

**MicroShield 8.03**  
**GA (8.03-0000)**

Date	By	Checked

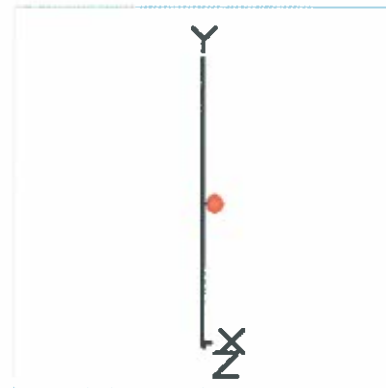
Filename	Run Date	Run Time	Duration
Scenario 3 Worker External Exposure.msdc	September 23, 2020	9:08:36 AM	00:00:00

Project Info	
Case Title	Scenario #3
Description	TRIGA Buried Pipe - Worker External Exposure
Geometry	10 - Cylinder Surface - External Dose Point

Source Dimensions	
Height	914.4 cm (30 ft)
Radius	3.505 cm (1.4 in)

Dose Points			
A	X	Y	Z
#1	30.48 cm (1 ft)	457.2 cm (15 ft)	30.48 cm (1 ft)

Shields			
Shield N	Dimension	Material	Density
Cyl. Radius	3.505 cm	Concrete	2.35
Transition		Air	0.00122
Air Gap		Air	0.00122
Wall Clad	.318 cm	Iron	7.86



Source Input: Grouping Method - Actual Photon Energies				
Nuclide	Ci	Bq	$\mu\text{Ci}/\text{cm}^2$	$\text{Bq}/\text{cm}^2$
Ba-137m	1.7983e-005	6.6539e+005	8.9299e-004	3.3040e+001
Cs-137	1.9010e-005	7.0337e+005	9.4396e-004	3.4926e+001

Buildup: The material reference is Wall Clad	
Integration Parameters	
Y Direction (axial)	20
Circumferential	20

Results					
Energy (MeV)	Activity (Photons/sec)	Fluence Rate MeV/cm <sup>2</sup> /sec No Buildup	Fluence Rate MeV/cm <sup>2</sup> /sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.0045	6.907e+03	3.569e-68	1.631e-30	2.446e-68	1.118e-30
0.0318	1.378e+04	2.982e-12	3.239e-12	2.484e-14	2.698e-14
0.0322	2.542e+04	9.952e-12	1.083e-11	8.009e-14	8.712e-14
0.0364	9.249e+03	6.474e-10	7.236e-10	3.678e-12	4.111e-12
0.6616	5.987e+05	9.274e-01	1.517e+00	1.798e-03	2.940e-03
<b>Totals</b>	<b>6.541e+05</b>	<b>9.274e-01</b>	<b>1.517e+00</b>	<b>1.798e-03</b>	<b>2.940e-03</b>

# Dose Equivalent Report

<b>Program</b>	MicroShield, Grove Software, Inc.
<b>Version</b>	8.03
<b>Organization</b>	GA
<b>Serial #</b>	8.03-0000
<b>Date / Time</b>	This case was run on Tuesday, May 18, 2021 at 8:00:35 AM
<b>Filename</b>	C:\Program Files (x86)\MicroShield 8\Examples\CaseFiles\Scenario 3 Worker External Exposure.msdc
<b>Case Title</b>	Scenario #3
<b>Description</b>	TRIGA Buried Pipe - Worker External Exposure
<b>Geometry</b>	10 - Cylinder Surface - External Dose Point
<b>Sensitivity</b>	No

