D.1 Radon Model Emanation Analysis

This appendix presents the radon emanation analyses performed in support of the EE/CA for the Ross-Adams Mine Site. The radon emanation analyses were used to determine the radon gas flux in pCi/m^2-s that would emanate through the mine rock piles (MRP) or the soil cover surface for Mine Rock Alternatives M-1 through M-5 described in the EE/CA. The flux values were then used in the calculation of the estimated dose/risk for each alternative, as described in Section 4.0 of the EE/CA and presented in Appendix F.

The radon exit flux through the MRP or soil cover was analyzed using the Nuclear Regulatory Commission (NRC) RADON model (NRC, 1989). The model utilizes the one - dimensional radon diffusion equation, which uses the physical and radiological characteristics of the mine rock and overlying materials to calculate the rate of radon emanation from the mine rock for Mine Rock Alternatives M-1 and M-2, or through the cover over the mine rock for Mine Rock Alternatives M-3, M-4, and M-5.

The RADON model (NRC, 1989) requires user input for select parameters. The following section describes the assumptions and calculations made to determine the input parameters. Assumed values were used when field and laboratory data was not available. Different profiles of MRP and soil cover were modeled depending on which Mine Rock Alternative was being analyzed.

D.1.1 Radon Model Input Parameters

There were two primary material types used in the radon analyses. They are the mine rock materials and the 2-foot thick cover constructed from on-site materials. The RADON model input parameters for the cover material were the same in each analysis. The assumptions for the MRPs varied according to the radiological properties of the mine rock for each MRP. The input parameters that varied among the MRPs for each of the analyses were the layer thickness and radium activity, which were calculated based on data collected in the SCR (Tetra Tech, 2010). The constant parameters for each type MRP material were the porosity, mass density, radon emanation coefficient, and the moisture content, all of which were estimated material properties.

On-Site Soil Cover

It was assumed that the cover material will be sourced from the Kendrick Creek delta in the intertidal zone. Kendrick Creek is a high energy creek with a low sediment load, and based on visual observations and the surrounding geomorphology, the Kendrick Creek delta is estimated to be composed of coarse material, ranging in size from fine - grained sand to boulders, and having less than 10 percent silt and clay. Screening of the delta material to a particle size less than 2-inch will be necessary to generate cover material. No laboratory test data exists for the on-site borrow material; therefore, properties of the cover material required as input parameters to the RADON model (NRC, 1989) were estimated, except for the thickness of the cover, which was set at 2 feet.

Input into the RADON model consists of layer thickness, density, long-term moisture content, porosity, radon emanation coefficient, and Ra-226 activity. Based on the assumptions listed

above, the material was classified as a gravelly and cobbley sand and parameters consistent with that material type were estimated for input into the model. The porosity of the material was calculated to be 0.31 based on the assumed parameters of mass density (1.93 g/cm^3) and the long-term gravimetric moisture content of 5 percent. The activity of the on-site borrow was estimated to be zero pCi/g, based on the assumption that the material comes from the non-mineralized zone and non-mine affected area. The radon emanation coefficient of the on-site soil cover was estimated to be 0.05, based on information from Sakoda et al. (2009). Sakoda et al. (2009) concludes that the radon emanation fraction of rock ranges from 0.6 to 4.6% (radon emanation coefficient of 0.006 to 0.046). The value of 0.05 was used in the RADON model as a conservative estimate for mine rock at the Site.

Mine Rock Piles

As described above, input into the RADON model consists of layer thickness, density, long-term moisture content, porosity, radon emanation coefficient, and Ra-226 activity. Except for the layer thickness and the Ra-226 activity, the input parameters for the MRPs were estimated. For modeling purposes, a thickness of 500 centimeters (cm) (approximately 16.4 feet) was conservatively used for each mine rock pile, except for the OSA materials. According to NRC guidance (NRC 1989), a 500 cm thickness represents an infinitely thick source for modeling radon flux. The existing thickness of all the MRPs are significantly less than 500 cm and grading of the MRPs for the Mine Rock Alternatives will not result in a thickness greater than 500 cm. The thickness of the OSA was maintained at two feet (61 cm), as described in the SCR (Tetra Tech, 2010). The Ra-226 activity of each MRP was calculated using the average measured gamma exposure rate for each pile and the established correlation between the gamma exposure rates and Ra-226 activity, as described in the SCR (Tetra Tech, 2010). The values used for the activity of each MRP and mine road embankments (900-Foot Level to the 700-Foot Level) are shown in Table D-1.

Table D-1. MRP Activity RADON Model Input Parameters

Location	Ra-226 Activity (pCi/g)
OSA	502
300-Foot Level MRP	129
700-Foot Level MRP	383
900-Foot Level North MRP	269
900-Foot Level South MRP	407
900-Foot Level Open Pit	383
Mine Road Embankment I	338
Mine Road Embankment II	198
Mine Road Embankment III	224
Mine Road Embankment IV	333
Mine Road Embankment V	275
Mine Road Embankment VI	244

Physical characteristics of the mine rock material were estimated for input into the RADON model. Estimates of density, long-term moisture content, and porosity were developed based on the

visual observations of the MRPs and information obtained during the ESI and previous investigations. Based on this available information, the material was classified as a gravel and cobble mixture with minimal fine-grained soil particles. Input parameters consistent with this soil type were used in the model. The porosity of the material was calculated to be 0.24 based on the estimated parameters of mass density of 2.18 g/cm^3 and the long-term gravimetric moisture content of 5 percent. The radon emanation coefficient of the MRP used was 0.05 and is based on Sakoda et al. (2009) as described above.

D.1.2 Radon Model Results

The RADON model was run using the input parameters previously described. The exit flux through the surface of either the MRP (Alternatives M-1 and M-2) or at the surface of the cover (Alternatives M-3 through M-5) was calculated by the RADON model. While the synthetic geomembrane will reduce radon emanation from the cover on the Open Pit repository for Alternatives M-4 and M-5, the reduction in radon was not included in the model calculations. Each subsection below describes the analyses performed for the respective Mine Rock Alternatives and provides the model inputs and calculated results. The model outputs for each alternative are included in Attachment D-1 to this appendix.

Mine Rock Alternative M-1 – No Action

The MRPs were the only material layer evaluated in Alternative M-1. The model requires a minimum of two layers be included, so the thickness of the MRP layer was divided into two equally thick layers. The regulatory guide on radon modeling (NRC, 1989) states, "*Because a thickness greater than about 100-200 cm is effectively equivalent to an infinitely thick radon source, a value of x_t = 500 cm represents an equivalent infinitely thick source of radon that may be used in the absence of more specific smaller values*." As described above, the default value of 500 cm was used in the analysis, except for the OSA. Radon model results and input parameters for Mine Rock Alternative M-1 are presented in Tables D-2a through D-2f and the model output files are included as Attachment D-1 Alternative 1. The number presented in bold in the bottom row of the tables represents the exit flux at the top of the MRP.

Table D-2a. OSA MRP RADON Model Parameters and Output

Layer	Thickness (cm)	Porosity	Density (g/cm^3)	Activity (pCi/g)	Emanation Coefficient	% MC	Exit Flux (pCi/m^2*s)
OSA	30.5	0.24	2.18	502	0.05	5	54.8
OSA	30.5	0.24	2.18	502	0.05	5	**83.7**

Table D-2b. 300-Foot Level MRP RADON Model Parameters and Output

Layer	Thickness (cm)	Porosity	Density (g/cm^3)	Activity (pCi/g)	Emanation Coefficient	% MC	Exit Flux (pCi/m^2*s)
300' Level MRP	250	0.24	2.18	129	0.05	5	0.4
300' Level MRP	250	0.24	2.18	129	0.05	5	**22.0**

Table D-2c. 700-Foot Level MRP RADON Model Parameters and Output

Layer	Thickness (cm)	Porosity	Density (g/cm^3)	Activity (pCi/g)	Emanation Coefficient	% MC	Exit Flux (pCi/m^2*s)
700' Level MRP	250	0.24	2.18	383	0.05	5	1.2
700' Level MRP	250	0.24	2.18	383	0.05	5	**65.4**

Table D-2d. 900-Foot Level North MRP RADON Model Parameters and Output

Layer	Thickness (cm)	Porosity	Density (g/cm^3)	Activity (pCi/g)	Emanation Coefficient	% MC	Exit Flux (pCi/m^2*s)
900' Level North MRP	250	0.24	2.18	269	0.05	5	0.8
900' Level North MRP	250	0.24	2.18	269	0.05	5	**45.9**

Table D-2e. 900-Foot Level South MRP RADON Model Parameters and Output

Layer	Thickness (cm)	Porosity	Density (g/cm^3)	Activity (pCi/g)	Emanation Coefficient	% MC	Exit Flux (pCi/m^2*s)
900' Level South MRP	250	0.24	2.18	407	0.05	5	1.3
900' Level South MRP	250	0.24	2.18	407	0.05	5	**69.4**

Table D-2f. 900-Foot Level Open Pit RADON Model Parameters and Output

Layer	Thickness (cm)	Porosity	Density (g/cm^3)	Activity (pCi/g)	Emanation Coefficient	% MC	Exit Flux (pCi/m^2*s)
900' Level Open Pit	250	0.24	2.18	383	0.05	5	1.2
900' Level Open Pit	250	0.24	2.18	383	0.05	5	**65.4**

Mine Rock Alternative M-2 – In Place Stabilization with Stormwater and Institutional Controls

For modeling purposes, the RADON model analysis for Alternative M-2 is similar to that conducted for Alternative M-1. Alternative M-2 includes regrading of some areas of the existing MRPs, but generally the thickest section of the pile remains in place and therefore the profile modeled is the same as in Alternative M-1. Therefore, the exit flux at the top surface of each MRPs is the same as those calculated for Alternative M-1. Radon model results and input parameters are presented in Tables D-2a through D-2f and the model output files are included as Attachment D-1 Alternative 2.

Mine Rock Alternative M-3 – Cover in Place

Mine Rock Alternative M-3 involves regrading the existing MRPs to 3:1 slopes (horizontal:vertical) and placement of a 2-foot thick cover over the MRP. This RADON analysis includes the input parameters discussed above for both the cover and the MRP. The default thickness of 500 cm for the MRPs was used as previously described, except for the OSA. Radon model results and input parameters are presented as Tables D-3a through D-3f and the model output files are included as Attachment D-1 Alternative 3. The number presented in bold in the bottom row of the tables represents the exit flux at the top of the MRP.

Table D-3a. OSA On-site RADON Model Parameters and Output

Parameter	Thickness (cm)	Porosity	Density (g/cm^3)	Activity (pCi/g)	Emanation Coefficient	% MC	Exit Flux (pCi/m^2*s)
OSA	61	0.24	2.18	502	0.05	5	39.5
On-Site Cover	61	0.31	1.93	0	0.05	5	**33.5**

Table D-3b. 300-Foot Level On-site RADON Model Parameters and Output

Parameter	Thickness (cm)	Porosity	Density (g/cm^3)	Activity (pCi/g)	Emanation Coefficient	% MC	Exit Flux (pCi/m^2*s)
300' Level MRP	500	0.24	2.18	129	0.05	5	17.5
On-Site Cover	61	0.31	1.93	0	0.05	5	**14.9**

Table D-3c. 700-Foot Level On-site RADON Model Parameters and Output

Parameter	Thickness (cm)	Porosity	Density (g/cm^3)	Activity (pCi/g)	Emanation Coefficient	% MC	Exit Flux (pCi/m^2*s)
700' Level MRP	500	0.24	2.18	383	0.05	5	52.0
On-Site Cover	61	0.31	1.93	0	0.05	5	**44.1**

Table D-3d. 900-Foot Level North MRP On-site RADON Model Parameters and Output

Parameter	Thickness (cm)	Porosity	Density (g/cm^3)	Activity (pCi/g)	Emanation Coefficient	% MC	Exit Flux (pCi/m^2*s)
900' Level North MRP	500	0.24	2.18	269	0.05	5	36.6
On-Site Cover	61	0.31	1.93	0	0.05	5	**31.0**

Table D-3e. 900-Foot Level South MRP On-site RADON Model Parameters and Output

Parameter	Thickness (cm)	Porosity	Density (g/cm^3)	Activity (pCi/g)	Emanation Coefficient	% MC	Exit Flux (pCi/m^2*s)
900' Level South MRP	500	0.24	2.18	407	0.05	5	55.3
On-Site Cover	61	0.31	1.93	0	0.05	5	**46.9**

Table D-3f. 900-Foot Level Open Pit On-site RADON Model Parameters and Output

Parameter	Thickness (cm)	Porosity	Density (g/cm^3)	Activity (pCi/g)	Emanation Coefficient	% MC	Exit Flux (pCi/m^2*s)
900' Level Open Pit	500	0.24	2.18	383	0.05	5	52.0
On-Site Cover	61	0.31	1.93	0	0.05	5	**44.1**

Mine Rock Alternative M-4 – Excavation, Consolidation and Cover at Mine Affected Areas

Mine Rock Alternative M-4 includes consolidating the OSA at the 300-Foot Level MRP, and consolidating the roads, 700-Foot Level and 900-Foot Level MRPs at the Open Pit. Therefore, the actual thickness of each layer was calculated based on the volumes of material and available areas within these repositories. The positioning of materials was assumed to be sequenced by placing the material with the highest activity at the bottom of the profile and placing materials with decreasing levels of activity upwards within the pile. At the top of the MRP profile a 2-foot thick cover of the on-site material was placed. The mine road embankments are included in the 900-Foot Level Open Pit profile and the activity assigned to that layer was a weighted average of the six mine road embankments. Radon model results and input parameters are presented as Tables D-4a through D-4b. The radon model output files are included as Attachment D-1 Alternative 4. The number presented in bold in the bottom row of the tables represents the exit flux through the cover at the top of the MRP.

Table D-4a. Alternative M-4 – 300-Foot Level MRP Repository RADON Model Parameters and Output

Layer	Thickness (cm)	Porosity	Density (g/cm^3)	Activity (pCi/g)	Emanation Coefficient	% MC	Exit Flux (pCi/m^2*s)
300' Level MRP	500	0.24	2.18	129	0.05	5	31.3
OSA	305	0.24	2.18	502	0.05	5	33.9
300' Level MRP	153	0.24	2.18	129	0.05	5	24.0
On-site Cover	61	0.31	1.93	0	0.05	5	**20.0**

Table D-4b. Alternative M-4 – Open Pit Repository RADON Model Parameters and Output

Layer	Thickness (cm)	Porosity	Density (g/cm^3)	Activity (pCi/g)	Emanation Coefficient	% MC	Exit Flux (pCi/m^2*s)
900' Level South MRP	18	0.24	2.18	407	0.05	5	41.4
700' Level MRP	226	0.24	2.18	383	0.05	5	9.3
Mine Road Embankments	92	0.24	2.18	281	0.05	5	4.6
900' Level North MRP	263	0.24	2.18	269	0.05	5	36.7
On-site Cover	61	0.31	1.93	0	0.05	5	**31.2**

Mine Rock Alternative M-5 – Excavation, Consolidation in Open Pit Repository

Mine Rock Alternative M-5 includes consolidating all of the MRPs and road embankment materials at the Open Pit. The layer thickness calculations, sequential placement of the layers, and weighted average activity of the mine road embankments were all assumed using the same methods described for Alternative M-4. At the top of the MRP profile, a 2-foot thick cover of the on-site material was placed. The radon model result and input parameters are presented as Table D-5 and the model output files are included as Attachment D-1 Alternative 5. The number presented in bold in the bottom row of the tables represents the exit flux through the cover at the top of the MRP.

Table D-5. Alternative M-5 – Open Pit MRP RADON Model Parameters and Output

Layer	Thickness (cm)	Porosity	Density (g/cm^3)	Activity (pCi/g)	Emanation Coefficient	% MC	Exit Flux (pCi/m^2*s)
OSA	171	0.24	2.18	502	0.05	5	6.1
900' Level South MRP	18	0.24	2.18	407	0.05	5	5.7
700' Level MRP	226	0.24	2.18	383	0.05	5	7.5
Mine Road Embankments	22	0.24	2.18	281	0.05	5	12.1
900' Level North MRP	61	0.24	2.18	269	0.05	5	15.9
300' Level MRP	204	0.24	2.18	129	0.05	5	19.1
On-site Cover	61	0.31	1.93	0	0.05	5	**16.2**

D.1.3 References

Tetra Tech, Inc. (Tt) 2010. Final Site Characterization Report, Ross-Adams Mine Site. Prepared for Dawn Mining Company, LLC and Newmont USA Limited. November 30

U.S. Nuclear Regulatory Commission (NRC), 1989. Calculation of Radon Flux Attenuation by Earthen Uranium Mill Tailings Covers. Regulatory Guide 3.64, U.S. Nuclear Regulatory Commission, Office of Nuclear Regulatory Research. June.

D.2 Gamma Radiation Analysis

The software program MicroShield® (Grove Software, 2010) is a dose assessment program used to design shields for gamma radiation, and estimate source strength from radiation measurements. It is used to calculate gamma radiation through a shield, such as an earthen cover. At the Ross Adams Site, MicroShield® was used to calculate exposure rates from calculated concentrations of uranium and thorium decay products in the mine features. The MicroShield® program was used to calculate gamma radiation exposure rates through 2 feet of cover for Mine Rock Alternatives M-3, M-4, and M-5. The gamma radiation exposure rates through the cover were calculated for the OSA, 300-Foot Level mine rock pile, 700-Foot Level mine rock pile, and 900-Foot Level mine rock piles.

As described in the text of the report, Alternatives M-3 through M-5 assume that cover materials be sourced on-site from Kendrick Creek delta in the intertidal zone. Based on visual observations and the surrounding geomorphology, the Kendrick Creek delta is estimated to be composed of coarse material, ranging in size from fine - grained sand to boulders, with less than 10 percent silt and clay. These physical properties of the cover material were input into the MicroShield® software.

A combination of GPS-based gamma radiation measurements and soil samples collected at the Site (Tetra Tech, 2010) were used to estimate the U-238 and Th-232 decay chain radionuclide activity concentrations for materials at specific mine rock locations. The two decay chains are complex, with gamma radiation over a large range of energies emitted by radionuclides throughout each chain. Simple approximation methods, often used to estimate shield material thickness for a single nuclide or decay chain, are insufficient for the Ross Adams Site. Dimensions of probable mine affected areas were developed for the MicroShield®, consistent with those shown in the figures of the mine affected areas shown in Section 6.0 of the EE/CA report. Data from the SCR (Tetra Tech, 2010) was used to support 42 executions of the current version of MicroShield® (Grove Software, 2010). Values of the other variables selected to support each code execution listed in the 42 input and output reports included as Attachments D-2.1 through D-2.5 to this Appendix. The code output was used to develop curves of radiation exposure rates for compacted soil cover thicknesses ranging from 0.5 to 3.5 feet. Shield thickness vs. exposure rate curves were developed for the OSA, 300-Foot Level, 700-Foot Level, and the 900-Foot Level mine rock piles. It should be noted that the gamma radiation exposure rate estimates associated with the specific source materials were analyzed and that background radiation levels are not included in the calculated exposure rates. For Alternatives M-4 and M-5, where materials from different areas are consolidated into on-Site repositories, the materials will be strategically placed to position those with higher gamma radiation activity at the bottom of the pile, and those with the lowest gamma radiation activity at the top of the pile, in order to reduce external gamma radiation at the surface of the repository. For Alternative M-4, the gamma radiation through the cover material at the 300-Foot Level repository is the same as that calculated for the 300-Foot Level mine rock pile covered in place, and the gamma radiation through the cover at the Open Pit repository is the same as that calculated for the 900-Foot Level north mine rock

pile covered in place. For Alternative M-5, the gamma radiation through the cover material at the Open Pit repository is the same as that calculated for the 300-Foot Level covered in place.

Figures D-1 through D-3 present the code output at three levels of resolution. Figures D-1 through D-3 show the following:

- All six source areas (the OSA, 300-Foot Level, 700-Foot Level, 900-Foot Level mine rock piles, and the Open Pit) are attenuated to less than 6 uR/hr at compacted soil cover thicknesses of 2 feet.
- All source areas are attenuated to less than 2 uR/hr at cover thicknesses of 2.5 feet.
- All source areas are attenuated to less than 1 uR/hr at cover thicknesses of 3 feet.

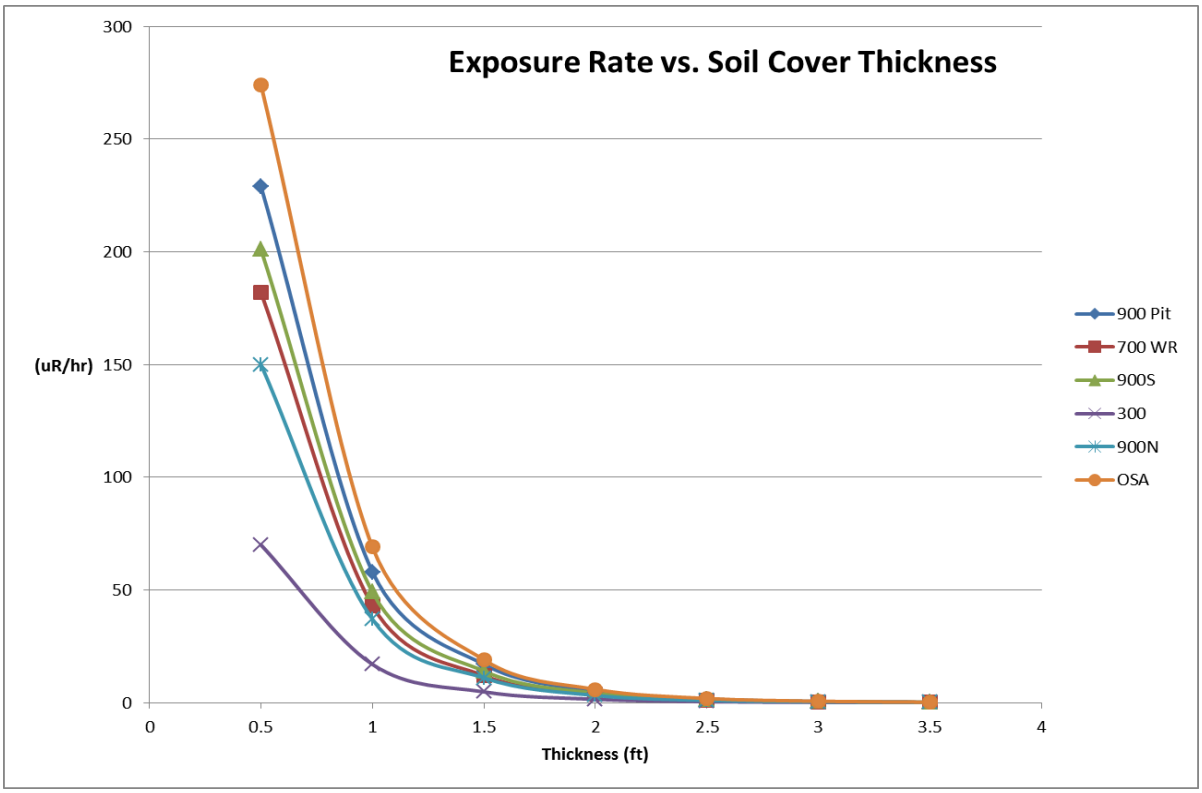


Figure D-1. MicroShield® Ross Adams Results: Exposure Rate vs. Soil Cover Thickness.

