APPENDIX J

MICROSHIELD® OUTPUT FILES

MicroShield® Output Files

Wastewater Truck Driver with 3,800 Gallons at the DOT Limit

MicroShield 9.05
Perma-Fix Environmental Services, Inc. (9.05-0000)

Date	By	Checked

Filename	Run Date	Run Time	Duration
Driver Water Truck DOT Limit.msd	June 23, 2014	1:21:46 PM	00:00:00

Project Info	
Case Title	Driver Water Truck
Description	Driver Water Truck DOT Limit 3800 Gallons
Geometry	8 - Cylinder Volume - End Shields

Source Dimensions	
Height	548.64 cm (18 ft)
Radius	91.44 cm (3 ft)

Dose Points			
A	X	Y	Z
#1	0.0 cm (0 in)	598.64 cm (19 ft 7.7 in)	0.0 cm (0 in)

Shields			
Shield N	Dimension	Material	Density
Source	14.412 m³	Water	1
Air Gap		Air	0.00122
Wall Clad	.005 m	Stainless Steel 304	8.03
Top Clad	.005 m	Stainless Steel 304	8.03

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	1.2970e-003	4.7990e+007	9.0000e-005	3.3300e+000
Bi-210	2.5941e-003	9.5981e+007	1.8000e-004	6.6600e+000
Bi-212	1.2970e-003	4.7990e+007	9.0000e-005	3.3300e+000
Bi-214	2.5941e-003	9.5981e+007	1.8000e-004	6.6600e+000
Pb-210	2.5941e-003	9.5981e+007	1.8000e-004	6.6600e+000
Pb-212	1.2970e-003	4.7990e+007	9.0000e-005	3.3300e+000
Pb-214	2.5941e-003	9.5981e+007	1.8000e-004	6.6600e+000
Po-210	2.5941e-003	9.5981e+007	1.8000e-004	6.6600e+000
Po-212	8.3010e-004	3.0714e+007	5.7600e-005	2.1312e+000
Po-214	2.5941e-003	9.5981e+007	1.8000e-004	6.6600e+000
Po-216	1.2970e-003	4.7990e+007	9.0000e-005	3.3300e+000
Po-218	2.5941e-003	9.5981e+007	1.8000e-004	6.6600e+000
Ra-224	1.2970e-003	4.7990e+007	9.0000e-005	3.3300e+000
Ra-226	2.5941e-003	9.5981e+007	1.8000e-004	6.6600e+000
Ra-228	1.2970e-003	4.7990e+007	9.0000e-005	3.3300e+000
Rn-220	1.2970e-003	4.7990e+007	9.0000e-005	3.3300e+000
Rn-222	2.5941e-003	9.5981e+007	1.8000e-004	6.6600e+000
Th-228	1.2970e-003	4.7990e+007	9.0000e-005	3.3300e+000
Tl-208	4.6693e-004	1.7277e+007	3.2400e-005	1.1988e+000

Buildup: The material reference is Source Integration Parameters	
Radial	20
Circumferential	10
Y Direction (axial)	10

