E+04	5.589E-07	1.789E+08	7.543E-11	*6.245E+09
U-238	3.000E+02	0.000E+00	8.076E-08	*3.360E+05	8.004E-08	*3.360E+05

*At specific activity limit

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

0Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+02	5.000E+02	1.000E+03	1.000E+04
K-40	K-40	1.000E+00	1.671E-03	1.370E-03	6.208E-04	2.307E-04	4.214E-12
0Pb-210	Pb-210	1.000E+00	4.316E-12	1.907E-13	7.262E-19	1.222E-25	0.000E+00
Pb-210	Ra-226	1.000E+00	6.741E-14	4.001E-12	3.307E-12	2.458E-12	1.173E-14
Pb-210	Th-230	1.000E+00	7.320E-18	9.674E-14	5.786E-13	1.040E-12	2.208E-12
Pb-210	U-234	1.000E+00	1.650E-23	3.509E-17	1.237E-15	4.615E-15	7.493E-14
Pb-210	U-238	1.000E+00	0.000E+00	2.798E-21	5.554E-19	4.274E-18	6.346E-16
Pb-210	äDOSE(j)		4.383E-12	4.288E-12	3.887E-12	3.502E-12	2.295E-12
0Ra-226	Ra-226	1.000E+00	9.759E-03	9.196E-03	7.252E-03	5.389E-03	2.571E-05
Ra-226	Th-230	1.000E+00	1.586E-06	3.093E-04	1.370E-03	2.381E-03	4.934E-03
Ra-226	U-234	1.000E+00	4.758E-12	1.402E-07	3.119E-06	1.091E-05	1.677E-04
Ra-226	U-238	1.000E+00	3.372E-18	1.334E-11	1.484E-09	1.042E-08	1.423E-06
Ra-226	äDOSE(j)		9.761E-03	9.506E-03	8.625E-03	7.780E-03	5.129E-03
0Th-230	Th-230	1.000E+00	1.236E-13	1.235E-13	1.231E-13	1.225E-13	1.128E-13
Th-230	U-234	1.000E+00	5.564E-19	1.105E-16	5.252E-16	9.910E-16	4.125E-15
Th-230	U-238	1.000E+00	5.258E-25	1.569E-20	3.660E-19	1.356E-18	3.901E-17
Th-230	äDOSE(j)		1.236E-13	1.236E-13	1.236E-13	1.235E-13	1.169E-13
0Th-232	Th-232	1.000E+00	3.590E-16	3.590E-16	3.590E-16	3.590E-16	3.584E-16
0Ra-228	Th-232	1.000E+00	1.783E-05	3.073E-04	3.073E-04	3.073E-04	3.068E-04
0Th-228	Th-232	1.000E+00	2.388E-05	3.689E-03	3.688E-03	3.688E-03	3.682E-03
0U-234	U-234	1.000E+00	1.204E-14	1.177E-14	1.075E-14	9.589E-15	1.237E-15
U-234	U-238	1.000E+00	1.707E-20	3.354E-18	1.526E-17	2.724E-17	3.557E-17
U-234	äDOSE(j)		1.204E-14	1.177E-14	1.076E-14	9.617E-15	1.273E-15
0U-238	U-238	1.000E+00	2.423E-05	2.369E-05	2.165E-05	1.935E-05	2.561E-06