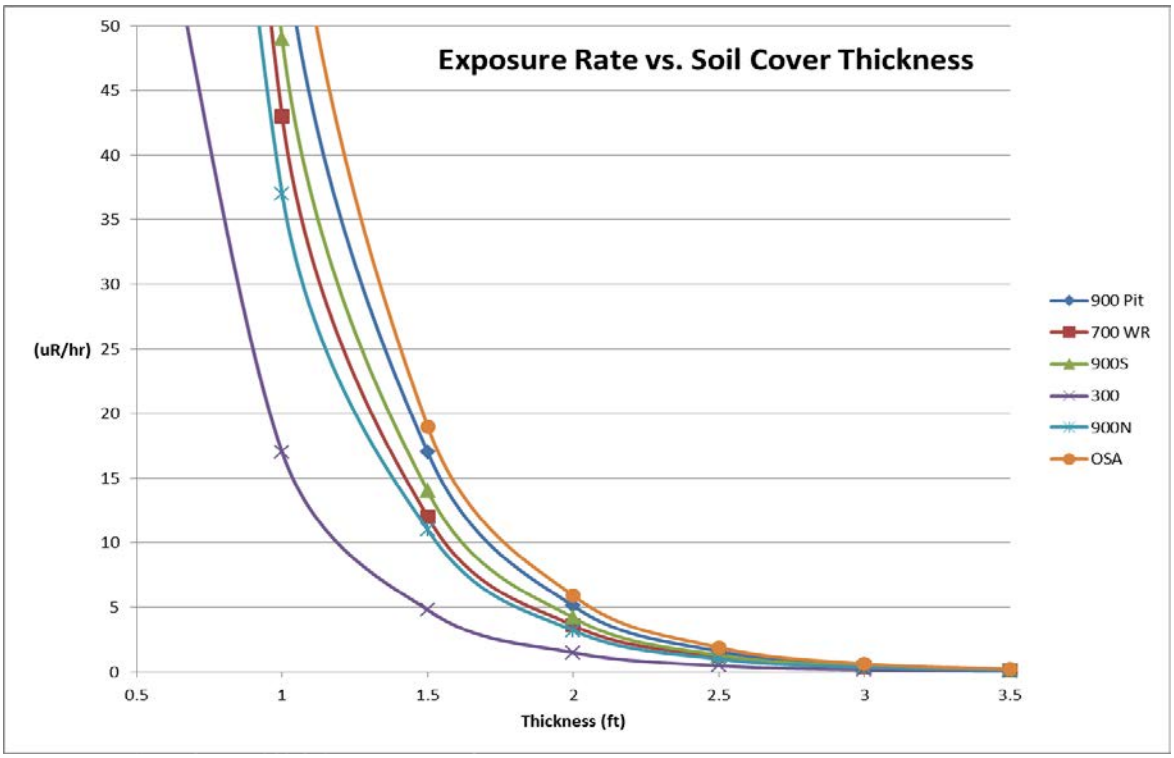


Figure D-2. Results for Shielded Exposure Rates up to 50 uR/hr.

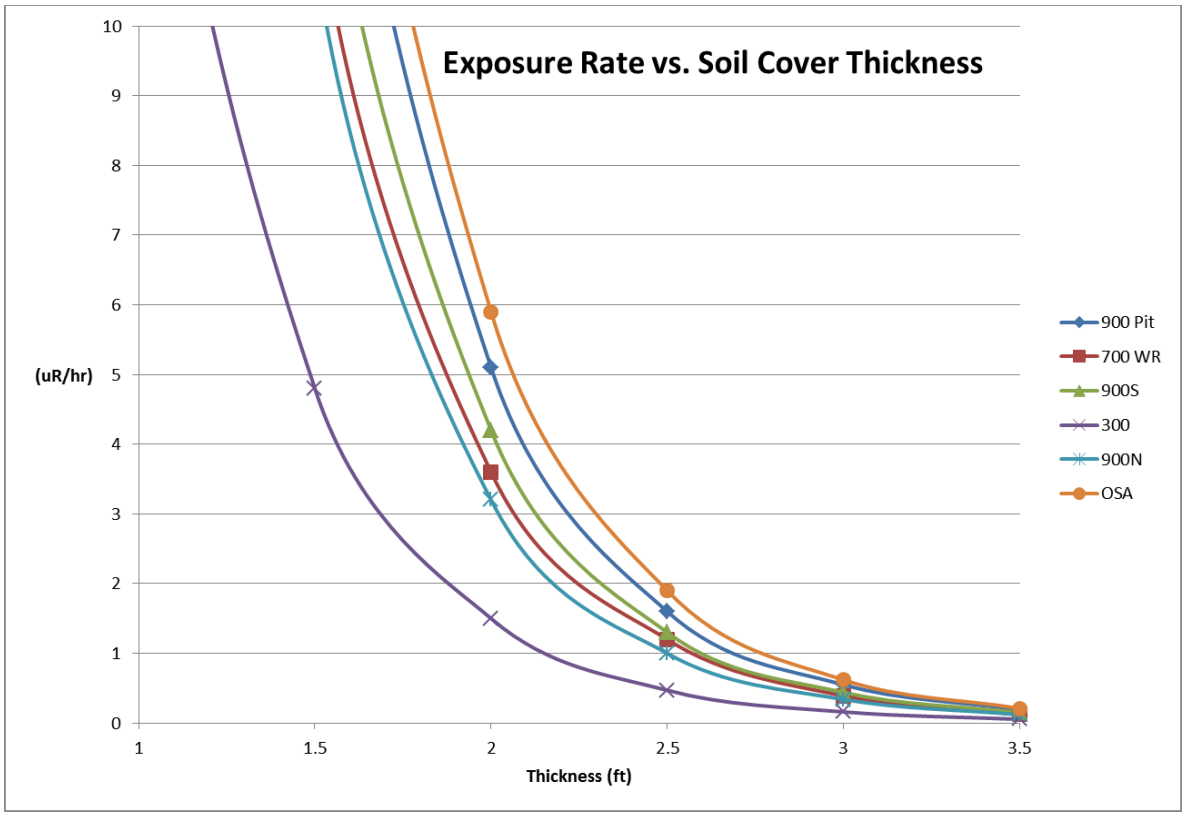


Figure D-3. Results for Shielded Exposure Rates up to 10 uR/hr.

ATTACHMENT D-1

RADON MODEL OUTPUT

ALTERNATIVE 1
RADON MODEL OUTPUT

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS
ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: 300

DESCRIPTION:

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	2	
NO LIMIT ON RADON FLUX		
LAYER THICKNESS NOT OPTIMIZED		
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.01	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 300' level waste rock

THICKNESS	250	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	129	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	1.230D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 2 300' level waste rock

THICKNESS	250	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	129	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	1.230D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
2	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-02

LAYER	DX	D	P	Q	XMS	RHO
1	2.500D+02	1.170D-02	2.400D-01	1.230D-04	4.542D-01	2.180
2	2.500D+02	1.170D-02	2.400D-01	1.230D-04	4.542D-01	2.180

BARE SOURCE FLUX FROM LAYER 1: 2.124D+01 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	2.500D+02	4.000D-01	5.554D+04
2	2.500D+02	2.201D+01	0.000D+00

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS
ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: 700

DESCRIPTION:

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	2	
NO LIMIT ON RADON FLUX		
LAYER THICKNESS NOT OPTIMIZED		
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.01	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 700' level waste rock

THICKNESS	250	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	383	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	3.653D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 2 700' level waste rock

THICKNESS	250	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	383	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	3.653D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
2	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-02

LAYER	DX	D	P	Q	XMS	RHO
1	2.500D+02	1.170D-02	2.400D-01	3.653D-04	4.542D-01	2.180
2	2.500D+02	1.170D-02	2.400D-01	3.653D-04	4.542D-01	2.180

BARE SOURCE FLUX FROM LAYER 1: 6.306D+01 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	2.500D+02	1.188D+00	1.649D+05
2	2.500D+02	6.535D+01	0.000D+00

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS
ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: 900 north

DESCRIPTION:

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	2	
NO LIMIT ON RADON FLUX		
LAYER THICKNESS NOT OPTIMIZED		
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.01	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 900' level north

THICKNESS	250	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	269	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	2.566D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 2 900' north MRP

THICKNESS	250	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	269	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	2.566D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
2	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-02

LAYER	DX	D	P	Q	XMS	RHO
1	2.500D+02	1.170D-02	2.400D-01	2.566D-04	4.542D-01	2.180
2	2.500D+02	1.170D-02	2.400D-01	2.566D-04	4.542D-01	2.180

BARE SOURCE FLUX FROM LAYER 1: 4.429D+01 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	2.500D+02	8.342D-01	1.158D+05
2	2.500D+02	4.590D+01	0.000D+00

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS
ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: 900' open pit

DESCRIPTION:

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	2	
NO LIMIT ON RADON FLUX		
LAYER THICKNESS NOT OPTIMIZED		
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.01	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 900 open pit

THICKNESS	250	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	383	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	3.653D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 2 900 open pit

THICKNESS	250	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	383	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	3.653D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

900' open pit.txt
DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
2	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-02

LAYER	DX	D	P	Q	XMS	RHO
1	2.500D+02	1.170D-02	2.400D-01	3.653D-04	4.542D-01	2.180
2	2.500D+02	1.170D-02	2.400D-01	3.653D-04	4.542D-01	2.180

BARE SOURCE FLUX FROM LAYER 1: 6.306D+01 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	2.500D+02	1.188D+00	1.649D+05
2	2.500D+02	6.535D+01	0.000D+00

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS
ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: 900' south

DESCRIPTION:

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	2	
NO LIMIT ON RADON FLUX		
LAYER THICKNESS NOT OPTIMIZED		
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.01	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 900' level south MRP

THICKNESS	250	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	407	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	3.882D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 2 900' level south MRP

THICKNESS	250	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	407	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	3.882D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

900' south.txt

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
2	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-02

LAYER	DX	D	P	Q	XMS	RHO
1	2.500D+02	1.170D-02	2.400D-01	3.882D-04	4.542D-01	2.180
2	2.500D+02	1.170D-02	2.400D-01	3.882D-04	4.542D-01	2.180

BARE SOURCE FLUX FROM LAYER 1: 6.701D+01 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	2.500D+02	1.262D+00	1.752D+05
2	2.500D+02	6.944D+01	0.000D+00

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS
ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: OSA

DESCRIPTION:

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	2	
NO LIMIT ON RADON FLUX		
LAYER THICKNESS NOT OPTIMIZED		
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.01	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 OSA waste rock

THICKNESS	250	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	502	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	4.788D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 2 OSA waste rock

THICKNESS	30.5	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	502	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	4.788D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
2	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-02

LAYER	DX	D	P	Q	XMS	RHO
1	2.500D+02	1.170D-02	2.400D-01	4.788D-04	4.542D-01	2.180
2	3.050D+01	1.170D-02	2.400D-01	4.788D-04	4.542D-01	2.180

BARE SOURCE FLUX FROM LAYER 1: 8.265D+01 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	2.500D+02	5.480D+01	7.424D+04
2	3.050D+01	8.374D+01	0.000D+00

ALTERNATIVE 2
RADON MODEL OUTPUT

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS
ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: 300

DESCRIPTION:

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	2	
NO LIMIT ON RADON FLUX		
LAYER THICKNESS NOT OPTIMIZED		
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.01	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 300' level waste rock

THICKNESS	250	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	129	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	1.230D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 2 300' level waste rock

THICKNESS	250	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	129	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	1.230D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
2	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-02

LAYER	DX	D	P	Q	XMS	RHO
1	2.500D+02	1.170D-02	2.400D-01	1.230D-04	4.542D-01	2.180
2	2.500D+02	1.170D-02	2.400D-01	1.230D-04	4.542D-01	2.180

BARE SOURCE FLUX FROM LAYER 1: 2.124D+01 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	2.500D+02	4.000D-01	5.554D+04
2	2.500D+02	2.201D+01	0.000D+00

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS
ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: 700

DESCRIPTION:

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	2	
NO LIMIT ON RADON FLUX		
LAYER THICKNESS NOT OPTIMIZED		
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.01	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 700' level waste rock

THICKNESS	250	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	383	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	3.653D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 2 700' level waste rock

THICKNESS	250	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	383	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	3.653D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
2	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-02

LAYER	DX	D	P	Q	XMS	RHO
1	2.500D+02	1.170D-02	2.400D-01	3.653D-04	4.542D-01	2.180
2	2.500D+02	1.170D-02	2.400D-01	3.653D-04	4.542D-01	2.180

BARE SOURCE FLUX FROM LAYER 1: 6.306D+01 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	2.500D+02	1.188D+00	1.649D+05
2	2.500D+02	6.535D+01	0.000D+00

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS
ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: 900 north

DESCRIPTION:

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	2	
NO LIMIT ON RADON FLUX		
LAYER THICKNESS NOT OPTIMIZED		
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.01	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 900' level north

THICKNESS	250	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	269	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	2.566D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 2 900' north MRP

THICKNESS	250	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	269	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	2.566D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

900 north.txt

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
2	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-02

LAYER	DX	D	P	Q	XMS	RHO
1	2.500D+02	1.170D-02	2.400D-01	2.566D-04	4.542D-01	2.180
2	2.500D+02	1.170D-02	2.400D-01	2.566D-04	4.542D-01	2.180

BARE SOURCE FLUX FROM LAYER 1: 4.429D+01 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	2.500D+02	8.342D-01	1.158D+05
2	2.500D+02	4.590D+01	0.000D+00

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS
ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: 900' open pit

DESCRIPTION:

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	2	
NO LIMIT ON RADON FLUX		
LAYER THICKNESS NOT OPTIMIZED		
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.01	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 900 open pit

THICKNESS	250	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	383	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	3.653D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 2 900 open pit

THICKNESS	250	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	383	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	3.653D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

900' open pit.txt
DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
2	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-02

LAYER	DX	D	P	Q	XMS	RHO
1	2.500D+02	1.170D-02	2.400D-01	3.653D-04	4.542D-01	2.180
2	2.500D+02	1.170D-02	2.400D-01	3.653D-04	4.542D-01	2.180

BARE SOURCE FLUX FROM LAYER 1: 6.306D+01 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	2.500D+02	1.188D+00	1.649D+05
2	2.500D+02	6.535D+01	0.000D+00

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS
ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: 900' south

DESCRIPTION:

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	2	
NO LIMIT ON RADON FLUX		
LAYER THICKNESS NOT OPTIMIZED		
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.01	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 900' level south MRP

THICKNESS	250	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	407	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	3.882D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 2 900' level south MRP

THICKNESS	250	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	407	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	3.882D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

900' south.txt

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
2	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-02

LAYER	DX	D	P	Q	XMS	RHO
1	2.500D+02	1.170D-02	2.400D-01	3.882D-04	4.542D-01	2.180
2	2.500D+02	1.170D-02	2.400D-01	3.882D-04	4.542D-01	2.180

BARE SOURCE FLUX FROM LAYER 1: 6.701D+01 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	2.500D+02	1.262D+00	1.752D+05
2	2.500D+02	6.944D+01	0.000D+00

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS
ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: OSA

DESCRIPTION:

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	2	
NO LIMIT ON RADON FLUX		
LAYER THICKNESS NOT OPTIMIZED		
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.01	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 OSA waste rock

THICKNESS	250	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	502	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	4.788D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 2 OSA waste rock

THICKNESS	30.5	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	502	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	4.788D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
2	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-02

LAYER	DX	D	P	Q	XMS	RHO
1	2.500D+02	1.170D-02	2.400D-01	4.788D-04	4.542D-01	2.180
2	3.050D+01	1.170D-02	2.400D-01	4.788D-04	4.542D-01	2.180

BARE SOURCE FLUX FROM LAYER 1: 8.265D+01 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	2.500D+02	5.480D+01	7.424D+04
2	3.050D+01	8.374D+01	0.000D+00

ALTERNATIVE 3
RADON MODEL OUTPUT

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS
ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: 300' Level

DESCRIPTION:

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	2	
NO LIMIT ON RADON FLUX		
LAYER THICKNESS NOT OPTIMIZED		
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.01	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 300' Level Waste Rock

THICKNESS	500	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	129	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	1.230D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 2 On-site cover

THICKNESS	61	cm
POROSITY	.31	
MEASURED MASS DENSITY	1.93	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.311	
CALCULATED DIFFUSION COEFFICIENT	2.245D-02	cm^2 s^-1

300' level.txt

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
2	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-02

LAYER	DX	D	P	Q	XMS	RHO
1	5.000D+02	1.170D-02	2.400D-01	1.230D-04	4.542D-01	2.180
2	6.100D+01	2.245D-02	3.100D-01	0.000D+00	3.113D-01	1.930

BARE SOURCE FLUX FROM LAYER 1: 2.201D+01 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	5.000D+02	1.753D+01	1.190D+04
2	6.100D+01	1.487D+01	0.000D+00

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS
ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: 700' Level

DESCRIPTION:

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	2	
NO LIMIT ON RADON FLUX		
LAYER THICKNESS NOT OPTIMIZED		
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.01	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 700' Level Waste Rock

THICKNESS	500	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	383	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	3.653D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 2 On-site cover

THICKNESS	61	cm
POROSITY	.31	
MEASURED MASS DENSITY	1.93	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.311	
CALCULATED DIFFUSION COEFFICIENT	2.245D-02	cm^2 s^-1

700' Level.txt

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
2	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-02

LAYER	DX	D	P	Q	XMS	RHO
1	5.000D+02	1.170D-02	2.400D-01	3.653D-04	4.542D-01	2.180
2	6.100D+01	2.245D-02	3.100D-01	0.000D+00	3.113D-01	1.930

BARE SOURCE FLUX FROM LAYER 1: 6.534D+01 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	5.000D+02	5.204D+01	3.534D+04
2	6.100D+01	4.414D+01	0.000D+00

900' North.txt

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS
ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: 900' North

DESCRIPTION:

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	2	
NO LIMIT ON RADON FLUX		
LAYER THICKNESS NOT OPTIMIZED		
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.01	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 900' Level North WRD

THICKNESS	500	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	269	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	2.566D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 2 On-site Cover

THICKNESS	61	cm
POROSITY	.31	
MEASURED MASS DENSITY	1.93	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.311	
CALCULATED DIFFUSION COEFFICIENT	2.245D-02	cm^2 s^-1

900' North.txt

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
2	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-02

LAYER	DX	D	P	Q	XMS	RHO
1	5.000D+02	1.170D-02	2.400D-01	2.566D-04	4.542D-01	2.180
2	6.100D+01	2.245D-02	3.100D-01	0.000D+00	3.113D-01	1.930

BARE SOURCE FLUX FROM LAYER 1: 4.589D+01 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	5.000D+02	3.655D+01	2.482D+04
2	6.100D+01	3.100D+01	0.000D+00

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS
ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: 900' Open Pit

DESCRIPTION:

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	2	
NO LIMIT ON RADON FLUX		
LAYER THICKNESS NOT OPTIMIZED		
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.01	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 Open Pit

THICKNESS	500	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	383	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	3.653D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 2 On-site cover

THICKNESS	61	cm
POROSITY	.31	
MEASURED MASS DENSITY	1.93	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.311	
CALCULATED DIFFUSION COEFFICIENT	2.245D-02	cm^2 s^-1

900' Open pit.txt

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
2	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-02

LAYER	DX	D	P	Q	XMS	RHO
1	5.000D+02	1.170D-02	2.400D-01	3.653D-04	4.542D-01	2.180
2	6.100D+01	2.245D-02	3.100D-01	0.000D+00	3.113D-01	1.930

BARE SOURCE FLUX FROM LAYER 1: 6.534D+01 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	5.000D+02	5.204D+01	3.534D+04
2	6.100D+01	4.414D+01	0.000D+00

900' South WRD.txt

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS
ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: 900' South

DESCRIPTION:

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	2	
NO LIMIT ON RADON FLUX		
LAYER THICKNESS NOT OPTIMIZED		
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.01	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 900' Level South WRD

THICKNESS	500	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	407	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	3.882D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 2 On-site cover

THICKNESS	61	cm
POROSITY	.31	
MEASURED MASS DENSITY	1.93	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.311	
CALCULATED DIFFUSION COEFFICIENT	2.245D-02	cm^2 s^-1

900' South WRD.txt

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
2	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-02

LAYER	DX	D	P	Q	XMS	RHO
1	5.000D+02	1.170D-02	2.400D-01	3.882D-04	4.542D-01	2.180
2	6.100D+01	2.245D-02	3.100D-01	0.000D+00	3.113D-01	1.930

BARE SOURCE FLUX FROM LAYER 1: 6.944D+01 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	5.000D+02	5.530D+01	3.755D+04
2	6.100D+01	4.690D+01	0.000D+00

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS
ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: OSA

DESCRIPTION: 2' thick

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	2	
NO LIMIT ON RADON FLUX		
LAYER THICKNESS NOT OPTIMIZED		
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.01	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 OSA Waste Rock

THICKNESS	61	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	502	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	4.788D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 2 On-site cover

THICKNESS	61	cm
POROSITY	.31	
MEASURED MASS DENSITY	1.93	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.311	
CALCULATED DIFFUSION COEFFICIENT	2.245D-02	cm^2 s^-1

OSA 2' thick.txt

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
2	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-02

LAYER	DX	D	P	Q	XMS	RHO
1	6.100D+01	1.170D-02	2.400D-01	4.788D-04	4.542D-01	2.180
2	6.100D+01	2.245D-02	3.100D-01	0.000D+00	3.113D-01	1.930