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	Absorbed Dose Rate mrad/hr No Buildup	Absorbed Dose Rate mrad/hr With Buildup	Absorbed Dose Rate mGy/hr No Buildup	Absorbed Dose Rate mGy/hr With Buildup
0.015	7.277e+07	2.505e-94	3.519e-26	2.149e-95	3.018e-27	1.876e-95	2.635e-27	1.876e-97	2.635e-29
0.04	4.907e+05	5.751e-10	3.285e-08	2.544e-12	1.453e-10	2.221e-12	1.268e-10	2.221e-14	1.268e-12
0.05	4.948e+06	5.258e-06	3.780e-04	1.401e-08	1.007e-06	1.223e-08	8.792e-07	1.223e-10	8.792e-09
0.06	2.406e+05	6.758e-06	4.280e-04	1.342e-08	8.500e-07	1.172e-08	7.421e-07	1.172e-10	7.421e-09
0.08	4.284e+07	2.270e-02	8.189e-01	3.592e-05	1.296e-03	3.136e-05	1.131e-03	3.136e-07	1.131e-05
0.1	3.536e+06	6.565e-03	1.430e-01	1.004e-05	2.188e-04	8.768e-06	1.910e-04	8.768e-08	1.910e-06
0.15	1.997e+06	1.340e-02	1.444e-01	2.207e-05	2.378e-04	1.927e-05	2.076e-04	1.927e-07	2.076e-06
0.2	3.641e+07	4.430e-01	3.440e+00	7.819e-04	6.072e-03	6.826e-04	5.301e-03	6.826e-06	5.301e-05
0.3	3.232e+07	7.918e-01	4.125e+00	1.502e-03	7.826e-03	1.311e-03	6.832e-03	1.311e-05	6.832e-05
0.4	3.786e+07	1.478e+00	6.228e+00	2.880e-03	1.214e-02	2.515e-03	1.059e-02	2.515e-05	1.059e-04
0.5	8.378e+06	4.669e-01	1.695e+00	9.165e-04	3.328e-03	8.001e-04	2.905e-03	8.001e-06	2.905e-05
0.6	6.156e+07	4.582e+00	1.493e+01	8.943e-03	2.913e-02	7.807e-03	2.543e-02	7.807e-05	2.543e-04
0.8	2.437e+07	2.863e+00	7.969e+00	5.445e-03	1.516e-02	4.754e-03	1.323e-02	4.754e-05	1.323e-04
1.0	5.800e+07	9.717e+00	2.435e+01	1.791e-02	4.489e-02	1.564e-02	3.919e-02	1.564e-04	3.919e-04
1.5	2.471e+07	7.882e+00	1.667e+01	1.326e-02	2.805e-02	1.158e-02	2.449e-02	1.158e-04	2.449e-04
2.0	2.583e+07	1.293e+01	2.481e+01	1.999e-02	3.837e-02	1.745e-02	3.350e-02	1.745e-04	3.350e-04
3.0	1.724e+07	1.603e+01	2.733e+01	2.174e-02	3.708e-02	1.898e-02	3.237e-02	1.898e-04	3.237e-04
Totals	**4.535e+08**	**5.722e+01**	**1.327e+02**	**9.344e-02**	**2.238e-01**	**8.158e-02**	**1.954e-01**	**8.158e-04**	**1.954e-03**

MicroShield® Output Files

Solid Waste Roll-off at the DOT Limit

MicroShield 9.05
Perma-Fix Environmental Services, Inc. (9.05-0000)

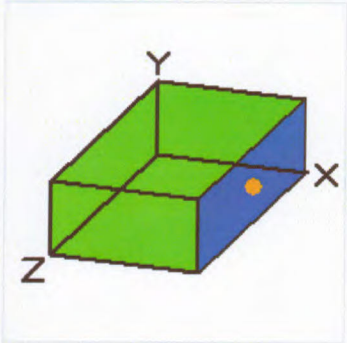
Date	By	Checked

Filename	Run Date	Run Time	Duration
Sludge RO DOT Limit.msd	June 24, 2014	1:08:55 PM	00:00:00

Project Info	
Case Title	Sludge RO DOT Limit
Description	20 yd3 RO Density 1.2
Geometry	13 - Rectangular Volume

Source Dimensions	
Length	243.84 cm (8 ft)
Width	487.68 cm (16 ft)
Height	121.92 cm (4 ft)

Dose Points			
A	X	Y	Z
#1	249.0 cm (8 ft 2.0 in)	60.96 cm (2 ft)	243.84 cm (8 ft)