## Results

<b>Nominal Case</b>			
<b>Dose Point #1</b>	(30.48, 457.2, 30.48) cm		
<b>Variable</b>	Not Applicable		
<b>Results (Summed over energies)</b>	<b>Units</b>	<b>Without Buildup</b>	<b>With Buildup</b>
Photon Fluence Rate (flux)	Photons/cm <sup>2</sup> /sec	1.402e+000	2.292e+000
Photon Energy Fluence Rate	MeV/cm <sup>2</sup> /sec	9.274e-001	1.517e+000
<b>Exposure and Dose Rates</b>			
Exposure Rate in Air	mR/hr	1.798e-003	2.940e-003
Absorbed Dose Rate in Air	mGy/hr	1.570e-005	2.567e-005
Absorbed Dose Rate in Air	mrads/hr	1.570e-003	2.567e-003
<b>Deep Dose Equivalent Rate (ICRP 51 - 1987)</b>			
Parallel Geometry	mSv/hr	1.858e-005	3.039e-005
Opposed Geometry	mSv/hr	1.488e-005	2.433e-005
Rational Geometry	mSv/hr	1.488e-005	2.433e-005
Isotropic Geometry	mSv/hr	1.316e-005	2.152e-005

<b>Shallow Dose Equivalent Rate (ICRP 51 - 1987)</b>			
Parallel Geometry	mSv/hr	1.975e-005	3.230e-005
Opposed Geometry	mSv/hr	1.876e-005	3.068e-005
Rational Geometry	mSv/hr	1.876e-005	3.068e-005
Isotropic Geometry	mSv/hr	1.407e-005	2.300e-005
<b>Effective Dose Equivalent Rate (ICRP 51 - 1987)</b>			
Anterior/Posterior Geometry	mSv/hr	1.643e-005	2.687e-005
Posterior/Anterior Geometry	mSv/hr	1.450e-005	2.372e-005
Lateral Geometry	mSv/hr	1.076e-005	1.759e-005
Rotational Geometry	mSv/hr	1.296e-005	2.120e-005
Isotropic Geometry	mSv/hr	1.103e-005	1.805e-005
<b>Nominal Case</b>			
<b>Dose Point #1</b>	<b>(30.48, 457.2, 30.48) cm</b>		
<b>Variable</b>	<b>Not Applicable</b>		
<b>Results (Summed over energies)</b>	<b>Units</b>	<b>Without Buildup</b>	<b>With Buildup</b>
Photon Fluence Rate (flux)	Photons/cm <sup>2</sup> /sec	1.402e+000	2.292e+000
Photon Energy Fluence Rate	MeV/cm <sup>2</sup> /sec	9.274e-001	1.517e+000
<b>Exposure and Dose Rates</b>			
Exposure Rate in Air	mR/hr	1.798e-003	2.940e-003
Absorbed Dose Rate in Air	mGy/hr	1.570e-005	2.567e-005
Absorbed Dose Rate in Air	mrads/hr	1.570e-003	2.567e-003
<b>Bladder Absorbed Dose (ICRP 74 - 1997)</b>			
Antero-posterior Geometry	mSv/hr	1.758e-005	2.875e-005
Postero-anterior Geometry	mSv/hr	1.162e-005	1.901e-005
Left Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Lateral Geometry	mSv/hr	8.939e-006	1.462e-005
Right Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Rotational Geometry	mSv/hr	1.226e-005	2.006e-005
Isotropic Geometry	mSv/hr	1.005e-005	1.643e-005
<b>Bone (Red Marrow) Absorbed Dose (ICRP 74 - 1997)</b>			
Antero-posterior Geometry	mSv/hr	1.201e-005	1.963e-005

