Ingestion MDC calc

Parent ROC	Contributing Progeny	Slope factor	Risk Limit	pCi	contact area ft2	contact area m2	contact area cm2	pCi/cm2	dpm/100cm2
^{241}Am		1.84E-10	1.00E-04	5.43E+05	3691	343	3429050	1.58E-01	3.52E+01
^{60}Co		3.81E-11	1.00E-04	2.62E+06	3691	343	3429050	7.65E-01	1.70E+02
^{137}Cs	^{137m}Ba	4.26E-11	1.00E-04	2.35E+06	3691	343	3429050	6.85E-01	1.52E+02
^{152}Eu		1.46E-11	1.00E-04	6.85E+06	3691	343	3429050	2.00E+00	4.43E+02
^{154}Eu		2.54E-11	1.00E-04	3.94E+06	3691	343	3429050	1.15E+00	2.55E+02
^{3}H		8.99E-14	1.00E-04	1.11E+09	3691	343	3429050	3.24E+02	7.20E+04
^{239}Pu	^{235m}U	2.28E-10	1.00E-04	4.39E+05	3691	343	3429050	1.28E-01	2.84E+01
^{226}Ra	^{222}Rn+D	6.77E-10	1.00E-04	1.48E+05	3691	343	3429050	4.31E-02	9.56E+00
^{90}Sr	^{90}Y	1.35E-10	1.00E-04	7.41E+05	3691	343	3429050	2.16E-01	4.80E+01
^{232}Th	^{228}Ra+D	2.17E-09	1.00E-04	4.61E+04	3691	343	3429050	1.34E-02	2.98E+00
^{235}U	^{231}Th	1.48E-10	1.00E-04	6.76E+05	3691	343	3429050	1.97E-01	4.37E+01

Contact area = walls to 8 ft and floors

floor	2187	ft2
Walls	1504	ft2
sum	**3691**	ft2

Decay progeny		gross alpha	gross beta	gross alpha	gross beta	USN gross	USN gross
# Alpha	# Beta						
1	0	3.52E+01					
0	1		1.70E+02				97.3
0	1		1.52E+02				90.6
0	1		4.43E+02				
0	1		2.55E+02				
0	1		7.20E+04				
1	0	2.84E+01				23.5	
3.2	1.6	3.06E+01	1.53E+01			7.67	84.2
0	2		9.59E+01				47.8
4.05	2.05	1.21E+01	6.12E+00	**12**	**6**	5.73	95.9
1	1	4.37E+01	4.37E+01				

Decay progeny from USN workplan

Plan limiting isotope

Th-232		Estimated MDC reduction
MDC	**count time**	**1.41**
68	2 min	
48	4 min	
34	8 min	
24	16 min	
17	32 min	
12	64 min	
9	128 min	
6	256 min	

Ra-226		Estimated MDC reduction
MDC	**count time**	**1.41**
60	2 min	
42	4 min	
30	8 min	
21	16 min	
15	32 min	
11	64 min	
8	128 min	
5	256 min	

Ingestion MDC calc

Parent ROC	Contributing Progeny	Slope factor	Risk Limit	pCi	contact area ft2	contact area m2	contact area cm2	pCi/cm2	dpm/100cm2
^{241}Am		1.84E-10	1.00E-04	5.43E+05	2939	273	2730419	1.99E-01	4.42E+01
^{60}Co		3.81E-11	1.00E-04	2.62E+06	2939	273	2730419	9.61E-01	2.13E+02
^{137}Cs	^{137m}Ba	4.26E-11	1.00E-04	2.35E+06	2939	273	2730419	8.60E-01	1.91E+02
^{152}Eu		1.46E-11	1.00E-04	6.85E+06	2939	273	2730419	2.51E+00	5.57E+02
^{154}Eu		2.54E-11	1.00E-04	3.94E+06	2939	273	2730419	1.44E+00	3.20E+02
^{3}H		8.99E-14	1.00E-04	1.11E+09	2939	273	2730419	4.07E+02	9.04E+04
^{239}Pu	^{235m}U	2.28E-10	1.00E-04	4.39E+05	2939	273	2730419	1.61E-01	3.57E+01
^{226}Ra	^{222}Rn+D	6.77E-10	1.00E-04	1.48E+05	2939	273	2730419	5.41E-02	1.20E+01
^{90}Sr	^{90}Y	1.35E-10	1.00E-04	7.41E+05	2939	273	2730419	2.71E-01	6.02E+01
^{232}Th	^{228}Ra+D	2.17E-09	1.00E-04	4.61E+04	2939	273	2730419	1.69E-02	3.75E+00
^{235}U	^{231}Th	1.48E-10	1.00E-04	6.76E+05	2939	273	2730419	2.47E-01	5.49E+01