Shields			
Shield N	Dimension	Material	Density
Source	14.498 m³	Carbon	1.2
Shield 1	.003 m	Iron	7.86
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	1.5658e-003	5.7935e+007	1.0800e-004	3.9960e+000
Bi-210	3.1316e-003	1.1587e+008	2.1600e-004	7.9920e+000
Bi-212	1.5658e-003	5.7935e+007	1.0800e-004	3.9960e+000
Bi-214	3.1316e-003	1.1587e+008	2.1600e-004	7.9920e+000
Pb-210	3.1316e-003	1.1587e+008	2.1600e-004	7.9920e+000
Pb-212	1.5658e-003	5.7935e+007	1.0800e-004	3.9960e+000
Pb-214	3.1316e-003	1.1587e+008	2.1600e-004	7.9920e+000
Po-210	3.1316e-003	1.1587e+008	2.1600e-004	7.9920e+000
Po-212	1.0021e-003	3.7078e+007	6.9120e-005	2.5574e+000
Po-214	3.1316e-003	1.1587e+008	2.1600e-004	7.9920e+000
Po-216	1.5658e-003	5.7935e+007	1.0800e-004	3.9960e+000
Po-218	3.1316e-003	1.1587e+008	2.1600e-004	7.9920e+000
Ra-224	1.5658e-003	5.7935e+007	1.0800e-004	3.9960e+000
Ra-226	3.1316e-003	1.1587e+008	2.1600e-004	7.9920e+000
Ra-228	1.5658e-003	5.7935e+007	1.0800e-004	3.9960e+000
Rn-220	1.5658e-003	5.7935e+007	1.0800e-004	3.9960e+000
Rn-222	3.1316e-003	1.1587e+008	2.1600e-004	7.9920e+000
Th-228	1.5658e-003	5.7935e+007	1.0800e-004	3.9960e+000
Tl-208	5.6369e-004	2.0857e+007	3.8880e-005	1.4386e+000

Buildup: The material reference is Source 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	Absorbed Dose Rate mrad/hr No Buildup	Absorbed Dose Rate mrad/hr With Buildup	Absorbed Dose Rate mGy/hr No Buildup	Absorbed Dose Rate mGy/hr With Buildup
0.015	8.785e+07	3.921e-60	2.119e-25	3.363e-61	1.818e-26	2.936e-61	1.587e-26	2.936e-63	1.587e-28
0.04	5.924e+05	2.371e-07	3.848e-05	1.049e-09	1.702e-07	9.155e-10	1.486e-07	9.155e-12	1.486e-09
0.05	5.974e+06	1.756e-04	2.252e-02	4.679e-07	5.998e-05	4.084e-07	5.237e-05	4.084e-09	5.237e-07
0.06	2.905e+05	6.855e-05	6.013e-03	1.362e-07	1.194e-05	1.189e-07	1.043e-05	1.189e-09	1.043e-07
0.08	5.172e+07	8.656e-02	4.038e+00	1.370e-04	6.389e-03	1.196e-04	5.578e-03	1.196e-06	5.578e-05
0.1	4.268e+06	1.794e-02	5.359e-01	2.744e-05	8.199e-04	2.395e-05	7.158e-04	2.395e-07	7.158e-06
0.15	2.411e+06	2.940e-02	4.450e-01	4.842e-05	7.328e-04	4.227e-05	6.397e-04	4.227e-07	6.397e-06
0.2	4.395e+07	9.314e-01	9.702e+00	1.644e-03	1.712e-02	1.435e-03	1.495e-02	1.435e-05	1.495e-04
0.3	3.902e+07	1.640e+00	1.115e+01	3.111e-03	2.114e-02	2.716e-03	1.846e-02	2.716e-05	1.846e-04
0.4	4.571e+07	3.061e+00	1.625e+01	5.965e-03	3.167e-02	5.207e-03	2.765e-02	5.207e-05	2.765e-04
0.5	1.011e+07	9.704e-01	4.324e+00	1.905e-03	8.488e-03	1.663e-03	7.410e-03	1.663e-05	7.410e-05
0.6	7.432e+07	9.569e+00	3.761e+01	1.868e-02	7.341e-02	1.631e-02	6.408e-02	1.631e-04	6.408e-04
0.8	2.942e+07	6.037e+00	1.956e+01	1.148e-02	3.721e-02	1.003e-02	3.249e-02	1.003e-04	3.249e-04
1.0	7.002e+07	2.070e+01	5.914e+01	3.816e-02	1.090e-01	3.331e-02	9.517e-02	3.331e-04	9.517e-04
1.5	2.983e+07	1.716e+01	4.059e+01	2.888e-02	6.829e-02	2.521e-02	5.962e-02	2.521e-04	5.962e-04
2.0	3.118e+07	2.865e+01	6.070e+01	4.431e-02	9.386e-02	3.868e-02	8.194e-02	3.868e-04	8.194e-04
3.0	2.081e+07	3.658e+01	6.768e+01	4.963e-02	9.182e-02	4.333e-02	8.016e-02	4.333e-04	8.016e-04
Totals	**5.475e+08**	**1.254e+02**	**3.317e+02**	**2.040e-01**	**5.600e-01**	**1.781e-01**	**4.889e-01**	**1.781e-03**	**4.889e-03**