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

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+02	5.000E+02	1.000E+03	1.000E+04
K-40	K-40	1.000E+00	3.000E+02	2.461E+02	1.115E+02	4.143E+01	7.568E-07
Pb-210	Pb-210	1.000E+00	4.000E+02	1.767E+01	6.731E-05	1.133E-11	0.000E+00
Pb-210	Ra-226	1.000E+00	0.000E+00	3.649E+02	3.019E+02	2.243E+02	1.070E+00
Pb-210	Th-230	1.000E+00	0.000E+00	8.769E+00	5.276E+01	9.485E+01	2.015E+02
Pb-210	U-234	1.000E+00	0.000E+00	3.163E-03	1.127E-01	4.208E-01	6.837E+00
Pb-210	U-238	1.000E+00	0.000E+00	2.509E-07	5.053E-05	3.895E-04	5.791E-02
Pb-210	äS(j):		4.000E+02	3.914E+02	3.548E+02	3.196E+02	2.095E+02
Ra-226	Ra-226	1.000E+00	4.000E+02	3.769E+02	2.972E+02	2.209E+02	1.054E+00
Ra-226	Th-230	1.000E+00	0.000E+00	1.261E+01	5.609E+01	9.751E+01	2.022E+02
Ra-226	U-234	1.000E+00	0.000E+00	5.690E-03	1.276E-01	4.467E-01	6.870E+00
Ra-226	U-238	1.000E+00	0.000E+00	5.384E-07	6.062E-05	4.264E-04	5.832E-02
Ra-226	äS(j):		4.000E+02	3.896E+02	3.534E+02	3.188E+02	2.102E+02
Th-230	Th-230	1.000E+00	3.000E+02	2.997E+02	2.986E+02	2.973E+02	2.737E+02
Th-230	U-234	1.000E+00	0.000E+00	2.669E-01	1.273E+00	2.404E+00	1.001E+01
Th-230	U-238	1.000E+00	0.000E+00	3.770E-05	8.865E-04	3.287E-03	9.466E-02
Th-230	äS(j):		3.000E+02	3.000E+02	2.999E+02	2.997E+02	2.838E+02
Th-232	Th-232	1.000E+00	5.000E+01	5.000E+01	5.000E+01	4.999E+01	4.991E+01
Ra-228	Th-232	1.000E+00	0.000E+00	4.993E+01	4.993E+01	4.992E+01	4.984E+01
Th-228	Th-232	1.000E+00	0.000E+00	4.993E+01	4.993E+01	4.992E+01	4.984E+01
U-234	U-234	1.000E+00	3.000E+02	2.933E+02	2.677E+02	2.389E+02	3.082E+01
U-234	U-238	1.000E+00	0.000E+00	8.315E-02	3.798E-01	6.784E-01	8.864E-01
U-234	äS(j):		3.000E+02	2.933E+02	2.681E+02	2.396E+02	3.171E+01
U-238	U-238	1.000E+00	3.000E+02	2.933E+02	2.681E+02	2.396E+02	3.171E+01

BRF(i) is the branch fraction of the parent nuclide.
RESCALC.EXE execution time = 1.73 seconds

RESPONSE TO COMMENTS ON CLEAN HARBORS DEER TRAIL, LLC, RADIOACTIVE MATERIALS LICENSE APPLICATION, DOCKET NUMBER 5873

Colorado Department of Public Health and Environment
Request for Information April 20, 2005

ATTACHMENT 3: RESRAD Output for Post Closure Radon Inhalation Analysis

Radon Inhalation

Table of Contents

Part I: Mixture Sums and Single Radionuclide Guidelines

Summary : Radon Inhalation File: Radon - Inhalation2.RAD

Dose Conversion Factor (and Related) Parameter Summary

File: FGR 13 Morbidity

Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	K-40	1.240E-05	1.240E-05	DCF2(1)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(2)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(3)
B-1	Ra-228+D	5.080E-03	5.080E-03	DCF2(4)
B-1	Th-228+D	3.450E-01	3.450E-01	DCF2(5)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(6)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(7)
B-1	U-234	1.320E-01	1.320E-01	DCF2(8)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(9)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	K-40	1.860E-05	1.860E-05	DCF3(1)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(2)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(3)
D-1	Ra-228+D	1.440E-03	1.440E-03	DCF3(4)
D-1	Th-228+D	8.080E-04	8.080E-04	DCF3(5)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(6)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(7)
D-1	U-234	2.830E-04	2.830E-04	DCF3(8)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(9)
D-34	Food transfer factors:			
D-34	K-40 , plant/soil concentration ratio, dimensionless	3.000E-01	3.000E-01	RTF(1,1)
D-34	K-40 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-02	2.000E-02	RTF(1,2)
D-34	K-40 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	7.000E-03	7.000E-03	RTF(1,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(2,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(2,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(2,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(3,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(3,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(3,3)
D-34				
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(4,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(4,3)
D-34				
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(5,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(5,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(5,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(6,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(6,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(6,3)
D-34				
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(7,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(7,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(7,3)