Contact area = walls to 8 ft and floors

floor	2187	ft2
2 Walls	752	ft2
sum	**2939**	ft2

Decay progeny		gross alpha	gross beta	gross alpha	gross beta	USN gross	USN gross
# Alpha	# Beta						
1	0	4.42E+01					
0	1		2.13E+02				97.3
0	1		1.91E+02				90.6
0	1		5.57E+02				
0	1		3.20E+02				
0	1		9.04E+04				
1	0	3.57E+01				23.5	
3.2	1.6	3.84E+01	1.92E+01			7.67	84.2
0	2		1.20E+02				47.8
4.05	2.05	1.52E+01	7.68E+00	**15**	**8**	5.73	95.9
1	1	5.49E+01	5.49E+01				

Decay progeny from USN workplan

Plan limiting isotope

Th-232		Estimated MDC reduction
MDC	**count time**	**1.41**
68	2 min	
48	4 min	
34	8 min	
24	16 min	
17	32 min	
12	64 min	
9	128 min	
6	256 min	

Ra-226		Estimated MDC reduction
MDC	**count time**	**1.41**
60	2 min	
42	4 min	
30	8 min	
21	16 min	
15	32 min	
11	64 min	
8	128 min	
5	256 min	

Ingestion MDC calc

Parent ROC	Contributing Progeny	Slope factor	Risk Limit	pCi	Exposure duration	half life	Activity over	contact area ft2
^{241}Am		1.84E-10	1.00E-04	5.43E+05	2.60E+01	4.32E+02	5.55E+05	2939
^{60}Co		3.81E-11	1.00E-04	2.62E+06	2.60E+01	5.27E+00	9.28E+06	2939
^{137}Cs	^{137m}Ba	4.26E-11	1.00E-04	2.35E+06	2.60E+01	3.02E+01	3.12E+06	2939
^{152}Eu		1.46E-11	1.00E-04	6.85E+06	2.60E+01	1.35E+01	1.24E+07	2939
^{154}Eu		2.54E-11	1.00E-04	3.94E+06	2.60E+01	8.59E+00	9.41E+06	2939
^{3}H		8.99E-14	1.00E-04	1.11E+09	2.60E+01	1.23E+01	2.12E+09	2939
^{239}Pu	^{235m}U	2.28E-10	1.00E-04	4.39E+05	2.60E+01	2.41E+04	4.39E+05	2939
^{226}Ra	^{222}Rn+D	5.69E-09	1.00E-04	1.76E+04	2.60E+01	1.60E+03	1.77E+04	2939
^{90}Sr	^{90}Y	1.35E-10	1.00E-04	7.41E+05	2.60E+01	2.88E+01	9.96E+05	2939
^{232}Th	^{228}Ra+D	2.90E-09	1.00E-04	3.45E+04	2.60E+01	1.41E+10	3.45E+04	2939
^{235}U	^{231}Th	1.48E-10	1.00E-04	6.76E+05	2.60E+01	7.04E+08	6.76E+05	2939

Contact area = walls to 8 ft and floors

floor	2187	ft2
2 Walls	752	ft2
sum	**2939**	ft2

SF for Th-232 and Ra-226 are from BPRG sum of individual daughter SF.