Postero-anterior Geometry	mSv/hr	1.559e-005	2.549e-005
Left Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Lateral Geometry	mSv/hr	1.025e-005	1.677e-005
Right Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Rotational Geometry	mSv/hr	1.243e-005	2.032e-005
Isotropic Geometry	mSv/hr	1.065e-005	1.742e-005
<b>Bone (Red Marrow) Absorbed Dose (ICRP 74 - 1997)</b>			
Antero-posterior Geometry	mSv/hr	1.356e-005	2.218e-005
Postero-anterior Geometry	mSv/hr	1.471e-005	2.405e-005
Left Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Lateral Geometry	mSv/hr	2.053e-006	3.358e-006
Right Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Rotational Geometry	mSv/hr	1.287e-005	2.105e-005
Isotropic Geometry	mSv/hr	1.114e-005	1.821e-005
<b>Breast - Female Absorbed Dose (ICRP 74 - 1997)</b>			
Antero-posterior Geometry	mSv/hr	1.812e-005	2.963e-005
Postero-anterior Geometry	mSv/hr	1.173e-005	1.918e-005
Left Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Lateral Geometry	mSv/hr	1.236e-005	2.021e-005
Right Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Rotational Geometry	mSv/hr	1.350e-005	2.208e-005
Isotropic Geometry	mSv/hr	1.267e-005	2.073e-005
<b>Colon Absorbed Dose (ICRP 74 - 1997)</b>			
Antero-posterior Geometry	mSv/hr	1.616e-005	2.643e-005
Postero-anterior Geometry	mSv/hr	1.349e-005	2.206e-005
Left Lateral Geometry	mSv/hr	8.999e-006	1.472e-005
Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Right Lateral Geometry	mSv/hr	8.999e-006	1.472e-005
Rotational Geometry	mSv/hr	1.229e-005	2.009e-005
Isotropic Geometry	mSv/hr	9.874e-006	1.615e-005
<b>Gonads - Female Ovaries Absorbed Dose (ICRP 74 - 1997)</b>			
Antero-posterior Geometry	mSv/hr	1.457e-005	2.383e-005

	mSv/hr	1.437e-005	2.350e-005
Left Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Lateral Geometry	mSv/hr	8.295e-006	1.357e-005
Right Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Rotational Geometry	mSv/hr	1.233e-005	2.016e-005
Isotropic Geometry	mSv/hr	9.960e-006	1.629e-005
<b>Gonads - Male Testes Absorbed Dose (ICRP 74 - 1997)</b>			
Antero-posterior Geometry	mSv/hr	1.923e-005	3.145e-005
Postero-anterior Geometry	mSv/hr	1.179e-005	1.928e-005
Left Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Lateral Geometry	mSv/hr	8.241e-006	1.348e-005
Right Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Rotational Geometry	mSv/hr	1.228e-005	2.008e-005
Isotropic Geometry	mSv/hr	1.146e-005	1.875e-005
<b>Gonads Absorbed Dose (ICRP 74 - 1997)</b>			
Antero-posterior Geometry	mSv/hr	1.694e-005	2.771e-005
Postero-anterior Geometry	mSv/hr	1.328e-005	2.172e-005
Left Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Lateral Geometry	mSv/hr	8.338e-006	1.364e-005
Right Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Rotational Geometry	mSv/hr	1.230e-005	2.012e-005
Isotropic Geometry	mSv/hr	5.474e-003	8.952e-003
<b>Liver Absorbed Dose (ICRP 74 - 1997)</b>			
Antero-posterior Geometry	mSv/hr	1.596e-005	2.610e-005
Postero-anterior Geometry	mSv/hr	1.383e-005	2.261e-005
Left Lateral Geometry	mSv/hr	5.291e-006	8.653e-006
Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Right Lateral Geometry	mSv/hr	1.340e-005	2.191e-005
Rotational Geometry	mSv/hr	1.261e-005	2.062e-005
Isotropic Geometry	mSv/hr	1.064e-005	1.739e-005
<b>Lung Absorbed Dose (ICRP 74 - 1997)</b>			
Antero-posterior Geometry	mSv/hr	1.570e-005	2.568e-005

