

TABLE A-4a RADIOLICAL PROPERTIES OF HYDROGEN									
Z=1		$\rho = 0.08375 \text{ kg/m}^3 \text{ (NTP)}$		$5.974 \times 10^{26} \text{ elect./kg}$ $5.974 \times 10^{26} \text{ atom/kg}$		A=1.0080			
Photon energy $h\nu$	Basic Coefficients in $(10^{-24} \frac{\text{cm}^2}{\text{atom}})$ or $(10^{-28} \frac{\text{m}^2}{\text{atom}})$				Interaction coef. in [cm^2/g] (To get [m^2/kg] divide by 10)			Av. energy transferred or absorbed	Stopping power \bar{S}
	σ_{coh} coh.	σ_{inc} incoh.	τ photo	κ pair	$(\frac{\mu}{\rho})$	$(\frac{\mu_{\text{tr}}}{\rho})$	$(\frac{\mu_{\text{ab}}}{\rho})$	\bar{E}_{tr} \bar{E}_{ab}	in $\frac{\text{MeV cm}^2}{\text{g}}$ \bar{S}^*
[keV]								[keV]	
1	.5805	.0844	11.58		7.316	6.919		.946	
1.5	.4984	.1655	2.957		2.163	1.766		1.23	276.
2	.4141	.2485	1.114		1.061	.6658		1.26	239.
3	.2763	.3832	.2787		.5605	.1682		.900	192.
4	.1881	.4683	.1038		.4542	.0646		.569	161.
5	.1341	.5194	.0481		.4192	.0322		.384	139.
6	.0999	.5508	.0257		.4040	.0196		.291	123.
8	.0613	.5842	.0095		.3913	.0114		.234	101.
10	.0412	.5994	.0044		.3853	.0098		.253	85.5
15	.0194	.6095	.0011		.3764	.0110		.438	63.8
20	.0112	.6068	.0004		.3694	.0135		.733	184.
30	.0051	.5924	.0001		.3570	.0186		1.57	203.
40	.0029	.5759			.3458	.0231		2.68	157.
50	.0018	.5597			.3355	.0271		4.04	122.
60	.0013	.5443			.3260	.0305		5.62	98.6
80	.0007	.5166			.3091	.0362		9.37	69.1
100	.0005	.4923			.2944	.0406		13.8	51.7
150	.0002	.4434			.2651	.0481		27.2	31.1
200	.0001	.4064			.2429	.0526		43.3	21.9
300	.0001	.3535			.2112	.0570		80.9	14.1
400		.3168			.1893	.0586		124.	10.8
500		.2893			.1728	.0590		171.	8.94
550		.2777			.1659	.0589		195.	8.32
662		.2560			.1530	.0584		253.	7.30
800		.2351			.1405	.0574		327.	6.50
[MeV]								[MeV]	
1		.2114			.1263	.0556		.440	5.81
1.25		.1890			.1129	.0531		.588	5.28
1.5		.1718			.1027	.0508		.742	4.95
2		.1466	.0002		.0877	.0466		1.06	4.59
3		.1153	.0006		.0692	.0400		1.73	4.29
4		.0962	.0010		.0581	.0353		2.43	4.17
5		.0831	.0014		.0505	.0319 .0317		3.15	4.13
6		.0734	.0018		.0449	.0291 .0290		3.89 3.87	4.11
8		.0601	.0025		.0374	.0253 .0251		5.40 5.37	4.11
10		.0512	.0033		.0325	.0227 .0225		6.97 6.91	4.14
15		.0379	.0045		.0253	.0186 .0183		11.0 10.8	4.21
20		.0304	.0056		.0215	.0164 .0161		15.2 14.9	4.27
30		.0221	.0071		.0175	.0140 .0136		24.0 23.3	4.39
40		.0176	.0081		.0154	.0127 .0122		33.1 31.8	4.48
50		.0147	.0090		.0142	.0120 .0114		42.5 40.4	4.54
60		.0126	.0096		.0133	.0115 .0109		51.9 48.9	4.60
80		.0100	.0107		.0124	.0110 .0102		71.2 65.8	4.69
100		.0083	.0116		.0119	.0108 .0098		90.8 82.5	4.76

*Av. Stopping Power in [$\text{MeV cm}^2 \text{ g}^{-1}$] for the spectrum of electrons produced in the medium by photons of energy $h\nu$