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

Menu	Parameter	Current Value	Default	Parameter Name
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(8,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(8,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(8,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(9,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(9,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(9,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	K-40 , fish	1.000E+03	1.000E+03	BIOFAC(1,1)
D-5	K-40 , crustacea and mollusks	2.000E+02	2.000E+02	BIOFAC(1,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(2,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(2,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(3,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(3,2)
D-5				
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(4,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(4,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(5,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(5,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(6,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(6,2)
D-5				
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(7,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(7,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(8,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(8,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(9,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(9,2)

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)		3.300E+05	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)		1.000E+01	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)		1.000E+02	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)		2.500E+01	2.500E+01	---	BRDL
R011	Time since placement of material (yr)		0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)		1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)		1.000E+03	3.000E+00	---	T(3)
R011	Times for calculations (yr)		not used	1.000E+01	---	T(4)
R011	Times for calculations (yr)		not used	3.000E+01	---	T(5)
R011	Times for calculations (yr)		not used	1.000E+02	---	T(6)
R011	Times for calculations (yr)		not used	3.000E+02	---	T(7)
R011	Times for calculations (yr)		not used	1.000E+03	---	T(8)
R011	Times for calculations (yr)		not used	0.000E+00	---	T(9)
R011	Times for calculations (yr)		not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g):	K-40	3.000E+02	0.000E+00	---	S1(1)
R012	Initial principal radionuclide (pCi/g):	Pb-210	4.000E+02	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g):	Ra-226	4.000E+02	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g):	Th-230	3.000E+02	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g):	Th-232	3.000E+02	0.000E+00	---	S1(7)
R012	Initial principal radionuclide (pCi/g):	U-234	3.000E+02	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g):	U-238	3.000E+02	0.000E+00	---	S1(9)
R012	Concentration in groundwater (pCi/L):	K-40	not used	0.000E+00	---	W1(1)
R012	Concentration in groundwater (pCi/L):	Pb-210	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L):	Ra-226	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L):	Th-230	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L):	Th-232	not used	0.000E+00	---	W1(7)
R012	Concentration in groundwater (pCi/L):	U-234	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L):	U-238	not used	0.000E+00	---	W1(9)
R013	Cover depth (m)		1.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)		1.500E+00	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)		0.000E+00	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)		0.000E+00	1.000E-03	---	VCZ
R013	Contaminated zone total porosity		4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity		2.000E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)		1.000E+01	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter		5.300E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)		2.000E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)		not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient		5.000E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)		4.000E-01	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)		0.000E+00	2.000E-01	---	RI
R013	Irrigation mode		overhead	overhead	---	IDITCH
R013	Runoff coefficient		5.000E-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