BARE SOURCE FLUX FROM LAYER 1: 4.625D+01 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	6.100D+01	3.946D+01	2.680D+04
2	6.100D+01	3.347D+01	0.000D+00

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS
ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: Alt 4 300 level

DESCRIPTION:

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	4	
NO LIMIT ON RADON FLUX		
LAYER THICKNESS NOT OPTIMIZED		
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.001	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 300' MRP

THICKNESS	500	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	129	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	1.230D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 2 OSA

THICKNESS	305	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	502	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	4.788D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

□
LAYER 3 300' MRP

ALT 4 300' level.txt

THICKNESS	153	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	129	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	1.230D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 4 On-site cover

THICKNESS	61	cm
POROSITY	.31	
MEASURED MASS DENSITY	1.93	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.311	
CALCULATED DIFFUSION COEFFICIENT	2.245D-02	cm^2 s^-1

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
4	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-03

LAYER	DX	D	P	Q	XMS	RHO
1	5.000D+02	1.170D-02	2.400D-01	1.230D-04	4.542D-01	2.180
2	3.050D+02	1.170D-02	2.400D-01	4.788D-04	4.542D-01	2.180
3	1.530D+02	1.170D-02	2.400D-01	1.230D-04	4.542D-01	2.180
4	6.100D+01	2.245D-02	3.100D-01	0.000D+00	3.113D-01	1.930

BARE SOURCE FLUX FROM LAYER 1: 2.201D+01 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	5.000D+02	-3.129D+01	1.417D+05
2	3.050D+02	3.389D+01	1.350D+05
3	1.530D+02	2.398D+01	1.628D+04
4	6.100D+01	2.033D+01	0.000D+00

ALTERNATIVE 4
RADON MODEL OUTPUT

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS
ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: Alt 4 open pit

DESCRIPTION:

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	5	
NO LIMIT ON RADON FLUX		
LAYER THICKNESS NOT OPTIMIZED		
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.01	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 900' south MRP

THICKNESS	18	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	407	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	3.882D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 2 700' MRP

THICKNESS	226	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	383	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	3.653D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

□
LAYER 3 Mine Road Embankments

THICKNESS	92	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	281	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	2.680D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 4 900' North MRP

THICKNESS	263	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	269	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	2.566D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 5 On-site cover

THICKNESS	61	cm
POROSITY	.31	
MEASURED MASS DENSITY	1.93	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.311	
CALCULATED DIFFUSION COEFFICIENT	2.245D-02	cm^2 s^-1

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
5	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-02

LAYER	DX	D	P	Q	XMS	RHO
1	1.800D+01	1.170D-02	2.400D-01	3.882D-04	4.542D-01	2.180
2	2.260D+02	1.170D-02	2.400D-01	3.653D-04	4.542D-01	2.180
3	9.200D+01	1.170D-02	2.400D-01	2.680D-04	4.542D-01	2.180
4	2.630D+02	1.170D-02	2.400D-01	2.566D-04	4.542D-01	2.180
5	6.100D+01	2.245D-02	3.100D-01	0.000D+00	3.113D-01	1.930

BARE SOURCE FLUX FROM LAYER 1: 1.476D+01 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

ALT 4 Open pit.txt

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	1.800D+01	-4.144D-01	1.704D+05
2	2.260D+02	9.284D+00	1.490D+05
3	9.200D+01	4.633D+00	1.287D+05
4	2.630D+02	3.677D+01	2.497D+04
5	6.100D+01	3.118D+01	0.000D+00

ALTERNATIVE 5
RADON MODEL OUTPUT

ALT 5 open pit.txt

-----*****! RADON !*****-----

Version 1.2 - MAY 22, 1989 - G.F. Birchard tel.# (301)492-7000
U.S. Nuclear Regulatory Commission Office of Research

RADON FLUX, CONCENTRATION AND TAILINGS COVER THICKNESS
ARE CALCULATED FOR MULTIPLE LAYERS

OUTPUT FILE: Alt 5 Open Pit

DESCRIPTION:

CONSTANTS

RADON DECAY CONSTANT	.0000021	s^-1
RADON WATER/AIR PARTITION COEFFICIENT	.26	
DEFAULT SPECIFIC GRAVITY OF COVER & TAILINGS	2.65	

GENERAL INPUT PARAMETERS

LAYERS OF COVER AND TAILINGS	7	
NO LIMIT ON RADON FLUX		
LAYER THICKNESS NOT OPTIMIZED		
DEFAULT SURFACE RADON CONCENTRATION	0	pCi l^-1
SURFACE FLUX PRECISION	.001	pCi m^-2 s^-1

LAYER INPUT PARAMETERS

LAYER 1 OSA

THICKNESS	171	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	502	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	4.788D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 2 900' South MRP

THICKNESS	18	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	407	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	3.882D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

□
LAYER 3 700' MRP

THICKNESS	226	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	383	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	3.653D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 4 Mine Road Embankments

THICKNESS	22	cm
CALCULATED POROSITY	0.177	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	281	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	3.627D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.615	
CALCULATED DIFFUSION COEFFICIENT	4.558D-03	cm^2 s^-1

LAYER 5 900' North MRP

THICKNESS	61	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	269	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	2.566D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 6 300' MRP

THICKNESS	204	cm
POROSITY	.24	
MEASURED MASS DENSITY	2.18	g cm^-3
MEASURED RADIUM ACTIVITY	129	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	1.230D-04	pCi cm^-3 s^-1
WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.454	
CALCULATED DIFFUSION COEFFICIENT	1.170D-02	cm^2 s^-1

LAYER 7 On-site Cover

THICKNESS	61	cm
POROSITY	.31	
MEASURED MASS DENSITY	1.93	g cm^-3
MEASURED RADIUM ACTIVITY	0	pCi/g^-1
MEASURED EMANATION COEFFICIENT	.05	
CALCULATED SOURCE TERM CONCENTRATION	0.000D+00	pCi cm^-3 s^-1

WEIGHT % MOISTURE	5	%
MOISTURE SATURATION FRACTION	.311	
CALCULATED DIFFUSION COEFFICIENT	2.245D-02	cm^2 s^-1

DATA SENT TO THE FILE `RNDATA' ON DRIVE A:

N	F01	CN1	ICOST	CRITJ	ACC
7	-1.000D+00	0.000D+00	0	0.000D+00	1.000D-03

LAYER	DX	D	P	Q	XMS	RHO
1	1.710D+02	1.170D-02	2.400D-01	4.788D-04	4.542D-01	2.180
2	1.800D+01	1.170D-02	2.400D-01	3.882D-04	4.542D-01	2.180
3	2.260D+02	1.170D-02	2.400D-01	3.653D-04	4.542D-01	2.180
4	2.200D+01	4.558D-03	1.774D-01	3.627D-04	6.146D-01	2.180
5	6.100D+01	1.170D-02	2.400D-01	2.566D-04	4.542D-01	2.180
6	2.040D+02	1.170D-02	2.400D-01	1.230D-04	4.542D-01	2.180
7	6.100D+01	2.245D-02	3.100D-01	0.000D+00	3.113D-01	1.930

BARE SOURCE FLUX FROM LAYER 1: 7.651D+01 pCi m^-2 s^-1

RESULTS OF THE RADON DIFFUSION CALCULATIONS

LAYER	THICKNESS (cm)	EXIT FLUX (pCi m^-2 s^-1)	EXIT CONC. (pCi l^-1)
1	1.710D+02	6.106D+00	1.911D+05
2	1.800D+01	5.715D+00	1.873D+05
3	2.260D+02	7.463D+00	1.555D+05
4	2.200D+01	1.214D+01	1.015D+05
5	6.100D+01	1.593D+01	9.469D+04
6	2.040D+02	1.908D+01	1.296D+04
7	6.100D+01	1.618D+01	0.000D+00

ATTACHMENT D-2.1

MICROSHIELD® INPUT AND OUTPUT DETAILED RESULTS FOR OSA

MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

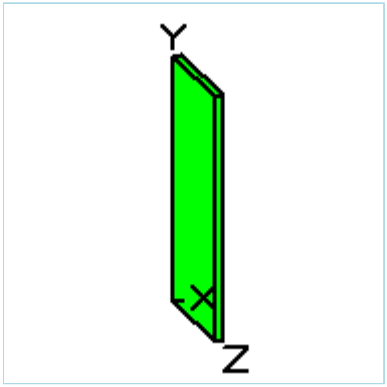
Filename	Run Date	Run Time	Duration
7Feb.msd	February 8, 2011	6:20:27 PM	00:00:00

Project Info	
Case Title	OSA
Description	0.5 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	304.8 cm (10 ft 0.0 in)
Width	4.4e+3 cm (145 ft 0.0 in)
Height	9.2e+3 cm (303 ft 0.0 in)

Dose Points			
A	**X**	**Y**	**Z**
#1	411.48 cm (13 ft 6.0 in)	4.6e+3 cm (151 ft)	2.2e+3 cm (72 ft)

Shields			
Shield N	**Dimension**	**Material**	**Density**
Source	1.24e+10 cm³	Quartz-Pegmatite	2.18
Shield 1	15.24 cm	Soil	1.8
Air Gap		Air	0.00122



Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Bi-210	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Bi-212	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Bi-214	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Pb-210	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Pb-212	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Pb-214	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Po-210	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Po-212	3.4835e+000	1.2889e+011	2.8000e-004	1.0360e+001
Po-214	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Po-216	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Po-218	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Ra-224	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Ra-226	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001

Ra-228	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Rn-220	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Rn-222	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Th-228	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Th-230	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Th-232	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Th-234	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Tl-208	1.9906e+000	7.3651e+010	1.6000e-004	5.9200e+000
U-234	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
U-238	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001

Buildup: The material reference is Shield 1 Integration Parameters	
X Direction	10
Y Direction	20
Z Direction	20

Results					
Energy (MeV)	**Activity (Photons/sec)**	**Fluence Rate MeV/cm²/sec No Buildup**	**Fluence Rate MeV/cm²/sec With Buildup**	**Exposure Rate mR/hr No Buildup**	**Exposure Rate mR/hr With Buildup**
0.015	5.491e+11	6.107e-223	2.419e-24	5.238e-224	2.075e-25
0.04	2.024e+09	3.503e-17	1.265e-16	1.549e-19	5.593e-19
0.05	2.670e+10	3.698e-10	2.265e-09	9.852e-13	6.034e-12
0.06	2.305e+10	1.437e-07	1.322e-06	2.853e-10	2.625e-09
0.08	2.030e+11	2.085e-04	2.968e-03	3.299e-07	4.696e-06
0.1	4.357e+10	3.578e-04	6.417e-03	5.474e-07	9.817e-06
0.15	8.669e+09	6.048e-04	1.201e-02	9.960e-07	1.978e-05
0.2	1.621e+11	3.161e-02	5.820e-01	5.579e-05	1.027e-03
0.3	1.563e+11	1.047e-01	1.504e+00	1.987e-04	2.852e-03
0.4	1.984e+11	3.016e-01	3.451e+00	5.876e-04	6.723e-03
0.5	3.705e+10	1.043e-01	9.853e-01	2.048e-04	1.934e-03
0.6	3.092e+11	1.428e+00	1.150e+01	2.787e-03	2.245e-02
0.8	1.113e+11	1.107e+00	7.001e+00	2.106e-03	1.332e-02
1.0	2.738e+11	4.891e+00	2.585e+01	9.016e-03	4.764e-02
1.5	1.229e+11	6.183e+00	2.434e+01	1.040e-02	4.095e-02
2.0	1.361e+11	1.370e+01	4.548e+01	2.119e-02	7.033e-02
3.0	7.350e+10	1.839e+01	4.938e+01	2.496e-02	6.700e-02
Totals	**2.437e+12**	**4.625e+01**	**1.701e+02**	**7.151e-02**	**2.743e-01**

MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

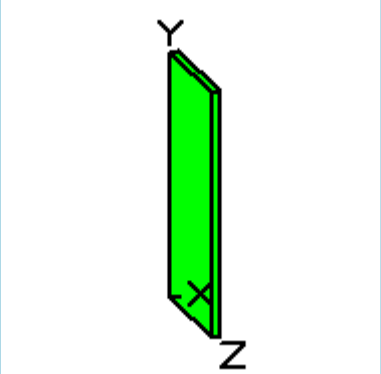
Filename	Run Date	Run Time	Duration
8Feb RA Basic.msd	February 8, 2011	6:24:33 PM	00:00:00

Project Info	
Case Title	OSA
Description	1 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	304.8 cm (10 ft 0.0 in)
Width	4.4e+3 cm (145 ft 0.0 in)
Height	9.2e+3 cm (303 ft 0.0 in)

Dose Points			
A	**X**	**Y**	**Z**
#1	426.72 cm (14 ft 0.0 in)	4.6e+3 cm (151 ft)	2.2e+3 cm (72 ft)

Shields			
Shield N	**Dimension**	**Material**	**Density**
Source	4.39e+05 ft³	Quartz-Pegmatite	2.18
Shield 1	1.0 ft	Soil	1.8
Air Gap		Air	0.00122



Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Bi-210	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Bi-212	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Bi-214	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Pb-210	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Pb-212	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Pb-214	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Po-210	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Po-212	3.4835e+000	1.2889e+011	2.8000e-004	1.0360e+001
Po-214	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Po-216	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Po-218	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Ra-224	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Ra-226	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001

Ra-228	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Rn-220	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Rn-222	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Th-228	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Th-230	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Th-232	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Th-234	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Tl-208	1.9906e+000	7.3651e+010	1.6000e-004	5.9200e+000
U-234	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
U-238	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001

Buildup: The material reference is Shield 1 Integration Parameters	
X Direction	10
Y Direction	20
Z Direction	20

Results					
Energy (MeV)	**Activity (Photons/sec)**	**Fluence Rate MeV/cm²/sec No Buildup**	**Fluence Rate MeV/cm²/sec With Buildup**	**Exposure Rate mR/hr No Buildup**	**Exposure Rate mR/hr With Buildup**
0.015	5.491e+11	0.000e+00	2.358e-24	0.000e+00	2.023e-25
0.04	2.024e+09	6.664e-28	8.233e-26	2.947e-30	3.641e-28
0.05	2.670e+10	1.283e-16	1.049e-15	3.417e-19	2.794e-18
0.06	2.305e+10	3.857e-12	5.368e-11	7.662e-15	1.066e-13
0.08	2.030e+11	1.892e-07	4.747e-06	2.994e-10	7.512e-09
0.1	4.357e+10	1.237e-06	4.428e-05	1.893e-09	6.774e-08
0.15	8.669e+09	7.071e-06	3.111e-04	1.164e-08	5.123e-07
0.2	1.621e+11	6.105e-04	2.564e-02	1.077e-06	4.526e-05
0.3	1.563e+11	3.488e-03	1.102e-01	6.616e-06	2.090e-04
0.4	1.984e+11	1.410e-02	3.356e-01	2.747e-05	6.539e-04
0.5	3.705e+10	6.235e-03	1.163e-01	1.224e-05	2.283e-04
0.6	3.092e+11	1.033e-01	1.569e+00	2.017e-04	3.063e-03
0.8	1.113e+11	1.066e-01	1.179e+00	2.029e-04	2.243e-03
1.0	2.738e+11	5.805e-01	5.054e+00	1.070e-03	9.315e-03
1.5	1.229e+11	1.036e+00	6.066e+00	1.743e-03	1.021e-02
2.0	1.361e+11	2.826e+00	1.312e+01	4.371e-03	2.029e-02
3.0	7.350e+10	4.820e+00	1.682e+01	6.539e-03	2.281e-02
Totals	**2.437e+12**	**9.497e+00**	**4.440e+01**	**1.417e-02**	**6.907e-02**

MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

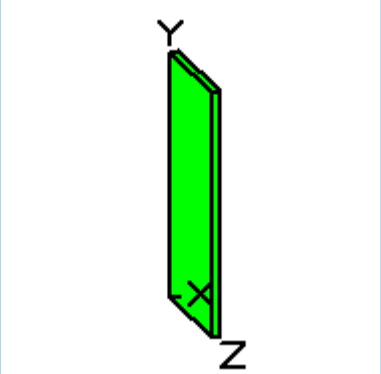
Filename	Run Date	Run Time	Duration
8Feb RA OSA.msd	February 8, 2011	6:26:40 PM	00:00:00

Project Info	
Case Title	OSA
Description	1.5 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	304.8 cm (10 ft 0.0 in)
Width	4.4e+3 cm (145 ft 0.0 in)
Height	9.2e+3 cm (303 ft 0.0 in)

Dose Points			
A	**X**	**Y**	**Z**
#1	441.96 cm (14 ft 6.0 in)	4.6e+3 cm (151 ft)	2.2e+3 cm (72 ft)

Shields			
Shield N	**Dimension**	**Material**	**Density**
Source	4.39e+05 ft³	Quartz-Pegmatite	2.18
Shield 1	1.5 ft	Soil	1.8
Air Gap		Air	0.00122



Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Bi-210	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Bi-212	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Bi-214	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Pb-210	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Pb-212	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Pb-214	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Po-210	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Po-212	3.4835e+000	1.2889e+011	2.8000e-004	1.0360e+001
Po-214	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Po-216	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Po-218	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Ra-224	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Ra-226	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001

Ra-228	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Rn-220	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Rn-222	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Th-228	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Th-230	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Th-232	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Th-234	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Tl-208	1.9906e+000	7.3651e+010	1.6000e-004	5.9200e+000
U-234	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
U-238	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001

Buildup: The material reference is Shield 1 Integration Parameters	
X Direction	10
Y Direction	20
Z Direction	20

Results					
Energy (MeV)	**Activity (Photons/sec)**	**Fluence Rate MeV/cm²/sec No Buildup**	**Fluence Rate MeV/cm²/sec With Buildup**	**Exposure Rate mR/hr No Buildup**	**Exposure Rate mR/hr With Buildup**
0.015	5.491e+11	0.000e+00	2.302e-24	0.000e+00	1.975e-25
0.04	2.024e+09	3.037e-38	7.834e-26	1.343e-40	3.465e-28
0.05	2.670e+10	7.542e-23	6.954e-22	2.009e-25	1.853e-24
0.06	2.305e+10	1.508e-16	2.802e-15	2.994e-19	5.566e-18
0.08	2.030e+11	2.219e-10	8.219e-09	3.512e-13	1.301e-11
0.1	4.357e+10	5.310e-09	3.084e-07	8.124e-12	4.719e-10
0.15	8.669e+09	9.941e-08	7.814e-06	1.637e-10	1.287e-08
0.2	1.621e+11	1.401e-05	1.083e-03	2.473e-08	1.912e-06
0.3	1.563e+11	1.364e-04	7.744e-03	2.587e-07	1.469e-05
0.4	1.984e+11	7.674e-04	3.153e-02	1.495e-06	6.143e-05
0.5	3.705e+10	4.311e-04	1.335e-02	8.462e-07	2.620e-05
0.6	3.092e+11	8.604e-03	2.094e-01	1.679e-05	4.088e-04
0.8	1.113e+11	1.172e-02	1.968e-01	2.230e-05	3.743e-04
1.0	2.738e+11	7.811e-02	9.872e-01	1.440e-04	1.820e-03
1.5	1.229e+11	1.946e-01	1.544e+00	3.274e-04	2.597e-03
2.0	1.361e+11	6.493e-01	3.912e+00	1.004e-03	6.050e-03
3.0	7.350e+10	1.396e+00	5.999e+00	1.894e-03	8.139e-03
Totals	**2.437e+12**	**2.339e+00**	**1.290e+01**	**3.411e-03**	**1.949e-02**

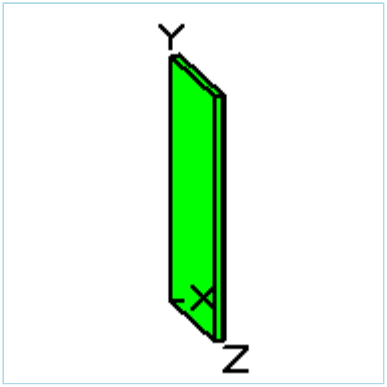
MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

Filename	Run Date	Run Time	Duration
8Feb RA OSA.msd	February 8, 2011	6:28:23 PM	00:00:00

Project Info	
Case Title	OSA
Description	2 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	304.8 cm (10 ft 0.0 in)
Width	4.4e+3 cm (145 ft 0.0 in)
Height	9.2e+3 cm (303 ft 0.0 in)



Dose Points			
A	**X**	**Y**	**Z**
#1	457.2 cm (15 ft)	4.6e+3 cm (151 ft)	2.2e+3 cm (72 ft)

Shields			
Shield N	**Dimension**	**Material**	**Density**
Source	4.39e+05 ft³	Quartz-Pegmatite	2.18
Shield 1	2.0 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Bi-210	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Bi-212	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Bi-214	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Pb-210	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Pb-212	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Pb-214	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Po-210	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Po-212	3.4835e+000	1.2889e+011	2.8000e-004	1.0360e+001
Po-214	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Po-216	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Po-218	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Ra-224	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Ra-226	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001

Ra-228	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Rn-220	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Rn-222	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Th-228	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Th-230	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Th-232	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Th-234	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Tl-208	1.9906e+000	7.3651e+010	1.6000e-004	5.9200e+000
U-234	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
U-238	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001

Buildup: The material reference is Shield 1 Integration Parameters	
X Direction	10
Y Direction	20
Z Direction	20