TABLE A-4b RADIOLOGICAL PROPERTIES OF CARBON									
Z=6		$\rho = 2250 \text{ kg/m}^3$		$3.008 \times 10^{26} \text{ elect./kg}$ $5.014 \times 10^{25} \text{ atom/kg}$		A=12.011			
Photon energy $h\nu$	Basic Coefficients in $(10^{-24} \frac{\text{cm}^2}{\text{atom}})$ or $(10^{-28} \frac{\text{m}^2}{\text{atom}})$				Interaction coef. in [cm ² /g] (To get [m ² /kg] divide by 10)			Av. energy transferred or absorbed	Stopping power \bar{S}
	σ_{coh} coh.	σ_{inc} incoh.	τ photo	κ pair	$(\frac{\mu}{\rho})$	$(\frac{\mu_{\text{tr}}}{\rho})$	$(\frac{\mu_{\text{ab}}}{\rho})$	\bar{E}_{tr} \bar{E}_{ab}	in $\frac{\text{MeV cm}^2}{\text{g}}$ \bar{S}^*
[keV]								[keV]	
1	21.57	.2525	43820.		2198.	2197.		1.00	
1.5	19.21	.5016	14130.		709.4	708.5		1.50	93.4
2	16.69	.7730	6107.		307.1	306.2		1.99	82.6
3	12.30	1.283	1793.		90.58	89.89		2.98	68.2
4	9.243	1.690	731.7		37.23	36.68		3.94	58.3
5	7.218	1.990	360.3		18.53	18.07		4.88	51.1
6	5.857	2.208	200.4		10.45	10.05		5.77	45.7
8	4.204	2.503	78.54		4.274	3.940		7.38	37.9
10	3.247	2.704	37.66		2.187	1.891		8.65	32.6
15	1.958	3.023	9.770		.7396	.4945		10.0	24.8
20	1.294	3.192	3.725		.4117	.1930		9.38	20.2
30	.6719	3.307	.9539		.2473	.0570		6.91	16.1
40	.4082	3.300	.3634		.2041	.0297		5.83	16.0
50	.2735	3.252	.1725		.1854	.0222		5.99	17.9
60	.1957	3.188	.0941		.1744	.0200		6.89	20.2
80	.1139	3.054	.0365		.1607	.0200		9.98	21.1
100	.0742	2.924	.0176		.1512	.0213		14.1	18.5
150	.0336	2.647	.0048		.1346	.0245		27.3	12.4
200	.0190	2.431	.0020		.1229	.0266		43.2	8.95
300	.0085	2.117	.0006		.1066	.0287		80.8	5.86
400	.0048	1.899	.0002		.0954	.0295		124.	4.53
500	.0031	1.734	.0001		.0871	.0297		171.	3.78
550	.0025	1.665	.0001		.0836	.0297		195.	3.53
662	.0018	1.535	.0001		.0771	.0294		253.	3.11
800	.0012	1.410			.0708	.0289		327.	2.78
[MeV]								[MeV]	
1	.0008	1.268			.0636	.0280		.440	2.49
1.25	.0005	1.134	.0001		.0569	.0268		.588	2.27
1.5	.0003	1.031	.0016		.0518	.0256		.742 .739	2.13
2	.0002	.8795	.0064		.0444	.0236		1.06 1.06	1.97
3	.0001	.6919	.0186		.0356	.0206		1.74 1.73	1.84
4		.5772	.0308		.0305	.0187 .0185		2.46 2.43	1.78
5		.4984	.0419		.0271	.0174 .0171		3.21 3.16	1.75
6		.4405	.0502		.0246	.0163 .0160		3.98 3.91	1.74
8		.3604	.0670		.0214	.0150 .0146		5.60 5.45	1.72
10		.3069	.0840		.0196	.0143 .0138		7.30 7.06	1.72
15		.2272	.1094		.0169	.0132 .0125		11.7 11.1	1.72
20		.1823	.1321		.0158	.0129 .0121		16.4 15.3	1.73
30		.1327	.1609		.0147	.0128 .0115		26.0 23.5	1.74
40		.1055	.1798		.0143	.0128 .0112		35.8 31.3	1.76
50		.0880	.1962		.0143	.0130 .0111		45.7 38.8	1.77
60		.0759	.2069		.0142	.0132 .0109		55.7 46.0	1.78
80		.0598	.2251		.0143	.0135 .0106		75.6 59.4	1.79
100		.0497	.2404		.0145	.0139 .0104		95.6 71.7	1.81

*Av. Stopping Power in [MeV cm² g⁻¹] for the spectrum of electrons produced in the medium by photons of energy $h\nu$

TABLE A-4c RADIOLOGICAL PROPERTIES OF NITROGEN									
Z=7		$\rho = 1.165 \text{ kg/m}^3 \text{ (NTP)}$		$3.010 \times 10^{26} \text{ elct./kg}$ $4.299 \times 10^{25} \text{ atom/kg}$		A=14.007			
Photon energy $h\nu$	Basic Coefficients in				Interaction coef. in			Av. energy transferred or absorbed \bar{E}_{tr} \bar{E}_{ab}	Stopping power \bar{S} in $\frac{\text{MeV cm}^2}{\text{g}}$ \bar{S}^*
	$(10^{-24} \frac{\text{cm}^2}{\text{atom}})$	$(10^{-28} \frac{\text{m}^2}{\text{atom}})$	τ	κ	$[\text{cm}^2/\text{g}]$ (To get $[\text{m}^2/\text{kg}]$ divide by 10)	$(\frac{\mu}{\rho})$	$(\frac{\mu_{tr}}{\rho})$		
	σ_{coh} coh.	σ_{inc} incoh.	photo	pair					
[keV]								[keV]	
1	30.02	.2566	78950.		3396.	3395.		1.00	
1.5	27.35	.5215	26080.		1123.	1122.		1.50	91.8
2	24.33	.8195	11470.		494.2	493.2		2.00	81.3
3	18.61	1.398	3448.		149.1	148.3		2.98	67.2
4	14.21	1.873	1430.		62.17	61.49		3.96	57.5
5	11.10	2.233	713.1		31.23	30.66		4.91	50.4
6	8.925	2.501	400.7		17.72	17.23		5.83	45.1
8	6.243	2.865	159.4		7.245	6.856		7.57	37.5
10	4.722	3.102	77.31		3.660	3.327		9.09	32.2
15	2.802	3.461	20.45		1.149	.8840		11.5	24.5
20	1.867	3.658	7.899		.5771	.3457		12.0	20.0
30	.9810	3.810	2.056		.2944	.0975		9.93	15.5
40	.6015	3.817	.7917		.2240	.0455		8.13	14.1
50	.4043	3.770	.3785		.1957	.0298		7.61	14.6
60	.2903	3.703	.2076		.1806	.0242		8.05	16.1
80	.1698	3.552	.0810		.1635	.0217		10.6	18.1
100	.1111	3.404	.0393		.1528	.0221		14.5	17.0
150	.0506	3.085	.0108		.1353	.0247		27.4	12.1
200	.0287	2.834	.0044		.1233	.0267		43.3	8.85
300	.0128	2.469	.0013		.1068	.0288		80.8	5.82
400	.0072	2.214	.0006		.0955	.0296		124.	4.50
500	.0046	2.023	.0003		.0872	.0297		171.	3.76
550	.0038	1.943	.0002		.0837	.0297		195.	3.51
662	.0026	1.791	.0001		.0771	.0294		252.	3.09
800	.0018	1.645	.0001		.0708	.0289		327.	2.76
[MeV]								[MeV]	
1	.0012	1.479			.0637	.0280		.440	2.48
1.25	.0007	1.323	.0001		.0569	.0268		.588 .586	2.27
1.5	.0005	1.202	.0021		.0518	.0256		.741 .739	2.14
2	.0003	1.026	.0088		.0445	.0236		1.06 1.06	1.99
3	.0001	.8072	.0253		.0358	.0208 .0206		1.74 1.73	1.88
4	.0001	.6733	.0418		.0308	.0189 .0187		2.46 2.43	1.83
5		.5815	.0567		.0274	.0176 .0174		3.21 3.17	1.82
6		.5140	.0678		.0250	.0167 .0163		3.99 3.92	1.82
8		.4204	.0902		.0220	.0155 .0150		5.63 5.48	1.82
10		.3581	.1129		.0203	.0149 .0144		7.35 7.10	1.83
15		.2650	.1466		.0177	.0140 .0133		11.8 11.2	1.87
20		.2127	.1767		.0167	.0139 .0129		16.6 15.4	1.90
30		.1549	.2148		.0159	.0139 .0126		26.2 23.7	1.95
40		.1231	.2400		.0156	.0141 .0124		36.1 31.7	1.99
50		.1027	.2615		.0157	.0144 .0124		46.0 39.4	2.02
60		.0885	.2757		.0157	.0146 .0122		56.0 46.8	2.05
80		.0698	.2996		.0159	.0151 .0120		75.9 60.6	2.09
100		.0579	.3196		.0162	.0156 .0119		96.0 73.4	2.13