contact area m2	contact area cm2	pCi/cm2	dpm/100cm2	Decay progeny		gross alpha	gross beta
				# Alpha	# Beta		
273	2730419	2.03E-01	4.51E+01	1	0	4.51E+01	
273	2730419	3.40E+00	7.54E+02	0	1		7.54E+02
273	2730419	1.14E+00	2.53E+02	0	1		2.53E+02
273	2730419	4.54E+00	1.01E+03	0	1		1.01E+03
273	2730419	3.45E+00	7.65E+02	0	1		7.65E+02
273	2730419	7.76E+02	1.72E+05	0	1		1.72E+05
273	2730419	1.61E-01	3.57E+01	1	0	3.57E+01	
273	2730419	6.47E-03	1.44E+00	1	0	1.44E+00	0.00E+00
273	2730419	3.65E-01	8.10E+01	0	2		1.62E+02
273	2730419	1.26E-02	2.80E+00	3	0	8.41E+00	0.00E+00
273	2730419	2.47E-01	5.49E+01	1	1	5.49E+01	5.49E+01

Decay progeny from USN workplan

Plan limiting isotope

gross alpha	gross beta	USN gross	USN gross
			97.3
			90.6
		23.5	
	2	7.67	84.2
			47.8
8	**0**	5.73	95.9

Ingestion MDC calc

Parent ROC	Contributing Progeny	Slope factor	Risk Limit	pCi	Exposure duration	half life	Activity over	contact area ft2
^{241}Am		1.84E-10	1.00E-04	5.43E+05	2.60E+01	4.32E+02	5.55E+05	2939
^{60}Co		3.81E-11	1.00E-04	2.62E+06	2.60E+01	5.27E+00	9.28E+06	2939
^{137}Cs	^{137m}Ba	4.26E-11	1.00E-04	2.35E+06	2.60E+01	3.02E+01	3.12E+06	2939
^{152}Eu		1.46E-11	1.00E-04	6.85E+06	2.60E+01	1.35E+01	1.24E+07	2939
^{154}Eu		2.54E-11	1.00E-04	3.94E+06	2.60E+01	8.59E+00	9.41E+06	2939
^{3}H		8.99E-14	1.00E-04	1.11E+09	2.60E+01	1.23E+01	2.12E+09	2939
^{239}Pu	^{235m}U	2.28E-10	1.00E-04	4.39E+05	2.60E+01	2.41E+04	4.39E+05	2939
^{226}Ra	^{222}Rn+D	6.77E-10	1.00E-04	1.48E+05	2.60E+01	1.60E+03	1.49E+05	2939
^{90}Sr	^{90}Y	1.35E-10	1.00E-04	7.41E+05	2.60E+01	2.88E+01	9.96E+05	2939
^{232}Th	^{228}Ra+D	2.17E-09	1.00E-04	4.61E+04	2.60E+01	1.41E+10	4.61E+04	2939
^{235}U	^{231}Th	1.48E-10	1.00E-04	6.76E+05	2.60E+01	7.04E+08	6.76E+05	2939

Contact area = walls to 8 ft and floors

floor	2187	ft2
2 Walls	752	ft2
sum	**2939**	ft2

SF for Th-232 and Ra-226 are +E from DCFPak.

contact area m2	contact area cm2	pCi/cm2	dpm/100cm2	Decay progeny		gross alpha	gross beta
				# Alpha	# Beta		
273	2730419	2.03E-01	4.51E+01	1	0	4.51E+01	
273	2730419	3.40E+00	7.54E+02	0	1		7.54E+02
273	2730419	1.14E+00	2.53E+02	0	1		2.53E+02
273	2730419	4.54E+00	1.01E+03	0	1		1.01E+03
273	2730419	3.45E+00	7.65E+02	0	1		7.65E+02
273	2730419	7.76E+02	1.72E+05	0	1		1.72E+05
273	2730419	1.61E-01	3.57E+01	1	0	3.57E+01	
273	2730419	5.44E-02	1.21E+01	3.2	1.6	3.86E+01	1.93E+01
273	2730419	3.65E-01	8.10E+01	0	2		1.62E+02
273	2730419	1.69E-02	3.75E+00	4.05	2.05	1.52E+01	7.68E+00
273	2730419	2.47E-01	5.49E+01	1	1	5.49E+01	5.49E+01