Results					
Energy (MeV)	**Activity (Photons/sec)**	**Fluence Rate MeV/cm²/sec No Buildup**	**Fluence Rate MeV/cm²/sec With Buildup**	**Exposure Rate mR/hr No Buildup**	**Exposure Rate mR/hr With Buildup**
0.015	5.491e+11	0.000e+00	2.250e-24	0.000e+00	1.930e-25
0.04	2.024e+09	2.324e-48	7.656e-26	1.028e-50	3.386e-28
0.05	2.670e+10	6.077e-29	3.125e-24	1.619e-31	8.325e-27
0.06	2.305e+10	7.378e-21	1.727e-19	1.465e-23	3.430e-22
0.08	2.030e+11	3.031e-13	1.509e-11	4.796e-16	2.388e-14
0.1	4.357e+10	2.584e-11	2.186e-09	3.954e-14	3.344e-12
0.15	8.669e+09	1.549e-09	1.928e-07	2.551e-12	3.175e-10
0.2	1.621e+11	3.535e-07	4.460e-05	6.240e-10	7.872e-08
0.3	1.563e+11	5.809e-06	5.288e-04	1.102e-08	1.003e-06
0.4	1.984e+11	4.527e-05	2.887e-03	8.822e-08	5.624e-06
0.5	3.705e+10	3.219e-05	1.498e-03	6.319e-08	2.941e-06
0.6	3.092e+11	7.715e-04	2.739e-02	1.506e-06	5.347e-05
0.8	1.113e+11	1.381e-03	3.245e-02	2.627e-06	6.172e-05
1.0	2.738e+11	1.122e-02	1.921e-01	2.069e-05	3.542e-04
1.5	1.229e+11	3.879e-02	3.941e-01	6.527e-05	6.631e-04
2.0	1.361e+11	1.577e-01	1.177e+00	2.438e-04	1.820e-03
3.0	7.350e+10	4.254e-01	2.177e+00	5.771e-04	2.953e-03
Totals	**2.437e+12**	**6.353e-01**	**4.005e+00**	**9.112e-04**	**5.915e-03**

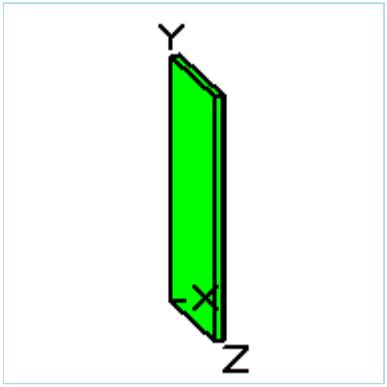
MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

Filename	Run Date	Run Time	Duration
8Feb RA OSA.msd	February 8, 2011	6:29:31 PM	00:00:00

Project Info	
Case Title	OSA
Description	2.5 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	304.8 cm (10 ft 0.0 in)
Width	4.4e+3 cm (145 ft 0.0 in)
Height	9.2e+3 cm (303 ft 0.0 in)



Dose Points			
A	**X**	**Y**	**Z**
#1	472.44 cm (15 ft 6.0 in)	4.6e+3 cm (151 ft)	2.2e+3 cm (72 ft)

Shields			
Shield N	**Dimension**	**Material**	**Density**
Source	4.39e+05 ft³	Quartz-Pegmatite	2.18
Shield 1	2.5 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Bi-210	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Bi-212	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Bi-214	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Pb-210	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Pb-212	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Pb-214	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Po-210	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Po-212	3.4835e+000	1.2889e+011	2.8000e-004	1.0360e+001
Po-214	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Po-216	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Po-218	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Ra-224	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Ra-226	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001

Ra-228	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Rn-220	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Rn-222	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Th-228	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Th-230	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Th-232	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Th-234	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Tl-208	1.9906e+000	7.3651e+010	1.6000e-004	5.9200e+000
U-234	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
U-238	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001

Buildup: The material reference is Shield 1 Integration Parameters	
X Direction	10
Y Direction	20
Z Direction	20

Results					
Energy (MeV)	**Activity (Photons/sec)**	**Fluence Rate MeV/cm²/sec No Buildup**	**Fluence Rate MeV/cm²/sec With Buildup**	**Exposure Rate mR/hr No Buildup**	**Exposure Rate mR/hr With Buildup**
0.015	5.491e+11	0.000e+00	2.201e-24	0.000e+00	1.888e-25
0.04	2.024e+09	2.444e-58	7.489e-26	1.081e-60	3.312e-28
0.05	2.670e+10	5.948e-35	3.057e-24	1.585e-37	8.143e-27
0.06	2.305e+10	4.153e-25	2.256e-23	8.248e-28	4.482e-26
0.08	2.030e+11	4.555e-16	2.859e-14	7.209e-19	4.525e-17
0.1	4.357e+10	1.361e-13	1.564e-11	2.083e-16	2.393e-14
0.15	8.669e+09	2.575e-11	4.706e-09	4.241e-14	7.750e-12
0.2	1.621e+11	9.459e-09	1.805e-06	1.670e-11	3.185e-09
0.3	1.563e+11	2.609e-07	3.527e-05	4.950e-10	6.690e-08
0.4	1.984e+11	2.807e-06	2.586e-04	5.470e-09	5.038e-07
0.5	3.705e+10	2.521e-06	1.651e-04	4.948e-09	3.241e-07
0.6	3.092e+11	7.240e-05	3.528e-03	1.413e-07	6.886e-06
0.8	1.113e+11	1.698e-04	5.287e-03	3.230e-07	1.006e-05
1.0	2.738e+11	1.680e-03	3.710e-02	3.097e-06	6.838e-05
1.5	1.229e+11	8.029e-03	1.005e-01	1.351e-05	1.690e-04
2.0	1.361e+11	3.966e-02	3.554e-01	6.133e-05	5.496e-04
3.0	7.350e+10	1.339e-01	7.965e-01	1.817e-04	1.081e-03
Totals	**2.437e+12**	**1.835e-01**	**1.299e+00**	**2.601e-04**	**1.885e-03**

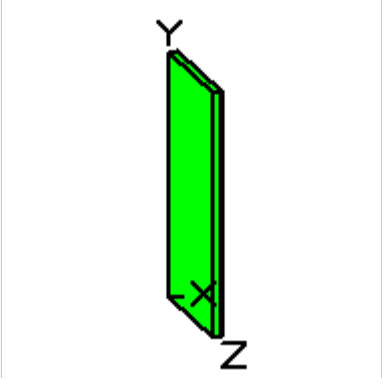
MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

Filename	Run Date	Run Time	Duration
8Feb RA OSA.msd	February 8, 2011	6:32:00 PM	00:00:00

Project Info	
Case Title	OSA
Description	3 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	304.8 cm (10 ft 0.0 in)
Width	4.4e+3 cm (145 ft 0.0 in)
Height	9.2e+3 cm (303 ft 0.0 in)



Dose Points			
A	**X**	**Y**	**Z**
#1	487.68 cm (16 ft)	4.6e+3 cm (151 ft)	2.2e+3 cm (72 ft)

Shields			
Shield N	**Dimension**	**Material**	**Density**
Source	4.39e+05 ft³	Quartz-Pegmatite	2.18
Shield 1	3.0 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Bi-210	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Bi-212	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Bi-214	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Pb-210	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Pb-212	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Pb-214	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Po-210	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Po-212	3.4835e+000	1.2889e+011	2.8000e-004	1.0360e+001
Po-214	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Po-216	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Po-218	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Ra-224	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Ra-226	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001

Ra-228	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Rn-220	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Rn-222	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Th-228	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Th-230	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Th-232	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Th-234	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Tl-208	1.9906e+000	7.3651e+010	1.6000e-004	5.9200e+000
U-234	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
U-238	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001

Buildup: The material reference is Shield 1 Integration Parameters	
X Direction	10
Y Direction	20
Z Direction	20

Results					
Energy (MeV)	**Activity (Photons/sec)**	**Fluence Rate MeV/cm²/sec No Buildup**	**Fluence Rate MeV/cm²/sec With Buildup**	**Exposure Rate mR/hr No Buildup**	**Exposure Rate mR/hr With Buildup**
0.015	5.491e+11	0.000e+00	2.154e-24	0.000e+00	1.848e-25
0.04	2.024e+09	3.136e-68	7.331e-26	1.387e-70	3.242e-28
0.05	2.670e+10	6.585e-41	2.993e-24	1.754e-43	7.972e-27
0.06	2.305e+10	2.556e-29	1.067e-23	5.077e-32	2.119e-26
0.08	2.030e+11	7.285e-19	5.657e-17	1.153e-21	8.952e-20
0.1	4.357e+10	7.551e-16	1.127e-13	1.155e-18	1.723e-16
0.15	8.669e+09	4.467e-13	1.136e-10	7.356e-16	1.871e-13
0.2	1.621e+11	2.632e-10	7.174e-08	4.645e-13	1.266e-10
0.3	1.563e+11	1.214e-08	2.312e-06	2.303e-11	4.386e-09
0.4	1.984e+11	1.799e-07	2.275e-05	3.506e-10	4.434e-08
0.5	3.705e+10	2.037e-07	1.791e-05	3.998e-10	3.515e-08
0.6	3.092e+11	7.004e-06	4.488e-04	1.367e-08	8.761e-07
0.8	1.113e+11	2.149e-05	8.531e-04	4.088e-08	1.623e-06
1.0	2.738e+11	2.586e-04	7.113e-03	4.766e-07	1.311e-05
1.5	1.229e+11	1.705e-03	2.553e-02	2.868e-06	4.295e-05
2.0	1.361e+11	1.022e-02	1.074e-01	1.580e-05	1.662e-04
3.0	7.350e+10	4.311e-02	2.928e-01	5.848e-05	3.972e-04
Totals	**2.437e+12**	**5.532e-02**	**4.342e-01**	**7.769e-05**	**6.220e-04**

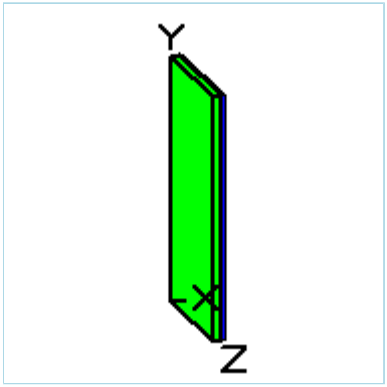
MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

Filename	Run Date	Run Time	Duration
8Feb RA OSA.msd	February 8, 2011	6:33:23 PM	00:00:00

Project Info	
Case Title	OSA
Description	3.5 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	304.8 cm (10 ft 0.0 in)
Width	4.4e+3 cm (145 ft 0.0 in)
Height	9.2e+3 cm (303 ft 0.0 in)



Dose Points			
A	**X**	**Y**	**Z**
#1	502.92 cm (16 ft 6.0 in)	4.6e+3 cm (151 ft)	2.2e+3 cm (72 ft)

Shields			
Shield N	**Dimension**	**Material**	**Density**
Source	4.39e+05 ft³	Quartz-Pegmatite	2.18
Shield 1	3.5 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Bi-210	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Bi-212	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Bi-214	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Pb-210	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Pb-212	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Pb-214	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Po-210	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Po-212	3.4835e+000	1.2889e+011	2.8000e-004	1.0360e+001
Po-214	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Po-216	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Po-218	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Ra-224	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Ra-226	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001

Ra-228	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Rn-220	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Rn-222	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Th-228	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Th-230	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Th-232	5.3496e+000	1.9794e+011	4.3000e-004	1.5910e+001
Th-234	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
Tl-208	1.9906e+000	7.3651e+010	1.6000e-004	5.9200e+000
U-234	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001
U-238	1.3685e+001	5.0635e+011	1.1000e-003	4.0700e+001

Buildup: The material reference is Shield 1 Integration Parameters	
X Direction	10
Y Direction	20
Z Direction	20

Results					
Energy (MeV)	**Activity (Photons/sec)**	**Fluence Rate MeV/cm²/sec No Buildup**	**Fluence Rate MeV/cm²/sec With Buildup**	**Exposure Rate mR/hr No Buildup**	**Exposure Rate mR/hr With Buildup**
0.015	5.491e+11	0.000e+00	2.111e-24	0.000e+00	1.810e-25
0.04	2.024e+09	4.568e-78	7.182e-26	2.020e-80	3.176e-28
0.05	2.670e+10	7.892e-47	2.932e-24	2.102e-49	7.810e-27
0.06	2.305e+10	1.668e-33	1.045e-23	3.313e-36	2.076e-26
0.08	2.030e+11	1.215e-21	1.151e-19	1.922e-24	1.821e-22
0.1	4.357e+10	4.338e-18	8.120e-16	6.637e-21	1.242e-18
0.15	8.669e+09	7.978e-15	2.711e-12	1.314e-17	4.465e-15
0.2	1.621e+11	7.522e-12	2.809e-09	1.328e-14	4.957e-12
0.3	1.563e+11	5.790e-10	1.494e-07	1.098e-12	2.833e-10
0.4	1.984e+11	1.180e-08	1.974e-06	2.300e-11	3.847e-09
0.5	3.705e+10	1.683e-08	1.919e-06	3.304e-11	3.766e-09
0.6	3.092e+11	6.925e-07	5.650e-05	1.352e-09	1.103e-07
0.8	1.113e+11	2.777e-06	1.364e-04	5.282e-09	2.595e-07
1.0	2.738e+11	4.060e-05	1.353e-03	7.483e-08	2.493e-06
1.5	1.229e+11	3.688e-04	6.475e-03	6.205e-07	1.089e-05
2.0	1.361e+11	2.681e-03	3.248e-02	4.146e-06	5.023e-05
3.0	7.350e+10	1.411e-02	1.080e-01	1.915e-05	1.465e-04
Totals	**2.437e+12**	**1.721e-02**	**1.485e-01**	**2.399e-05**	**2.105e-04**

ATTACHMENT D-2.2

MICROSHIELD® INPUT AND OUTPUT DETAILED RESULTS FOR 300-FOOT LEVEL MINE ROCK PILE

MicroShield 8.03
BobMeyer (8.03-0000)

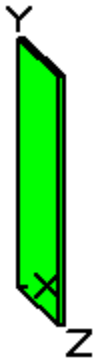
Date	By	Checked

Filename	Run Date	Run Time	Duration
8Feb RA 300WR.msd	August 28, 2011	8:27:48 PM	00:00:00

Project Info	
Case Title	300 WR
Description	0.5 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	304.8 cm (10 ft 0.0 in)
Width	6.6e+3 cm (216 ft 0.0 in)
Height	1.5e+4 cm (490 ft 0.0 in)

Dose Points			
A	X	Y	Z
#1	411.48 cm (13 ft 6.0 in)	7.5e+3 cm (245 ft 0.0 in)	3.3e+3 cm (108 ft 0.0 in)



Shields			
Shield N	Dimension	Material	Density
Source	1.06e+06 ft³	Quartz-Pegmatite	2.18
Shield 1	.5 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Bi-210	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Bi-212	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000

Bi-214	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Pb-210	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Pb-212	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Pb-214	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Po-210	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Po-212	2.2778e+000	8.4277e+010	7.6000e-005	2.8120e+000
Po-214	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Po-216	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Po-218	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Ra-224	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Ra-226	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Ra-228	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Rn-220	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Rn-222	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Th-228	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Th-230	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Th-232	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Th-234	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Tl-208	1.2887e+000	4.7683e+010	4.3000e-005	1.5910e+000
U-234	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
U-238	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001

Buildup: The material reference is Shield 1
Integration Parameters

X Direction	10
Y Direction	20
Z Direction	20

Results

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	3.462e+11	3.678e-265	7.375e-25	3.154e-266	6.326e-26

0.04	1.361e+09	2.978e-20	1.118e-19	1.317e-22	4.943e-22
0.05	1.637e+10	3.546e-12	2.383e-11	9.447e-15	6.348e-14
0.06	1.421e+10	4.221e-09	4.416e-08	8.385e-12	8.772e-11
0.08	1.294e+11	1.554e-05	2.625e-04	2.460e-08	4.154e-07
0.1	2.755e+10	3.698e-05	8.114e-04	5.658e-08	1.241e-06
0.15	5.807e+09	8.899e-05	2.194e-03	1.465e-07	3.612e-06
0.2	1.057e+11	5.090e-03	1.157e-01	8.983e-06	2.042e-04
0.3	9.876e+10	1.844e-02	3.190e-01	3.497e-05	6.052e-04
0.4	1.220e+11	5.546e-02	7.494e-01	1.081e-04	1.460e-03
0.5	2.398e+10	2.123e-02	2.323e-01	4.166e-05	4.560e-04
0.6	1.919e+11	2.892e-01	2.660e+00	5.644e-04	5.193e-03
0.8	7.172e+10	2.456e-01	1.738e+00	4.671e-04	3.305e-03
1.0	1.747e+11	1.115e+00	6.481e+00	2.055e-03	1.195e-02
1.5	7.696e+10	1.465e+00	6.189e+00	2.466e-03	1.041e-02
2.0	8.350e+10	3.289e+00	1.154e+01	5.086e-03	1.784e-02
3.0	4.759e+10	4.823e+00	1.346e+01	6.543e-03	1.827e-02
Totals	**1.538e+12**	**1.133e+01**	**4.349e+01**	**1.737e-02**	**6.969e-02**

MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

Filename	Run Date	Run Time	Duration
8Feb RA 300WR.msd	August 28, 2011	8:27:02 PM	00:00:00

Project Info

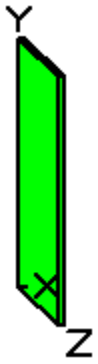
Case Title	300 WR
Description	1 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions

Length	304.8 cm (10 ft 0.0 in)
Width	6.6e+3 cm (216 ft 0.0 in)
Height	1.5e+4 cm (490 ft 0.0 in)

Dose Points

A	X	Y	Z
#1	426.72 cm (14 ft 0.0 in)	7.5e+3 cm (245 ft 0.0 in)	3.3e+3 cm (108 ft 0.0 in)



Shields

Shield N	Dimension	Material	Density
Source	1.06e+06 ft³	Quartz-Pegmatite	2.18
Shield 1	1.0 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Bi-210	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Bi-212	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000

Bi-214	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Pb-210	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Pb-212	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Pb-214	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Po-210	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Po-212	2.2778e+000	8.4277e+010	7.6000e-005	2.8120e+000
Po-214	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Po-216	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Po-218	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Ra-224	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Ra-226	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Ra-228	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Rn-220	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Rn-222	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Th-228	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Th-230	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Th-232	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Th-234	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Tl-208	1.2887e+000	4.7683e+010	4.3000e-005	1.5910e+000
U-234	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
U-238	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001

Buildup: The material reference is Shield 1
Integration Parameters

X Direction	10
Y Direction	20
Z Direction	20

Results

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	3.462e+11	0.000e+00	7.211e-25	0.000e+00	6.185e-26

0.04	1.361e+09	3.648e-32	2.616e-26	1.613e-34	1.157e-28
0.05	1.637e+10	2.436e-19	2.123e-18	6.489e-22	5.656e-21
0.06	1.421e+10	3.697e-14	5.810e-13	7.343e-17	1.154e-15
0.08	1.294e+11	6.928e-09	2.050e-07	1.096e-11	3.245e-10
0.1	2.755e+10	7.386e-08	3.239e-06	1.130e-10	4.956e-09
0.15	5.807e+09	7.015e-07	3.906e-05	1.155e-09	6.433e-08
0.2	1.057e+11	7.078e-05	3.776e-03	1.249e-07	6.664e-06
0.3	9.876e+10	4.748e-04	1.865e-02	9.007e-07	3.537e-05
0.4	1.220e+11	2.094e-03	6.062e-02	4.080e-06	1.181e-04
0.5	2.398e+10	1.056e-03	2.344e-02	2.073e-06	4.602e-05
0.6	1.919e+11	1.782e-02	3.160e-01	3.479e-05	6.169e-04
0.8	7.172e+10	2.082e-02	2.632e-01	3.960e-05	5.006e-04
1.0	1.747e+11	1.191e-01	1.162e+00	2.195e-04	2.142e-03
1.5	7.696e+10	2.289e-01	1.462e+00	3.850e-04	2.460e-03
2.0	8.350e+10	6.453e-01	3.218e+00	9.978e-04	4.976e-03
3.0	4.759e+10	1.230e+00	4.524e+00	1.669e-03	6.138e-03
Totals	**1.538e+12**	**2.266e+00**	**1.105e+01**	**3.353e-03**	**1.704e-02**

MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

Filename	Run Date	Run Time	Duration
8Feb RA 300WR.msd	August 28, 2011	8:26:14 PM	00:00:00

Project Info

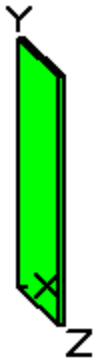
Case Title	300 WR
Description	1.5 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions

Length	304.8 cm (10 ft 0.0 in)
Width	6.6e+3 cm (216 ft 0.0 in)
Height	1.5e+4 cm (490 ft 0.0 in)

Dose Points

A	X	Y	Z
#1	441.96 cm (14 ft 6.0 in)	7.5e+3 cm (245 ft 0.0 in)	3.3e+3 cm (108 ft 0.0 in)



Shields

Shield N	Dimension	Material	Density
Source	1.06e+06 ft³	Quartz-Pegmatite	2.18
Shield 1	1.5 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Bi-210	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Bi-212	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000

Bi-214	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Pb-210	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Pb-212	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Pb-214	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Po-210	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Po-212	2.2778e+000	8.4277e+010	7.6000e-005	2.8120e+000
Po-214	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Po-216	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Po-218	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Ra-224	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Ra-226	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Ra-228	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Rn-220	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Rn-222	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Th-228	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Th-230	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Th-232	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Th-234	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Tl-208	1.2887e+000	4.7683e+010	4.3000e-005	1.5910e+000
U-234	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
U-238	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001

Buildup: The material reference is Shield 1
Integration Parameters

X Direction	10
Y Direction	20
Z Direction	20

Results

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	3.462e+11	0.000e+00	7.058e-25	0.000e+00	6.054e-26

0.04	1.361e+09	3.201e-43	2.561e-26	1.416e-45	1.133e-28
0.05	1.637e+10	5.443e-26	1.447e-24	1.450e-28	3.854e-27
0.06	1.421e+10	7.422e-19	1.545e-17	1.474e-21	3.068e-20
0.08	1.294e+11	5.332e-12	2.290e-10	8.438e-15	3.623e-13
0.1	2.755e+10	2.288e-10	1.601e-08	3.500e-13	2.449e-11
0.15	5.807e+09	7.786e-09	7.651e-07	1.282e-11	1.260e-09
0.2	1.057e+11	1.333e-06	1.301e-04	2.353e-09	2.296e-07
0.3	9.876e+10	1.591e-05	1.123e-03	3.017e-08	2.130e-06
0.4	1.220e+11	1.004e-04	5.014e-03	1.956e-07	9.770e-06
0.5	2.398e+10	6.561e-05	2.422e-03	1.288e-07	4.754e-06
0.6	1.919e+11	1.354e-03	3.866e-02	2.642e-06	7.545e-05
0.8	7.172e+10	2.133e-03	4.094e-02	4.056e-06	7.786e-05
1.0	1.747e+11	1.516e-02	2.156e-01	2.794e-05	3.973e-04
1.5	7.696e+10	4.154e-02	3.595e-01	6.990e-05	6.049e-04
2.0	8.350e+10	1.449e-01	9.368e-01	2.240e-04	1.449e-03
3.0	4.759e+10	3.522e-01	1.596e+00	4.778e-04	2.166e-03
Totals	**1.538e+12**	**5.574e-01**	**3.196e+00**	**8.067e-04**	**4.787e-03**

MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

Filename	Run Date	Run Time	Duration
8Feb RA 300WR.msd	August 28, 2011	8:24:39 PM	00:00:00

Project Info

Case Title	300 WR
Description	2 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions

Length	304.8 cm (10 ft 0.0 in)
Width	6.6e+3 cm (216 ft 0.0 in)
Height	1.5e+4 cm (490 ft 0.0 in)

Dose Points

A	X	Y	Z
#1	457.2 cm (15 ft)	7.5e+3 cm (245 ft 0.0 in)	3.3e+3 cm (108 ft 0.0 in)

Shields

Shield N	Dimension	Material	Density
Source	1.06e+06 ft³	Quartz-Pegmatite	2.18
Shield 1	2.0 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Bi-210	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Bi-212	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000

Bi-214	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Pb-210	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Pb-212	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Pb-214	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Po-210	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Po-212	2.2778e+000	8.4277e+010	7.6000e-005	2.8120e+000
Po-214	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Po-216	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Po-218	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Ra-224	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Ra-226	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Ra-228	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Rn-220	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Rn-222	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Th-228	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Th-230	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Th-232	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Th-234	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Tl-208	1.2887e+000	4.7683e+010	4.3000e-005	1.5910e+000
U-234	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
U-238	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001

Buildup: The material reference is Shield 1
Integration Parameters

X Direction	10
Y Direction	20
Z Direction	20

Results

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	3.462e+11	0.000e+00	6.916e-25	0.000e+00	5.932e-26

0.04	1.361e+09	9.408e-54	2.509e-26	4.161e-56	1.110e-28
0.05	1.637e+10	2.511e-32	9.343e-25	6.690e-35	2.489e-27
0.06	1.421e+10	2.483e-23	6.464e-22	4.931e-26	1.284e-24
0.08	1.294e+11	5.748e-15	3.244e-13	9.095e-18	5.133e-16
0.1	2.755e+10	9.286e-13	9.273e-11	1.421e-15	1.419e-13
0.15	5.807e+09	1.066e-10	1.628e-08	1.755e-13	2.681e-11
0.2	1.057e+11	3.020e-08	4.737e-06	5.331e-11	8.361e-09
0.3	9.876e+10	6.240e-07	6.952e-05	1.184e-09	1.319e-07
0.4	1.220e+11	5.542e-06	4.244e-04	1.080e-08	8.269e-07
0.5	2.398e+10	4.639e-06	2.547e-04	9.105e-09	5.000e-07
0.6	1.919e+11	1.160e-04	4.777e-03	2.263e-07	9.325e-06
0.8	7.172e+10	2.432e-04	6.478e-03	4.625e-07	1.232e-05
1.0	1.747e+11	2.127e-03	4.053e-02	3.920e-06	7.471e-05
1.5	7.696e+10	8.190e-03	9.015e-02	1.378e-05	1.517e-04
2.0	8.350e+10	3.499e-02	2.790e-01	5.411e-05	4.314e-04
3.0	4.759e+10	1.074e-01	5.773e-01	1.456e-04	7.833e-04
Totals	**1.538e+12**	**1.530e-01**	**9.990e-01**	**2.182e-04**	**1.464e-03**

MicroShield 8.03
BobMeyer (8.03-0000)

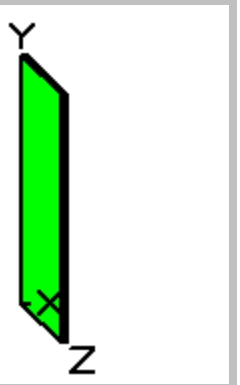
Date	By	Checked

Filename	Run Date	Run Time	Duration
8Feb RA 300WR.msd	August 28, 2011	8:23:56 PM	00:00:00

Project Info	
Case Title	300 WR
Description	2.5 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	304.8 cm (10 ft 0.0 in)
Width	6.6e+3 cm (216 ft 0.0 in)
Height	1.5e+4 cm (490 ft 0.0 in)

Dose Points			
A	X	Y	Z
#1	472.44 cm (15 ft 6.0 in)	7.5e+3 cm (245 ft 0.0 in)	3.3e+3 cm (108 ft 0.0 in)



Shields			
Shield N	Dimension	Material	Density
Source	1.06e+06 ft³	Quartz-Pegmatite	2.18
Shield 1	2.5 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Bi-210	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Bi-212	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000

Bi-214	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Pb-210	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Pb-212	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Pb-214	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Po-210	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Po-212	2.2778e+000	8.4277e+010	7.6000e-005	2.8120e+000
Po-214	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Po-216	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Po-218	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Ra-224	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Ra-226	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Ra-228	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Rn-220	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Rn-222	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Th-228	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Th-230	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Th-232	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Th-234	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Tl-208	1.2887e+000	4.7683e+010	4.3000e-005	1.5910e+000
U-234	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
U-238	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001

Buildup: The material reference is Shield 1
Integration Parameters

X Direction	10
Y Direction	20
Z Direction	20

Results

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	3.462e+11	0.000e+00	6.783e-25	0.000e+00	5.818e-26

0.04	1.361e+09	5.919e-64	2.461e-26	2.618e-66	1.088e-28
0.05	1.637e+10	1.830e-38	9.164e-25	4.876e-41	2.441e-27
0.06	1.421e+10	1.147e-27	3.304e-24	2.278e-30	6.563e-27
0.08	1.294e+11	7.669e-18	5.418e-16	1.214e-20	8.574e-19
0.1	2.755e+10	4.475e-15	5.959e-13	6.846e-18	9.117e-16
0.15	5.807e+09	1.667e-12	3.668e-10	2.745e-15	6.040e-13
0.2	1.057e+11	7.698e-10	1.790e-07	1.359e-12	3.159e-10
0.3	9.876e+10	2.706e-08	4.401e-06	5.133e-11	8.348e-09
0.4	1.220e+11	3.347e-07	3.642e-05	6.521e-10	7.096e-08
0.5	2.398e+10	3.560e-07	2.710e-05	6.987e-10	5.320e-08
0.6	1.919e+11	1.072e-05	5.985e-04	2.092e-08	1.168e-06
0.8	7.172e+10	2.965e-05	1.035e-03	5.640e-08	1.969e-06
1.0	1.747e+11	3.172e-04	7.730e-03	5.847e-07	1.425e-05
1.5	7.696e+10	1.699e-03	2.285e-02	2.859e-06	3.845e-05
2.0	8.350e+10	8.845e-03	8.409e-02	1.368e-05	1.300e-04
3.0	4.759e+10	3.402e-02	2.116e-01	4.615e-05	2.871e-04
Totals	**1.538e+12**	**4.492e-02**	**3.280e-01**	**6.335e-05**	**4.731e-04**

MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

Filename	Run Date	Run Time	Duration
8Feb RA 300WR.msd	August 28, 2011	8:22:49 PM	00:00:00

Project Info	
Case Title	300 WR
Description	3 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	304.8 cm (10 ft 0.0 in)
Width	6.6e+3 cm (216 ft 0.0 in)
Height	1.5e+4 cm (490 ft 0.0 in)

Dose Points			
A	**X**	**Y**	**Z**
#1	487.68 cm (16 ft)	7.5e+3 cm (245 ft 0.0 in)	3.3e+3 cm (108 ft 0.0 in)

Shields			
Shield N	**Dimension**	**Material**	**Density**
Source	1.06e+06 ft³	Quartz-Pegmatite	2.18
Shield 1	3.0 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Bi-210	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Bi-212	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000

Bi-214	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Pb-210	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Pb-212	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Pb-214	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Po-210	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Po-212	2.2778e+000	8.4277e+010	7.6000e-005	2.8120e+000
Po-214	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Po-216	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Po-218	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Ra-224	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Ra-226	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Ra-228	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Rn-220	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Rn-222	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Th-228	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Th-230	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Th-232	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Th-234	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Tl-208	1.2887e+000	4.7683e+010	4.3000e-005	1.5910e+000
U-234	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
U-238	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001

Buildup: The material reference is Shield 1
Integration Parameters

X Direction	10
Y Direction	20
Z Direction	20

Results

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	3.462e+11	0.000e+00	6.658e-25	0.000e+00	5.711e-26

0.04	1.361e+09	6.064e-74	2.416e-26	2.682e-76	1.068e-28
0.05	1.637e+10	1.790e-44	8.995e-25	4.768e-47	2.396e-27
0.06	1.421e+10	6.520e-32	3.225e-24	1.295e-34	6.406e-27
0.08	1.294e+11	1.175e-20	1.020e-18	1.859e-23	1.614e-21
0.1	2.755e+10	2.411e-17	4.099e-15	3.689e-20	6.271e-18
0.15	5.807e+09	2.845e-14	8.542e-12	4.685e-17	1.407e-14
0.2	1.057e+11	2.119e-11	6.900e-09	3.739e-14	1.218e-11
0.3	9.876e+10	1.253e-09	2.823e-07	2.378e-12	5.354e-10
0.4	1.220e+11	2.143e-08	3.151e-06	4.176e-11	6.139e-09
0.5	2.398e+10	2.882e-08	2.904e-06	5.658e-11	5.700e-09
0.6	1.919e+11	1.041e-06	7.546e-05	2.032e-09	1.473e-07
0.8	7.172e+10	3.779e-06	1.662e-04	7.188e-09	3.162e-07
1.0	1.747e+11	4.924e-05	1.478e-03	9.076e-08	2.725e-06
1.5	7.696e+10	3.645e-04	5.819e-03	6.133e-07	9.791e-06
2.0	8.350e+10	2.304e-03	2.552e-02	3.562e-06	3.947e-05
3.0	4.759e+10	1.106e-02	7.819e-02	1.501e-05	1.061e-04
Totals	**1.538e+12**	**1.378e-02**	**1.113e-01**	**1.928e-05**	**1.585e-04**

MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

Filename	Run Date	Run Time	Duration
8Feb RA 300WR.msd	August 28, 2011	8:21:29 PM	00:00:00

Project Info

Case Title	300 WR
Description	3.5 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions

Length	304.8 cm (10 ft 0.0 in)
Width	6.6e+3 cm (216 ft 0.0 in)
Height	1.5e+4 cm (490 ft 0.0 in)

Dose Points

A	X	Y	Z
#1	502.92 cm (16 ft 6.0 in)	7.5e+3 cm (245 ft 0.0 in)	3.3e+3 cm (108 ft 0.0 in)

Shields

Shield N	Dimension	Material	Density
Source	1.06e+06 ft³	Quartz-Pegmatite	2.18
Shield 1	3.5 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Bi-210	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Bi-212	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Bi-214	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001

Pb-210	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Pb-212	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Pb-214	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Po-210	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Po-212	2.2778e+000	8.4277e+010	7.6000e-005	2.8120e+000
Po-214	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Po-216	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Po-218	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Ra-224	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Ra-226	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Ra-228	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Rn-220	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Rn-222	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Th-228	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Th-230	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Th-232	3.5965e+000	1.3307e+011	1.2000e-004	4.4400e+000
Th-234	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
Tl-208	1.2887e+000	4.7683e+010	4.3000e-005	1.5910e+000
U-234	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001
U-238	8.3918e+000	3.1049e+011	2.8000e-004	1.0360e+001

Buildup: The material reference is Shield 1
Integration Parameters

X Direction	10
Y Direction	20
Z Direction	20

Results

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	3.462e+11	0.000e+00	6.541e-25	0.000e+00	5.610e-26
0.04	1.361e+09	8.521e-84	2.373e-26	3.768e-86	1.050e-28

0.05	1.637e+10	2.118e-50	8.836e-25	5.643e-53	2.354e-27
0.06	1.421e+10	4.245e-36	3.168e-24	8.432e-39	6.293e-27
0.08	1.294e+11	1.970e-23	2.220e-21	3.118e-26	3.513e-24
0.1	2.755e+10	1.398e-19	2.943e-17	2.139e-22	4.503e-20
0.15	5.807e+09	5.144e-16	2.030e-13	8.471e-19	3.343e-16
0.2	1.057e+11	6.138e-13	2.692e-10	1.083e-15	4.752e-13
0.3	9.876e+10	6.067e-11	1.820e-08	1.151e-13	3.453e-11
0.4	1.220e+11	1.428e-09	2.737e-07	2.783e-12	5.333e-10
0.5	2.398e+10	2.420e-09	3.117e-07	4.751e-12	6.118e-10
0.6	1.919e+11	1.046e-07	9.531e-06	2.042e-10	1.860e-08
0.8	7.172e+10	4.963e-07	2.672e-05	9.441e-10	5.083e-08
1.0	1.747e+11	7.855e-06	2.828e-04	1.448e-08	5.212e-07
1.5	7.696e+10	8.004e-05	1.488e-03	1.347e-07	2.503e-06
2.0	8.350e+10	6.125e-04	7.771e-03	9.472e-07	1.202e-05
3.0	4.759e+10	3.664e-03	2.903e-02	4.970e-06	3.939e-05
Totals	**1.538e+12**	**4.365e-03**	**3.861e-02**	**6.068e-06**	**5.450e-05**

ATTACHMENT D-2.3

MICROSHIELD® INPUT AND OUTPUT DETAILED RESULTS FOR 700-FOOT LEVEL MINE ROCK PILE

MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

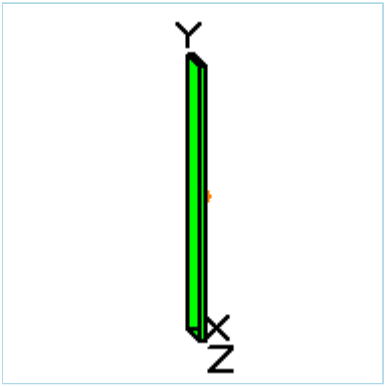
Filename	Run Date	Run Time	Duration
8Feb RA 700WR.msd	February 9, 2011	2:25:20 PM	00:00:00

Project Info	
Case Title	700 WR
Description	0.5 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	304.8 cm (10 ft 0.0 in)
Width	2.0e+3 cm (67 ft 0.0 in)
Height	1.7e+4 cm (550 ft)

Dose Points			
A	X	Y	Z
#1	411.48 cm (13 ft 6.0 in)	8.4e+3 cm (275 ft)	1.0e+3 cm (34 ft)

Shields			
Shield N	Dimension	Material	Density
Source	3.69e+05 ft³	Quartz-Pegmatite	2.18
Shield 1	.5 ft	Soil	1.8
Air Gap		Air	0.00122



Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Bi-210	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Bi-212	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Bi-214	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Pb-210	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Pb-212	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Pb-214	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Po-210	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Po-212	2.1913e+000	8.1078e+010	2.1000e-004	7.7700e+000
Po-214	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Po-216	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Po-218	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Ra-224	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Ra-226	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001

Ra-228	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Rn-220	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Rn-222	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Th-228	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Th-230	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Th-232	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Th-234	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Tl-208	1.2522e+000	4.6330e+010	1.2000e-004	4.4400e+000
U-234	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
U-238	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001

Buildup: The material reference is Shield 1 Integration Parameters	
X Direction	10
Y Direction	20
Z Direction	20

Results					
Energy (MeV)	**Activity (Photons/sec)**	**Fluence Rate MeV/cm²/sec No Buildup**	**Fluence Rate MeV/cm²/sec With Buildup**	**Exposure Rate mR/hr No Buildup**	**Exposure Rate mR/hr With Buildup**
0.015	3.492e+11	1.291e-269	1.467e-24	1.107e-270	1.258e-25
0.04	1.303e+09	1.478e-20	5.564e-20	6.535e-23	2.461e-22
0.05	1.690e+10	2.857e-12	1.953e-11	7.611e-15	5.203e-14
0.06	1.460e+10	4.408e-09	4.761e-08	8.755e-12	9.457e-11
0.08	1.293e+11	2.087e-05	3.730e-04	3.302e-08	5.903e-07
0.1	2.773e+10	5.690e-05	1.352e-03	8.706e-08	2.068e-06
0.15	5.576e+09	1.495e-04	4.096e-03	2.462e-07	6.745e-06
0.2	1.037e+11	9.296e-03	2.372e-01	1.641e-05	4.186e-04
0.3	9.939e+10	3.710e-02	7.204e-01	7.038e-05	1.367e-03
0.4	1.256e+11	1.196e-01	1.800e+00	2.331e-04	3.507e-03
0.5	2.352e+10	4.508e-02	5.450e-01	8.849e-05	1.070e-03
0.6	1.955e+11	6.547e-01	6.613e+00	1.278e-03	1.291e-02
0.8	7.096e+10	5.614e-01	4.300e+00	1.068e-03	8.178e-03
1.0	1.745e+11	2.645e+00	1.649e+01	4.876e-03	3.040e-02
1.5	7.810e+10	3.691e+00	1.644e+01	6.211e-03	2.766e-02
2.0	8.615e+10	8.642e+00	3.168e+01	1.336e-02	4.898e-02
3.0	4.624e+10	1.229e+01	3.544e+01	1.667e-02	4.809e-02
Totals	**1.548e+12**	**2.869e+01**	**1.143e+02**	**4.387e-02**	**1.826e-01**

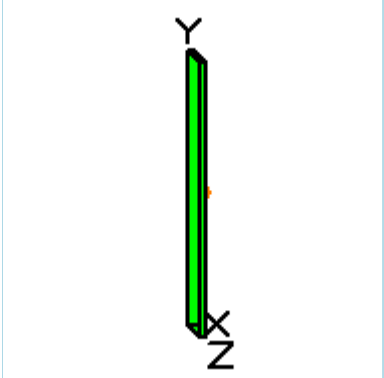
MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

Filename	Run Date	Run Time	Duration
9Feb RA 700WR.msd	February 9, 2011	2:35:00 PM	00:00:00

Project Info	
Case Title	700 WR
Description	1 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	304.8 cm (10 ft 0.0 in)
Width	2.0e+3 cm (67 ft 0.0 in)
Height	1.7e+4 cm (550 ft)



Dose Points			
A	**X**	**Y**	**Z**
#1	426.72 cm (14 ft 0.0 in)	8.4e+3 cm (275 ft)	1.0e+3 cm (34 ft)

Shields			
Shield N	**Dimension**	**Material**	**Density**
Source	3.69e+05 ft³	Quartz-Pegmatite	2.18
Shield 1	1.0 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Bi-210	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Bi-212	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Bi-214	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Pb-210	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Pb-212	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Pb-214	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Po-210	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Po-212	2.1913e+000	8.1078e+010	2.1000e-004	7.7700e+000
Po-214	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Po-216	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Po-218	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Ra-224	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Ra-226	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001

Ra-228	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Rn-220	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Rn-222	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Th-228	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Th-230	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Th-232	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Th-234	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Tl-208	1.2522e+000	4.6330e+010	1.2000e-004	4.4400e+000
U-234	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
U-238	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001

Buildup: The material reference is Shield 1 Integration Parameters	
X Direction	10
Y Direction	20
Z Direction	20

Results					
Energy (MeV)	**Activity (Photons/sec)**	**Fluence Rate MeV/cm²/sec No Buildup**	**Fluence Rate MeV/cm²/sec With Buildup**	**Exposure Rate mR/hr No Buildup**	**Exposure Rate mR/hr With Buildup**
0.015	3.492e+11	0.000e+00	1.421e-24	0.000e+00	1.219e-25
0.04	1.303e+09	1.282e-32	4.893e-26	5.670e-35	2.164e-28
0.05	1.690e+10	1.457e-19	1.279e-18	3.881e-22	3.408e-21
0.06	1.460e+10	2.913e-14	4.688e-13	5.787e-17	9.312e-16
0.08	1.293e+11	7.287e-09	2.254e-07	1.153e-11	3.566e-10
0.1	2.773e+10	9.118e-08	4.260e-06	1.395e-10	6.518e-09
0.15	5.576e+09	9.713e-07	5.914e-05	1.600e-09	9.738e-08
0.2	1.037e+11	1.079e-04	6.373e-03	1.905e-07	1.125e-05
0.3	9.939e+10	8.116e-04	3.546e-02	1.540e-06	6.726e-05
0.4	1.256e+11	3.886e-03	1.248e-01	7.572e-06	2.432e-04
0.5	2.352e+10	1.952e-03	4.790e-02	3.831e-06	9.401e-05
0.6	1.955e+11	3.546e-02	6.920e-01	6.921e-05	1.351e-03
0.8	7.096e+10	4.250e-02	5.861e-01	8.085e-05	1.115e-03
1.0	1.745e+11	2.559e-01	2.701e+00	4.716e-04	4.978e-03
1.5	7.810e+10	5.353e-01	3.650e+00	9.006e-04	6.141e-03
2.0	8.615e+10	1.600e+00	8.435e+00	2.475e-03	1.304e-02
3.0	4.624e+10	3.014e+00	1.158e+01	4.089e-03	1.571e-02
Totals	**1.548e+12**	**5.490e+00**	**2.786e+01**	**8.099e-03**	**4.275e-02**

MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

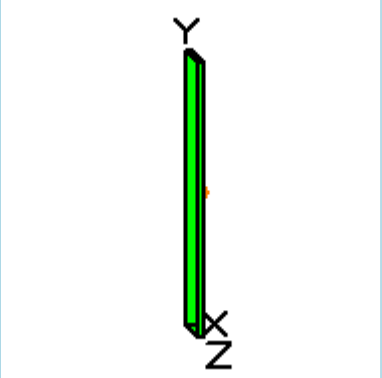
Filename	Run Date	Run Time	Duration
9Feb RA 700WR.msd	February 9, 2011	2:36:15 PM	00:00:00

Project Info	
Case Title	700 WR
Description	1.5 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	304.8 cm (10 ft 0.0 in)
Width	2.0e+3 cm (67 ft 0.0 in)
Height	1.7e+4 cm (550 ft)

Dose Points			
A	X	Y	Z
#1	441.96 cm (14 ft 6.0 in)	8.4e+3 cm (275 ft)	1.0e+3 cm (34 ft)

Shields			
Shield N	Dimension	Material	Density
Source	3.69e+05 ft³	Quartz-Pegmatite	2.18
Shield 1	1.5 ft	Soil	1.8
Air Gap		Air	0.00122



Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Bi-210	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Bi-212	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Bi-214	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Pb-210	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Pb-212	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Pb-214	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Po-210	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Po-212	2.1913e+000	8.1078e+010	2.1000e-004	7.7700e+000
Po-214	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Po-216	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Po-218	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Ra-224	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Ra-226	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001

Ra-228	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Rn-220	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Rn-222	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Th-228	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Th-230	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Th-232	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Th-234	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Tl-208	1.2522e+000	4.6330e+010	1.2000e-004	4.4400e+000
U-234	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
U-238	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001

Buildup: The material reference is Shield 1 Integration Parameters	
X Direction	10
Y Direction	20
Z Direction	20

Results					
Energy (MeV)	**Activity (Photons/sec)**	**Fluence Rate MeV/cm²/sec No Buildup**	**Fluence Rate MeV/cm²/sec With Buildup**	**Exposure Rate mR/hr No Buildup**	**Exposure Rate mR/hr With Buildup**
0.015	3.492e+11	0.000e+00	1.377e-24	0.000e+00	1.181e-25
0.04	1.303e+09	9.236e-44	4.744e-26	4.085e-46	2.098e-28
0.05	1.690e+10	2.810e-26	2.145e-24	7.486e-29	5.714e-27
0.06	1.460e+10	5.089e-19	1.080e-17	1.011e-21	2.145e-20
0.08	1.293e+11	4.938e-12	2.196e-10	7.814e-15	3.476e-13
0.1	2.773e+10	2.513e-10	1.854e-08	3.844e-13	2.836e-11
0.15	5.576e+09	9.725e-09	1.032e-06	1.602e-11	1.699e-09
0.2	1.037e+11	1.847e-06	1.969e-04	3.260e-09	3.475e-07
0.3	9.939e+10	2.491e-05	1.930e-03	4.725e-08	3.662e-06
0.4	1.256e+11	1.717e-04	9.410e-03	3.346e-07	1.833e-05
0.5	2.352e+10	1.123e-04	4.536e-03	2.205e-07	8.904e-06
0.6	1.955e+11	2.506e-03	7.797e-02	4.891e-06	1.522e-04
0.8	7.096e+10	4.085e-03	8.504e-02	7.769e-06	1.617e-04
1.0	1.745e+11	3.076e-02	4.715e-01	5.670e-05	8.691e-04
1.5	7.810e+10	9.307e-02	8.593e-01	1.566e-04	1.446e-03
2.0	8.615e+10	3.474e-01	2.378e+00	5.373e-04	3.678e-03
3.0	4.624e+10	8.445e-01	4.008e+00	1.146e-03	5.437e-03
Totals	**1.548e+12**	**1.323e+00**	**7.896e+00**	**1.909e-03**	**1.178e-02**

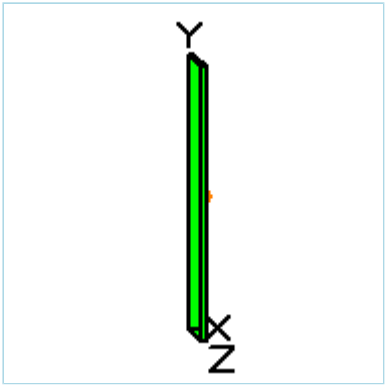
MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

Filename	Run Date	Run Time	Duration
9Feb RA 700WR.msd	February 9, 2011	2:37:05 PM	00:00:00

Project Info	
Case Title	700 WR
Description	2 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	304.8 cm (10 ft 0.0 in)
Width	2.0e+3 cm (67 ft 0.0 in)
Height	1.7e+4 cm (550 ft)



Dose Points			
A	**X**	**Y**	**Z**
#1	457.2 cm (15 ft)	8.4e+3 cm (275 ft)	1.0e+3 cm (34 ft)

Shields			
Shield N	**Dimension**	**Material**	**Density**
Source	3.69e+05 ft³	Quartz-Pegmatite	2.18
Shield 1	2.0 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Bi-210	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Bi-212	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Bi-214	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Pb-210	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Pb-212	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Pb-214	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Po-210	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Po-212	2.1913e+000	8.1078e+010	2.1000e-004	7.7700e+000
Po-214	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Po-216	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Po-218	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Ra-224	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Ra-226	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001

Ra-228	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Rn-220	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Rn-222	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Th-228	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Th-230	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Th-232	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Th-234	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Tl-208	1.2522e+000	4.6330e+010	1.2000e-004	4.4400e+000
U-234	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
U-238	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001

Buildup: The material reference is Shield 1 Integration Parameters	
X Direction	10
Y Direction	20
Z Direction	20

Results					
Energy (MeV)	**Activity (Photons/sec)**	**Fluence Rate MeV/cm²/sec No Buildup**	**Fluence Rate MeV/cm²/sec With Buildup**	**Exposure Rate mR/hr No Buildup**	**Exposure Rate mR/hr With Buildup**
0.015	3.492e+11	0.000e+00	1.337e-24	0.000e+00	1.147e-25
0.04	1.303e+09	2.412e-54	4.605e-26	1.067e-56	2.037e-28
0.05	1.690e+10	1.195e-32	1.848e-24	3.185e-35	4.924e-27
0.06	1.460e+10	1.580e-23	4.223e-22	3.139e-26	8.387e-25
0.08	1.293e+11	4.965e-15	2.882e-13	7.857e-18	4.561e-16
0.1	2.773e+10	9.563e-13	9.987e-11	1.463e-15	1.528e-13
0.15	5.576e+09	1.258e-10	2.055e-08	2.072e-13	3.384e-11
0.2	1.037e+11	3.970e-08	6.735e-06	7.007e-11	1.189e-08
0.3	9.939e+10	9.317e-07	1.127e-04	1.767e-09	2.138e-07
0.4	1.256e+11	9.073e-06	7.539e-04	1.768e-08	1.469e-06
0.5	2.352e+10	7.622e-06	4.533e-04	1.496e-08	8.898e-07
0.6	1.955e+11	2.066e-04	9.193e-03	4.032e-07	1.794e-05
0.8	7.096e+10	4.501e-04	1.290e-02	8.561e-07	2.454e-05
1.0	1.745e+11	4.187e-03	8.556e-02	7.719e-06	1.577e-04
1.5	7.810e+10	1.794e-02	2.098e-01	3.018e-05	3.530e-04
2.0	8.615e+10	8.254e-02	6.948e-01	1.276e-04	1.074e-03
3.0	4.624e+10	2.550e-01	1.434e+00	3.460e-04	1.946e-03
Totals	**1.548e+12**	**3.604e-01**	**2.448e+00**	**5.128e-04**	**3.576e-03**

MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

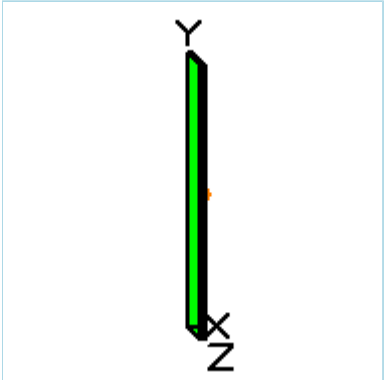
Filename	Run Date	Run Time	Duration
9Feb RA 700WR.msd	February 9, 2011	2:34:02 PM	00:00:00

Project Info	
Case Title	700 WR
Description	2.5 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	304.8 cm (10 ft 0.0 in)
Width	2.0e+3 cm (67 ft 0.0 in)
Height	1.7e+4 cm (550 ft)

Dose Points			
A	X	Y	Z
#1	472.44 cm (15 ft 6.0 in)	8.4e+3 cm (275 ft)	1.0e+3 cm (34 ft)

Shields			
Shield N	Dimension	Material	Density
Source	3.69e+05 ft³	Quartz-Pegmatite	2.18
Shield 1	2.5 ft	Soil	1.8
Air Gap		Air	0.00122



Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Bi-210	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Bi-212	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Bi-214	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Pb-210	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Pb-212	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Pb-214	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Po-210	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Po-212	2.1913e+000	8.1078e+010	2.1000e-004	7.7700e+000
Po-214	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Po-216	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Po-218	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Ra-224	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Ra-226	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001

Ra-228	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Rn-220	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Rn-222	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Th-228	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Th-230	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Th-232	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Th-234	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Tl-208	1.2522e+000	4.6330e+010	1.2000e-004	4.4400e+000
U-234	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
U-238	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001

Buildup: The material reference is Shield 1 Integration Parameters	
X Direction	10
Y Direction	20
Z Direction	20

Results					
Energy (MeV)	**Activity (Photons/sec)**	**Fluence Rate MeV/cm²/sec No Buildup**	**Fluence Rate MeV/cm²/sec With Buildup**	**Exposure Rate mR/hr No Buildup**	**Exposure Rate mR/hr With Buildup**
0.015	3.492e+11	0.000e+00	1.300e-24	0.000e+00	1.115e-25
0.04	1.303e+09	1.418e-64	4.476e-26	6.273e-67	1.979e-28
0.05	1.690e+10	8.334e-39	1.796e-24	2.220e-41	4.785e-27
0.06	1.460e+10	7.015e-28	6.413e-24	1.393e-30	1.274e-26
0.08	1.293e+11	6.385e-18	4.635e-16	1.010e-20	7.335e-19
0.1	2.773e+10	4.454e-15	6.169e-13	6.814e-18	9.437e-16
0.15	5.576e+09	1.910e-12	4.460e-10	3.145e-15	7.344e-13
0.2	1.037e+11	9.846e-10	2.454e-07	1.738e-12	4.332e-10
0.3	9.939e+10	3.944e-08	6.905e-06	7.481e-11	1.310e-08
0.4	1.256e+11	5.359e-07	6.272e-05	1.044e-09	1.222e-07
0.5	2.352e+10	5.731e-07	4.687e-05	1.125e-09	9.199e-08
0.6	1.955e+11	1.873e-05	1.121e-03	3.657e-08	2.189e-06
0.8	7.096e+10	5.401e-05	2.014e-03	1.027e-07	3.831e-06
1.0	1.745e+11	6.159e-04	1.598e-02	1.135e-06	2.946e-05
1.5	7.810e+10	3.688e-03	5.242e-02	6.204e-06	8.820e-05
2.0	8.615e+10	2.074e-02	2.075e-01	3.208e-05	3.209e-04
3.0	4.624e+10	8.070e-02	5.238e-01	1.095e-04	7.106e-04
Totals	**1.548e+12**	**1.058e-01**	**8.029e-01**	**1.490e-04**	**1.155e-03**

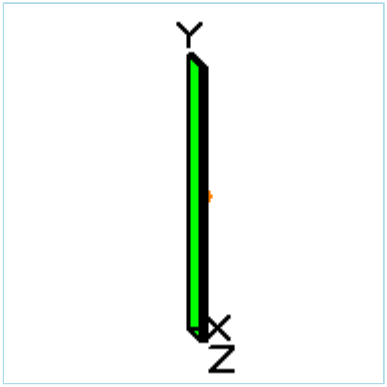
MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

Filename	Run Date	Run Time	Duration
9Feb RA 700WR.msd	February 9, 2011	2:38:09 PM	00:00:00

Project Info	
Case Title	700 WR
Description	3 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	304.8 cm (10 ft 0.0 in)
Width	2.0e+3 cm (67 ft 0.0 in)
Height	1.7e+4 cm (550 ft)



Dose Points			
A	X	Y	Z
#1	487.68 cm (16 ft)	8.4e+3 cm (275 ft)	1.0e+3 cm (34 ft)

Shields			
Shield N	Dimension	Material	Density
Source	3.69e+05 ft³	Quartz-Pegmatite	2.18
Shield 1	3.0 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Bi-210	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Bi-212	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Bi-214	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Pb-210	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Pb-212	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Pb-214	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Po-210	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Po-212	2.1913e+000	8.1078e+010	2.1000e-004	7.7700e+000
Po-214	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Po-216	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Po-218	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Ra-224	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Ra-226	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001

Ra-228	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Rn-220	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Rn-222	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Th-228	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Th-230	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Th-232	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Th-234	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Tl-208	1.2522e+000	4.6330e+010	1.2000e-004	4.4400e+000
U-234	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
U-238	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001

Buildup: The material reference is Shield 1 Integration Parameters	
X Direction	10
Y Direction	20
Z Direction	20

Results					
Energy (MeV)	**Activity (Photons/sec)**	**Fluence Rate MeV/cm²/sec No Buildup**	**Fluence Rate MeV/cm²/sec With Buildup**	**Exposure Rate mR/hr No Buildup**	**Exposure Rate mR/hr With Buildup**
0.015	3.492e+11	0.000e+00	1.264e-24	0.000e+00	1.084e-25
0.04	1.303e+09	1.404e-74	4.354e-26	6.211e-77	1.926e-28
0.05	1.690e+10	7.973e-45	1.748e-24	2.124e-47	4.655e-27
0.06	1.460e+10	3.914e-32	6.236e-24	7.774e-35	1.239e-26
0.08	1.293e+11	9.613e-21	8.557e-19	1.521e-23	1.354e-21
0.1	2.773e+10	2.362e-17	4.157e-15	3.614e-20	6.360e-18
0.15	5.576e+09	3.217e-14	1.019e-11	5.298e-17	1.678e-14
0.2	1.037e+11	2.678e-11	9.289e-09	4.727e-14	1.639e-11
0.3	9.939e+10	1.809e-09	4.354e-07	3.431e-12	8.260e-10
0.4	1.256e+11	3.403e-08	5.343e-06	6.631e-11	1.041e-08
0.5	2.352e+10	4.606e-08	4.949e-06	9.041e-11	9.714e-09
0.6	1.955e+11	1.808e-06	1.395e-04	3.529e-09	2.723e-07
0.8	7.096e+10	6.849e-06	3.197e-04	1.303e-08	6.080e-07
1.0	1.745e+11	9.526e-05	3.026e-03	1.756e-07	5.577e-06
1.5	7.810e+10	7.905e-04	1.328e-02	1.330e-06	2.234e-05
2.0	8.615e+10	5.409e-03	6.282e-02	8.364e-06	9.714e-05
3.0	4.624e+10	2.634e-02	1.937e-01	3.574e-05	2.628e-04
Totals	**1.548e+12**	**3.265e-02**	**2.733e-01**	**4.563e-05**	**3.888e-04**

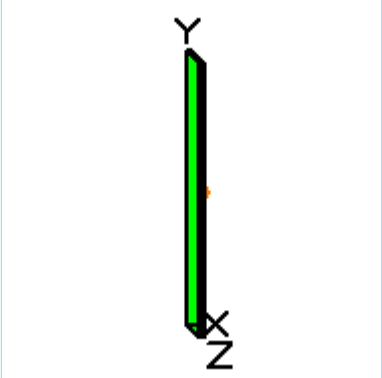
MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

Filename	Run Date	Run Time	Duration
9Feb RA 700WR.msd	February 9, 2011	2:38:57 PM	00:00:00

Project Info	
Case Title	700 WR
Description	3.5 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	304.8 cm (10 ft 0.0 in)
Width	2.0e+3 cm (67 ft 0.0 in)
Height	1.7e+4 cm (550 ft)



Dose Points			
A	**X**	**Y**	**Z**
#1	487.68 cm (16 ft)	8.4e+3 cm (275 ft)	1.0e+3 cm (34 ft)

Shields			
Shield N	**Dimension**	**Material**	**Density**
Source	3.69e+05 ft³	Quartz-Pegmatite	2.18
Shield 1	3.5 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Bi-210	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Bi-212	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Bi-214	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Pb-210	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Pb-212	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Pb-214	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Po-210	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Po-212	2.1913e+000	8.1078e+010	2.1000e-004	7.7700e+000
Po-214	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Po-216	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Po-218	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Ra-224	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Ra-226	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001

Ra-228	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Rn-220	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Rn-222	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Th-228	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Th-230	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Th-232	3.4435e+000	1.2741e+011	3.3000e-004	1.2210e+001
Th-234	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
Tl-208	1.2522e+000	4.6330e+010	1.2000e-004	4.4400e+000
U-234	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001
U-238	8.6608e+000	3.2045e+011	8.3000e-004	3.0710e+001

Buildup: The material reference is Shield 1 Integration Parameters	
X Direction	10
Y Direction	20
Z Direction	20

Results					
Energy (MeV)	**Activity (Photons/sec)**	**Fluence Rate MeV/cm²/sec No Buildup**	**Fluence Rate MeV/cm²/sec With Buildup**	**Exposure Rate mR/hr No Buildup**	**Exposure Rate mR/hr With Buildup**
0.015	3.492e+11	0.000e+00	1.264e-24	0.000e+00	1.084e-25
0.04	1.303e+09	6.029e-86	4.354e-26	2.666e-88	1.926e-28
0.05	1.690e+10	1.211e-51	1.748e-24	3.226e-54	4.655e-27
0.06	1.460e+10	6.086e-37	6.236e-24	1.209e-39	1.239e-26
0.08	1.293e+11	6.297e-24	9.986e-22	9.965e-27	1.580e-24
0.1	2.773e+10	6.464e-20	1.445e-17	9.890e-23	2.210e-20
0.15	5.576e+09	3.281e-16	1.414e-13	5.403e-19	2.329e-16
0.2	1.037e+11	4.721e-13	2.293e-10	8.333e-16	4.046e-13
0.3	9.939e+10	5.794e-11	1.928e-08	1.099e-13	3.657e-11
0.4	1.256e+11	1.582e-09	3.350e-07	3.083e-12	6.527e-10
0.5	2.352e+10	2.804e-09	3.971e-07	5.505e-12	7.794e-10
0.6	1.955e+11	1.357e-07	1.353e-05	2.649e-10	2.642e-08
0.8	7.096e+10	7.026e-07	4.113e-05	1.336e-09	7.824e-08
1.0	1.745e+11	1.226e-05	4.769e-04	2.260e-08	8.792e-07
1.5	7.810e+10	1.476e-04	2.941e-03	2.484e-07	4.948e-06
2.0	8.615e+10	1.263e-03	1.706e-02	1.953e-06	2.638e-05
3.0	4.624e+10	7.940e-03	6.637e-02	1.077e-05	9.004e-05
Totals	**1.548e+12**	**9.364e-03**	**8.690e-02**	**1.300e-05**	**1.224e-04**

ATTACHMENT D-2.4

MICROSHIELD® INPUT AND OUTPUT DETAILED RESULTS FOR 900-FOOT LEVEL NORTH MINE ROCK PILE

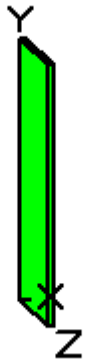
MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

Filename	Run Date	Run Time	Duration
8Feb RA 900N WR.msd	February 8, 2011	8:36:22 PM	00:00:00

Project Info	
Case Title	900N WR
Description	0.5 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	304.8 cm (10 ft 0.0 in)
Width	3.3e+3 cm (108 ft 0.0 in)
Height	1.1e+4 cm (370 ft 0.0 in)



Dose Points			
A	X	Y	Z
#1	411.48 cm (13 ft 6.0 in)	5.6e+3 cm (185 ft 0.0 in)	1.6e+3 cm (54 ft 0.0 in)

Shields			
Shield N	Dimension	Material	Density
Source	4.00e+05 ft³	Quartz-Pegmatite	2.18
Shield 1	.5 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Bi-210	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Bi-212	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Bi-214	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Pb-210	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Pb-212	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Pb-214	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Po-210	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Po-212	1.6973e+000	6.2801e+010	1.5000e-004	5.5500e+000
Po-214	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Po-216	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Po-218	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Ra-224	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000

Ra-226	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Ra-228	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Rn-220	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Rn-222	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Th-228	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Th-230	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Th-232	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Th-234	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Tl-208	9.6181e-001	3.5587e+010	8.5000e-005	3.1450e+000
U-234	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
U-238	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001

Buildup: The material reference is Shield 1 Integration Parameters	
X Direction	10
Y Direction	20
Z Direction	20

Results					
Energy (MeV)	**Activity (Photons/sec)**	**Fluence Rate MeV/cm²/sec No Buildup**	**Fluence Rate MeV/cm²/sec With Buildup**	**Exposure Rate mR/hr No Buildup**	**Exposure Rate mR/hr With Buildup**
0.015	2.710e+11	1.576e-232	1.225e-24	1.352e-233	1.051e-25
0.04	1.027e+09	4.069e-18	1.485e-17	1.800e-20	6.566e-20
0.05	1.303e+10	7.206e-11	4.513e-10	1.920e-13	1.202e-12
0.06	1.127e+10	3.640e-08	3.463e-07	7.230e-11	6.878e-10
0.08	1.006e+11	6.870e-05	1.036e-03	1.087e-07	1.640e-06
0.1	2.153e+10	1.321e-04	2.568e-03	2.021e-07	3.929e-06
0.15	4.394e+09	2.583e-04	5.670e-03	4.254e-07	9.338e-06
0.2	8.118e+10	1.407e-02	2.870e-01	2.482e-05	5.065e-04
0.3	7.713e+10	4.863e-02	7.666e-01	9.225e-05	1.454e-03
0.4	9.690e+10	1.435e-01	1.783e+00	2.796e-04	3.475e-03
0.5	1.824e+10	5.127e-02	5.205e-01	1.006e-04	1.022e-03
0.6	1.506e+11	7.069e-01	6.075e+00	1.380e-03	1.186e-02
0.8	5.529e+10	5.734e-01	3.821e+00	1.091e-03	7.267e-03
1.0	1.358e+11	2.574e+00	1.420e+01	4.744e-03	2.617e-02
1.5	6.050e+10	3.310e+00	1.341e+01	5.569e-03	2.256e-02
2.0	6.641e+10	7.370e+00	2.498e+01	1.140e-02	3.864e-02
3.0	3.552e+10	9.922e+00	2.700e+01	1.346e-02	3.663e-02
Totals	**1.200e+12**	**2.471e+01**	**9.285e+01**	**3.814e-02**	**1.496e-01**

MicroShield 8.03
BobMeyer (8.03-0000)

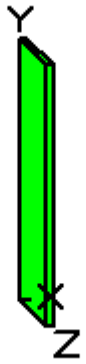
Date	By	Checked

Filename	Run Date	Run Time	Duration
8Feb RA 900N WR.msd	February 8, 2011	8:38:06 PM	00:00:00

Project Info	
Case Title	900N WR
Description	1 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	304.8 cm (10 ft 0.0 in)
Width	3.3e+3 cm (108 ft 0.0 in)
Height	1.1e+4 cm (370 ft 0.0 in)