*Av. Stopping Power in $[\text{MeV cm}^2 \text{ g}^{-1}]$ for the spectrum of electrons produced in the medium by photons of energy $h\nu$

TABLE A-4d RADIOLOGICAL PROPERTIES OF OXYGEN										
Z=8		$\rho = 1.332 \text{ kg/m}^3 \text{ (NTP)}$		$3.011 \times 10^{26} \text{ elect./kg}$ $3.764 \times 10^{25} \text{ atom/kg}$		A=15.999				
Photon energy $h\nu$	Basic Coefficients in				Interaction coef. in			Av. energy transferred or absorbed		Stopping power \bar{S}
	$(10^{-24} \frac{\text{cm}^2}{\text{atom}})$ or $(10^{-28} \frac{\text{m}^2}{\text{atom}})$				[cm^2/g] (To get [m^2/kg] divide by 10)			\bar{E}_{tr}	\bar{E}_{ab}	in $\frac{\text{MeV cm}^2}{\text{g}}$
[keV]	σ_{coh} coh.	σ_{inc} incoh.	τ photo	κ pair	$(\frac{\mu}{\rho})$	$(\frac{\mu_{\text{tr}}}{\rho})$	$(\frac{\mu_{\text{ab}}}{\rho})$	[keV]		\bar{S}^*
1	39.89	.2268	122100		4597.		4596.			
1.5	36.97	.4713	41670.		1570.		1569.	1.00		
2	33.55	.7590	18730.		706.2		704.9	1.50		86.4
3	26.61	1.358	5796.		219.2		218.2	2.00		76.8
4	20.79	1.895	2451.		93.11		92.25	2.99		63.8
5	16.40	2.333	1240.		47.38		46.68	3.96		54.8
6	13.20	2.675	704.6		27.12		26.52	4.93		48.2
8	9.143	3.149	285.1		11.19		10.73	5.87		43.2
10	6.804	3.449	140.0		5.656		5.273	7.67		36.0
15	3.941	3.877	37.82		1.718		1.428	9.32		31.0
20	2.622	4.107	14.81		.8107		.5634	12.5		23.7
30	1.389	4.300	3.921		.3617		.1565	13.9		19.3
40	.8552	4.324	1.526		.2524		.0688	13.0		14.7
50	.5761	4.281	.7350		.2105		.0412	10.9		12.9
60	.4144	4.211	.4054		.1893		.0305	9.78		12.5
80	.2432	4.046	.1595		.1674		.0242	9.68		13.2
100	.1595	3.881	.0778		.1550		.0234	11.6		15.0
150	.0729	3.521	.0215		.1361		.0251	15.1		15.0
200	.0414	3.236	.0088		.1237		.0268	27.6		11.5
300	.0186	2.821	.0026		.1070		.0288	43.4		8.55
400	.0105	2.530	.0011		.0957		.0296	80.8		5.67
500	.0067	2.312	.0006		.0873		.0298	124.		4.39
550	.0055	2.220	.0004		.0838		.0297	171.		3.67
662	.0038	2.047	.0003		.0772		.0294	195.		3.43
800	.0026	1.880	.0002		.0709		.0289	252.		3.02
								327.		2.71
[MeV]								[MeV]		
1	.0017	1.691	.0001		.0637		.0280	.440		2.43
1.25	.0011	1.512	.0001	.0002	.0570		.0268			
1.5	.0007	1.374		.0028	.0519		.0256	.588	.586	2.22
2	.0004	1.173		.0115	.0446	.0237	.0235	.741	.738	2.10
3	.0002	.9225		.0331	.0360	.0209	.0207	1.06	1.05	1.96
4	.0001	.7695		.0544	.0310	.0191	.0189	1.74	1.72	1.84
5	.0001	.6646		.0736	.0278	.0179	.0176	2.46	2.43	1.80
6		.5874		.0880	.0254	.0170	.0166	3.22	3.17	1.79
8		.4804		.1169	.0225	.0159	.0154	4.01	3.92	1.79
10								5.66	5.49	1.79
15	.4092		.1459		.0209	.0155	.0149			
20	.3029		.1892		.0185	.0147	.0139	7.40	7.12	1.81
30	.2431		.2277		.0177	.0148	.0137	11.9	11.3	1.84
40	.1770		.2764		.0171	.0148	.0137	16.7	15.4	1.87
50	.1406		.3085		.0169	.0153	.0133	26.4	23.7	1.92
60	.1174		.3360		.0171	.0158	.0133	36.3	31.5	1.96
80	.1011		.3540		.0171	.0161	.0132	46.3	39.1	2.00
100	.0798		.3843		.0175	.0166	.0130	56.2	46.2	2.02
	.0662		.4097		.0179	.0172	.0129	76.2	59.6	2.07
								96.3	71.9	2.10