Decay progeny from USN workplan

Plan limiting isotope

gross alpha	gross beta	USN gross	USN gross
			97.3
			90.6
		23.5	
		7.67	84.2
			47.8
15	**8**	5.73	95.9

Th-232		**Estimated MDC reduction**
MDC	**count time**	**1.41**
68	2 min	
48	4 min	
34	8 min	
24	16 min	
17	32 min	
12	64 min	
9	128 min	
6	256 min	

Ra-226		**Estimated MDC reduction**
MDC	**count time**	**1.41**
60	2 min	
42	4 min	
30	8 min	
21	16 min	
15	32 min	
11	64 min	
8	128 min	
5	256 min	

Ingestion MDC calc

Parent ROC	Contributing Progeny	Slope factor	Risk Limit	pCi	contact area m2	contact area cm2	pCi/cm2	dpm/100cm2
^{241}Am		1.84E-10	1.00E-04	5.43E+05	320	3200400	1.70E-01	3.77E+01
^{60}Co		3.81E-11	1.00E-04	2.62E+06	320	3200400	8.20E-01	1.82E+02
^{137}Cs	^{137m}Ba	4.26E-11	1.00E-04	2.35E+06	320	3200400	7.33E-01	1.63E+02
^{152}Eu		1.46E-11	1.00E-04	6.85E+06	320	3200400	2.14E+00	4.75E+02
^{154}Eu		2.54E-11	1.00E-04	3.94E+06	320	3200400	1.23E+00	2.73E+02
^{3}H		8.99E-14	1.00E-04	1.11E+09	320	3200400	3.48E+02	7.72E+04
^{239}Pu	^{235m}U	2.28E-10	1.00E-04	4.39E+05	320	3200400	1.37E-01	3.04E+01
^{226}Ra	^{222}Rn+D	6.77E-10	1.00E-04	1.48E+05	320	3200400	4.62E-02	1.02E+01
^{90}Sr	^{90}Y	1.35E-10	1.00E-04	7.41E+05	320	3200400	2.31E-01	5.14E+01
^{232}Th	^{228}Ra+D	2.17E-09	1.00E-04	4.61E+04	320	3200400	1.44E-02	3.20E+00
^{235}U	^{231}Th	1.48E-10	1.00E-04	6.76E+05	320	3200400	2.11E-01	4.69E+01

Decay progeny		gross alpha	gross beta	gross alpha	gross beta	USN gross	USN gross
# Alpha	# Beta						
1	0	3.77E+01					
0	1		1.82E+02				97.3
0	1		1.63E+02				90.6
0	1		4.75E+02				
0	1		2.73E+02				
0	1		7.72E+04				
1	0	3.04E+01				23.5	
3.2	1.6	3.28E+01	1.64E+01			7.67	84.2
0	2		1.03E+02				47.8
4.05	2.05	1.29E+01	6.55E+00	**13**	**7**	5.73	95.9
1	1	4.69E+01	4.69E+01				

Decay progeny from USN workplan

Plan limiting isotope

ED	26
ln2	0.693
T/2	5.27
decay 26y	9277488.9
	2.898852932

Th-232		Estimated MDC reduction
MDC	**count time**	**1.41**
68	2 min	
48	4 min	
34	8 min	
24	16 min	
17	32 min	
12	64 min	
9	128 min	
6	256 min	

Ra-226		Estimated MDC reduction
MDC	**count time**	**1.41**
60	2 min	
42	4 min	
30	8 min	
21	16 min	
15	32 min	
11	64 min	
8	128 min	
5	256 min	