MicroShield® Output Files

Solid Waste Container on Day 1

Print

MicroShield 6.22 (6.22-0000)
Safety and Ecology

Page	1
DOS File	iMS_Ra-226 Decay 1 Day.ms6
Run Date	December 28, 2014
Run Time	7:51:30 PM
Duration	00:00:00

File Ref	
Date	
By	
Checked	

Case Title: Ra-226 Only 1 day
Description: 20 yd3 RO Density 1.5
Geometry: 13 - Rectangular Volume

Source Dimensions:

Length	243.84 cm	(8 ft)
Width	487.68 cm	(16 ft)
Height	121.92 cm	(4 ft)

Dose Points

A	X	Y	Z
# 1	249 cm	60.96 cm	243.84 cm
	8 ft 2.0 in	2 ft	8 ft

Shields

Shield N	Dimension	Material	Density
Source	1.45e+07 cm³	Carbon	1.5
Shield 1	.274 cm	Iron	7.86
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	curies	becquerels	µCi/cm³	Bq/cm³
Bi-210	8.2408e-011	3.0491e+000	5.6840e-012	2.1031e-007
Bi-214	4.5868e-005	1.6971e+006	3.1637e-006	1.1706e-001
Pb-210	1.9129e-009	7.0777e+001	1.3194e-010	4.8818e-006
Pb-214	4.6750e-005	1.7297e+006	3.2245e-006	1.1931e-001
Po-210	9.9798e-014	3.6925e-003	6.8834e-015	2.5469e-010
Po-214	4.5858e-005	1.6967e+006	3.1630e-006	1.1703e-001
Po-218	4.7943e-005	1.7739e+006	3.3068e-006	1.2235e-001
Ra-226	2.8996e-004	1.0729e+007	2.0000e-005	7.4000e-001
Rn-222	4.8077e-005	1.7788e+006	3.3161e-006	1.2269e-001

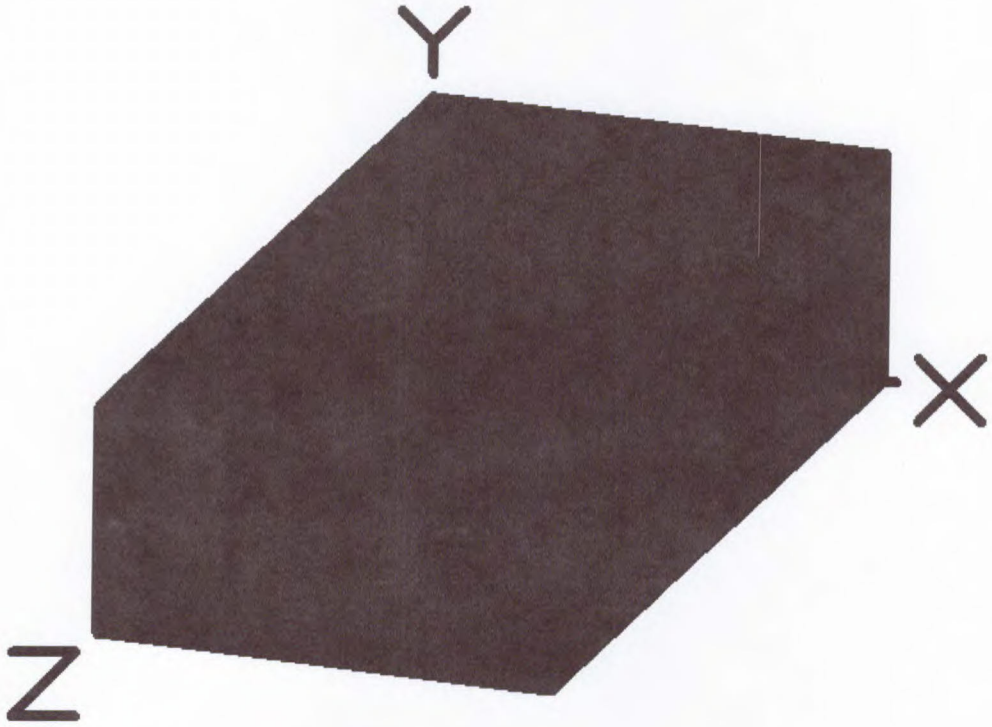
Buildup : The material reference is - Source
Integration Parameters