*Av. Stopping Power in [$\text{MeV cm}^2 \text{ g}^{-1}$] for the spectrum of electrons produced in the medium by photons of energy $h\nu$

TABLE A-4e RADIOLOGICAL PROPERTIES OF ALUMINUM										
Z=13		$\rho = 2699 \text{ kg/m}^3$		$2.902 \times 10^{26} \text{ elect./kg}$		A=26.981				
				$2.232 \times 10^{25} \text{ atom/kg}$						
Photon energy $h\nu$	Basic Coefficients in				Interaction coef. in			Av. energy transferred or absorbed		Stopping power \bar{S} in $\frac{\text{MeV cm}^2}{\text{g}}$ \bar{S}^*
	$(10^{-24} \frac{\text{cm}^2}{\text{atom}})$ or $(10^{-28} \frac{\text{m}^2}{\text{atom}})$				$[\text{cm}^2/\text{g}]$ (To get $[\text{m}^2/\text{kg}]$ divide by 10)			\bar{E}_{tr}	\bar{E}_{ab}	
[keV]	σ_{coh} coh.	σ_{inc} incoh.	τ photo pair	κ	$(\frac{\mu}{\rho})$	$(\frac{\mu_{\text{tr}}}{\rho})$	$(\frac{\mu_{\text{ab}}}{\rho})$	[keV]		
1.55	90.07	1.163	15870.		356.2	354.1		1.55	65.4	
1.56	90.05	1.164	189900.		4241.	4105.		1.51	65.4	
2	82.30	1.515	103200.		2305.	2247.		1.95	59.9	
3	68.17	2.125	36080.		806.9	792.1		2.95	50.8	
4	57.97	2.611	16490.		369.4	363.6		3.94	44.2	
5	49.93	3.054	8814.		197.9	194.8		4.92	39.3	
6	43.13	3.465	5224.		117.6	115.6		5.90	35.5	
8	32.33	4.186	2246.		50.95	49.83		7.82	29.9	
10	24.65	4.767	1151.		26.35	25.57		9.70	26.0	
15	14.02	5.695	333.0		7.873	7.411		14.1	20.1	
20	9.145	6.169	135.9		3.375	3.031		18.0	16.5	
30	4.894	6.588	37.84		1.101	.8514	.8510	23.2	12.5	
40	3.067	6.721	15.17		.5571	.3489	.3487	25.1	10.3	
50	2.094	6.725	7.453		.3632	.1790	.1789	24.6	9.00	
60	1.517	6.663	4.171		.2757	.1076	.1075	23.4	8.27	
80	.8974	6.458	1.673		.2015	.0547	.0547	21.7	7.82	
100	.5929	6.225	.8266		.1706	.0381	.0381	22.3	8.02	
150	.2744	5.680	.2327		.1381	.0285	.0285	31.0	8.13	
200	.1571	5.234	.0961		.1225	.0277	.0276	45.2	6.95	
300	.0708	4.573	.0284		.1043	.0283	.0283	81.4	4.93	
400	.0401	4.105	.0122		.0928	.0287	.0287	124.	3.88	
500	.0257	3.752	.0065		.0845	.0288	.0287	171.	3.26	
550	.0213	3.604	.0050		.0810	.0287	.0287	195.	3.05	
662	.0147	3.324	.0030		.0746	.0284	.0283	252.	2.70	
800	.0101	3.053	.0018		.0684	.0279	.0278	327. 325.	2.42	
[MeV]								[MeV]		
1	.0064	2.746	.0010		.0615	.0270	.0269	.440 .437	2.18	
1.25	.0041	2.456	.0007	.0003	.0549	.0258	.0257	.588 .584	1.99	
1.5	.0029	2.232	.0005	.0075	.0501	.0247	.0245	.741 .735	1.88	
2	.0016	1.905	.0003	.0306	.0433	.0229	.0227	1.06 1.05	1.75	
3	.0007	1.499	.0002	.0872	.0354	.0206	.0203	1.75 1.72	1.64	
4	.0004	1.250	.0001	.1420	.0311	.0193	.0189	2.48 2.43	1.60	
5	.0003	1.080	.0001	.1918	.0284	.0185	.0180	3.27 3.17	1.58	
6	.0002	.9545	.0001	.2283	.0264	.0179	.0173	4.08 3.93	1.57	
8	.0001	.7808		.3010	.0242	.0175	.0166	5.79 5.51	1.56	
10	.0001	.6650		.3734	.0232	.0176	.0166	7.61 7.14	1.56	
15		.4922		.4811	.0217	.0178	.0162	12.3 11.2	1.57	
20		.3950		.5761	.0217	.0186	.0165	17.2 15.2	1.59	
30		.2876		.6961	.0220	.0198	.0167	27.1 22.8	1.61	
40		.2285		.7752	.0224	.0207	.0166	37.0 29.7	1.62	
50		.1908		.8428	.0231	.0217	.0167	47.0 36.1	1.64	
60		.1644		.8858	.0234	.0223	.0164	57.0 42.0	1.65	
80		.1296		.9581	.0243	.0234	.0160	77.1 52.8	1.67	
100		.1076		1.018	.0251	.0244	.0156	97.1 62.3	1.69	