643.5453509

Ingestion MDC calc with decay

Parent ROC	Contributing Progeny	Slope factor	Risk Limit	pCi	Exposure duration	half life	Activity over	contact area m2
^{241}Am		1.84E-10	1.00E-04	5.43E+05	2.60E+01	4.32E+02	5.55E+05	320
^{60}Co		3.81E-11	1.00E-04	2.62E+06	2.60E+01	5.27E+00	9.28E+06	320
^{137}Cs	^{137m}Ba	4.26E-11	1.00E-04	2.35E+06	2.60E+01	3.02E+01	3.12E+06	320
^{152}Eu		1.46E-11	1.00E-04	6.85E+06	2.60E+01	1.35E+01	1.24E+07	320
^{154}Eu		2.54E-11	1.00E-04	3.94E+06	2.60E+01	8.59E+00	9.41E+06	320
^{3}H		8.99E-14	1.00E-04	1.11E+09	2.60E+01	1.23E+01	2.12E+09	320
^{239}Pu	^{235m}U	2.28E-10	1.00E-04	4.39E+05	2.60E+01	2.41E+04	4.39E+05	320
^{226}Ra	^{222}Rn+D	5.69E-09	1.00E-04	1.76E+04	2.60E+01	1.60E+03	1.77E+04	320
^{90}Sr	^{90}Y	1.35E-10	1.00E-04	7.41E+05	2.60E+01	2.88E+01	9.96E+05	320
^{232}Th	^{228}Ra+D	2.90E-09	1.00E-04	3.45E+04	2.60E+01	1.41E+10	3.45E+04	320
^{235}U	^{231}Th	1.48E-10	1.00E-04	6.76E+05	2.60E+01	7.04E+08	6.76E+05	320

Check

BPRG reported **ingestion** BPRG pCi/cm2		above calc with decay	no decay
Co-60	2.90E+00	2.90E+00	8.20E-01
Cs-137	9.76E-01	9.74E-01	7.33E-01
Sr-90	3.11E-01	3.11E-01	2.31E-01

Sr90/Y90 BPRG combined 1/(1/Sr90 + 1/Y-90)

All show good agrement between calculator and spreadsheet with decay

ingestion BPRG used

SF for Th-232 and Ra-226 are from BPRG sum of individual daughter SF.

contact area cm2	pCi/cm2	dpm/100cm2		Decay progeny		gross alpha	gross beta	gross alpha
				# Alpha	# Beta			
3200400	1.73E-01	3.85E+01		1	0	3.85E+01		
3200400	2.90E+00	6.44E+02		0	1		6.44E+02	
3200400	9.74E-01	2.16E+02		0	1		2.16E+02	
3200400	3.88E+00	8.61E+02		0	1		8.61E+02	
3200400	2.94E+00	6.53E+02		0	1		6.53E+02	
3200400	6.62E+02	1.47E+05		0	1		1.47E+05	
3200400	1.37E-01	3.04E+01		1	0	3.04E+01		
3200400	5.52E-03	1.23E+00		1	1.6	1.23E+00	1.96E+00	
3200400	3.11E-01	6.91E+01		0	2		1.38E+02	
3200400	1.08E-02	2.39E+00		3	2.05	7.18E+00	4.90E+00	**7**
3200400	2.11E-01	4.69E+01		1	1	4.69E+01	4.69E+01	

Decay progeny from USN workplan

Plan limiting isotope

gross beta	USN gross	USN gross
		97.3
		90.6
	23.5	
	7.67	84.2
		47.8
5	5.73	95.9

ln2 0.693

Ingestion MDC calc

Parent ROC	Contributing Progeny	Slope factor	Risk Limit	pCi	contact area m2	contact area cm2	pCi/cm2	dpm/100cm2
^{241}Am		1.84E-10	1.00E-04	5.43E+05	200	2000000	2.72E-01	6.03E+01
^{60}Co		3.81E-11	1.00E-04	2.62E+06	200	2000000	1.31E+00	2.91E+02
^{137}Cs	^{137m}Ba	4.26E-11	1.00E-04	2.35E+06	200	2000000	1.17E+00	2.61E+02
^{152}Eu		1.46E-11	1.00E-04	6.85E+06	200	2000000	3.42E+00	7.60E+02
^{154}Eu		2.54E-11	1.00E-04	3.94E+06	200	2000000	1.97E+00	4.37E+02
^{3}H		8.99E-14	1.00E-04	1.11E+09	200	2000000	5.56E+02	1.23E+05
^{239}Pu	^{235m}U	2.28E-10	1.00E-04	4.39E+05	200	2000000	2.19E-01	4.87E+01
^{226}Ra	^{222}Rn+D	6.77E-10	1.00E-04	1.48E+05	200	2000000	7.39E-02	1.64E+01
^{90}Sr	^{90}Y	1.35E-10	1.00E-04	7.41E+05	200	2000000	3.70E-01	8.22E+01
^{232}Th	^{228}Ra+D	2.17E-09	1.00E-04	4.61E+04	200	2000000	2.30E-02	5.12E+00
^{235}U	^{231}Th	1.48E-10	1.00E-04	6.76E+05	200	2000000	3.38E-01	7.50E+01