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	3.285e+05	6.768e-63	7.926e-28	5.805e-64	6.798e-29
0.05	1.912e+04	4.442e-07	5.844e-05	1.183e-09	1.557e-07
0.08	4.415e+05	5.775e-04	2.752e-02	9.138e-07	4.355e-05
0.1	1.456e+04	4.746e-05	1.461e-03	7.261e-08	2.235e-06
0.2	4.815e+05	7.887e-03	8.516e-02	1.392e-05	1.503e-04
0.3	3.575e+05	1.168e-02	8.223e-02	2.215e-05	1.560e-04
0.4	6.616e+05	3.459e-02	1.891e-01	6.739e-05	3.685e-04
0.5	3.075e+04	2.311e-03	1.060e-02	4.536e-06	2.080e-05

0.6	8.184e+05	8.278e-02	3.341e-01	1.616e-04	6.522e-04
0.8	1.609e+05	2.606e-02	8.623e-02	4.956e-05	1.640e-04
1.0	5.314e+05	1.244e-01	3.625e-01	2.293e-04	6.681e-04
1.5	3.231e+05	1.482e-01	3.568e-01	2.493e-04	6.002e-04
2.0	4.542e+05	3.343e-01	7.206e-01	5.170e-04	1.114e-03
Totals	**4.623e+06**	**7.728e-01**	**2.256e+00**	**1.316e-03**	**3.940e-03**


Y
X
Z

MicroShield® Output Files

Solid Waste Container on Day 3

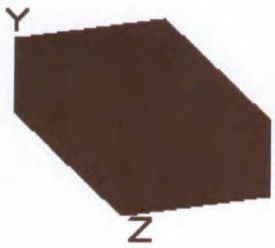
Print

MicroShield 6.22 (6.22-0000)
Safety and Ecology

Page	1
DOS File	iMS_Ra-226 Decay 3 Days.ms6
Run Date	December 28, 2014
Run Time	7:56:17 PM
Duration	00:00:00

File Ref	
Date	
By	
Checked	

Case Title: Ra-226 Decay 3 days
Description: 20 yd3 RO Density 1.5
Geometry: 13 - Rectangular Volume



Source Dimensions:

Length	243.84 cm	(8 ft)
Width	487.68 cm	(16 ft)
Height	121.92 cm	(4 ft)

Dose Points

A	X	Y	Z
# 1	249 cm	60.96 cm	243.84 cm
	8 ft 2.0 in	2 ft	8 ft

Shields

Shield N	Dimension	Material	Density
Source	1.45e+07 cm³	Carbon	1.5
Shield 1	.274 cm	Iron	7.86
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	curies	becquerels	µCi/cm³	Bq/cm³
Bi-210	2.1066e-009	7.7946e+001	1.4530e-010	5.3762e-006
Bi-214	1.2008e-004	4.4431e+006	8.2826e-006	3.0646e-001
Pb-210	1.6438e-008	6.0820e+002	1.1338e-009	4.1950e-005
Pb-214	1.2070e-004	4.4658e+006	8.3250e-006	3.0802e-001
Po-210	8.1269e-012	3.0070e-001	5.6055e-013	2.0740e-008
Po-214	1.2006e-004	4.4422e+006	8.2809e-006	3.0639e-001
Po-218	1.2155e-004	4.4972e+006	8.3835e-006	3.1019e-001
Ra-226	2.8996e-004	1.0729e+007	2.0000e-005	7.4000e-001
Rn-222	1.2164e-004	4.5006e+006	8.3899e-006	3.1043e-001