*Av. Stopping Power in $[\text{MeV cm}^2 \text{ g}^{-1}]$ for the spectrum of electrons produced in the medium by photons of energy $h\nu$

TABLE A-4f RADIOLOGICAL PROPERTIES OF CALCIUM									
Z=20		$\rho = 1550 \text{ kg/m}^3$		$3.005 \times 10^{26} \text{ elect./kg}$ $1.503 \times 10^{25} \text{ atom/kg}$		A=40.080			
Photon energy $h\nu$	Basic Coefficients in $(10^{-24} \frac{\text{cm}^2}{\text{atom}})$ or $(10^{-28} \frac{\text{m}^2}{\text{atom}})$				Interaction coef. in [cm ² /g] (To get [m ² /kg] divide by 10)			Av. energy transferred or absorbed	Stopping power S
	σ_{coh} coh.	σ_{inc} incoh.	τ photo pair	κ	$(\frac{\mu}{\rho})$	$(\frac{\mu_{\text{tr}}}{\rho})$	$(\frac{\mu_{\text{ab}}}{\rho})$	\bar{E}_{tr} \bar{E}_{ab}	in $\frac{\text{MeV cm}^2}{\text{g}}$ \bar{S}^*
[keV]								[keV]	
1.5	216.7	1.571	115300		1736.	1733.		1.50	63.5
2	197.0	2.068	53720.		810.2	807.4		1.99	57.7
3	163.6	2.991	17840.		270.6	268.1		2.97	49.3
4.03	135.2	3.847	7801.		119.3	117.2		3.97	42.9
4.5	124.1	4.193	53680.		808.5	709.7		3.95	40.7
5	114.2	4.540	40880.		616.0	547.7		4.45	38.5
6	97.21	5.161	25200.		380.2	344.5		5.44	34.9
8	74.07	6.132	11490.		173.8	160.9		7.41	29.5
10	59.40	6.845	6147.		93.36	87.38		9.36	25.7
15	37.54	8.076	1911.		29.40	27.68		14.1	19.9
20	25.28	8.855	817.7		12.80	11.96		18.7	16.4
30	13.59	9.627	241.7		3.981	3.575 3.572		26.9	12.4
40	8.614	9.901	100.7		1.791	1.503 1.502		33.6	10.2
50	5.975	9.969	50.85		1.004	.7689 .7679		38.3	8.73
60	4.394	9.933	29.06		.6519	.4474 .4468		41.2	7.76
80	2.650	9.711	12.01		.3662	.1971 .1967		43.1	6.60
100	1.767	9.413	6.061		.2590	.1107 .1105		42.8	6.04
150	.8277	8.651	1.764		.1689	.0505 .0504		44.9	5.78
200	.4779	7.998	.7429		.1385	.0375 .0374		54.2	5.63
300	.2174	7.008	.2244		.1119	.0320 .0319		85.7 85.5	4.66
400	.1235	6.300	.0980		.0980	.0309 .0308		126. 126.	3.83
500	.0794	5.762	.0522		.0886	.0305 .0303		172. 171.	3.27
550	.0657	5.536	.0401		.0848	.0302 .0301		196. 195.	3.07
662	.0455	5.107	.0242		.0778	.0297 .0296		253. 252.	2.73
800	.0312	4.693	.0145		.0712	.0291 .0289		327. 325.	2.45
[MeV]								[MeV]	
1	.0200	4.222	.0081		.0639	.0281 .0279		.440 .436	2.21
1.25	.0128	3.777	.0055 .0005		.0570	.0268 .0266		.588 .582	2.03
1.5	.0089	3.433	.0039 .0185		.0521	.0257 .0254		.740 .732	1.92
2	.0050	2.930	.0024 .0736		.0453	.0240 .0236		1.06 1.04	1.79
3	.0022	2.306	.0013 .2072		.0378	.0221 .0216		1.75 1.71	1.69
4	.0013	1.924	.0009 .3346		.0340	.0213 .0206		2.51 2.43	1.65
5	.0008	1.661	.0007 .4505		.0318	.0211 .0202		3.32 3.18	1.64
6	.0006	1.468	.0005 .5342		.0301	.0209 .0198		4.16 3.95	1.63
8	.0003	1.201	.0004 .6996		.0286	.0212 .0198		5.94 5.54	1.62
10	.0002	1.023	.0003 .8633		.0284	.0222 .0203		7.82 7.17	1.62
15	.0001	.7572	.0002 1.110		.0281	.0236 .0209		12.6 11.2	1.64
20	.0001	.6077	.0001 1.327		.0291	.0256 .0218		17.6 15.0	1.65
30		.4424	.0001 1.598		.0307	.0282 .0225		27.6 22.0	1.68
40		.3516	.0001 1.773		.0319	.0300 .0225		37.6 28.2	1.70
50		.2935	.0001 1.922		.0333	.0317 .0226		47.6 33.9	1.71
60		.2529	2.016		.0341	.0327 .0222		57.6 39.0	1.73
80		.1994	2.175		.0357	.0346 .0215		77.6 48.2	1.75
100		.1655	2.306		.0371	.0363 .0208		97.7 56.0	1.76