Decay progeny		gross alpha	gross beta	gross alpha	gross beta	USN gross	USN gross
# Alpha	# Beta						
1	0	6.03E+01					
0	1		2.91E+02				97.3
0	1		2.61E+02				90.6
0	1		7.60E+02				
0	1		4.37E+02				
0	1		1.23E+05				
1	0	4.87E+01				23.5	
3.2	1.6	5.25E+01	2.62E+01			7.67	84.2
0	2		1.64E+02				47.8
4.05	2.05	2.07E+01	1.05E+01	**21**	**10**	5.73	95.9
1	1	7.50E+01	7.50E+01				

Decay progeny from USN workplan

Plan limiting isotope

Th-232		Estimated MDC reduction
MDC	**count time**	**1.41**
68	2 min	
48	4 min	
34	8 min	
24	16 min	
17	32 min	
12	64 min	
9	128 min	
6	256 min	

Ra-226		Estimated MDC reduction
MDC	**count time**	**1.41**
60	2 min	
42	4 min	
30	8 min	
21	16 min	
15	32 min	
11	64 min	
8	128 min	
5	256 min	

Ingestion MDC calc

Parent ROC	Contributing Progeny	Slope factor	Risk Limit	pCi	contact area m2	contact area cm2	pCi/cm2	dpm/100cm2
^{241}Am		1.84E-10	1.00E-04	5.43E+05	100	1000000	5.43E-01	1.21E+02
^{60}Co		3.81E-11	1.00E-04	2.62E+06	100	1000000	2.62E+00	5.83E+02
^{137}Cs	^{137m}Ba	4.26E-11	1.00E-04	2.35E+06	100	1000000	2.35E+00	5.21E+02
^{152}Eu		1.46E-11	1.00E-04	6.85E+06	100	1000000	6.85E+00	1.52E+03
^{154}Eu		2.54E-11	1.00E-04	3.94E+06	100	1000000	3.94E+00	8.74E+02
^{3}H		8.99E-14	1.00E-04	1.11E+09	100	1000000	1.11E+03	2.47E+05
^{239}Pu	^{235m}U	2.28E-10	1.00E-04	4.39E+05	100	1000000	4.39E-01	9.74E+01
^{226}Ra	^{222}Rn+D	6.77E-10	1.00E-04	1.48E+05	100	1000000	1.48E-01	3.28E+01
^{90}Sr	^{90}Y	1.35E-10	1.00E-04	7.41E+05	100	1000000	7.41E-01	1.64E+02
^{232}Th	^{228}Ra+D	2.17E-09	1.00E-04	4.61E+04	100	1000000	4.61E-02	1.02E+01
^{235}U	^{231}Th	1.48E-10	1.00E-04	6.76E+05	100	1000000	6.76E-01	1.50E+02

Decay progeny		gross alpha	gross beta	gross alpha	gross beta	USN gross	USN gross
# Alpha	# Beta						
1	0	1.21E+02					
0	1		5.83E+02				97.3
0	1		5.21E+02				90.6
0	1		1.52E+03				
0	1		8.74E+02				
0	1		2.47E+05				
1	0	9.74E+01				23.5	
3.2	1.6	1.05E+02	5.25E+01			7.67	84.2
0	2		3.29E+02				47.8
4.05	2.05	4.14E+01	2.10E+01	**41**	**21**	5.73	95.9
1	1	1.50E+02	1.50E+02				

Decay progeny from USN workplan

Plan limiting isotope

Th-232		Estimated MDC reduction
MDC	**count time**	**1.41**
68	2 min	
48	4 min	
34	8 min	
24	16 min	
17	32 min	
12	64 min	
9	128 min	
6	256 min	