Buildup : The material reference is - Source
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	7.125e+05	1.468e-62	1.719e-27	1.259e-63	1.474e-28
0.05	4.939e+04	1.147e-06	1.509e-04	3.056e-09	4.021e-07
0.08	1.059e+06	1.385e-03	6.602e-02	2.192e-06	1.045e-04
0.1	1.456e+04	4.746e-05	1.461e-03	7.261e-08	2.235e-06
0.2	6.864e+05	1.124e-02	1.214e-01	1.985e-05	2.143e-04
0.3	9.220e+05	3.012e-02	2.121e-01	5.713e-05	4.023e-04
0.4	1.709e+06	8.933e-02	4.884e-01	1.741e-04	9.517e-04
0.5	7.967e+04	5.988e-03	2.745e-02	1.175e-05	5.389e-05

0.6	2.142e+06	2.167e-01	8.747e-01	4.230e-04	1.707e-03
0.8	4.202e+05	6.805e-02	2.252e-01	1.294e-04	4.283e-04
1.0	1.391e+06	3.256e-01	9.490e-01	6.003e-04	1.749e-03
1.5	8.459e+05	3.879e-01	9.340e-01	6.527e-04	1.571e-03
2.0	1.189e+06	8.752e-01	1.887e+00	1.353e-03	2.917e-03
Totals	**1.122e+07**	**2.012e+00**	**5.786e+00**	**3.424e-03**	**1.010e-02**

MicroShield® Output Files

Solid Waste Container on Day 10

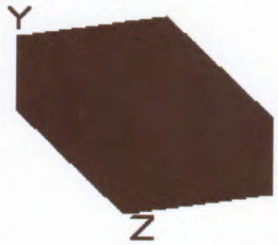
Print

MicroShield 6.22 (6.22-0000)
Safety and Ecology

Page	1
DOS File	iMS_Ra-226 Decay 10 Days.ms6
Run Date	December 28, 2014
Run Time	7:59:05 PM
Duration	00:00:00

File Ref	
Date	
By	
Checked	

Case Title: Ra-226 Only 10 day
Description: 20 yd3 RO Density 1.5
Geometry: 13 - Rectangular Volume



Source Dimensions:

Length	243.84 cm	(8 ft)
Width	487.68 cm	(16 ft)
Height	121.92 cm	(4 ft)

Dose Points

A	X	Y	Z
# 1	249 cm	60.96 cm	243.84 cm
	8 ft 2.0 in	2 ft	8 ft

Shields

Shield N	Dimension	Material	Density
Source	1.45e+07 cm³	Carbon	1.5
Shield 1	.274 cm	Iron	7.86
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	curies	becquerels	µCi/cm³	Bq/cm³
Bi-210	6.1066e-008	2.2595e+003	4.2120e-009	1.5584e-004
Bi-214	2.5008e-004	9.2530e+006	1.7249e-005	6.3821e-001
Pb-210	1.5294e-007	5.6589e+003	1.0549e-008	3.9032e-004
Pb-214	2.5022e-004	9.2583e+006	1.7259e-005	6.3858e-001
Po-210	9.6841e-010	3.5831e+001	6.6795e-011	2.4714e-006
Po-214	2.5003e-004	9.2510e+006	1.7245e-005	6.3808e-001
Po-218	2.5047e-004	9.2673e+006	1.7276e-005	6.3920e-001
Ra-226	2.8996e-004	1.0729e+007	2.0000e-005	7.3999e-001
Rn-222	2.5049e-004	9.2681e+006	1.7277e-005	6.3926e-001