Dose Points			
A	X	Y	Z
#1	426.72 cm (14 ft 0.0 in)	5.6e+3 cm (185 ft 0.0 in)	1.6e+3 cm (54 ft 0.0 in)



Shields			
Shield N	Dimension	Material	Density
Source	4.00e+05 ft³	Quartz-Pegmatite	2.18
Shield 1	1.0 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Bi-210	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Bi-212	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Bi-214	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Pb-210	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Pb-212	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Pb-214	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Po-210	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Po-212	1.6973e+000	6.2801e+010	1.5000e-004	5.5500e+000
Po-214	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Po-216	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Po-218	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Ra-224	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000

Ra-226	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Ra-228	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Rn-220	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Rn-222	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Th-228	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Th-230	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Th-232	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Th-234	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Tl-208	9.6181e-001	3.5587e+010	8.5000e-005	3.1450e+000
U-234	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
U-238	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001

Buildup: The material reference is Shield 1 Integration Parameters	
X Direction	10
Y Direction	20
Z Direction	20

Results					
Energy (MeV)	**Activity (Photons/sec)**	**Fluence Rate MeV/cm²/sec No Buildup**	**Fluence Rate MeV/cm²/sec With Buildup**	**Exposure Rate mR/hr No Buildup**	**Exposure Rate mR/hr With Buildup**
0.015	2.710e+11	0.000e+00	1.192e-24	0.000e+00	1.022e-25
0.04	1.027e+09	4.333e-29	4.171e-26	1.916e-31	1.845e-28
0.05	1.303e+10	1.771e-17	1.471e-16	4.718e-20	3.919e-19
0.06	1.127e+10	7.608e-13	1.089e-11	1.511e-15	2.162e-14
0.08	1.006e+11	5.128e-08	1.344e-06	8.116e-11	2.127e-09
0.1	2.153e+10	3.824e-07	1.457e-05	5.851e-10	2.229e-08
0.15	4.394e+09	2.588e-06	1.245e-04	4.262e-09	2.050e-07
0.2	8.118e+10	2.363e-04	1.096e-02	4.171e-07	1.935e-05
0.3	7.713e+10	1.440e-03	5.025e-02	2.731e-06	9.532e-05
0.4	9.690e+10	6.059e-03	1.585e-01	1.181e-05	3.089e-04
0.5	1.824e+10	2.805e-03	5.706e-02	5.506e-06	1.120e-04
0.6	1.506e+11	4.734e-02	7.778e-01	9.240e-05	1.518e-03
0.8	5.529e+10	5.200e-02	6.158e-01	9.891e-05	1.171e-03
1.0	1.358e+11	2.913e-01	2.687e+00	5.370e-04	4.953e-03
1.5	6.050e+10	5.401e-01	3.300e+00	9.087e-04	5.553e-03
2.0	6.641e+10	1.498e+00	7.189e+00	2.317e-03	1.112e-02
3.0	3.552e+10	2.594e+00	9.248e+00	3.520e-03	1.255e-02
Totals	**1.200e+12**	**5.034e+00**	**2.410e+01**	**7.494e-03**	**3.739e-02**

MicroShield 8.03
BobMeyer (8.03-0000)

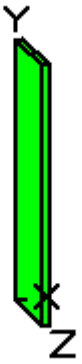
Date	By	Checked

Filename	Run Date	Run Time	Duration
8Feb RA 900N WR.msd	February 8, 2011	8:39:14 PM	00:00:00

Project Info	
Case Title	900N WR
Description	1.5 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	304.8 cm (10 ft 0.0 in)
Width	3.3e+3 cm (108 ft 0.0 in)
Height	1.1e+4 cm (370 ft 0.0 in)

Dose Points			
A	X	Y	Z
#1	441.96 cm (14 ft 6.0 in)	5.6e+3 cm (185 ft 0.0 in)	1.6e+3 cm (54 ft 0.0 in)



Shields			
Shield N	Dimension	Material	Density
Source	4.00e+05 ft³	Quartz-Pegmatite	2.18
Shield 1	1.5 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Bi-210	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Bi-212	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Bi-214	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Pb-210	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Pb-212	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Pb-214	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Po-210	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Po-212	1.6973e+000	6.2801e+010	1.5000e-004	5.5500e+000
Po-214	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Po-216	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Po-218	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Ra-224	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000

Ra-226	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Ra-228	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Rn-220	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Rn-222	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Th-228	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Th-230	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Th-232	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Th-234	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Tl-208	9.6181e-001	3.5587e+010	8.5000e-005	3.1450e+000
U-234	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
U-238	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001

Buildup: The material reference is Shield 1 Integration Parameters	
X Direction	10
Y Direction	20
Z Direction	20

Results					
Energy (MeV)	**Activity (Photons/sec)**	**Fluence Rate MeV/cm²/sec No Buildup**	**Fluence Rate MeV/cm²/sec With Buildup**	**Exposure Rate mR/hr No Buildup**	**Exposure Rate mR/hr With Buildup**
0.015	2.710e+11	0.000e+00	1.161e-24	0.000e+00	9.957e-26
0.04	1.027e+09	1.410e-39	4.063e-26	6.234e-42	1.797e-28
0.05	1.303e+10	8.551e-24	8.028e-23	2.278e-26	2.139e-25
0.06	1.127e+10	2.593e-17	4.943e-16	5.150e-20	9.818e-19
0.08	1.006e+11	5.464e-11	2.098e-09	8.646e-14	3.320e-12
0.1	2.153e+10	1.507e-09	9.210e-08	2.306e-12	1.409e-10
0.15	4.394e+09	3.372e-08	2.854e-06	5.552e-11	4.700e-09
0.2	8.118e+10	5.052e-06	4.257e-04	8.916e-09	7.513e-07
0.3	7.713e+10	5.284e-05	3.287e-03	1.002e-07	6.235e-06
0.4	9.690e+10	3.118e-04	1.399e-02	6.076e-07	2.726e-05
0.5	1.824e+10	1.845e-04	6.210e-03	3.622e-07	1.219e-05
0.6	1.506e+11	3.772e-03	9.930e-02	7.363e-06	1.938e-04
0.8	5.529e+10	5.521e-03	9.925e-02	1.050e-05	1.888e-04
1.0	1.358e+11	3.814e-02	5.124e-01	7.031e-05	9.445e-04
1.5	6.050e+10	9.997e-02	8.296e-01	1.682e-04	1.396e-03
2.0	6.641e+10	3.416e-01	2.132e+00	5.283e-04	3.297e-03
3.0	3.552e+10	7.514e-01	3.306e+00	1.019e-03	4.485e-03
Totals	**1.200e+12**	**1.241e+00**	**7.003e+00**	**1.805e-03**	**1.055e-02**

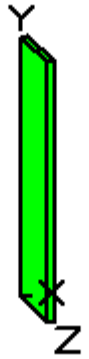
MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

Filename	Run Date	Run Time	Duration
8Feb RA 900N WR.msd	February 8, 2011	8:40:09 PM	00:00:00

Project Info	
Case Title	900N WR
Description	2 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	304.8 cm (10 ft 0.0 in)
Width	3.3e+3 cm (108 ft 0.0 in)
Height	1.1e+4 cm (370 ft 0.0 in)



Dose Points			
A	**X**	**Y**	**Z**
#1	457.2 cm (15 ft)	5.6e+3 cm (185 ft 0.0 in)	1.6e+3 cm (54 ft 0.0 in)

Shields			
Shield N	**Dimension**	**Material**	**Density**
Source	4.00e+05 ft³	Quartz-Pegmatite	2.18
Shield 1	2.0 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Bi-210	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Bi-212	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Bi-214	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Pb-210	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Pb-212	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Pb-214	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Po-210	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Po-212	1.6973e+000	6.2801e+010	1.5000e-004	5.5500e+000
Po-214	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Po-216	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Po-218	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Ra-224	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Ra-226	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001

Ra-228	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Rn-220	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Rn-222	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Th-228	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Th-230	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Th-232	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Th-234	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Tl-208	9.6181e-001	3.5587e+010	8.5000e-005	3.1450e+000
U-234	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
U-238	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001

Buildup: The material reference is Shield 1 Integration Parameters	
X Direction	10
Y Direction	20
Z Direction	20

Results					
Energy (MeV)	**Activity (Photons/sec)**	**Fluence Rate MeV/cm²/sec No Buildup**	**Fluence Rate MeV/cm²/sec With Buildup**	**Exposure Rate mR/hr No Buildup**	**Exposure Rate mR/hr With Buildup**
0.015	2.710e+11	0.000e+00	1.132e-24	0.000e+00	9.712e-26
0.04	1.027e+09	8.942e-50	3.963e-26	3.955e-52	1.753e-28
0.05	1.303e+10	6.181e-30	1.554e-24	1.647e-32	4.141e-27
0.06	1.127e+10	1.179e-21	2.822e-20	2.341e-24	5.606e-23
0.08	1.006e+11	7.106e-14	3.645e-12	1.125e-16	5.768e-15
0.1	2.153e+10	7.035e-12	6.210e-10	1.076e-14	9.500e-13
0.15	4.394e+09	5.064e-10	6.715e-08	8.339e-13	1.106e-10
0.2	8.118e+10	1.231e-07	1.675e-05	2.173e-10	2.955e-08
0.3	7.713e+10	2.182e-06	2.152e-04	4.140e-09	4.082e-07
0.4	9.690e+10	1.790e-05	1.235e-03	3.488e-08	2.406e-06
0.5	1.824e+10	1.345e-05	6.751e-04	2.640e-08	1.325e-06
0.6	1.506e+11	3.311e-04	1.262e-02	6.463e-07	2.464e-05
0.8	5.529e+10	6.400e-04	1.602e-02	1.217e-06	3.048e-05
1.0	1.358e+11	5.417e-03	9.807e-02	9.984e-06	1.808e-04
1.5	6.050e+10	1.984e-02	2.103e-01	3.338e-05	3.539e-04
2.0	6.641e+10	8.291e-02	6.403e-01	1.282e-04	9.901e-04
3.0	3.552e+10	2.298e-01	1.203e+00	3.117e-04	1.632e-03
Totals	**1.200e+12**	**3.390e-01**	**2.183e+00**	**4.853e-04**	**3.216e-03**

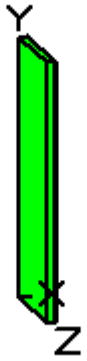
MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

Filename	Run Date	Run Time	Duration
8Feb RA 900N WR.msd	February 8, 2011	8:41:06 PM	00:00:00

Project Info	
Case Title	900N WR
Description	2.5 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	304.8 cm (10 ft 0.0 in)
Width	3.3e+3 cm (108 ft 0.0 in)
Height	1.1e+4 cm (370 ft 0.0 in)



Dose Points			
A	X	Y	Z
#1	472.44 cm (15 ft 6.0 in)	5.6e+3 cm (185 ft 0.0 in)	1.6e+3 cm (54 ft 0.0 in)

Shields			
Shield N	Dimension	Material	Density
Source	4.00e+05 ft³	Quartz-Pegmatite	2.18
Shield 1	2.5 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Bi-210	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Bi-212	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Bi-214	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Pb-210	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Pb-212	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Pb-214	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Po-210	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Po-212	1.6973e+000	6.2801e+010	1.5000e-004	5.5500e+000
Po-214	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Po-216	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Po-218	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Ra-224	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000

Ra-226	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Ra-228	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Rn-220	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Rn-222	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Th-228	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Th-230	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Th-232	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Th-234	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Tl-208	9.6181e-001	3.5587e+010	8.5000e-005	3.1450e+000
U-234	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
U-238	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001

Buildup: The material reference is Shield 1 Integration Parameters	
X Direction	10
Y Direction	20
Z Direction	20

Results					
Energy (MeV)	**Activity (Photons/sec)**	**Fluence Rate MeV/cm²/sec No Buildup**	**Fluence Rate MeV/cm²/sec With Buildup**	**Exposure Rate mR/hr No Buildup**	**Exposure Rate mR/hr With Buildup**
0.015	2.710e+11	0.000e+00	1.105e-24	0.000e+00	9.482e-26
0.04	1.027e+09	8.558e-60	3.869e-26	3.785e-62	1.711e-28
0.05	1.303e+10	5.736e-36	1.518e-24	1.528e-38	4.043e-27
0.06	1.127e+10	6.403e-26	7.246e-24	1.272e-28	1.439e-26
0.08	1.006e+11	1.045e-16	6.734e-15	1.653e-19	1.066e-17
0.1	2.153e+10	3.638e-14	4.337e-12	5.566e-17	6.636e-15
0.15	4.394e+09	8.288e-12	1.601e-09	1.365e-14	2.636e-12
0.2	8.118e+10	3.248e-09	6.618e-07	5.732e-12	1.168e-09
0.3	7.713e+10	9.684e-08	1.405e-05	1.837e-10	2.665e-08
0.4	9.690e+10	1.099e-06	1.085e-04	2.140e-09	2.114e-07
0.5	1.824e+10	1.044e-06	7.316e-05	2.049e-09	1.436e-07
0.6	1.506e+11	3.086e-05	1.603e-03	6.023e-08	3.129e-06
0.8	5.529e+10	7.837e-05	2.585e-03	1.491e-07	4.916e-06
1.0	1.358e+11	8.093e-04	1.882e-02	1.492e-06	3.468e-05
1.5	6.050e+10	4.113e-03	5.351e-02	6.920e-06	9.003e-05
2.0	6.641e+10	2.094e-02	1.935e-01	3.238e-05	2.993e-04
3.0	3.552e+10	7.273e-02	4.418e-01	9.868e-05	5.994e-04
Totals	**1.200e+12**	**9.870e-02**	**7.121e-01**	**1.397e-04**	**1.032e-03**

MicroShield 8.03
BobMeyer (8.03-0000)

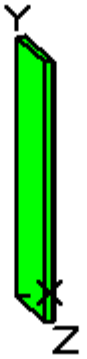
Date	By	Checked

Filename	Run Date	Run Time	Duration
8Feb RA 900N WR.msd	February 8, 2011	8:42:25 PM	00:00:00

Project Info	
Case Title	900N WR
Description	3 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	304.8 cm (10 ft 0.0 in)
Width	3.3e+3 cm (108 ft 0.0 in)
Height	1.1e+4 cm (370 ft 0.0 in)

Dose Points			
A	X	Y	Z
#1	487.68 cm (16 ft)	5.6e+3 cm (185 ft 0.0 in)	1.6e+3 cm (54 ft 0.0 in)



Shields			
Shield N	Dimension	Material	Density
Source	4.00e+05 ft³	Quartz-Pegmatite	2.18
Shield 1	3.0 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Bi-210	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Bi-212	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Bi-214	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Pb-210	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Pb-212	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Pb-214	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Po-210	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Po-212	1.6973e+000	6.2801e+010	1.5000e-004	5.5500e+000
Po-214	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Po-216	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Po-218	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Ra-224	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Ra-226	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001

Ra-228	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Rn-220	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Rn-222	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Th-228	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Th-230	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Th-232	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Th-234	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Tl-208	9.6181e-001	3.5587e+010	8.5000e-005	3.1450e+000
U-234	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
U-238	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001

Buildup: The material reference is Shield 1 Integration Parameters	
X Direction	10
Y Direction	20
Z Direction	20

Results					
Energy (MeV)	**Activity (Photons/sec)**	**Fluence Rate MeV/cm²/sec No Buildup**	**Fluence Rate MeV/cm²/sec With Buildup**	**Exposure Rate mR/hr No Buildup**	**Exposure Rate mR/hr With Buildup**
0.015	2.710e+11	0.000e+00	1.080e-24	0.000e+00	9.267e-26
0.04	1.027e+09	1.061e-69	3.781e-26	4.691e-72	1.672e-28
0.05	1.303e+10	6.235e-42	1.483e-24	1.661e-44	3.951e-27
0.06	1.127e+10	3.898e-30	5.301e-24	7.742e-33	1.053e-26
0.08	1.006e+11	1.661e-19	1.323e-17	2.629e-22	2.093e-20
0.1	2.153e+10	2.010e-16	3.097e-14	3.075e-19	4.738e-17
0.15	4.394e+09	1.434e-13	3.828e-11	2.361e-16	6.303e-14
0.2	8.118e+10	9.015e-11	2.605e-08	1.591e-13	4.597e-11
0.3	7.713e+10	4.501e-09	9.131e-07	8.538e-12	1.732e-09
0.4	9.690e+10	7.040e-08	9.478e-06	1.372e-10	1.847e-08
0.5	1.824e+10	8.444e-08	7.889e-06	1.658e-10	1.548e-08
0.6	1.506e+11	2.990e-06	2.030e-04	5.837e-09	3.963e-07
0.8	5.529e+10	9.950e-06	4.159e-04	1.893e-08	7.912e-07
1.0	1.358e+11	1.251e-04	3.603e-03	2.306e-07	6.641e-06
1.5	6.050e+10	8.786e-04	1.362e-02	1.478e-06	2.292e-05
2.0	6.641e+10	5.431e-03	5.872e-02	8.398e-06	9.080e-05
3.0	3.552e+10	2.357e-02	1.632e-01	3.198e-05	2.214e-04
Totals	**1.200e+12**	**3.002e-02**	**2.397e-01**	**4.211e-05**	**3.429e-04**

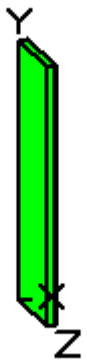
MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

Filename	Run Date	Run Time	Duration
8Feb RA 900N WR.msd	February 8, 2011	8:43:24 PM	00:00:00

Project Info	
Case Title	900N WR
Description	3.5 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	304.8 cm (10 ft 0.0 in)
Width	3.3e+3 cm (108 ft 0.0 in)
Height	1.1e+4 cm (370 ft 0.0 in)



Dose Points			
A	X	Y	Z
#1	502.92 cm (16 ft 6.0 in)	5.6e+3 cm (185 ft 0.0 in)	1.6e+3 cm (54 ft 0.0 in)

Shields			
Shield N	Dimension	Material	Density
Source	4.00e+05 ft³	Quartz-Pegmatite	2.18
Shield 1	3.5 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Bi-210	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Bi-212	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Bi-214	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Pb-210	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Pb-212	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Pb-214	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Po-210	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Po-212	1.6973e+000	6.2801e+010	1.5000e-004	5.5500e+000
Po-214	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Po-216	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Po-218	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Ra-224	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000

Ra-226	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Ra-228	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Rn-220	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Rn-222	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Th-228	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Th-230	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Th-232	2.7157e+000	1.0048e+011	2.4000e-004	8.8800e+000
Th-234	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
Tl-208	9.6181e-001	3.5587e+010	8.5000e-005	3.1450e+000
U-234	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001
U-238	6.6761e+000	2.4702e+011	5.9000e-004	2.1830e+001

Buildup: The material reference is Shield 1 Integration Parameters	
X Direction	10
Y Direction	20
Z Direction	20

Results					
Energy (MeV)	**Activity (Photons/sec)**	**Fluence Rate MeV/cm²/sec No Buildup**	**Fluence Rate MeV/cm²/sec With Buildup**	**Exposure Rate mR/hr No Buildup**	**Exposure Rate mR/hr With Buildup**
0.015	2.710e+11	0.000e+00	1.057e-24	0.000e+00	9.063e-26
0.04	1.027e+09	1.550e-79	3.698e-26	6.855e-82	1.636e-28
0.05	1.303e+10	7.503e-48	1.451e-24	1.999e-50	3.865e-27
0.06	1.127e+10	2.555e-34	5.184e-24	5.074e-37	1.030e-26
0.08	1.006e+11	2.782e-22	2.712e-20	4.403e-25	4.291e-23
0.1	2.153e+10	1.160e-18	2.235e-16	1.775e-21	3.419e-19
0.15	4.394e+09	2.573e-15	9.131e-13	4.236e-18	1.504e-15
0.2	8.118e+10	2.590e-12	1.019e-09	4.571e-15	1.799e-12
0.3	7.713e+10	2.159e-10	5.896e-08	4.095e-13	1.118e-10
0.4	9.690e+10	4.648e-09	8.227e-07	9.056e-12	1.603e-09
0.5	1.824e+10	7.026e-09	8.457e-07	1.379e-11	1.660e-09
0.6	1.506e+11	2.978e-07	2.559e-05	5.812e-10	4.995e-08
0.8	5.529e+10	1.296e-06	6.669e-05	2.465e-09	1.268e-07
1.0	1.358e+11	1.980e-05	6.873e-04	3.649e-08	1.267e-06
1.5	6.050e+10	1.917e-04	3.473e-03	3.225e-07	5.842e-06
2.0	6.641e+10	1.436e-03	1.784e-02	2.221e-06	2.758e-05
3.0	3.552e+10	7.772e-03	6.045e-02	1.054e-05	8.201e-05
Totals	**1.200e+12**	**9.422e-03**	**8.254e-02**	**1.313e-05**	**1.169e-04**

ATTACHMENT D-2.5

MICROSHIELD® INPUT AND OUTPUT DETAILED RESULTS FOR 900-FOOT LEVEL SOUTH MINE ROCK PILE

MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

Filename	Run Date	Run Time	Duration
9002 3 28Aug11.msd	August 28, 2011	7:20:40 PM	00:00:00

Project Info

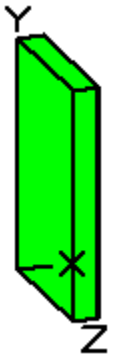
Case Title	900S WR
Description	.5 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions

Length	304.8 cm (10 ft 0.0 in)
Width	1.8e+3 cm (59 ft)
Height	2.7e+3 cm (90 ft)

Dose Points

A	X	Y	Z
#1	411.48 cm (13 ft 6.0 in)	1.4e+3 cm (45 ft)	899.16 cm (29 ft 6.0 in)



Shields

Shield N	Dimension	Material	Density
Source	5.31e+04 ft³	Quartz-Pegmatite	2.18
Shield 1	.5 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Bi-210	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Bi-212	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001

Bi-214	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Pb-210	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Pb-212	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Pb-214	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Po-210	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Po-212	3.4583e-001	1.2796e+010	2.3000e-004	8.5100e+000
Po-214	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Po-216	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Po-218	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Ra-224	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Ra-226	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Ra-228	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Rn-220	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Rn-222	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Th-228	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Th-230	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Th-232	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Th-234	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Tl-208	1.9547e-001	7.2324e+009	1.3000e-004	4.8100e+000
U-234	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
U-238	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001