Ra-226		Estimated MDC reduction
MDC	**count time**	**1.41**
60	2 min	
42	4 min	
30	8 min	
21	16 min	
15	32 min	
11	64 min	
8	128 min	
5	256 min	

Ingestion MDC calc

Parent ROC	Contributing Progeny	Slope factor	Risk Limit	pCi	contact area m2	contact area cm2	pCi/cm2	dpm/100cm2
^{241}Am		1.84E-10	1.00E-04	5.43E+05	43	430000	1.26E+00	2.81E+02
^{60}Co		3.81E-11	1.00E-04	2.62E+06	43	430000	6.10E+00	1.36E+03
^{137}Cs	^{137m}Ba	4.26E-11	1.00E-04	2.35E+06	43	430000	5.46E+00	1.21E+03
^{152}Eu		1.46E-11	1.00E-04	6.85E+06	43	430000	1.59E+01	3.54E+03
^{154}Eu		2.54E-11	1.00E-04	3.94E+06	43	430000	9.16E+00	2.03E+03
^{3}H		8.99E-14	1.00E-04	1.11E+09	43	430000	2.59E+03	5.74E+05
^{239}Pu	^{235m}U	2.28E-10	1.00E-04	4.39E+05	43	430000	1.02E+00	2.26E+02
^{226}Ra	^{222}Rn+D	6.77E-10	1.00E-04	1.48E+05	43	430000	3.44E-01	7.63E+01
^{90}Sr	^{90}Y	1.35E-10	1.00E-04	7.41E+05	43	430000	1.72E+00	3.82E+02
^{232}Th	^{228}Ra+D	2.17E-09	1.00E-04	4.61E+04	43	430000	1.07E-01	2.38E+01
^{235}U	^{231}Th	1.48E-10	1.00E-04	6.76E+05	43	430000	1.57E+00	3.49E+02

Decay progeny		gross alpha	gross beta	gross alpha	gross beta	USN gross	USN gross
# Alpha	# Beta						
1	0	2.81E+02					
0	1		1.36E+03				97.3
0	1		1.21E+03				90.6
0	1		3.54E+03				
0	1		2.03E+03				
0	1		5.74E+05				
1	0	2.26E+02				23.5	
3.2	1.6	2.44E+02	1.22E+02			7.67	84.2
0	2		7.65E+02				47.8
4.05	2.05	9.64E+01	4.88E+01	**96**	**49**	5.73	95.9
1	1	3.49E+02	3.49E+02				

Decay progeny from USN workplan

Plan limiting isotope

Th-232		Estimated MDC reduction
MDC	**count time**	**1.41**
68	2 min	
48	4 min	
34	8 min	
24	16 min	
17	32 min	
12	64 min	
9	128 min	
6	256 min	

Ra-226		Estimated MDC reduction
MDC	**count time**	**1.41**
60	2 min	
42	4 min	
30	8 min	
21	16 min	
15	32 min	
11	64 min	
8	128 min	
5	256 min	

Ingestion MDC calc

Parent ROC	Contributing Progeny	Slope factor	Risk Limit	pCi	contact area m2	contact area cm2	pCi/cm2	dpm/100cm2
^{241}Am		1.84E-10	1.00E-04	5.43E+05	32	320000	1.70E+00	3.77E+02
^{60}Co		3.81E-11	1.00E-04	2.62E+06	32	320000	8.20E+00	1.82E+03
^{137}Cs	^{137m}Ba	4.26E-11	1.00E-04	2.35E+06	32	320000	7.34E+00	1.63E+03
^{152}Eu		1.46E-11	1.00E-04	6.85E+06	32	320000	2.14E+01	4.75E+03
^{154}Eu		2.54E-11	1.00E-04	3.94E+06	32	320000	1.23E+01	2.73E+03
^{3}H		8.99E-14	1.00E-04	1.11E+09	32	320000	3.48E+03	7.72E+05
^{239}Pu	^{235m}U	2.28E-10	1.00E-04	4.39E+05	32	320000	1.37E+00	3.04E+02
^{226}Ra	^{222}Rn+D	6.77E-10	1.00E-04	1.48E+05	32	320000	4.62E-01	1.02E+02
^{90}Sr	^{90}Y	1.35E-10	1.00E-04	7.41E+05	32	320000	2.31E+00	5.14E+02
^{232}Th	^{228}Ra+D	2.17E-09	1.00E-04	4.61E+04	32	320000	1.44E-01	3.20E+01
^{235}U	^{231}Th	1.48E-10	1.00E-04	6.76E+05	32	320000	2.11E+00	4.69E+02