	mSv/hr	1.678e-005	2.745e-005
Left Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Lateral Geometry	mSv/hr	1.016e-005	1.661e-005
Right Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Rotational Geometry	mSv/hr	1.355e-005	2.216e-005
Isotropic Geometry	mSv/hr	1.150e-005	1.882e-005
<b>Oesophagus Absorbed Dose (ICRP 74 - 1997)</b>			
Antero-posterior Geometry	mSv/hr	1.289e-005	2.108e-005
Postero-anterior Geometry	mSv/hr	1.410e-005	2.306e-005
Left Lateral Geometry	mSv/hr	1.143e-005	1.869e-005
Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Right Lateral Geometry	mSv/hr	1.040e-005	1.701e-005
Rotational Geometry	mSv/hr	1.232e-005	2.014e-005
Isotropic Geometry	mSv/hr	1.042e-005	1.704e-005
<b>Remainder Absorbed Dose (ICRP 74 - 1997)</b>			
Antero-posterior Geometry	mSv/hr	1.431e-005	2.341e-005
Postero-anterior Geometry	mSv/hr	1.435e-005	2.347e-005
Left Lateral Geometry	mSv/hr	1.017e-005	1.663e-005
Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Right Lateral Geometry	mSv/hr	9.121e-006	1.492e-005
Rotational Geometry	mSv/hr	1.257e-005	2.055e-005
Isotropic Geometry	mSv/hr	1.052e-005	1.721e-005
<b>Skin Absorbed Dose (ICRP 74 - 1997)</b>			
Antero-posterior Geometry	mSv/hr	1.522e-005	2.489e-005
Postero-anterior Geometry	mSv/hr	1.516e-005	2.480e-005
Left Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Lateral Geometry	mSv/hr	1.271e-005	2.078e-005
Right Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Rotational Geometry	mSv/hr	1.420e-005	2.323e-005
Isotropic Geometry	mSv/hr	1.318e-005	2.156e-005
<b>Stomach Absorbed Dose (ICRP 74 - 1997)</b>			
Antero-posterior Geometry	mSv/hr	1.747e-005	2.858e-005

	mSv/hr	1.192e-005	2.405e-005
Left Lateral Geometry	mSv/hr	1.343e-005	2.196e-005
Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Right Lateral Geometry	mSv/hr	5.429e-006	8.879e-006
Rotational Geometry	mSv/hr	1.264e-005	2.067e-005
Isotropic Geometry	mSv/hr	1.052e-005	1.720e-005
<b>Thyroid Absorbed Dose (ICRP 74 - 1997)</b>			
Antero-posterior Geometry	mSv/hr	2.026e-005	3.313e-005
Postero-anterior Geometry	mSv/hr	1.025e-005	1.676e-005
Left Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Right Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Rotational Geometry	mSv/hr	1.682e-005	2.751e-005
Isotropic Geometry	mSv/hr	1.600e-005	2.617e-005
<b>Effective Dose (ICRP 74 - 1997)</b>			
Antero-posterior Geometry	mSv/hr	1.599e-005	2.615e-005
Postero-anterior Geometry	mSv/hr	1.368e-005	2.237e-005
Left Lateral Geometry	mSv/hr	1.027e-005	1.679e-005
Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Right Lateral Geometry	mSv/hr	9.560e-006	1.564e-005
Rotational Geometry	mSv/hr	1.280e-005	2.094e-005
Isotropic Geometry	mSv/hr	1.083e-005	1.771e-005
<b>Eye Lens Absorbed Dose (ICRP 74 - 1997)</b>			
Antero-posterior Geometry	mSv/hr	1.823e-005	2.981e-005
Postero-anterior Geometry	mSv/hr	6.569e-006	1.074e-005
Left Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Lateral Geometry	mSv/hr	1.584e-005	2.590e-005
Right Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Rotational Geometry	mSv/hr	1.584e-005	2.590e-005
Isotropic Geometry	mSv/hr	1.429e-005	2.337e-005
<b>Thymus Absorbed Dose (ICRP 74 - 1997)</b>			
Antero-posterior Geometry	mSv/hr	1.883e-005	3.079e-005

	mSv/hr	8.382e-006	1.371e-005
Left Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Lateral Geometry	mSv/hr	1.029e-005	1.683e-005
Right Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Rotational Geometry	mSv/hr	1.029e-005	1.683e-005
Isotropic Geometry	mSv/hr	1.307e-005	2.138e-005
<b>Uterus Absorbed Dose (ICRP 74 - 1997)</b>			
Antero-posterior Geometry	mSv/hr	1.487e-005	2.431e-005
Postero-anterior Geometry	mSv/hr	1.339e-005	2.189e-005
Left Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Lateral Geometry	mSv/hr	7.925e-006	1.296e-005
Right Lateral Geometry	mSv/hr	0.000e+000	0.000e+000
Rotational Geometry	mSv/hr	7.925e-006	1.296e-005
Isotropic Geometry	mSv/hr	1.178e-005	1.927e-005