Buildup: The material reference is Shield 1
Integration Parameters

X Direction	10
Y Direction	20
Z Direction	20

Results

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	5.379e+10	2.140e-195	1.224e-24	1.835e-196	1.050e-25

0.04	1.991e+08	3.488e-16	1.211e-15	1.543e-18	5.358e-18
0.05	2.611e+09	7.549e-10	4.350e-09	2.011e-12	1.159e-11
0.06	2.255e+09	1.623e-07	1.395e-06	3.223e-10	2.772e-09
0.08	1.990e+10	1.656e-04	2.231e-03	2.621e-07	3.530e-06
0.1	4.269e+09	2.608e-04	4.489e-03	3.990e-07	6.867e-06
0.15	8.526e+08	4.223e-04	8.237e-03	6.955e-07	1.356e-05
0.2	1.591e+10	2.182e-02	3.993e-01	3.852e-05	7.048e-04
0.3	1.531e+10	7.191e-02	1.040e+00	1.364e-04	1.973e-03
0.4	1.941e+10	2.071e-01	2.405e+00	4.035e-04	4.687e-03
0.5	3.636e+09	7.214e-02	6.944e-01	1.416e-04	1.363e-03
0.6	3.026e+10	9.885e-01	8.137e+00	1.929e-03	1.588e-02
0.8	1.092e+10	7.745e-01	5.020e+00	1.473e-03	9.547e-03
1.0	2.684e+10	3.445e+00	1.867e+01	6.351e-03	3.441e-02
1.5	1.204e+10	4.420e+00	1.783e+01	7.436e-03	3.000e-02
2.0	1.331e+10	9.898e+00	3.362e+01	1.531e-02	5.198e-02
3.0	7.218e+09	1.355e+01	3.710e+01	1.838e-02	5.034e-02
Totals	**2.387e+11**	**3.345e+01**	**1.249e+02**	**5.160e-02**	**2.009e-01**

MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

Filename	Run Date	Run Time	Duration
9002 3 28Aug11.msd	August 28, 2011	7:19:47 PM	00:00:00

Project Info

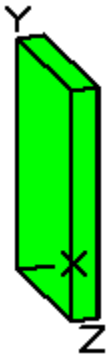
Case Title	900S WR
Description	1 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions

Length	304.8 cm (10 ft 0.0 in)
Width	1.8e+3 cm (59 ft)
Height	2.7e+3 cm (90 ft)

Dose Points

A	X	Y	Z
#1	426.72 cm (14 ft 0.0 in)	1.4e+3 cm (45 ft)	899.16 cm (29 ft 6.0 in)



Shields

Shield N	Dimension	Material	Density
Source	5.31e+04 ft³	Quartz-Pegmatite	2.18
Shield 1	1.0 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Bi-210	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Bi-212	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001

Bi-214	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Pb-210	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Pb-212	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Pb-214	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Po-210	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Po-212	3.4583e-001	1.2796e+010	2.3000e-004	8.5100e+000
Po-214	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Po-216	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Po-218	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Ra-224	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Ra-226	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Ra-228	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Rn-220	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Rn-222	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Th-228	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Th-230	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Th-232	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Th-234	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Tl-208	1.9547e-001	7.2324e+009	1.3000e-004	4.8100e+000
U-234	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
U-238	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001

Buildup: The material reference is Shield 1
Integration Parameters

X Direction	10
Y Direction	20
Z Direction	20

Results

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	5.379e+10	0.000e+00	1.177e-24	0.000e+00	1.010e-25

0.04	1.991e+08	3.465e-26	1.712e-25	1.532e-28	7.573e-28
0.05	2.611e+09	6.345e-16	4.927e-15	1.690e-18	1.312e-17
0.06	2.255e+09	7.334e-12	9.502e-11	1.457e-14	1.887e-13
0.08	1.990e+10	1.881e-07	4.377e-06	2.976e-10	6.926e-09
0.1	4.269e+09	1.019e-06	3.401e-05	1.559e-09	5.204e-08
0.15	8.526e+08	5.169e-06	2.167e-04	8.511e-09	3.569e-07
0.2	1.591e+10	4.305e-04	1.748e-02	7.598e-07	3.085e-05
0.3	1.531e+10	2.395e-03	7.448e-02	4.543e-06	1.413e-04
0.4	1.941e+10	9.583e-03	2.269e-01	1.867e-05	4.421e-04
0.5	3.636e+09	4.242e-03	7.922e-02	8.326e-06	1.555e-04
0.6	3.026e+10	7.009e-02	1.070e+00	1.368e-04	2.089e-03
0.8	1.092e+10	7.275e-02	8.141e-01	1.384e-04	1.548e-03
1.0	2.684e+10	3.977e-01	3.513e+00	7.331e-04	6.476e-03
1.5	1.204e+10	7.189e-01	4.293e+00	1.210e-03	7.223e-03
2.0	1.331e+10	1.984e+00	9.409e+00	3.068e-03	1.455e-02
3.0	7.218e+09	3.462e+00	1.234e+01	4.697e-03	1.674e-02
Totals	**2.387e+11**	**6.722e+00**	**3.184e+01**	**1.002e-02**	**4.940e-02**

MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

Filename	Run Date	Run Time	Duration
9002 3 28Aug11.msd	August 28, 2011	7:18:57 PM	00:00:00

Project Info

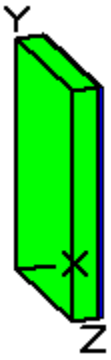
Case Title	900S WR
Description	1.5 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions

Length	304.8 cm (10 ft 0.0 in)
Width	1.8e+3 cm (59 ft)
Height	2.7e+3 cm (90 ft)

Dose Points

A	X	Y	Z
#1	441.96 cm (14 ft 6.0 in)	1.4e+3 cm (45 ft)	899.16 cm (29 ft 6.0 in)



Shields

Shield N	Dimension	Material	Density
Source	5.31e+04 ft³	Quartz-Pegmatite	2.18
Shield 1	1.5 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Bi-210	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Bi-212	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001

Bi-214	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Pb-210	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Pb-212	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Pb-214	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Po-210	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Po-212	3.4583e-001	1.2796e+010	2.3000e-004	8.5100e+000
Po-214	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Po-216	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Po-218	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Ra-224	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Ra-226	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Ra-228	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Rn-220	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Rn-222	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Th-228	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Th-230	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Th-232	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Th-234	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Tl-208	1.9547e-001	7.2324e+009	1.3000e-004	4.8100e+000
U-234	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
U-238	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001

Buildup: The material reference is Shield 1
Integration Parameters

X Direction	10
Y Direction	20
Z Direction	20

Results

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	5.379e+10	0.000e+00	1.134e-24	0.000e+00	9.727e-26

0.04	1.991e+08	3.983e-36	3.876e-26	1.762e-38	1.714e-28
0.05	2.611e+09	6.230e-22	5.624e-21	1.660e-24	1.498e-23
0.06	2.255e+09	3.931e-16	6.821e-15	7.807e-19	1.355e-17
0.08	1.990e+10	2.563e-10	8.820e-09	4.056e-13	1.396e-11
0.1	4.269e+09	4.779e-09	2.579e-07	7.311e-12	3.946e-10
0.15	8.526e+08	7.550e-08	5.601e-06	1.243e-10	9.224e-09
0.2	1.591e+10	1.009e-05	7.461e-04	1.781e-08	1.317e-06
0.3	1.531e+10	9.418e-05	5.217e-03	1.786e-07	9.896e-06
0.4	1.941e+10	5.209e-04	2.113e-02	1.015e-06	4.117e-05
0.5	3.636e+09	2.918e-04	8.986e-03	5.727e-07	1.764e-05
0.6	3.026e+10	5.792e-03	1.409e-01	1.131e-05	2.751e-04
0.8	1.092e+10	7.914e-03	1.338e-01	1.505e-05	2.544e-04
1.0	2.684e+10	5.290e-02	6.760e-01	9.750e-05	1.246e-03
1.5	1.204e+10	1.333e-01	1.074e+00	2.243e-04	1.807e-03
2.0	1.331e+10	4.498e-01	2.759e+00	6.956e-04	4.266e-03
3.0	7.218e+09	9.905e-01	4.341e+00	1.344e-03	5.889e-03
Totals	**2.387e+11**	**1.641e+00**	**9.161e+00**	**2.389e-03**	**1.381e-02**

MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

Filename	Run Date	Run Time	Duration
9002 3 28Aug11.msd	August 28, 2011	7:17:25 PM	00:00:00

Project Info

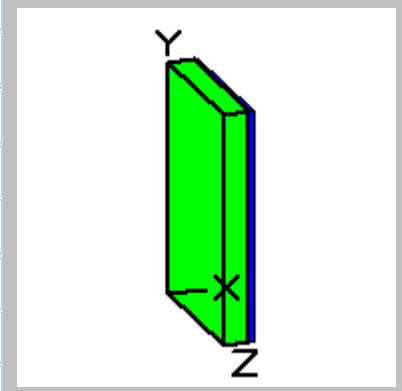
Case Title	900S WR
Description	2 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions

Length	304.8 cm (10 ft 0.0 in)
Width	1.8e+3 cm (59 ft)
Height	2.7e+3 cm (90 ft)

Dose Points

A	X	Y	Z
#1	457.2 cm (15 ft)	1.4e+3 cm (45 ft)	899.16 cm (29 ft 6.0 in)



Shields

Shield N	Dimension	Material	Density
Source	5.31e+04 ft³	Quartz-Pegmatite	2.18
Shield 1	2.0 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Bi-210	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Bi-212	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Bi-214	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001

Pb-210	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Pb-212	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Pb-214	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Po-210	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Po-212	3.4583e-001	1.2796e+010	2.3000e-004	8.5100e+000
Po-214	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Po-216	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Po-218	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Ra-224	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Ra-226	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Ra-228	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Rn-220	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Rn-222	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Th-228	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Th-230	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Th-232	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Th-234	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Tl-208	1.9547e-001	7.2324e+009	1.3000e-004	4.8100e+000
U-234	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
U-238	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001

Buildup: The material reference is Shield 1
Integration Parameters

X Direction	10
Y Direction	20
Z Direction	20

Results

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	5.379e+10	0.000e+00	1.094e-24	0.000e+00	9.382e-26
0.04	1.991e+08	4.956e-46	3.738e-26	2.192e-48	1.653e-28

0.05	2.611e+09	6.569e-28	1.521e-24	1.750e-30	4.053e-27
0.06	2.255e+09	2.271e-20	4.989e-19	4.511e-23	9.909e-22
0.08	1.990e+10	3.790e-13	1.767e-11	5.998e-16	2.797e-14
0.1	4.269e+09	2.437e-11	1.925e-09	3.729e-14	2.944e-12
0.15	8.526e+08	1.200e-09	1.410e-07	1.976e-12	2.322e-10
0.2	1.591e+10	2.571e-07	3.099e-05	4.538e-10	5.470e-08
0.3	1.531e+10	4.018e-06	3.562e-04	7.623e-09	6.757e-07
0.4	1.941e+10	3.067e-05	1.927e-03	5.976e-08	3.754e-06
0.5	3.636e+09	2.170e-05	1.003e-03	4.260e-08	1.969e-06
0.6	3.026e+10	5.167e-04	1.832e-02	1.009e-06	3.576e-05
0.8	1.092e+10	9.268e-04	2.188e-02	1.763e-06	4.162e-05
1.0	2.684e+10	7.554e-03	1.304e-01	1.392e-05	2.404e-04
1.5	1.204e+10	2.642e-02	2.718e-01	4.444e-05	4.574e-04
2.0	1.331e+10	1.086e-01	8.233e-01	1.679e-04	1.273e-03
3.0	7.218e+09	3.003e-01	1.564e+00	4.074e-04	2.121e-03
Totals	**2.387e+11**	**4.444e-01**	**2.833e+00**	**6.366e-04**	**4.176e-03**

MicroShield 8.03
BobMeyer (8.03-0000)

Date	By	Checked

Filename	Run Date	Run Time	Duration
9002 3 28Aug11.msd	August 28, 2011	7:15:09 PM	00:00:00

Project Info

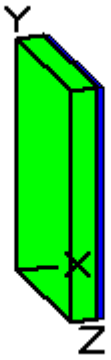
Case Title	900S WR
Description	2.5 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions

Length	304.8 cm (10 ft 0.0 in)
Width	1.8e+3 cm (59 ft)
Height	2.7e+3 cm (90 ft)

Dose Points

A	X	Y	Z
#1	472.44 cm (15 ft 6.0 in)	1.4e+3 cm (45 ft)	899.16 cm (29 ft 6.0 in)



Shields

Shield N	Dimension	Material	Density
Source	5.31e+04 ft³	Quartz-Pegmatite	2.18
Shield 1	2.5 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Bi-210	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Bi-212	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001

Bi-214	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Pb-210	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Pb-212	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Pb-214	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Po-210	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Po-212	3.4583e-001	1.2796e+010	2.3000e-004	8.5100e+000
Po-214	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Po-216	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Po-218	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Ra-224	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Ra-226	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Ra-228	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Rn-220	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Rn-222	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Th-228	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Th-230	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Th-232	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Th-234	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Tl-208	1.9547e-001	7.2324e+009	1.3000e-004	4.8100e+000
U-234	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
U-238	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001

Buildup: The material reference is Shield 1
Integration Parameters

X Direction	10
Y Direction	20
Z Direction	20

Results

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	5.379e+10	0.000e+00	1.056e-24	0.000e+00	9.059e-26

0.04	1.991e+08	6.485e-56	3.609e-26	2.868e-58	1.596e-28
0.05	2.611e+09	7.231e-34	1.465e-24	1.926e-36	3.901e-27
0.06	2.255e+09	1.371e-24	4.182e-23	2.723e-27	8.306e-26
0.08	1.990e+10	5.874e-16	3.486e-14	9.296e-19	5.517e-17
0.1	4.269e+09	1.305e-13	1.411e-11	1.996e-16	2.159e-14
0.15	8.526e+08	2.003e-11	3.473e-09	3.298e-14	5.719e-12
0.2	1.591e+10	6.883e-09	1.258e-06	1.215e-11	2.221e-09
0.3	1.531e+10	1.800e-07	2.374e-05	3.415e-10	4.502e-08
0.4	1.941e+10	1.895e-06	1.721e-04	3.691e-09	3.354e-07
0.5	3.636e+09	1.692e-06	1.101e-04	3.321e-09	2.161e-07
0.6	3.026e+10	4.828e-05	2.349e-03	9.424e-08	4.585e-06
0.8	1.092e+10	1.135e-04	3.549e-03	2.159e-07	6.751e-06
1.0	2.684e+10	1.127e-03	2.507e-02	2.077e-06	4.621e-05
1.5	1.204e+10	5.452e-03	6.900e-02	9.172e-06	1.161e-04
2.0	1.331e+10	2.725e-02	2.476e-01	4.214e-05	3.829e-04
3.0	7.218e+09	9.436e-02	5.703e-01	1.280e-04	7.737e-04
Totals	**2.387e+11**	**1.284e-01**	**9.182e-01**	**1.817e-04**	**1.331e-03**

MicroShield 8.03
BobMeyer (8.03-0000)

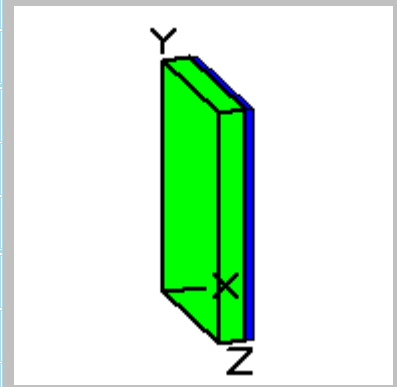
Date	By	Checked

Filename	Run Date	Run Time	Duration
9002 3 28Aug11.msd	August 28, 2011	7:11:13 PM	00:00:00

Project Info	
Case Title	900S WR
Description	3 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	304.8 cm (10 ft 0.0 in)
Width	1.8e+3 cm (59 ft)
Height	2.7e+3 cm (90 ft)

Dose Points			
A	X	Y	Z
#1	487.68 cm (16 ft)	1.4e+3 cm (45 ft)	899.16 cm (29 ft 6.0 in)



Shields			
Shield N	Dimension	Material	Density
Source	5.31e+04 ft³	Quartz-Pegmatite	2.18
Shield 1	3.0 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Bi-210	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Bi-212	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Bi-214	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001

Pb-210	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Pb-212	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Pb-214	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Po-210	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Po-212	3.4583e-001	1.2796e+010	2.3000e-004	8.5100e+000
Po-214	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Po-216	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Po-218	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Ra-224	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Ra-226	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Ra-228	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Rn-220	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Rn-222	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Th-228	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Th-230	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Th-232	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Th-234	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Tl-208	1.9547e-001	7.2324e+009	1.3000e-004	4.8100e+000
U-234	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
U-238	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001

Buildup: The material reference is Shield 1
Integration Parameters

X Direction	10
Y Direction	20
Z Direction	20

Results

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	5.379e+10	0.000e+00	1.021e-24	0.000e+00	8.756e-26
0.04	1.991e+08	8.784e-66	3.489e-26	3.885e-68	1.543e-28

0.05	2.611e+09	8.196e-40	1.416e-24	2.183e-42	3.771e-27
0.06	2.255e+09	8.525e-29	5.048e-24	1.693e-31	1.003e-26
0.08	1.990e+10	9.392e-19	6.910e-17	1.486e-21	1.094e-19
0.1	4.269e+09	7.212e-16	1.020e-13	1.103e-18	1.560e-16
0.15	8.526e+08	3.455e-13	8.389e-11	5.689e-16	1.381e-13
0.2	1.591e+10	1.904e-10	4.998e-08	3.360e-13	8.821e-11
0.3	1.531e+10	8.331e-09	1.552e-06	1.580e-11	2.945e-09
0.4	1.941e+10	1.208e-07	1.511e-05	2.355e-10	2.943e-08
0.5	3.636e+09	1.362e-07	1.191e-05	2.672e-10	2.338e-08
0.6	3.026e+10	4.654e-06	2.981e-04	9.085e-09	5.818e-07
0.8	1.092e+10	1.433e-05	5.713e-04	2.725e-08	1.087e-06
1.0	2.684e+10	1.731e-04	4.796e-03	3.190e-07	8.840e-06
1.5	1.204e+10	1.157e-03	1.751e-02	1.946e-06	2.946e-05
2.0	1.331e+10	7.022e-03	7.475e-02	1.086e-05	1.156e-04
3.0	7.218e+09	3.039e-02	2.095e-01	4.123e-05	2.842e-04
Totals	**2.387e+11**	**3.876e-02**	**3.074e-01**	**5.439e-05**	**4.398e-04**

MicroShield 8.03
BobMeyer (8.03-0000)

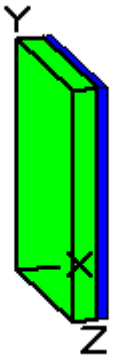
Date	By	Checked

Filename	Run Date	Run Time	Duration
8Feb RA 900S WR.msd	August 28, 2011	5:00:24 PM	00:00:00

Project Info	
Case Title	900S WR
Description	3.5 ft soil
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	304.8 cm (10 ft 0.0 in)
Width	1.8e+3 cm (59 ft)
Height	2.7e+3 cm (90 ft)

Dose Points			
A	X	Y	Z
#1	502.92 cm (16 ft 6.0 in)	1.4e+3 cm (45 ft)	899.16 cm (29 ft 6.0 in)



Shields

Shield N	Dimension	Material	Density
Source	5.31e+04 ft³	Quartz-Pegmatite	2.18
Shield 1	3.5 ft	Soil	1.8
Air Gap		Air	0.00122

Source Input: Grouping Method - Standard Indices
Number of Groups: 25
Lower Energy Cutoff: 0.015
Photons < 0.015: Included
Library: Grove

Nuclide	Ci	Bq	µCi/cm³	Bq/cm³
Ac-228	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Bi-210	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Bi-212	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001

Bi-214	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Pb-210	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Pb-212	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Pb-214	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Po-210	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Po-212	3.4583e-001	1.2796e+010	2.3000e-004	8.5100e+000
Po-214	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Po-216	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Po-218	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Ra-224	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Ra-226	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Ra-228	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Rn-220	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Rn-222	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Th-228	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Th-230	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Th-232	5.2627e-001	1.9472e+010	3.5000e-004	1.2950e+001
Th-234	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
Tl-208	1.9547e-001	7.2324e+009	1.3000e-004	4.8100e+000
U-234	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001
U-238	1.3382e+000	4.9514e+010	8.9000e-004	3.2930e+001

Buildup: The material reference is Shield 1
Integration Parameters

X Direction	10
Y Direction	20
Z Direction	20

Results

Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.015	5.379e+10	0.000e+00	9.876e-25	0.000e+00	8.471e-26

0.04	1.991e+08	1.219e-75	3.375e-26	5.393e-78	1.493e-28
0.05	2.611e+09	9.491e-46	1.369e-24	2.528e-48	3.648e-27
0.06	2.255e+09	5.415e-33	4.884e-24	1.075e-35	9.700e-27
0.08	1.990e+10	1.536e-21	1.382e-19	2.430e-24	2.187e-22
0.1	4.269e+09	4.079e-18	7.289e-16	6.240e-21	1.115e-18
0.15	8.526e+08	6.101e-15	1.992e-12	1.005e-17	3.280e-15
0.2	1.591e+10	5.391e-12	1.949e-09	9.514e-15	3.440e-12
0.3	1.531e+10	3.946e-10	9.996e-08	7.486e-13	1.896e-10
0.4	1.941e+10	7.887e-09	1.307e-06	1.537e-11	2.548e-09
0.5	3.636e+09	1.121e-08	1.273e-06	2.200e-11	2.499e-09
0.6	3.026e+10	4.588e-07	3.745e-05	8.956e-10	7.311e-08
0.8	1.092e+10	1.848e-06	9.126e-05	3.516e-09	1.736e-07
1.0	2.684e+10	2.716e-05	9.113e-04	5.006e-08	1.680e-06
1.5	1.204e+10	2.504e-04	4.441e-03	4.213e-07	7.471e-06
2.0	1.331e+10	1.844e-03	2.260e-02	2.852e-06	3.495e-05
3.0	7.218e+09	9.966e-03	7.730e-02	1.352e-05	1.049e-04
Totals	**2.387e+11**	**1.209e-02**	**1.054e-01**	**1.685e-05**	**1.492e-04**