*Av. Stopping Power in [MeV cm² g⁻¹] for the spectrum of electrons produced in the medium by photons of energy $h\nu$

TABLE A-4g RADIOLOGICAL PROPERTIES OF COPPER									
Z=29	$\rho = 8960 \text{ kg/m}^3$			$2.749 \times 10^{26} \text{ elect./kg}$ $9.478 \times 10^{24} \text{ atom/kg}$		A=63.540			
Photon energy $h\nu$	Basic Coefficients in $(10^{-24} \frac{\text{cm}^2}{\text{atom}})$ or $(10^{-28} \frac{\text{m}^2}{\text{atom}})$				Interaction coef. in $[\text{cm}^2/\text{g}]$ (To get $[\text{m}^2/\text{kg}]$ divide by 10)			Av. energy transferred or absorbed	Stopping power \bar{S} in $\frac{\text{MeV cm}^2}{\text{g}}$
	σ_{coh} coh.	$\sigma_{\text{inc.}}$ incoh.	τ photo	κ pair	$(\frac{\mu}{\rho})$	$(\frac{\mu_{\text{tr}}}{\rho})$	$(\frac{\mu_{\text{ab}}}{\rho})$	\bar{E}_{tr}	\bar{E}_{ab}
[keV]								[keV]	
1.09	526.8	.7259	1036000		9824.	9815.		1.10	45.6
1.1	526.8	.7269	1199000		11370.	11360.		1.10	45.6
2	477.1	1.685	247400.		2349.	2344.		2.00	40.5
4	358.5	3.740	37410.		358.0	354.5		3.96	32.0
5	307.1	4.658	20090.		193.4	190.4		4.92	28.9
6	263.3	5.500	12030.		116.6	114.0		5.87	26.5
8.97	172.5	7.616	3809.		37.81	36.10		8.57	21.4
8.97	172.5	7.617	30300.		288.9	185.9		5.78	21.4
10	152.4	8.214	22970.		219.2	148.7		6.79	20.1
15	92.32	10.37	7785.		74.76	58.21 58.19		11.7	15.8
20	63.47	11.68	3497.		33.86	27.90 27.88		16.5	13.2
30	35.12	13.09	1091.		10.80	9.259 9.248		25.7	10.1
40	22.24	13.69	468.3		4.779	4.097 4.090		34.3	8.32
50	15.34	13.91	241.0		2.561	2.151 2.147		42.0	7.14
60	11.29	13.93	139.6		1.562	1.266 1.263		48.6	6.32
80	6.886	13.72	58.72		.7519	.5506 .5490		58.6 58.4	5.26
100	4.642	13.37	29.98		.4549	.2934 .2924		64.5 64.3	4.63
150	2.202	12.39	8.892		.2226	.1044 .1040		70.4 70.1	3.95
200	1.278	11.50	3.793		.1570	.0594 .0592		75.7 75.4	3.73
300	.5855	10.11	1.169		.1125	.0371 .0370		99.0 98.5	3.43
400	.3340	9.104	.5192		.0944	.0318 .0316		135. 134.	3.04
500	.2153	8.335	.2812		.0837	.0298 .0296		178. 177.	2.68
550	.1783	8.009	.2178		.0797	.0291 .0289		201. 200.	2.54
662	.1236	7.393	.1339		.0725	.0281 .0279		257. 254.	2.29
800	.0848	6.797	.0819		.0660	.0272 .0269		329. 326.	2.07
[MeV]								[MeV]	
1	.0544	6.116	.0470		.0589	.0260 .0257		.441 .436	1.88
1.25	.0349	5.473	.0315 .0009		.0525	.0248 .0244		.589 .580	1.73
1.5	.0242	4.976	.0226 .0414		.0480	.0237 .0233		.741 .727	1.64
2	.0136	4.248	.0135 .1598		.0420	.0223 .0217		1.06 1.03	1.54
3	.0061	3.343	.0074 .4393		.0360	.0211 .0204		1.76 1.70	1.45
4	.0034	2.789	.0050 .7031		.0332	.0211 .0200		2.54 2.42	1.42
5	.0022	2.409	.0037 .9345		.0317	.0214 .0201		3.37 3.17	1.40
6	.0015	2.129	.0030 1.107		.0307	.0217 .0202		4.25 3.94	1.39
8	.0009	1.742	.0021 1.447		.0303	.0230 .0208		6.08 5.51	1.38
10	.0005	1.483	.0016 1.783		.0310	.0248 .0220		8.01 7.09	1.39
15	.0002	1.098	.0011 2.281		.0320	.0276 .0232		12.9 10.9	1.39
20	.0001	.8812	.0008 2.717		.0341	.0305 .0246		17.9 14.4	1.41
30	.0001	.6415	.0005 3.268		.0371	.0345 .0255		27.9 20.7	1.43
40		.5098	.0004 3.620		.0391	.0371 .0255		37.9 26.1	1.44
50		.4255	.0003 3.918		.0412	.0395 .0254		48.0 30.8	1.46
60		.3667	.0002 4.107		.0424	.0410 .0248		58.0 35.1	1.47
80		.2892	.0002 4.422		.0447	.0435 .0237		78.0 42.5	1.48
100		.2400	.0001 4.684		.0467	.0458 .0227		98.0 48.7	1.50

