MicroShield 8.03
Perma-Fix Environmental Services (8.03-0000)

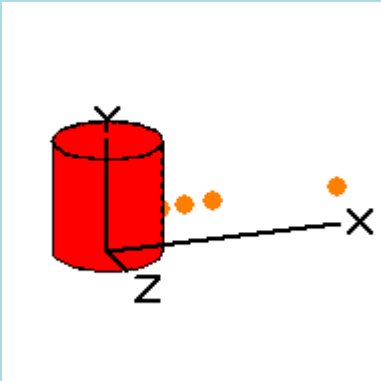
Date	By	Checked

Filename	Run Date	Run Time	Duration
Deck Markers in 55 Gallon Drum Rev 1.msd	September 4, 2019	12:14:12 PM	00:00:00

Project Info	
Case Title	55-G Drum Deck Marke
Description	Ra-226 Deck Markers in 55 Gallon Drum
Geometry	7 - Cylinder Volume - Side Shields

Source Dimensions	
Height	62.484 cm (2 ft 0.6 in)
Radius	28.575 cm (11.3 in)

Dose Points			
A	X	Y	Z
#1	29.695 cm (11.7 in)	20.828 cm (8.2 in)	0.0 cm (0 in)
#2	43.695 cm (1 ft 5.2 in)	20.828 cm (8.2 in)	0.0 cm (0 in)
#3	58.695 cm (1 ft 11.1 in)	20.828 cm (8.2 in)	0.0 cm (0 in)
#4	128.695 cm (4 ft 2.7 in)	20.828 cm (8.2 in)	0.0 cm (0 in)



Shields			
Shield N	Dimension	Material	Density
Source	1.60e+05 cm³	Concrete	1.5
Transition	.2 cm	Iron	7.6
Air Gap		Air	0.00122
Wall Clad	.12 cm	Iron	7.6
Top Clad	.15 cm	Iron	7.6

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
Bi-210	1.2823e-003	4.7444e+007	8.0000e-003	2.9600e+002
Bi-214	1.2823e-003	4.7444e+007	8.0000e-003	2.9600e+002
Pb-210	1.2823e-003	4.7444e+007	8.0000e-003	2.9600e+002
Pb-214	1.2823e-003	4.7444e+007	8.0000e-003	2.9600e+002
Po-210	1.2823e-003	4.7444e+007	8.0000e-003	2.9600e+002
Po-214	1.2823e-003	4.7444e+007	8.0000e-003	2.9600e+002
Po-218	1.2823e-003	4.7444e+007	8.0000e-003	2.9600e+002
Ra-226	2.5645e-003	9.4888e+007	1.6000e-002	5.9200e+002
Rn-222	1.2823e-003	4.7444e+007	8.0000e-003	2.9600e+002

Buildup: The material reference is Transition

Integration Parameters	
Radial	10
Circumferential	10
Y Direction (axial)	20

Results - Dose Point # 1 - (29.695,20.828,0) cm					
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	1.896e+07	2.219e-89	2.461e-25	1.903e-90	2.111e-26
0.05	2.446e+06	4.779e-04	5.915e-04	1.273e-06	1.576e-06
0.08	1.117e+07	6.715e-01	1.010e+00	1.063e-03	1.599e-03
0.1	1.288e+05	2.593e-02	4.365e-02	3.968e-05	6.678e-05
0.2	6.667e+06	8.790e+00	2.039e+01	1.551e-02	3.599e-02
0.3	9.794e+06	2.610e+01	6.516e+01	4.950e-02	1.236e-01
0.4	1.815e+07	7.702e+01	1.922e+02	1.501e-01	3.744e-01
0.5	8.475e+05	5.127e+00	1.244e+01	1.006e-02	2.442e-02
0.6	2.288e+07	1.846e+02	4.324e+02	3.603e-01	8.439e-01
0.8	4.484e+06	5.698e+01	1.247e+02	1.084e-01	2.373e-01
1.0	1.485e+07	2.685e+02	5.541e+02	4.949e-01	1.021e+00
1.5	9.033e+06	3.081e+02	5.681e+02	5.184e-01	9.559e-01
2.0	1.270e+07	6.710e+02	1.155e+03	1.038e+00	1.787e+00
Totals	**1.321e+08**	**1.607e+03**	**3.126e+03**	**2.746e+00**	**5.405e+00**