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R014	Saturated zone effective porosity	2.000E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	2.000E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	1.000E+02	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	2.000E-02	2.000E-02	---	HGWT
R014	Saturated zone b parameter	5.300E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	1.000E+01	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	not used	1	---	NS
R015	Unsat. zone 1, thickness (m)	4.000E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.500E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.000E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	2.000E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	5.300E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	1.000E+01	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for K-40				
R016	Contaminated zone (cm**3/g)	5.500E+00	5.500E+00	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	5.500E+00	5.500E+00	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	5.500E+00	5.500E+00	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.172E-03	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for Pb-210				
R016	Contaminated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	1.000E+02	1.000E+02	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.654E-05	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Ra-226				
R016	Contaminated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	7.000E+01	7.000E+01	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	9.498E-05	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for Th-230				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.111E-07	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Th-232				
R016	Contaminated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCC(7)
R016	Unsaturated zone 1 (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCU(7,1)
R016	Saturated zone (cm**3/g)	6.000E+04	6.000E+04	---	DCNUCS(7)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.111E-07	ALEACH(7)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(7)
R016	Distribution coefficients for U-234				
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	1.328E-04	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for U-238				
R016	Contaminated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCU(9,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.328E-04	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for daughter Ra-228				
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	9.498E-05	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for daughter Th-228				
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	1.111E-07	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R017	Inhalation rate (m**3/yr)	5.256E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-05	1.000E-04	---	MLINH
R017	Exposure duration	1.000E+00	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	0.000E+00	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	5.000E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	not used	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	not used	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	not used	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	not used	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	not used	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	not used	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	not used	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	not used	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	not used	1.000E+00	---	FDW
R018	Contamination fraction of household water	1.000E+00	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	not used	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	not used	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	not used	5.000E-01	---	FR9
R018	Contamination fraction of plant food	not used	-1	---	FPLANT
R018	Contamination fraction of meat	not used	-1	---	FMEAT
R018	Contamination fraction of milk	not used	-1	---	FMILK
R019	Livestock fodder intake for meat (kg/day)	not used	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	not used	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	not used	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	not used	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	not used	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	not used	1.000E-04	---	MLFD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	not used	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	not used	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	1.000E+00	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	not used	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	not used	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	not used	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	not used	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	not used	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	not used	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	not used	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	not used	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	not used	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	not used	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	not used	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	not used	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	not used	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	not used	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	not used	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	not used	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	not used	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	not used	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	not used	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	not used	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (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
C14	DCF correction factor for gaseous forms of C14	not used	8.894E+01	---	CO2F
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	4.000E-01	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	5.000E-02	5.000E-02	---	PH2OCV

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	2.000E-06	2.000E-06	---	DIFCV
R021	in foundation material	not used	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 building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	code computed (time dependent)	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	code computed (time dependent)	DMFL
R021	Emanating power of Rn-222 gas	2.500E-01	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	1.500E-01	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	32	---	---	NPTS
TITL	Maximum number of integration points for dose	17	---	---	LYMAX
TITL	Maximum number of integration points for risk	257	---	---	KYMAX

Summary of Pathway Selections

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

Contaminated Zone Dimensions

Area:	330000.00 square meters
Thickness:	10.00 meters
Cover Depth:	1.00 meters

Initial Soil Concentrations, pCi/g

K-40	3.000E+02
Pb-210	4.000E+02
Ra-226	4.000E+02
Th-230	3.000E+02
Th-232	3.000E+02
U-234	3.000E+02
U-238	3.000E+02

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

t (years):	0.000E+00	1.000E+00	1.000E+03
TDOSE(t):	2.989E+01	2.989E+01	2.519E+01
M(t):	1.196E+00	1.195E+00	1.008E+00

0Maximum TDOSE(t): 2.989E+01 mrem/yr at t = 0.000E+00 years

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
K-40	1.393E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	3.596E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	8.133E-03	0.0003	0.000E+00	0.0000	2.988E+01	0.9995	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	1.321E-06	0.0000	0.000E+00	0.0000	4.854E-03	0.0002	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	2.085E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	3.975E-12	0.0000	0.000E+00	0.0000	1.457E-08	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	2.019E-05	0.0000	0.000E+00	0.0000	1.032E-14	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	9.756E-03	0.0003	0.000E+00	0.0000	2.988E+01	0.9997	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 0.000E+00 years
Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
K-40	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.393E-03	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.596E-12	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.988E+01	0.9998
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.855E-03	0.0002
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.085E-04	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.457E-08	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.019E-05	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.989E+01	1.0000

0*Sum of all water independent and dependent pathways.