*Av. Stopping Power in $[\text{MeV cm}^2 \text{g}^{-1}]$ for the spectrum of electrons produced in the medium by photons of energy $h\nu$

TABLE A-4h RADIOLOGICAL PROPERTIES OF TIN										
Z=50		$\rho = 7298 \text{ kg/m}^3$		$2.537 \times 10^{26} \text{ elect./kg}$ $5.074 \times 10^{24} \text{ atom/kg}$		A=118.69				
Photon energy $h\nu$	Basic Coefficients in $(10^{-24} \frac{\text{cm}^2}{\text{atom}})$ or $(10^{-28} \frac{\text{m}^2}{\text{atom}})$				Interaction coef. in [cm^2/g] (To get [m^2/kg] divide by 10)			Av. energy transferred or absorbed	Stopping power \bar{S} in $\frac{\text{MeV cm}^2}{\text{g}}$	
	σ_{coh} coh.	σ_{inc} incoh.	τ photo	κ pair	$(\frac{\mu}{\rho})$	$(\frac{\mu_{\text{tr}}}{\rho})$	$(\frac{\mu_{\text{ab}}}{\rho})$	\bar{E}_{tr}	\bar{E}_{ab}	\bar{S}^*
[keV]								[keV]		
2	1395.	2.778	354100.		1804.	1797.		1.99	27.9	
3.92	1071.	5.656	62570.		322.9	317.5		3.86	23.8	
4	1062.	5.752	183000.		933.9	874.1		3.74	23.7	
4.15	1037.	5.955	166400.		849.6	796.8		3.90	23.4	
4.46	992.9	6.352	195800.		998.4	941.2		4.21	22.8	
4.46	992.8	6.353	227000.		1157.	1091.		4.21	22.8	
4.5	988.0	6.397	222500.		1134.	1070.		4.25	22.7	
6	811.4	8.171	106400.		544.0	518.8		5.72	20.3	
8	636.5	10.25	49950.		256.7	246.0		7.67	17.8	
10	516.5	12.05	27420.		141.8	135.9		9.58	15.9	
15	339.2	15.36	8958.		47.25	44.73	44.70	14.2	12.8	
20	237.7	17.51	3960.		21.39	19.86	19.84	18.6	10.7	
30	133.3	20.08	7942.		41.08	14.91	14.88	10.9	8.35	
40	86.84	21.44	3734.		19.50	10.00	9.976	20.5	6.93	
50	61.28	22.15	2037.		10.76	6.439	6.417	29.9	5.97	
60	45.45	22.47	1228.		6.575	4.279	4.262	39.1	5.30	
80	27.69	22.49	544.9		3.019	2.125	2.114	56.3	4.39	
100	18.71	22.13	287.7		1.667	1.200	1.193	72.0	3.82	
150	9.040	20.78	89.60		.6059	.4173	.4136	103.	3.05	
200	5.321	19.43	39.36		.3253	.2028	.2007	125.	2.66	
300	2.466	17.23	12.63		.1640	.0841	.0830	154.	2.33	
400	1.416	15.57	5.796		.1156	.0529	.0521	183.	2.17	
500	.9173	14.28	3.234		.0935	.0408	.0401	218.	2.05	
550	.7612	13.74	2.542		.0865	.0374	.0368	238.	1.99	
662	.5293	12.70	1.612		.0753	.0327	.0321	288.	1.86	
800	.3643	11.68	1.021		.0663	.0294	.0288	355.	1.74	
[MeV]								[MeV]		
1	.2342	10.52	.6172		.0577	.0267	.0260	.462	.450	1.61
1.25	.1504	9.420	.4096	.0022	.0507	.0246	.0239	.607	.589	1.50
1.5	.1046	8.567	.2930	.1503	.0463	.0233	.0225	.755	.728	1.43
2	.0590	7.317	.1727	.5250	.0410	.0219	.0209	1.07	1.02	1.36
3	.0262	5.761	.0938	1.357	.0367	.0219	.0205	1.79	1.68	1.30
4	.0148	4.807	.0631	2.105	.0355	.0231	.0212	2.60	2.40	1.27
5	.0095	4.152	.0464	2.766	.0354	.0246	.0223	3.48	3.15	1.26
6	.0066	3.670	.0369	3.237	.0353	.0258	.0229	4.39	3.90	1.25
8	.0037	3.002	.0258	4.149	.0364	.0287	.0246	6.29	5.40	1.25
10	.0024	2.557	.0195	5.033	.0386	.0319	.0266	8.26	6.88	1.25
15	.0011	1.893	.0126	6.412	.0422	.0372	.0289	13.2	10.3	1.27
20	.0006	1.519	.0093	7.616	.0464	.0423	.0310	18.2	13.4	1.28
30	.0003	1.106	.0060	9.127	.0520	.0490	.0322	28.3	18.6	1.30
40	.0001	.8789	.0044	10.10	.0557	.0533	.0319	38.3	22.9	1.32
50	.0001	.7337	.0035	10.92	.0592	.0572	.0316	48.3	26.7	1.33
60	.0001	.6321	.0028	11.42	.0612	.0595	.0305	58.3	29.9	1.34
80		.4985	.0021	12.26	.0648	.0634	.0287	78.4	35.4	1.36
100		.4138	.0016	12.95	.0678	.0667	.0271	98.4	40.0	1.37

*Av. Stopping Power in [$\text{MeV cm}^2 \text{g}^{-1}$] for the spectrum of electrons produced in the medium by photons of energy $h\nu$