Results - Dose Point # 2 - (43.695,20.828,0) cm					
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	1.896e+07	1.842e-81	1.041e-25	1.580e-82	8.927e-27
0.05	2.446e+06	2.496e-04	3.071e-04	6.648e-07	8.181e-07
0.08	1.117e+07	2.281e-01	3.334e-01	3.609e-04	5.276e-04
0.1	1.288e+05	7.871e-03	1.280e-02	1.204e-05	1.958e-05
0.2	6.667e+06	2.540e+00	5.990e+00	4.483e-03	1.057e-02
0.3	9.794e+06	7.744e+00	2.040e+01	1.469e-02	3.871e-02
0.4	1.815e+07	2.332e+01	6.237e+01	4.543e-02	1.215e-01
0.5	8.475e+05	1.577e+00	4.133e+00	3.095e-03	8.113e-03
0.6	2.288e+07	5.754e+01	1.461e+02	1.123e-01	2.851e-01
0.8	4.484e+06	1.816e+01	4.315e+01	3.455e-02	8.207e-02
1.0	1.485e+07	8.714e+01	1.948e+02	1.606e-01	3.591e-01
1.5	9.033e+06	1.034e+02	2.052e+02	1.740e-01	3.452e-01
2.0	1.270e+07	2.301e+02	4.239e+02	3.558e-01	6.555e-01
Totals	**1.321e+08**	**5.317e+02**	**1.106e+03**	**9.053e-01**	**1.907e+00**

Results - Dose Point # 3 - (58.695,20.828,0) cm					
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	1.896e+07	1.580e-81	5.763e-26	1.355e-82	4.943e-27
0.05	2.446e+06	1.211e-04	1.490e-04	3.226e-07	3.969e-07
0.08	1.117e+07	1.051e-01	1.532e-01	1.664e-04	2.424e-04
0.1	1.288e+05	3.542e-03	5.734e-03	5.418e-06	8.772e-06
0.2	6.667e+06	1.156e+00	2.773e+00	2.040e-03	4.895e-03
0.3	9.794e+06	3.579e+00	9.656e+00	6.789e-03	1.832e-02
0.4	1.815e+07	1.087e+01	2.982e+01	2.118e-02	5.810e-02
0.5	8.475e+05	7.395e-01	1.989e+00	1.452e-03	3.905e-03
0.6	2.288e+07	2.711e+01	7.065e+01	5.292e-02	1.379e-01
0.8	4.484e+06	8.624e+00	2.104e+01	1.640e-02	4.003e-02
1.0	1.485e+07	4.163e+01	9.563e+01	7.674e-02	1.763e-01
1.5	9.033e+06	4.999e+01	1.019e+02	8.411e-02	1.715e-01
2.0	1.270e+07	1.122e+02	2.123e+02	1.734e-01	3.284e-01
Totals	**1.321e+08**	**2.560e+02**	**5.460e+02**	**4.353e-01**	**9.396e-01**

Results - Dose Point # 4 - (128.695,20.828,0) cm					
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	1.896e+07	3.462e-82	1.206e-26	2.969e-83	1.035e-27
0.05	2.446e+06	2.144e-05	2.634e-05	5.710e-08	7.017e-08
0.08	1.117e+07	1.591e-02	2.306e-02	2.518e-05	3.650e-05
0.1	1.288e+05	5.168e-04	8.332e-04	7.906e-07	1.275e-06
0.2	6.667e+06	1.700e-01	4.171e-01	3.000e-04	7.362e-04
0.3	9.794e+06	5.353e-01	1.489e+00	1.015e-03	2.824e-03
0.4	1.815e+07	1.643e+00	4.664e+00	3.200e-03	9.088e-03
0.5	8.475e+05	1.127e-01	3.147e-01	2.211e-04	6.176e-04
0.6	2.288e+07	4.158e+00	1.128e+01	8.116e-03	2.201e-02
0.8	4.484e+06	1.338e+00	3.410e+00	2.544e-03	6.486e-03
1.0	1.485e+07	6.523e+00	1.569e+01	1.202e-02	2.892e-02
1.5	9.033e+06	8.001e+00	1.714e+01	1.346e-02	2.884e-02
2.0	1.270e+07	1.824e+01	3.630e+01	2.821e-02	5.613e-02
Totals	**1.321e+08**	**4.074e+01**	**9.073e+01**	**6.912e-02**	**1.557e-01**