Decay progeny		gross alpha	gross beta	gross alpha	gross beta	USN gross	USN gross
# Alpha	# Beta						
1	0	3.77E+02					
0	1		1.82E+03				97.3
0	1		1.63E+03				90.6
0	1		4.75E+03				
0	1		2.73E+03				
0	1		7.72E+05				
1	0	3.04E+02				23.5	
3.2	1.6	3.28E+02	1.64E+02			7.67	84.2
0	2		1.03E+03				47.8
4.05	2.05	1.29E+02	6.55E+01	**129**	**66**	5.73	95.9
1	1	4.69E+02	4.69E+02				

Decay progeny from USN workplan

Plan limiting isotope

Th-232		Estimated MDC reduction
MDC	**count time**	**1.41**
68	2 min	
48	4 min	
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17	32 min	
12	64 min	
9	128 min	
6	256 min	

Ra-226		Estimated MDC reduction
MDC	**count time**	**1.41**
60	2 min	
42	4 min	
30	8 min	
21	16 min	
15	32 min	
11	64 min	
8	128 min	
5	256 min	

Ingestion MDC calc

Parent ROC	Contributing Progeny	Slope factor	Risk Limit	pCi	contact area m2	contact area cm2	pCi/cm2	dpm/100cm2
^{241}Am		1.84E-10	1.00E-04	5.43E+05	20	200000	2.72E+00	6.03E+02
^{60}Co		3.81E-11	1.00E-04	2.62E+06	20	200000	1.31E+01	2.91E+03
^{137}Cs	^{137m}Ba	4.26E-11	1.00E-04	2.35E+06	20	200000	1.17E+01	2.61E+03
^{152}Eu		1.46E-11	1.00E-04	6.85E+06	20	200000	3.42E+01	7.60E+03
^{154}Eu		2.54E-11	1.00E-04	3.94E+06	20	200000	1.97E+01	4.37E+03
^{3}H		8.99E-14	1.00E-04	1.11E+09	20	200000	5.56E+03	1.23E+06
^{239}Pu	^{235m}U	2.28E-10	1.00E-04	4.39E+05	20	200000	2.19E+00	4.87E+02
^{226}Ra	^{222}Rn+D	6.77E-10	1.00E-04	1.48E+05	20	200000	7.39E-01	1.64E+02
^{90}Sr	^{90}Y	1.35E-10	1.00E-04	7.41E+05	20	200000	3.70E+00	8.22E+02
^{232}Th	^{228}Ra+D	2.17E-09	1.00E-04	4.61E+04	20	200000	2.30E-01	5.12E+01
^{235}U	^{231}Th	1.48E-10	1.00E-04	6.76E+05	20	200000	3.38E+00	7.50E+02

Decay progeny		gross alpha	gross beta	gross alpha	gross beta	USN gross	USN gross
# Alpha	# Beta						
1	0	6.03E+02					
0	1		2.91E+03				97.3
0	1		2.61E+03				90.6
0	1		7.60E+03				
0	1		4.37E+03				
0	1		1.23E+06				
1	0	4.87E+02				23.5	
3.2	1.6	5.25E+02	2.62E+02			7.67	84.2
0	2		1.64E+03				47.8
4.05	2.05	2.07E+02	1.05E+02	**207**	**105**	5.73	95.9
1	1	7.50E+02	7.50E+02				

Decay progeny from USN workplan

Plan limiting isotope

Th-232		Estimated MDC reduction
MDC	count time	1.41
68	2 min	
48	4 min	
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Ra-226		Estimated MDC reduction
MDC	count time	1.41
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