Buildup : The material reference is - Source
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	1.386e+06	2.855e-62	3.344e-27	2.449e-63	2.868e-28
0.05	1.026e+05	2.382e-06	3.135e-04	6.346e-09	8.350e-07
0.08	2.141e+06	2.801e-03	1.335e-01	4.432e-06	2.112e-04
0.1	1.456e+04	4.746e-05	1.461e-03	7.261e-08	2.235e-06
0.2	1.045e+06	1.713e-02	1.849e-01	3.023e-05	3.264e-04
0.3	1.911e+06	6.242e-02	4.395e-01	1.184e-04	8.337e-04
0.4	3.543e+06	1.852e-01	1.013e+00	3.609e-04	1.973e-03
0.5	1.654e+05	1.243e-02	5.698e-02	2.439e-05	1.118e-04

0.6	4.461e+06	4.513e-01	1.821e+00	8.808e-04	3.555e-03
0.8	8.745e+05	1.416e-01	4.686e-01	2.693e-04	8.913e-04
1.0	2.897e+06	6.782e-01	1.976e+00	1.250e-03	3.643e-03
1.5	1.762e+06	8.079e-01	1.945e+00	1.359e-03	3.273e-03
2.0	2.476e+06	1.823e+00	3.929e+00	2.819e-03	6.076e-03
Totals	**2.278e+07**	**4.182e+00**	**1.197e+01**	**7.116e-03**	**2.090e-02**

MicroShield® Output Files

Solid Waste Container on Day 21

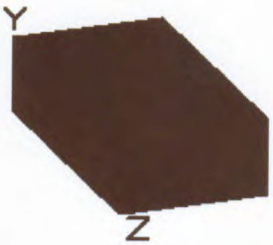
Print

MicroShield 6.22 (6.22-0000)
Safety and Ecology

Page	1
DOS File	iMS_Ra-226 Decay 21 Days.ms6
Run Date	December 28, 2014
Run Time	8:00:35 PM
Duration	00:00:00

File Ref	
Date	
By	
Checked	

Case Title: Ra-226 Only 21 day
Description: 20 yd3 RO Density 1.5
Geometry: 13 - Rectangular Volume



Source Dimensions:

Length	243.84 cm	(8 ft)
Width	487.68 cm	(16 ft)
Height	121.92 cm	(4 ft)

Dose Points

A	X	Y	Z
# 1	249 cm	60.96 cm	243.84 cm
	8 ft 2.0 in	2 ft	8 ft

Shields

Shield N	Dimension	Material	Density
Source	1.45e+07 cm³	Carbon	1.5
Shield 1	.274 cm	Iron	7.86
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	curies	becquerels	µCi/cm³	Bq/cm³
Bi-210	4.8175e-007	1.7825e+004	3.3228e-008	1.2294e-003
Bi-214	2.8901e-004	1.0693e+007	1.9934e-005	7.3757e-001
Pb-210	6.5283e-007	2.4155e+004	4.5028e-008	1.6660e-003
Pb-214	2.8902e-004	1.0694e+007	1.9935e-005	7.3758e-001
Po-210	2.6540e-008	9.8199e+002	1.8306e-009	6.7732e-005
Po-214	2.8895e-004	1.0691e+007	1.9930e-005	7.3742e-001
Po-218	2.8908e-004	1.0696e+007	1.9939e-005	7.3774e-001
Ra-226	2.8995e-004	1.0728e+007	1.9999e-005	7.3997e-001
Rn-222	2.8908e-004	1.0696e+007	1.9939e-005	7.3774e-001

Buildup : The material reference is - Source
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	1.592e+06	3.279e-62	3.840e-27	2.813e-63	3.294e-28
0.05	1.192e+05	2.768e-06	3.642e-04	7.374e-09	9.703e-07
0.08	2.466e+06	3.225e-03	1.537e-01	5.103e-06	2.432e-04
0.1	1.456e+04	4.746e-05	1.461e-03	7.261e-08	2.235e-06
0.2	1.153e+06	1.889e-02	2.039e-01	3.333e-05	3.599e-04
0.3	2.207e+06	7.209e-02	5.076e-01	1.367e-04	9.629e-04
0.4	4.092e+06	2.139e-01	1.170e+00	4.169e-04	2.279e-03
0.5	1.910e+05	1.436e-02	6.582e-02	2.818e-05	1.292e-04