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
Water Independent Pathways (Inhalation excludes radon)

Radio-Nuclide	Ground mrem/yr	Ground fract.	Inhalation mrem/yr	Inhalation fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	Soil mrem/yr	Soil fract.
K-40	1.391E-03	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	3.486E-12	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	8.129E-03	0.0003	0.000E+00	0.0000	2.986E+01	0.9992	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	3.963E-06	0.0000	0.000E+00	0.0000	1.456E-02	0.0005	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	9.863E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	2.776E-11	0.0000	0.000E+00	0.0000	1.019E-07	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	2.019E-05	0.0000	0.000E+00	0.0000	1.548E-13	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
íííííí	íííííííí	íííííí	íííííííí	íííííí	íííííííí	íííííí	íííííííí	íííííí	íííííííí	íííííí	íííííííí	íííííí	íííííííí	íííííí
Total	1.053E-02	0.0004	0.000E+00	0.0000	2.988E+01	0.9996	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

Total Dose Contributions TDOSE(i,p,t) for Individual Radionuclides (i) and Pathways (p)
As mrem/yr and Fraction of Total Dose At t = 1.000E+00 years
Water Dependent Pathways

Radio-Nuclide	Water mrem/yr	Water fract.	Fish mrem/yr	Fish fract.	Radon mrem/yr	Radon fract.	Plant mrem/yr	Plant fract.	Meat mrem/yr	Meat fract.	Milk mrem/yr	Milk fract.	All Pathways* mrem/yr	All Pathways* fract.
K-40	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.391E-03	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.486E-12	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.987E+01	0.9994
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.456E-02	0.0005
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	9.863E-04	0.0000
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.020E-07	0.0000
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.019E-05	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.989E+01	1.0000

0*Sum of all water independent and dependent pathways.

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

Radio-Nuclide	Ground		Inhalation		Radon		Plant		Meat		Milk		Soil	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	4.315E-04	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Pb-210	1.066E-25	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Ra-226	4.796E-03	0.0002	0.000E+00	0.0000	1.762E+01	0.6994	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-230	2.044E-03	0.0001	0.000E+00	0.0000	7.509E+00	0.2981	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Th-232	1.999E-02	0.0008	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-234	9.572E-06	0.0000	0.000E+00	0.0000	3.516E-02	0.0014	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
U-238	1.769E-05	0.0000	0.000E+00	0.0000	3.394E-05	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000
Total	2.729E-02	0.0011	0.000E+00	0.0000	2.516E+01	0.9989	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000

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

Radio-Nuclide	Water		Fish		Radon		Plant		Meat		Milk		All Pathways*	
	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.	mrem/yr	fract.
K-40	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	4.315E-04	0.0000
Pb-210	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.066E-25	0.0000
Ra-226	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.762E+01	0.6996
Th-230	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	7.511E+00	0.2982
Th-232	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	1.999E-02	0.0008
U-234	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	3.517E-02	0.0014
U-238	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	5.163E-05	0.0000
Total	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	0.000E+00	0.0000	2.519E+01	1.0000

0*Sum of all water independent and dependent pathways.