TABLE A-4i RADIOLICAL PROPERTIES OF LEAD										
Z=82		$\rho = 11360 \text{ kg/m}^3$		$2.383 \times 10^{26} \text{ elect./kg}$		A=207.20				
				$2.907 \times 10^{24} \text{ atom/kg}$						
Photon energy $h\nu$	Basic Coefficients in				Interaction coef. in			Av. energy transferred or absorbed		Stopping power \bar{S} in $\frac{\text{MeV cm}^2}{\text{g}}$ \bar{S}^*
	$(10^{-24} \frac{\text{cm}^2}{\text{atom}})$ or $(10^{-28} \frac{\text{m}^2}{\text{atom}})$				$[\text{cm}^2/\text{g}]$ (To get $[\text{m}^2/\text{kg}]$ divide by 10)			\bar{E}_{tr}	\bar{E}_{ab}	
	σ_{coh}	σ_{inc}	τ	κ	$(\frac{\mu}{\rho})$	$(\frac{\mu_{\text{tr}}}{\rho})$	$(\frac{\mu_{\text{ab}}}{\rho})$			
	coh.	incoh.	photo	pair						
[keV]								[keV]		
2.48	3686.	4.278	276000.		812.9	802.1		2.45	14.9	
2.48	3686.	4.280	736200.		2151.	2073.		2.39	14.9	
2.58	3647.	4.477	663300.		1939.	1870.		2.49	15.0	
2.58	3646.	4.479	921300.		2688.	2597.		2.50	15.0	
3.06	3475.	5.385	590700.		1727.	1673.		2.97	15.0	
3.06	3475.	5.386	793400.		2316.	2247.		2.98	15.0	
3.55	3280.	6.262	539600.		1578.	1534.		3.45	15.0	
3.55	3280.	6.263	609000.		1780.	1731.		3.46	15.0	
3.84	3179.	6.780	494399.		1446.	1408.		3.75	14.9	
3.85	3179.	6.782	533600.		1560.	1519.		3.75	14.9	
6	2504.	10.28	167200.		493.3	479.7		5.83	13.7	
8	2035.	13.20	78790.		235.0	226.8		7.72	12.6	
10	1686.	15.75	43960.		132.7	126.8		9.55	11.5	
13	1285.	18.87	21980.		67.68	63.52	63.48	12.2	10.3	
15.2	1095.	20.72	36270.		108.7	80.52	80.43	11.3	9.60	
15.2	1095.	20.72	51139.		151.9	113.5	113.4	11.4	9.60	
15.8	1040.	21.23	45730.		136.0	102.8	102.7	12.0	9.39	
15.8	1039.	21.23	53030.		157.2	119.2	119.1	12.0	9.39	
20	781.5	24.00	28750.		85.91	68.56	68.43	16.0	8.33	
30	455.7	28.69	9745.		29.73	24.93	24.85	25.2	6.64	
50	213.3	33.03	2441.		7.811	6.594	6.556	42.2	4.87	
60	159.2	33.90	1480.		4.863	4.054	4.026	50.0	4.35	
88	83.99	34.49	512.7		1.835	1.444	1.429	69.2	3.44	
88	83.99	34.49	2456.		7.483	2.118	2.096	24.9	3.42	
100	67.57	34.41	1777.		5.461	1.974	1.952	36.2	3.17	
150	32.81	32.90	620.3		1.994	1.075	1.058	80.9	2.52	
200	19.51	31.03	290.5		.9913	.6027	.5902	122.	2.17	
300	9.230	27.77	100.5		.3996	.2540	.2469	191.	1.81	
400	5.366	25.22	48.33		.2294	.1419	.1371	247.	1.64	
500	3.502	23.21	27.93		.1588	.0945	.0909	298.	1.54	
662	2.038	20.68	14.59		.1084	.0616	.0589	376.	1.44	
800	1.410	19.06	9.549		.0872	.0485	.0461	444.	1.38	
[MeV]								[MeV]		
1	.9111	17.19	6.028		.0701	.0386	.0364	.550	.520	1.32
1.25	.5875	15.40	3.987	.0055	.0581	.0322	.0302	.693	.649	1.26
2	.2317	11.98	1.669	1.701	.0453	.0257	.0235	1.13	1.04	1.18
3	.1034	9.437	.8630	3.944	.0417	.0259	.0231	1.86	1.66	1.14
4	.0583	7.878	.5672	5.782	.0415	.0281	.0244	2.70	2.35	1.12
5	.0373	6.805	.4096	7.288	.0423	.0305	.0258	3.60	3.06	1.11
6	.0259	6.016	.3241	8.380	.0429	.0324	.0268	4.54	3.76	1.11
8	.0146	4.922	.2239	10.45	.0454	.0367	.0291	6.47	5.12	1.11
10	.0093	4.193	.1681	12.40	.0488	.0412	.0313	8.45	6.42	1.12
15	.0042	3.103	.1075	15.66	.0549	.0491	.0342	13.4	9.37	1.13
20	.0023	2.491	.0783	18.48	.0612	.0564	.0366	18.5	12.0	1.15
30	.0010	1.814	.0501	22.23	.0700	.0665	.0378	28.5	16.2	1.17
40	.0006	1.441	.0365	24.56	.0757	.0728	.0371	38.5	19.6	1.19
50	.0004	1.203	.0285	26.54	.0807	.0783	.0363	48.5	22.5	1.20
60	.0003	1.037	.0233	27.77	.0838	.0817	.0348	58.5	24.9	1.21
80	.0001	.8176	.0170	29.83	.0891	.0875	.0324	78.6	29.1	1.23
100	.0001	.6786	.0133	31.53	.0937	.0923	.0304	98.6	32.4	1.24

*Av. Stopping Power in $[\text{MeV cm}^2 \text{g}^{-1}]$ for the spectrum of electrons produced in the medium by photons of energy $h\nu$