0.6	5.156e+06	5.215e-01	2.105e+00	1.018e-03	4.109e-03
0.8	1.010e+06	1.636e-01	5.415e-01	3.112e-04	1.030e-03
1.0	3.348e+06	7.838e-01	2.284e+00	1.445e-03	4.210e-03
1.5	2.036e+06	9.336e-01	2.248e+00	1.571e-03	3.782e-03
2.0	2.862e+06	2.106e+00	4.541e+00	3.257e-03	7.022e-03
Totals	**2.625e+07**	**4.831e+00**	**1.382e+01**	**8.222e-03**	**2.413e-02**

MicroShield® Output Files

Solid Waste Container on Day 28

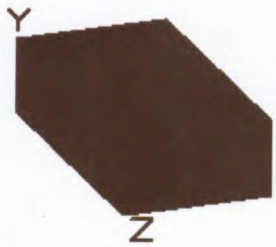
Print

MicroShield 6.22 (6.22-0000)
Safety and Ecology

Page	1
DOS File	iMS_Ra-226 Decay 28 Days.ms6
Run Date	December 28, 2014
Run Time	8:01:50 PM
Duration	00:00:00

File Ref	
Date	
By	
Checked	

Case Title: Ra-226 Only
Description: 20 yd3 RO Density 1.5 28 Days
Geometry: 13 - Rectangular Volume



Source Dimensions:

Length	243.84 cm	(8 ft)
Width	487.68 cm	(16 ft)
Height	121.92 cm	(4 ft)

Dose Points

A	X	Y	Z
# 1	249 cm	60.96 cm	243.84 cm
	8 ft 2.0 in	2 ft	8 ft

Shields

Shield N	Dimension	Material	Density
Source	1.45e+07 cm³	Carbon	1.5
Shield 1	.274 cm	Iron	7.86
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	curies	becquerels	µCi/cm³	Bq/cm³
Bi-210	3.8835e-007	1.4369e+004	2.6786e-008	9.9107e-004
Bi-214	2.8807e-004	1.0659e+007	1.9869e-005	7.3517e-001
Pb-210	5.5464e-007	2.0522e+004	3.8256e-008	1.4155e-003
Pb-214	2.8808e-004	1.0659e+007	1.9870e-005	7.3519e-001
Po-210	1.8274e-008	6.7614e+002	1.2604e-009	4.6636e-005
Po-214	2.8801e-004	1.0656e+007	1.9865e-005	7.3502e-001
Po-218	2.8814e-004	1.0661e+007	1.9875e-005	7.3536e-001
Ra-226	2.8995e-004	1.0728e+007	1.9999e-005	7.3998e-001
Rn-222	2.8815e-004	1.0661e+007	1.9875e-005	7.3536e-001

Buildup : The material reference is - Source
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	1.586e+06	3.267e-62	3.827e-27	2.802e-63	3.282e-28
0.05	1.187e+05	2.756e-06	3.626e-04	7.341e-09	9.660e-07
0.08	2.458e+06	3.214e-03	1.532e-01	5.087e-06	2.424e-04
0.1	1.456e+04	4.746e-05	1.461e-03	7.261e-08	2.235e-06
0.2	1.150e+06	1.884e-02	2.035e-01	3.326e-05	3.591e-04
0.3	2.200e+06	7.186e-02	5.060e-01	1.363e-04	9.598e-04
0.4	4.079e+06	2.132e-01	1.166e+00	4.155e-04	2.272e-03
0.5	1.904e+05	1.431e-02	6.561e-02	2.809e-05	1.288e-04

0.6	5.139e+06	5.198e-01	2.098e+00	1.015e-03	4.095e-03
0.8	1.007e+06	1.631e-01	5.397e-01	3.102e-04	1.027e-03
1.0	3.337e+06	7.812e-01	2.277e+00	1.440e-03	4.196e-03
1.5	2.029e+06	9.306e-01	2.241e+00	1.566e-03	3.770e-03
2.0	2.852e+06	2.100e+00	4.526e+00	3.247e-03	6.999e-03
Totals	**2.616e+07**	**4.816e+00**	**1.378e+01**	**8.196e-03**	**2.405e-02**