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

0Parent (i)	Product (j)	Branch Fraction*	DSR(j,t) t= 0.000E+00	(mrem/yr)/(pCi/g) 1.000E+00	1.000E+03
K-40	K-40	1.000E+00	4.642E-06	4.637E-06	1.438E-06
0Pb-210	Pb-210	1.000E+00	8.991E-15	8.715E-15	2.666E-28
0Ra-226	Ra-226	1.000E+00	7.471E-02	7.467E-02	4.405E-02
Ra-226	Pb-210	1.000E+00	1.404E-16	4.154E-16	5.464E-15
Ra-226	äDSR(j)		7.471E-02	7.467E-02	4.405E-02
0Th-230	Th-230	1.000E+00	3.434E-16	3.434E-16	3.403E-16
Th-230	Ra-226	1.000E+00	1.618E-05	4.854E-05	2.504E-02
Th-230	Pb-210	1.000E+00	2.033E-20	1.411E-19	2.978E-15
Th-230	äDSR(j)		1.618E-05	4.854E-05	2.504E-02
0Th-232	Th-232	1.000E+00	5.984E-18	5.984E-18	5.983E-18
Th-232	Ra-228	1.000E+00	2.971E-07	8.458E-07	5.125E-06
Th-232	Th-228	1.000E+00	3.980E-07	2.442E-06	6.151E-05
Th-232	äDSR(j)		6.951E-07	3.288E-06	6.663E-05
0U-234	U-234	1.000E+00	3.345E-17	3.344E-17	2.920E-17
U-234	Th-230	1.000E+00	1.546E-21	4.636E-21	2.879E-18
U-234	Ra-226	1.000E+00	4.856E-11	3.399E-10	1.172E-04
U-234	Pb-210	1.000E+00	4.583E-26	6.828E-25	1.349E-17
U-234	äDSR(j)		4.856E-11	3.399E-10	1.172E-04
0U-238	U-238	1.000E+00	6.730E-08	6.729E-08	5.893E-08
U-238	U-234	1.000E+00	4.741E-23	1.422E-22	8.295E-20
U-238	Th-230	1.000E+00	1.461E-27	1.022E-26	4.000E-21
U-238	Ra-226	1.000E+00	3.442E-17	5.162E-16	1.132E-07
U-238	Pb-210	1.000E+00	2.602E-32	8.020E-31	1.262E-20
U-238	äDSR(j)		6.730E-08	6.729E-08	1.721E-07

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

Single Radionuclide Soil Guidelines G(i,t) in pCi/g
Basic Radiation Dose Limit = 2.500E+01 mrem/yr

0Nuclide (i)	t= 0.000E+00	1.000E+00	1.000E+03
K-40	5.385E+06	5.392E+06	*6.986E+06
Pb-210	*7.631E+13	*7.631E+13	*7.631E+13
Ra-226	3.346E+02	3.348E+02	5.675E+02
Th-230	1.545E+06	5.150E+05	9.986E+02
Th-232	*1.096E+05	*1.096E+05	*1.096E+05
U-234	*6.245E+09	*6.245E+09	2.132E+05
U-238	*3.360E+05	*3.360E+05	*3.360E+05

Í
*At specific activity limit

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

0Nuclide (i)	Initial (pCi/g)	tmin (years)	DSR(i,tmin)	G(i,tmin) (pCi/g)	DSR(i,tmax)	G(i,tmax) (pCi/g)
K-40	3.000E+02	0.000E+00	4.642E-06	5.385E+06	4.642E-06	5.385E+06
Pb-210	4.000E+02	0.000E+00	8.991E-15	*7.631E+13	8.991E-15	*7.631E+13
Ra-226	4.000E+02	0.000E+00	7.471E-02	3.346E+02	7.471E-02	3.346E+02
Th-230	3.000E+02	1.000E+03	2.504E-02	9.986E+02	1.618E-05	1.545E+06
Th-232	3.000E+02	117.6 ñ 0.2	6.664E-05	*1.096E+05	6.951E-07	*1.096E+05
U-234	3.000E+02	1.000E+03	1.172E-04	2.132E+05	4.856E-11	*6.245E+09
U-238	3.000E+02	1.000E+03	1.721E-07	*3.360E+05	6.730E-08	*3.360E+05

*At specific activity limit

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

Nuclide (j)	Parent (i)	BRF(i)	DOSE(j,t), mrem/yr t= 0.000E+00	1.000E+00	1.000E+03
K-40	K-40	1.000E+00	1.393E-03	1.391E-03	4.315E-04
0Pb-210	Pb-210	1.000E+00	3.596E-12	3.486E-12	1.066E-25
Pb-210	Ra-226	1.000E+00	5.617E-14	1.662E-13	2.186E-12
Pb-210	Th-230	1.000E+00	6.100E-18	4.232E-17	8.933E-13
Pb-210	U-234	1.000E+00	1.375E-23	2.048E-22	4.048E-15
Pb-210	U-238	1.000E+00	0.000E+00	0.000E+00	3.787E-18
Pb-210	äDOSE(j)		3.653E-12	3.652E-12	3.083E-12
0Ra-226	Ra-226	1.000E+00	2.988E+01	2.987E+01	1.762E+01
Ra-226	Th-230	1.000E+00	4.855E-03	1.456E-02	7.511E+00
Ra-226	U-234	1.000E+00	1.457E-08	1.020E-07	3.517E-02
Ra-226	U-238	1.000E+00	1.033E-14	1.549E-13	3.395E-05
Ra-226	äDOSE(j)		2.989E+01	2.988E+01	2.517E+01
0Th-230	Th-230	1.000E+00	1.030E-13	1.030E-13	1.021E-13
Th-230	U-234	1.000E+00	4.637E-19	1.391E-18	8.636E-16
Th-230	U-238	1.000E+00	4.382E-25	3.067E-24	1.200E-18
Th-230	äDOSE(j)		1.030E-13	1.030E-13	1.030E-13
0Th-232	Th-232	1.000E+00	1.795E-15	1.795E-15	1.795E-15
0Ra-228	Th-232	1.000E+00	8.913E-05	2.537E-04	1.537E-03
0Th-228	Th-232	1.000E+00	1.194E-04	7.326E-04	1.845E-02
0U-234	U-234	1.000E+00	1.003E-14	1.003E-14	8.761E-15
U-234	U-238	1.000E+00	1.422E-20	4.266E-20	2.488E-17
U-234	äDOSE(j)		1.003E-14	1.003E-14	8.786E-15
0U-238	U-238	1.000E+00	2.019E-05	2.019E-05	1.768E-05

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

Individual Nuclide Soil Concentration
Parent Nuclide and Branch Fraction Indicated

Nuclide (j)	Parent (i)	BRF(i)	S(j,t), pCi/g t= 0.000E+00	1.000E+00	1.000E+03
K-40	K-40	1.000E+00	3.000E+02	2.996E+02	9.296E+01
Pb-210	Pb-210	1.000E+00	4.000E+02	3.877E+02	1.186E-11
Pb-210	Ra-226	1.000E+00	0.000E+00	1.224E+01	2.394E+02
Pb-210	Th-230	1.000E+00	0.000E+00	1.999E-03	9.778E+01
Pb-210	U-234	1.000E+00	0.000E+00	6.013E-09	4.429E-01
Pb-210	U-238	1.000E+00	0.000E+00	4.268E-15	4.141E-04
Pb-210	äS(j):		4.000E+02	4.000E+02	3.376E+02
Ra-226	Ra-226	1.000E+00	4.000E+02	3.998E+02	2.359E+02
Ra-226	Th-230	1.000E+00	0.000E+00	1.299E-01	1.005E+02
Ra-226	U-234	1.000E+00	0.000E+00	5.848E-07	4.702E-01
Ra-226	U-238	1.000E+00	0.000E+00	5.527E-13	4.536E-04
Ra-226	äS(j):		4.000E+02	3.999E+02	3.368E+02
Th-230	Th-230	1.000E+00	3.000E+02	3.000E+02	2.973E+02
Th-230	U-234	1.000E+00	0.000E+00	2.700E-03	2.514E+00
Th-230	U-238	1.000E+00	0.000E+00	3.828E-09	3.491E-03
Th-230	äS(j):		3.000E+02	3.000E+02	2.998E+02
Th-232	Th-232	1.000E+00	3.000E+02	3.000E+02	3.000E+02
Ra-228	Th-232	1.000E+00	0.000E+00	3.407E+01	2.997E+02
Th-228	Th-232	1.000E+00	0.000E+00	5.593E+00	2.997E+02
U-234	U-234	1.000E+00	3.000E+02	3.000E+02	2.619E+02
U-234	U-238	1.000E+00	0.000E+00	8.504E-04	7.436E-01
U-234	äS(j):		3.000E+02	3.000E+02	2.627E+02
U-238	U-238	1.000E+00	3.000E+02	3.000E+02	2.627E+02

BRF(i) is the branch fraction of the parent nuclide.
RESCALC.EXE execution time = 1.78 seconds